energy design resources

eQUEST

Quick Energy Simulation Tool

Energy Simulation Training for Design & Construction Professionals

September 2004

jjh James J. Hirsch & Associates

Acknowledgements

The creation of eQUEST, which contains DOE-2.2 as its simulation engine, has been a team effort. It is not possible to acknowledge all the contributions of merit to eQUEST and DOE-2, but we wish to point out the most significant and enduring ones here.

DOE-2.2, both the program and its documentation, are based upon earlier versions of DOE-2. The DOE-2 family of programs was created primarily through a partnership between James J. Hirsch & Associates (JJH) and Lawrence Berkeley National Laboratory (LBNL) with additional smaller contributions, over a twenty five year period, from a large number of individuals and institutions around the world. Support for the continued development of DOE-2, over its two decades of wide distribution, has come from many public and private agencies, companies and educational institutions around the world. The primary support for DOE-2 development, however, has come from public funds provided by the United States Department of Energy (USDOE) and the United States electric and gas utility industry; particularly the USDOE Office of Energy Efficiency and Renewable Energy Building Technologies Program, Southern California Edison Company's Energy Efficiency Division, and the Electric Power Research Institute's Customer Systems Division.

Authorship of the DOE-2.2 program components and documentation is an ongoing team effort that has its roots in previous versions (2.1E, 2.1D, 2.1C, etc) going back over twenty-five years. The contributions to DOE-2, both directly as authors and indirectly in the form of advice, comment and testing or feedback, are too numerous to catalog here; however, the primary authors are mentioned below in alphabetical order. Currently, and over the past decade, Marlin Addison, Scott Criswell, Steve Gates, Jeff Hirsch, and Kevin Madison, as consulting staff for JJH, are the major contributors to DOE-2.2; Steve Gates and Jeff Hirsch were also major contributors to the DOE-2.1 versions. Fred Buhl, Ender Erdem, Kathy Ellington and Fred Winkelmann, as staff members of the Environmental Energy Technologies Division's Simulation Research Group at LBNL, were major contributors to 2.1 versions and the initial version of DOE-2.2.

The eQUEST user interface, first conceived in 1998, is based upon experience and technology originally developed for the PowerDOE®, COMcheck-Plus and Food Service Toolkit programs in the 1990's; the eQEST that exists today is the result of integrating the ideas from those earlier programs with enhancements, refinements, and extensions to their basic approaches, plus modernization to take best advantage of the current generation PC environment capabilities. Many people contributed to the development of those older programs as are listed in their individual acknowledgements. The primary conceivers/authors of the eQUEST interface, and its documentation, in alphabetical order are Marlin Addison, Scott Criswell, Jeff Hirsch, and Renny Werner as consulting staff for JJH.

The authors of DOE-2.2 and eQUEST would also like to acknowledge many persons who, apart from the financial support provided by their companies, have shown vision and unusual insight in their instrumental and ongoing support of the DOE-2 family of products including DOE-2.1, DOE-2.2, PowerDOE and eQUEST. In particular we extend our thanks to Gregg Ander, and his staff, and Jan Johnson, and her staff, at Southern California Edison Company.

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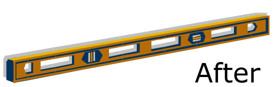
eQUEST … the QUick Energy Simulation Tool

Imagine a building energy simulation tool comprehensive enough to be useful to ALL design team members, yet so intuitive ANY design team member could use it, in ANY or ALL design phases, including schematic design. We believe you'll find that eQUEST is well named because it provides something you've been looking for but until now have been unable to find … a sophisticated, yet easy-to-use building energy use analysis tool. With eQUEST, you'll be able to provide professional-level results in an affordable level of effort.

Evaluate today's newest building technologies …
at the speed of tomorrow's design process

eQUEST allows you to perform detailed analysis of today's state-of-the-art building design technologies using today's most sophisticated building energy use simulation techniques but without requiring extensive experience in the "art" of building performance modeling. This is accomplished by combining a *building creation wizard*, an *energy efficiency measure (EEM) wizard*, and a graphical results display module with a simulation "engine" derived from an advanced version of the DOE-2 building energy use simulation program.

Imagine being able to evaluate today's newest building technologies, at the speed of today's design process. Well… imagine no longer! See for yourself. eQUEST is available for you to download **FREE** from *www.energydesignresources.com.*



A trusted tool…

After two decades of continuous development and enhancement, DOE-2 is the most widely recognized and trusted building energy simulation program available today. eQUEST will guide you through the creation of a detailed DOE-2 building model, allow you to automatically perform parametric simulations of your design alternatives, and provide you with intuitive graphics that highlight the performance of your proposed design alternatives … all within a fraction of the time previously required for professional-level analysis.

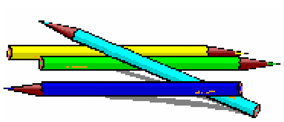
The Building Creation Wizard gets you going so quickly,
it may seem like magic…

Sophisticated energy use simulation programs have been in existence for more than two decades. Unfortunately, these programs have always required detailed knowledge of both the ART of building energy use analysis and the SCIENCE of the particular energy analysis program itself. The result has been that only specialists could reliably use the sophisticated simulation programs. The level of effort and associated expense generally meant that simulation analysis occurred only once during the design process, most frequently nearer the end of the process, when the most detailed inputs were available. Such a process was not only expensive… it did little to facilitate collaborative energy efficient design (i.e., involving several design team members) throughout the entire design process (i.e., from schematic through final design).

The Building Creation Wizard acts as an expert modeling advisor…

eQUEST 3.0 helps to overcome past barriers to simulation by incorporating two building creation wizards: the Schematic Design Wizard (the "Schematic Wizard") and the Design Development Wizard (the "DD Wizard"), as well as an Energy Efficiency Measure wizard (the "EEM Wizard"). It's like having an expert advisor, operating between you and the DOE-2 energy simulation program. Either Wizard will guide you through a series of steps designed to allow you to fully describe the principal energy-related features of your design. The wizards then create a detailed description of the proposed design as required DOE-2. At each step of describing your building design, the wizards provide easy-to-understand choices of component and system options.

Schematic Design Wizard



Users may elect to begin the building simulation process by using the Schematic Wizard. The sequence of steps the wizard takes you through allows you to describe the building's architectural features and its heating, ventilating, and air-conditioning (HVAC) equipment. The steps are organized so that the most general project information is requested first (Figure 1), followed by more detailed architectural and HVAC information (Figures 2 and 3).

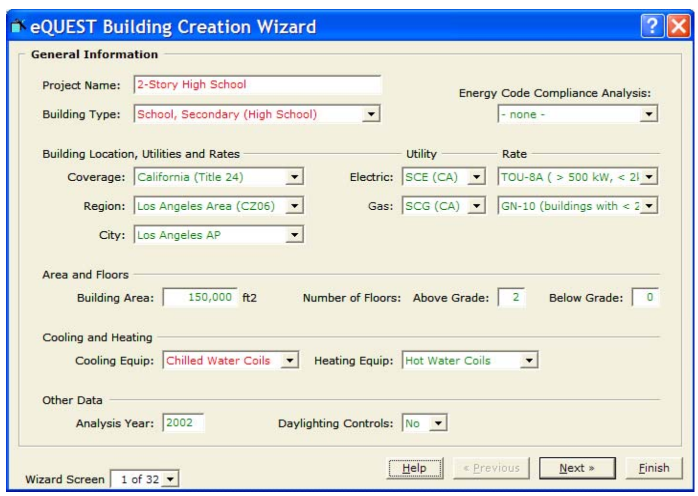


Figure 1
High-level eQUEST project information: building type (sets many subsequent defaults), weather location, heat/cool source (red fonts are user inputs, green fonts are wizard-provided defaults)

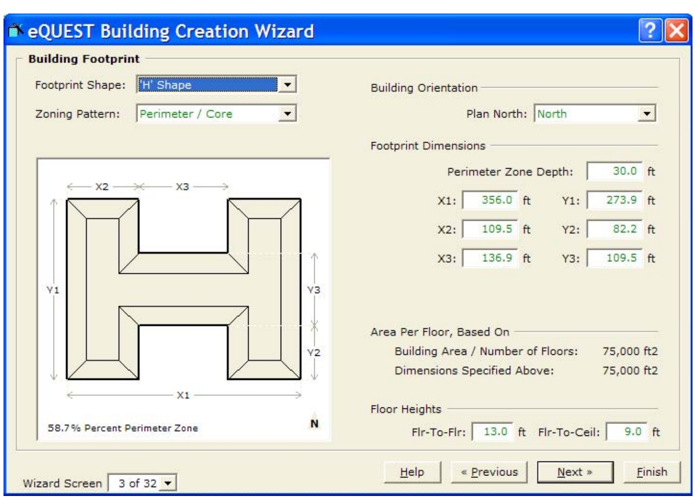


Figure 2
eQUEST building geometry information: use this screen to describe the building footprint and HVAC zoning. This can rely on automatic shapes or user-defined "custom" shapes (see Figure 9)

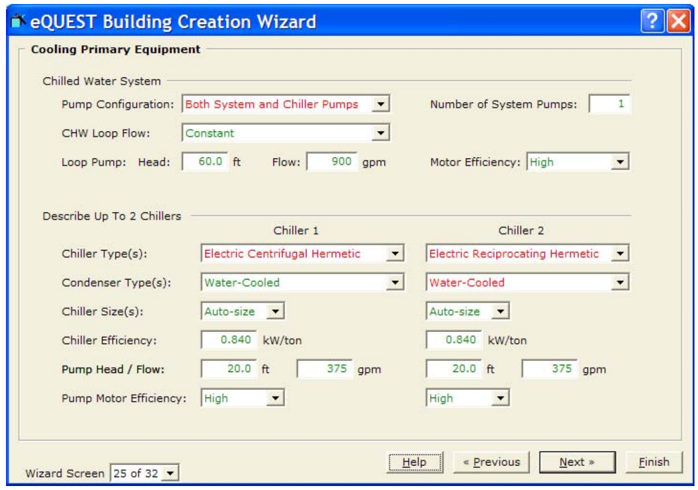


Figure 3

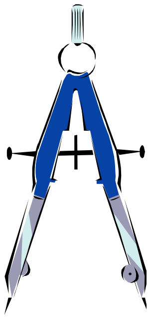
eQUEST water-side information: use this screen to describe the central plant primary cooling equipment.

When to use the Schematic Design Wizard?

The Schematic Wizard is designed to support the earliest design phase, when information is most limited. Although time may also be limited, with even a little practice, you will find that you can explore the energy impacts of numerous design features in an hour or less. The Schematic Wizard is also well suited for smaller, simpler structures. Other features include the following:

- Building geometry can rely on predefined generic shapes, or custom user input via a drawing tablet, including importing & tracing DWG plan files.
- Currently, the Schematic Wizard is limited to one building shell and one footprint, i.e., only one structure with all floors in the structure sharing the same basic footprint shape and thermal zoning pattern.
- Up to two different types of HVAC systems can be described in any one Schematic Wizard project (e.g., built-up chilled water plus rooftop DX units). There are 60+ HVAC system types to choose from.
- The description of internal loads relies on generic, code-based activity area types having default lighting and equipment power densities.
- The user can choose between simple building schedule information using occupied vs. unoccupied times and allowing up to two seasons per year or detailed, hour-by-hour occupancy and equipment usage profiles with more flexible season definitions.
- Zone assignments for internal loads, schedule, and HVAC system types are simple and schematic in detail.
- Defaults, categorized by building type, are provided for ALL wizard inputs.

Design Development Wizard (DD Wizard)



The Design Development Wizard (the "DD Wizard") is designed for later, more detailed design (i.e., during the Design Development phase), when more detailed information is available. It is also better suited for larger, more complicated structures, or for use with more detailed internal loads, schedules, and HVAC system assignment requirements. Users may begin their projects using the DD Wizard, or, if they began their building simulation project using the Schematic Wizard, they can elect at any time to continue their project analysis and development using the DD Wizard, e.g., as more detailed project information becomes available. Other features include the following:

- The generic and custom drawing capabilities of the DD Wizard work the same as in the Schematic Wizard, however, in the DD Wizard, users can describe multiple building shell components, each with similar or very different geometry, shell properties, and HVAC zoning and/or systems.
- Separate building shell components may be stacked (e.g., to form setback mid- or high-rise designs), or placed adjacent to one another (e.g., to form separate wings or a campus of separate structures).
- The same 60+ HVAC system types are available for use in the DD Wizard, however, there is effectively no limit on the number of these different system types that can be used in a single project.
- The description of internal loads can use generic, code-based activity area types (as in the Schematic Wizard), or users may provide much more detailed, even zone-by-zone, descriptions of internal loads and HVAC system assignments.
- Building schedule information is in the form of hour-by-hour descriptions of building occupancy and equipment usage profiles.
- Defaults, categorized by building type, are provided for ALL wizard inputs.

Not magic… just intelligent dynamic defaults

Both the Schematic and DD Wizards offer advice in the form of "intelligent defaults" for each choice. All wizard inputs have defaults (yes, ALL), however, the most important information is collected first, which is used to refine the defaults for later, more detailed inputs. The experience is intended to be like reading a good newspaper, i.e., the further you read into an article, the more detailed understanding you will gain, however, you can "get the gist" by covering only the first few paragraphs. Similarly, in eQUEST's wizards, it isn't necessary to complete every single step in either wizard. If you choose, you can "bail out" of the description process once you are satisfied with the level of detail you have provided. At that point, the wizard provides any missing information using eQUEST's hierarchical default process.

The Energy-Efficiency Measures (EEM) Wizard helps you quickly, easily, and reliably explore the energy performance of your preferred design alternatives

The greatest value that energy simulation can provide to the building design professional is reliable guidance in determining the energy performance of design alternatives. After creating a new building description (i.e., using the Building Wizard), you can launch the EEM Wizard to quickly describe up to nine design alternatives to your "base" building description. You can then automatically simulate any or all of these alternative cases and view the simulation results as either individual or comparative graphs or in a detailed "parametric" tabular report. Using the EEM Wizard, designers can easily "weigh" the energy impacts and tradeoffs of their design options. Building energy performance simulation was never so quick, easy, and reliable.

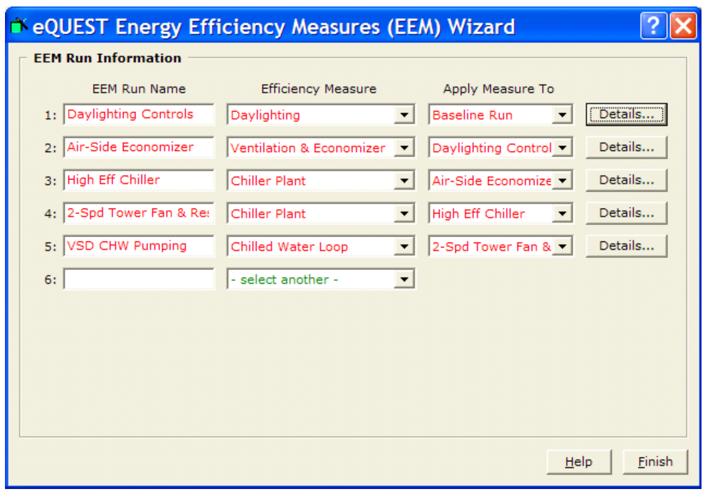


Figure 4

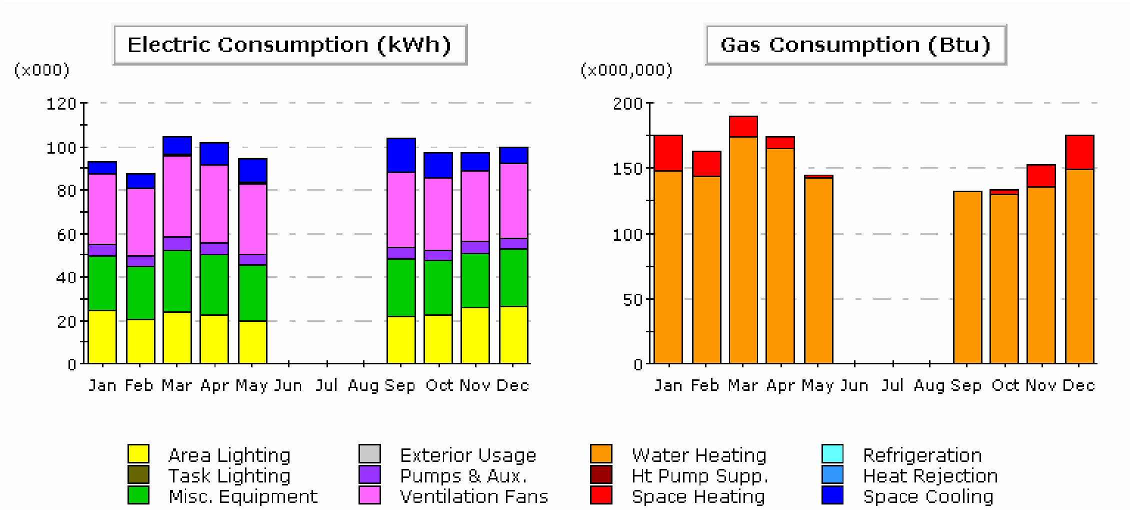
eQUEST Energy-Efficiency Measures (EEM) Wizard: use this screen to describe energy-related features of design alternatives

Intuitive Graphics Tell the Energy Story

Once a simulation has been completed, you visualize the results through a number of graphical formats. Overall building estimated energy use can be seen on an annual or monthly basis. Detailed performance of individual building components may also be examined. Figure 5, for example, shows the monthly electrical and gas consumption for a single building simulation and the fraction of that consumption attributed to each of the end-use categories. Figure 6, on the other hand, provides a pair of comparison graphics with associated tabular results that show the monthly electrical and gas consumption for each of five building EEM simulations.

A recently added feature now allows detailed "parametric" processing (Figures 15-17), in which you can define a series of detailed design alternatives and run them automatically. A new parametric tabular report details the annual use and savings (both incremental and cumulative), by end use (Figure 7) for both the EEM Wizard and detailed parametrics.

By performing multiple simulations on your building design alternatives you can take steps to optimize your design, with respect to energy consumption and operating cost, by viewing the alternative results in side-by-side graphics.



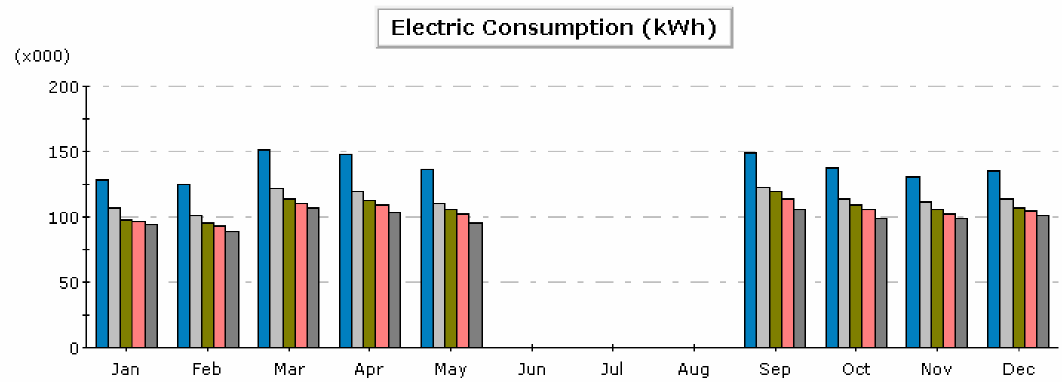
Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	5.41	7.10	8.59	10.08	11.03	-	-	-	15.30	11.65	7.99	7.37	84.53
Heat Reject.	0.07	0.09	0.13	0.25	0.30	-	-	-	0.45	0.28	0.15	0.08	1.78
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	32.70	31.07	37.61	35.97	32.70	-	-	-	34.34	32.70	32.70	34.34	304.14
Pumps & Aux.	4.93	4.75	5.73	5.53	5.11	-	-	-	5.38	5.10	5.00	5.24	46.76
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	25.22	23.96	29.01	27.75	25.22	-	-	-	26.49	25.22	25.22	26.49	234.59
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	24.58	20.62	23.53	22.25	19.94	-	-	-	21.78	22.11	25.79	26.20	206.80
Total	92.92	87.59	104.60	101.82	94.30	-	-	-	103.73	97.07	96.86	99.70	878.59

Gas Consumption (Btu x000,000)

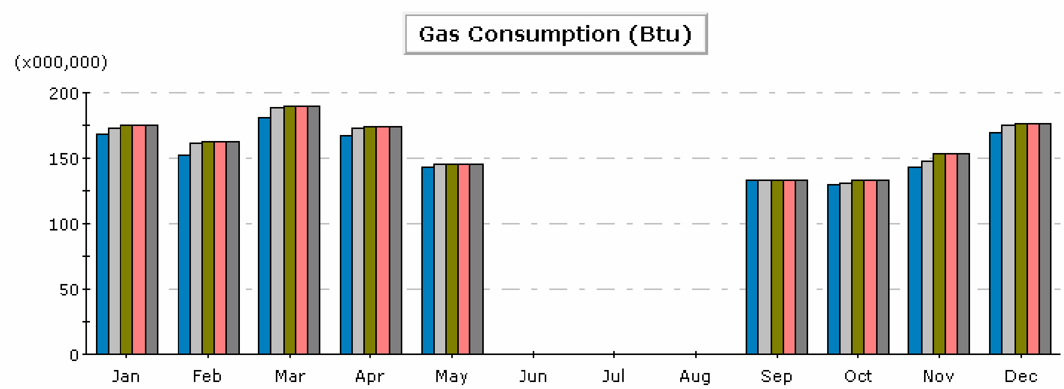
Jan	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	26.8	18.9	15.1	9.1	2.3	-	-	-	-	3.2	17.5	26.5	119.4
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	147.9	143.6	174.2	164.6	142.9	-	-	-	132.7	129.6	135.5	149.1	1,320.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	174.7	162.5	189.3	173.7	145.2	-	-	-	132.7	132.8	153.0	175.7	1,439.5

Figure 5, monthly electrical and gas consumption, by end-use



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	127.9	124.7	151.2	147.4	136.4	-	-	-	148.6	137.2	131.2	135.7	1,240.3
Run 2.	106.4	101.6	121.4	118.9	110.7	-	-	-	122.5	113.9	111.3	113.8	1,020.6
Run 3.	97.9	94.9	113.5	112.6	106.0	-	-	-	119.4	109.2	105.4	107.2	966.1
Run 4.	96.3	92.7	110.8	109.3	102.1	-	-	-	114.0	105.1	102.8	104.9	938.0
Run 5.	94.5	89.1	106.4	103.5	95.8	-	-	-	105.4	98.6	98.4	101.4	893.3

1. 2-Story High School - Baseline Run (03/09/00 @ 18:59)
2. 2-Story High School - Daylighting Controls (03/09/00 @ 19:00)
3. 2-Story High School - Air-Side Economizer (03/09/00 @ 19:01)
4. 2-Story High School - High Eff Chiller (03/09/00 @ 19:03)
5. 2-Story High School - 2-Spd Tower Fan & Reset (03/09/00 @ 19:04)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	167.7	152.4	180.3	166.9	142.9	-	-	-	132.7	129.6	143.2	169.4	1,385.2
Run 2.	172.8	160.9	188.1	172.7	145.2	-	-	-	132.7	130.3	147.8	174.8	1,425.2
Run 3.	174.7	162.5	189.3	173.7	145.2	-	-	-	132.7	132.8	153.0	175.7	1,439.5
Run 4.	174.7	162.5	189.3	173.7	145.2	-	-	-	132.7	132.8	153.0	175.7	1,439.5
Run 5.	174.7	162.5	189.3	173.7	145.2	-	-	-	132.7	132.8	153.0	175.7	1,439.5

Figure 6, monthly electric and gas consumption for 5 simulations

		Annual Site Energy		Annual Source Energy		Peak		Lighting	HVAC Energy		
		Elect kWh	Nat Gas Therms	Total Mbtu	EUI kBtu/sf/yr	Elect kW	Cooling Tons	Electric MWh	Electric kWh	Nat Gas Therms	Total Mbtu
Annual Energy USE or DEMAND											
0	Min T24 Compliance	250.004	1.311	2.691	110	125	50	68	89.017	956	399
1	00+Window Overhangs	236.519	2.059	2.628	107	108	35	68	75.532	1.705	428
2	1+High Eff Lighting	219.579	2.358	2.484	101	99	33	52	74.285	2.003	454
3	2+Side Daylighting	188,747	3,036	2,236	91	83	29	23	72,792	2,681	517
4	3+High Eff Chiller	174,001	3,036	2,085	85	75	29	23	58,046	2,681	466
5	4+VSD CHW Pumping	170,174	3,036	2,046	83	74	29	23	54,220	2,681	453
6	5+Chiller Plant Opt Start	168,911	3,036	2,033	83	74	29	23	52,956	2,681	449
Incremental SAVINGS	(percentage savings shown in parentheses, negative entries indicate increased use or cost)										
1	00+Window Overhangs	13,485 (5%)	-749 (-57%)	63 (2%)	3 (2%)	18 (14%)	15 (30%)	0 (0%)	3,485 (15%	-749 (-78%)	-29 (-7%)
2	1+High Eff Lighting	16,940 (7%)	-299 (-14%)	144 (5%)	6 (5%)	8 (8%)	2 (5%)	16 (23%)	1,246 (2%)	-299 (-18%)	-26 (-6%)
3	2+Side Daylighting	i0,832 (14%	-678 (-29%)	248 (10%)	10 (10%)	16 (16%)	4 (13%)	29 (56%)	1,493 (2%)	-678 (-34%)	-63 (-14%)
4	3+High Eff Chiller	14,746 (8%)	0 (0%)	151 (7%)	6 (7%)	8 (9%)	0 (0%)	0 (0%)	.4,746 (20%	0 (0%)	50 (10%)
5	4+VSD CHW Pumping	3,826 (2%)	0 (0%)	39 (2%)	2 (2%)	1 (2%)	0 (0%)	0 (0%)	3,826 (7%)	0 (0%)	13 (3%)
6	5+Chiller Plant Opt Start	1,263 (1%)	0 (0%)	13 (1%)	1 (1%)	-0 (-0%)	0 (0%)	0 (0%)	1,263 (2%)	0 (0%)	4 (1%)
Cumulative SAVINGS	(relative to Base Case, i.e. Case 0, percentage savings shown in parentheses, negative entries indicate use or cost)										
1	00+Window Overhangs	13,485 (5%)	-749 (-57%)	63 (2%)	3 (2%)	18 (14%)	15 (30%)	0 (0%)	3,485 (15%	-749 (-78%)	-29 (-7%)
2	1+High Eff Lighting	i0,425 (12%	1,047 (-80%	207 (8%)	8 (8%)	26 (21%)	17 (33%)	16 (23%)	.4,731 (17%	.,047 (-110%	-54 (-14%)
3	2+Side Daylighting	i1,257 (25%	.,725 (-132%	455 (17%)	19 (17%)	42 (34%)	21 (42%)	45 (66%)	.6,224 (18%	.,725 (-180%	-117 (-29%)
4	3+High Eff Chiller	'6,003 (30%	.,725 (-132%	606 (23%)	25 (23%)	50 (40%)	21 (42%)	45 (66%)	i0,970 (35%	.,725 (-180%	-67 (-17%)
5	4+VSD CHW Pumping	'9,829 (32%	.,725 (-132%	645 (24%)	26 (24%)	51 (41%)	21 (42%)	45 (66%)	i4,797 (39%	.,725 (-180%	-54 (-13%)
6	5+Chiller Plant Opt Start	i1,093 (32%	.,725 (-132%	658 (24%)	27 (24%)	51 (41%)	21 (42%)	45 (66%)	i6,060 (41%	.,725 (-180%	-49 (-12%)

Figure 7, detailed annual energy use, incremental savings, and cumulative savings for 6 parametric simulations

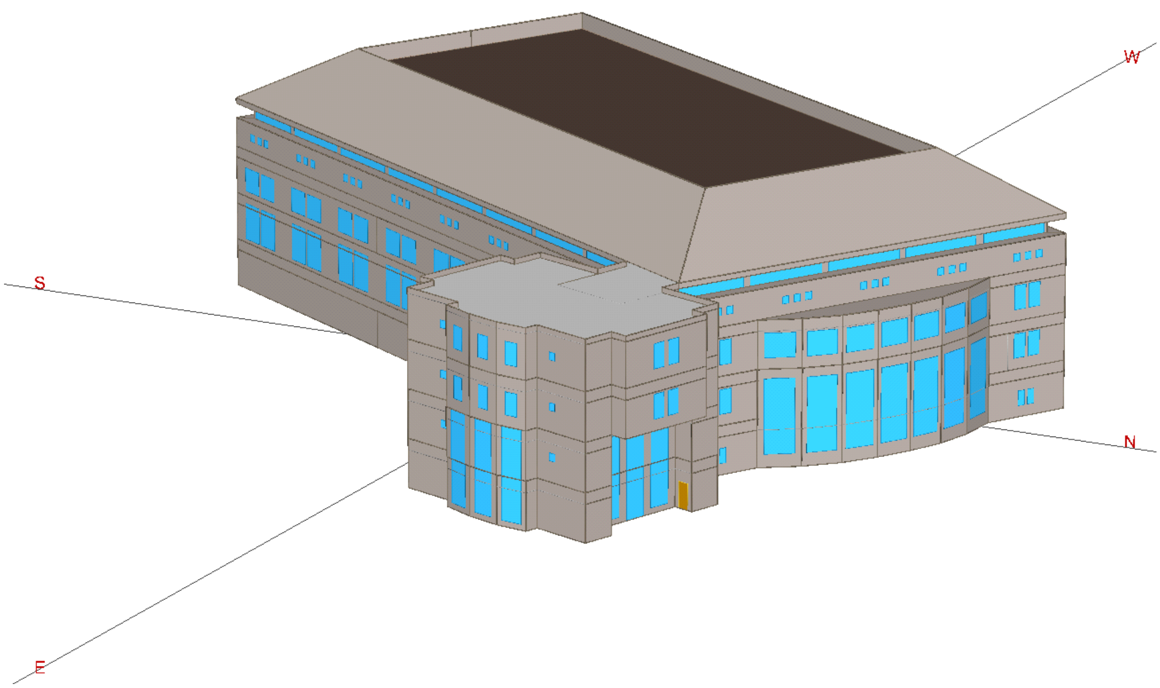


Figure 8, 3-D view of eQUEST model

Provide as much detail as you like… or as little…

With eQUEST, you decide how much detail is appropriate. You can rely on predefined building shapes and automatic HVAC zoning or you can import DWG files and use them to create a project-specific footprint shapes and HVAC zoning.

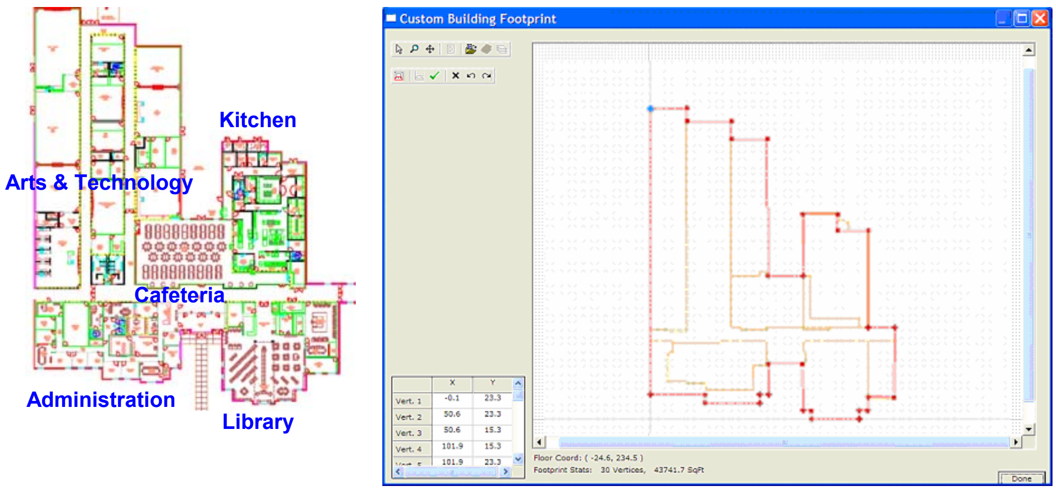


Figure 9, eQUEST custom drawing screen with DWG file imported

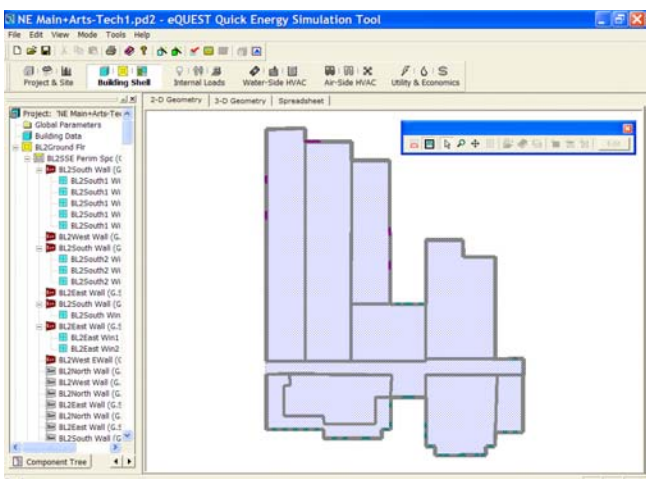
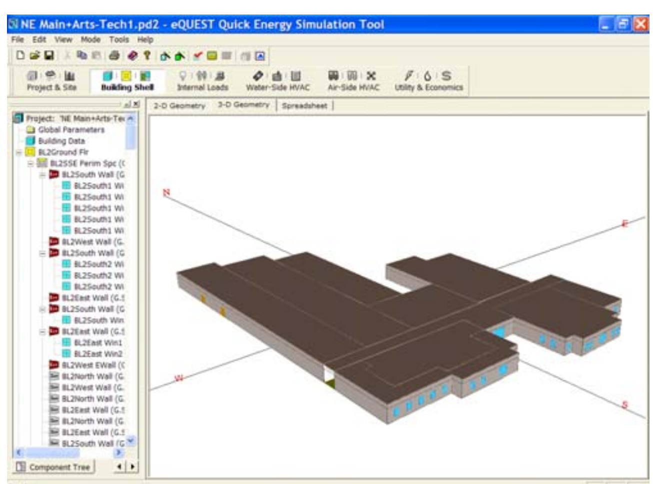


Figure 10

eQUEST building shell, 2-D geometry screen (from eQUEST's Detailed Interface), showing the completed building footprint and user-defined HVAC zoning. Components in the model are listed in the "tree' on the left side of the screen

Figure 11

eQUEST building shell, 3-D geometry screen (from eQUEST's Detailed Interface). Click on any object (i.e., from the component tree or 2-D or 3-D image) to see detailed inputs.



Use the Design Development wizard to define multiple architectural shell and/or HVAC components, then assemble these into a completed project (Figure 12).

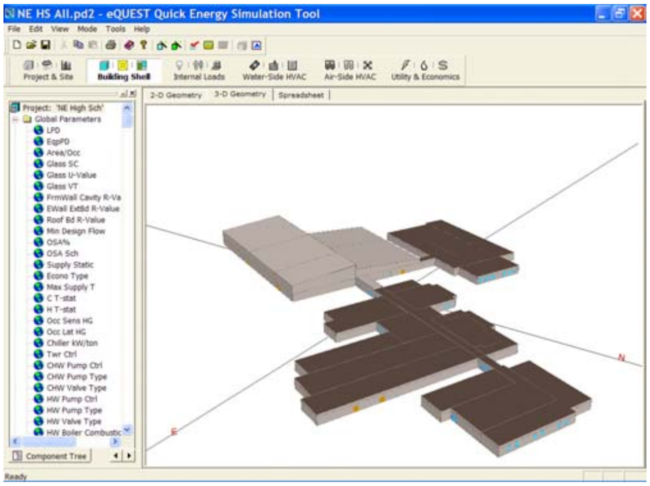


Figure 12

eQUEST building shell, 3-D geometry screen (from eQUEST's Detailed Interface), showing a full campus (the building in Figures 9-11 is seen here in the center of the campus). This example consists of four buildings.

Use eQUEST's Detailed Interface to explore project architectural and HVAC components in detail. Graphical presentation of project components make navigation intuitive (Figure 13).

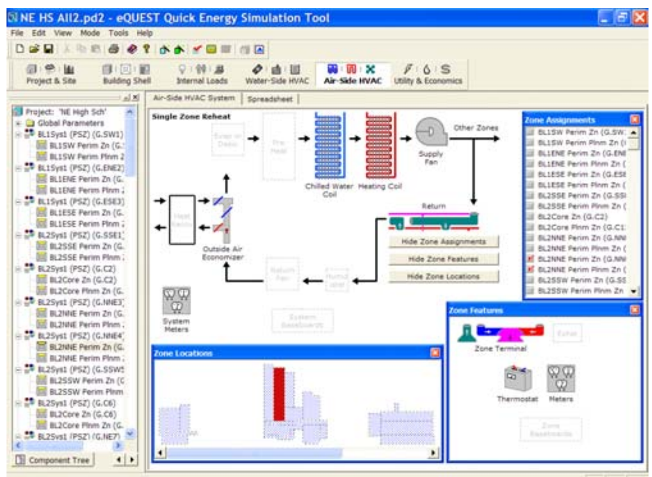


Figure 13
eQUEST air-side HVAC screen, showing the same building as in Figure 12.

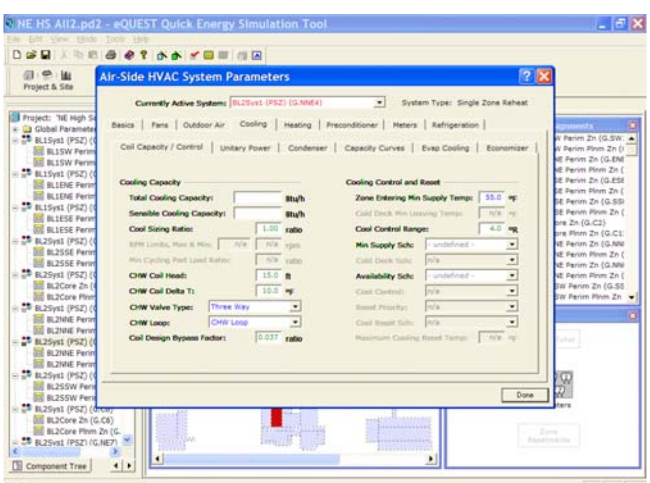


Figure 14

eQUEST air-side HVAC screen: Click on any object (i.e., from the component tree or system schematic image) to see detailed inputs. HVAC design inputs (e.g., capacities) left blank tell eQUEST "size these".

Use the Parametric Run dialog in eQUEST's Detailed Interface to define detailed parametric runs to explore, in detail, the benefit of selected energy-efficient design features (Figures 15-17). Tabular results are automatically produced showing the incremental and cumulative benefits of your selected design features (Figure 7).

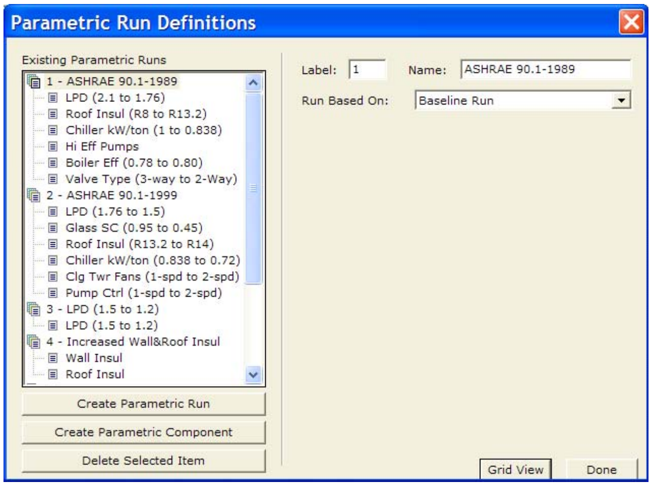


Figure 15
eQUEST's detailed parametric runs dialog (in eQUEST's Detailed Interface), showing a series of parametric runs exploring the incremental benefit of selected efficiency design features.

Figure 16
Example component list of eight parametric runs

1 - ASHRAE 90.1-1989
- LPD (2.1 to 1.76)
- Roof Insul (R8 to R13.2)
- Chiller kW/ton (1 to 0.838)
- Hi Eff Pumps
- Boiler Eff (0.78 to 0.80)
- Valve Type (3-way to 2-Way)

2 - ASHRAE 90.1-1999
- LPD (1.76 to 1.5)
- Glass SC (0.95 to 0.45)
- Roof Insul (R13.2 to R14)
- Chiller kW/ton (0.838 to 0.72)
- Clg Twr Fans (1-spd to 2-spd)
- Pump Ctrl (1-spd to 2-spd)

3 - LPD (1.5 to 1.2)
- LPD (1.5 to 1.2)

4 - Increased Wall&Roof Insul
- Wall Insul
- Roof Insul

5 - Reduced Static (2 to .75)
- Reduced Static

6 - Hi Eff Chiller (.72 to .65)
- Chiller kW/ton (.72 to .65)

7 - VSD CHW & HW Pumps
- VSD Drives

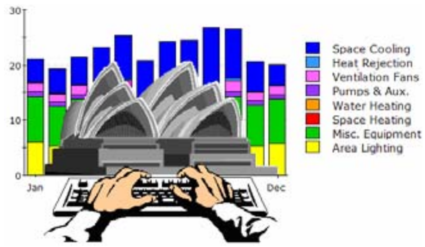
8 - OSA ShutOff when UnOcc
- OSA Sch

Component	Reference(s)	Baseline	ASHRAE 90....	ASHRAE 90.1-...	LPD (1.5 to 1.2)	Increased Wal...	Reduced Stati...	Hi Eff Chiller (...	VSD CHW & ...	OSA ShutO...
PARAMETER	LPD	2.100000	1.760	1.760	1.760	1.760	1.760	1.760	1.760	1.760
PARAMETER	Roof Bd R-Value	8.000000	13.200	13.200	13.200	13.200	13.200	13.200	13.200	13.200
PARAMETER	Chiller kW/ton	1.000000	0.838	0.838	0.838	0.838	0.838	0.838	0.838	0.838
PARAMETER	HW Pump Type(1 of 2)	STANDARD	HI-EFF	HI-EFF	HI-EFF	HI-EFF	HI-EFF	HI-EFF	HI-EFF	HI-EFF
PARAMETER	HW Boiler Combustion Eff	0.780000	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
PARAMETER	CHW Valve Type(1 of 2)	THREE-WAY	TWO-WAY	TWO-WAY	TWO-WAY	TWO-WAY	TWO-WAY	TWO-WAY	TWO-WAY	TWO-WAY
PARAMETER	LPD	2.100000	2.100000	1.500	1.500	1.500	1.500	1.500	1.500	1.500
PARAMETER	Glass SC	0.950000	0.950000	0.450	0.450	0.450	0.450	0.450	0.450	0.450
PARAMETER	Roof Bd R-Value	8.000000	8.000000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
PARAMETER	Chiller kW/ton	1.000000	1.000000	0.720	0.720	0.720	0.720	0.720	0.720	0.720
PARAMETER	Twr Ctrl	ONE-SPEED-FAN	ONE-SPEED-...	TWO-SPEED-FAN	TWO-SPEED-FAN	TWO-SPEED-FAN	TWO-SPEED-FAN	TWO-SPEED-F...	TWO-SPEED-...	TWO-SPEE...
PARAMETER	CHW Pump Ctrl(1 of 2)	ONE-SPEED-PUMP	ONE-SPEED-...	TWO-SPEED-P...	TWO-SPEED-P...	TWO-SPEED-P...	TWO-SPEED-P...	TWO-SPEED-P...	TWO-SPEED-...	TWO-SPEE...
PARAMETER	LPD	2.100000	2.100000	2.100000	1.200	1.200	1.200	1.200	1.200	1.200
PARAMETER	EWall ExtBd R-Value	0.100000	0.100000	0.100000	0.100000	4.300	4.300	4.300	4.300	4.300
PARAMETER	Roof Bd R-Value	8.000000	8.000000	8.000000	8.000000	21.000	21.000	21.000	21.000	21.000
PARAMETER	Supply Static	2.000000	2.000000	2.000000	2.000000	2.000000	0.750	0.750	0.750	0.750
PARAMETER	Chiller kW/ton	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	0.650	0.650	0.650
PARAMETER	CHW Pump Ctrl(1 of 2)	ONE-SPEED-PUMP	ONE-SPEED-...	ONE-SPEED-P...	ONE-SPEED-P...	ONE-SPEED-P...	ONE-SPEED-P...	ONE-SPEED-P...	VAR-SPEED-P...	VAR-SPEED...
PARAMETER	OSA Sch	NoOccSens Sch	NoOccSens S...	NoOccSens Sch	NoOccSens Sch	NoOccSens Sch	NoOccSens Sch	NoOccSens Sch	NoOccSens Sch	OccSens Sch

Figure 17, side-by-side "Grid View" comparison of eQUEST parametric runs

eQUEST … the Quick Energy Simulation Tool

What you've been looking for … High-Powered Simulation at the Touch of a Button



When you exit the eQUEST wizard, you have a complete building description ready for simulation. eQUEST uses an enhanced, interactive, simulation engine… an advanced derivation of DOE-2, to perform an hourly simulation of the described building for a user-selected one-year time period. For each hour of the simulation, heating and/or cooling loads are calculated based on contributions from walls, windows (including detailed shading), people, plug loads, and ventilation air and simulates the performance of fans, pumps, chillers, boilers, and all other energy-consuming building components as they respond to the building environment and controls. During the simulation, the energy use is tabulated for each of the end uses including lighting, general space equipment, heating, cooling, ventilation, and pumping.

The simulation "engine" within eQUEST is derived from the latest official version of DOE-2, however, eQUEST's engine extends and expands DOE-2's capabilities in several important ways, including: coupled air-side and water-side simulation, an all-new temperature/pressure/flow-based modular central plant simulation, more sophisticated (i.e., polygon-based) geometry, more dynamic/intelligent defaulting, and faster execution speed. Also, numerous long-standing shortcomings in DOE-2 that have contributed to its limited use by mainstream designers and buildings professionals have been improved. The full capabilities of this enhanced and improved DOE-2-derived engine have been integrated into eQUEST to provide you with detailed and accurate energy use estimates in remarkably little time.

Computer Requirements

To use eQUEST you need a PC with the following: Windows 95, 98, ME, NT, 2000, or XP (Windows 2000 or XP is recommended), having at least 64 Megabytes of RAM, 100 Megabytes of free hard drive space and a display capable of 800x600 resolution at 256 colors (or greater). You should also have internet access to allow the download of additional weather files and updates to new versions of eQUEST as they become available.

The *QUEST* Continues…

Version 3 of eQUEST provides a very capable tool for building energy use analysis, especially in the early conceptual design phase. Future enhancements to eQUEST are planned to permit even more comprehensive analysis…

1. Building energy code compliance checking (initially: California Title 24, later, ASHRAE 90-1)
2. HVAC-related enhancements that will make eQUEST a powerful and convenient HVAC design tool
3. Informative Q/A building model input and output reports to identify inconsistencies in the inputs and simulated results

Summary of *eQUEST* Features and Capabilities

eQUEST Availability, Cost, and Technical Support

eQUEST is provided **FREE** by courtesy of the State of California's *Energy Design Resources* program and is available for you to download from *www.energydesignresources.com.* Technical support is available via email at *equest@doe2.com.* For questions/problems regarding eQUEST's interface, contact Scott Criswell at scott.criswell@doe2.com. For questions/ problems regarding eQUEST's simulation methodology or results, contact Marlin Addison at marlin.addison@doe2.com.

Number of Users

Approximately 7,000 copies of eQUEST have been downloaded from *www.energydesignresources.com,* however, it is difficult to estimate what portion of these downloads represent active users. Although the original target audience for eQUEST has been California, e-mail support inquiries have been received from all around the world.

General Issues

Simulation Engine:
eQUEST's engine is "DOE-2.2", an advanced derivation of DOE-2, initially developed jointly by Lawrence Berkeley National Laboratory and J.J. Hirsch and Associates, under funding from the U.S. Department of Energy and the Electric Power Research Institute. On-going development of DOE-2-based tools, like eQUEST, is continuing under both public and industry funding. The principal focus of these ongoing efforts has been to make detailed hour-by-hour simulation more reliable and affordable for a broader base of design and buildings professionals.

# of unique simulation steps per year: 8760 (i.e., hourly) for up to one year maximum analysis period

# of specific day types:
eQUEST's schematic design wizard — 3 for each of two seasons (6 total)
eQUEST's detailed interface — hundreds of day types in up to 52 seasons

Types of available weather files:
all common long-term average weather files, i.e., TMY, TMY2, TRY, CTZ, CTMY, WYEC, WYEC2. There are 667 of these long-term average weather files, representing approximately 300 North American locations. They are available for free download from www.doe2.com. eQUEST automatically downloads missing weather files via ftp, on-demand (prompts for permission). Many international weather files are also available, including via *meteoNorm*™ (see http://www.meteotest.ch/en/mn_home?w=ber). Actual weather year data is also usable via the National Climatic Data Center (i.e., most popular NCDC weather file formats are supported, see http://lwf.ncdc.noaa.gov/oa/ncdc.html), as are WeatherMaker™ TMY2 files (used to adjust dry-bulb and wet-bulb temperatures to produce site weather data, see http://www.sbicouncil.org/enTen/weather.html).

Analysis methods

Heat Transmission through opaque exterior surfaces: two methods: "delayed" method via conduction transform functions (accounts for mass effects in delayed envelope heat transfer); "quick" method via steady-state UA∆T calculations. Heat Transmission through transparent surfaces: three methods are available: 1) shading coefficient method; 2) a predefined glass library (provides improved solar-optical transmission prediction at obtuse incident angles — user additions to library via *Windows* 4.1); 3) layer-by-layer method (permits detailed treatment of complex fenestration systems, including profile-angle-dependent slat-type shading devices, internal/external/integral — limited number of windows can be accommodated).

Interior sunlight/daylight modeling: DOE-2's solar heat gain calculations do not provide detailed treatment of solar distribution on interior surfaces (i.e., does not project "sun patches" into a space's interior), rather, relies on user-controlled assignment of the interior distribution of solar gain (e.g., assumes 60% of incoming solar is evenly distributed across the floor, 40% is evenly distributed across remaining interior surfaces). By contrast, DOE-2's daylighting prediction does provide for detailed tracking of the "direct" daylight component (that portion of the daylight which arrives at the workplane without first bouncing off interior surfaces). The treatment of the "indirect" (the internally reflected) component uses the "split-flux" method which predicts average reflected daylight levels and neglects internal obstructions of complex fenestration/spatial configurations. Space Loads: eQUEST relies on DOE-2's standard and/or custom weighting factors methods.

Coil Loads: now coupled in DOE-2.2 with water-side calculations into the same time step.

Water-Side: in DOE-2.2, now based on temperature and flow and very modular (i.e., allows for flexible coupling or assignment of primary and secondary equipment).

Design-Day Weather data and schedules of operations: in DOE-2.2, up to three 24-hour design day weather profiles can be user input — none are automatically derived from the user-selected weather file. These 24-hour design weather sequences can be repeated for any number of days to include different solar angles. In eQUEST's conceptual design wizard, design day conditions are automatically selected for any California climate zone locations, based on weather file selection (Title24 design day conditions).

The system types listed on the following page are available from eQUEST's Conventional HVAC Systems

Types of HVAC systems that can be modeled:

The system types listed on the following page are available from eQUEST's Building Creation Wizards (listed by cooling and heating source).

HVAC systems that can be modeled using eQUEST's Building Creation Wizards (shown by cooling/heating source)

Cooling Source	Heating Source	System Type
No Cooling	**No Heating**	- none -
No Cooling	No Heating	Unit Ventilator (no heating or cooling)
No Cooling	**Furnace**	Gas or Fuel Furnace with zone ventilation
No Cooling	Furnace	Gas or Fuel Furnace with NO zone ventilation
No Cooling	**Elec Resist**	Electric Furnace with zone ventilation
No Cooling	Elec Resist	Electric Furnace with NO zone ventilation
No Cooling	**HW Coils**	Hot Water Furnace with zone ventilation
No Cooling	HW Coils	Hot Water Furnace with NO zone ventilation
No Cooling	HW Coils	2-Pipe Fan Coils (heating only)
No Cooling	**Baseboards**	Electric Baseboards (only) with zone ventilation
No Cooling	Baseboards	Electric Baseboards (only) with NO zone ventilation
No Cooling	Baseboards	Hot Water Baseboards (only) with zone ventilation
No Cooling	Baseboards	Hot Water Baseboards (only) with NO zone ventilation
DX Coils	**No Heating**	Packaged Single Zone DX (no heating)
DX Coils	No Heating	Split System Single Zone DX (no heating)
DX Coils	No Heating	Packaged Terminal AC (no heating)
DX Coils	No Heating	Packaged VAV (no heating)
DX Coils	**Furnace**	Packaged Single Zone DX with Furnace
DX Coils	Furnace	Split System Single Zone DX with Furnace
DX Coils	Furnace	Packaged Multizone with Furnace
DX Coils	**Elec Resist**	Packaged Single Zone DX with Elec Resist Heat
DX Coils	Elec Resist	Split System Single Zone DX with Elec Resist Heat
DX Coils	Elec Resist	Packaged Terminal AC with Elec Resist Heat
DX Coils	Elec Resist	Packaged VAV with Elec Resist Reheat
DX Coils	Elec Resist	Packaged Multizone with Elec Resist Heat
DX Coils	**DX Coils (HP)**	Packaged Single Zone Heat Pump
DX Coils	DX Coils (HP)	Split System Single Zone Heat Pump
DX Coils	DX Coils (HP)	Packaged Terminal Heat Pump
DX Coils	DX Coils (HP)	Water-Source Heat Pump
DX Coils	**HW Coils**	Packaged VAV with Hot Water Reheat
CHW Coils	**No Heating**	Standard VAV (no reheat)
CHW Coils	No Heating	Parallel Fan-Powered VAV (no reheat)
CHW Coils	No Heating	Series Fan-Powered VAV (no reheat)
CHW Coils	No Heating	Single Zone Air Handler (cooling only)
CHW Coils	No Heating	2-Pipe Fan Coils (cooling only)
CHW Coils	No Heating	Multizone Air Handler (cooling only)
CHW Coils	No Heating	Single Fan Dual Duct (no heating)
CHW Coils	**Elec Resist**	Parallel Fan-Powered VAV (elec reheat)
CHW Coils	Elec Resist	Standard VAV (elec reheat)
CHW Coils	Elec Resist	Series Fan-Powered VAV (elec reheat)
CHW Coils	Elec Resist	Single Zone Air Handler (elec heat)
CHW Coils	Elec Resist	Reheat Fan System (elec reheat)
CHW Coils	Elec Resist	Multizone Air Handler (elec heat)
CHW Coils	Elec Resist	Dual Duct Air Handler (elec heat)
CHW Coils	**HW Coils**	Parallel Fan-Powered VAV (hot water reheat)
CHW Coils	HW Coils	Standard VAV (hot water reheat)
CHW Coils	HW Coils	Series Fan-Powered VAV (hot water reheat)
CHW Coils	HW Coils	Single Zone Air Handler (hot water heat)
CHW Coils	HW Coils	Reheat Fan System (hot water reheat)
CHW Coils	HW Coils	4-Pipe Fan Coils (hot water reheat)
CHW Coils	HW Coils	Multizone Air Handler (hot water heat)
CHW Coils	HW Coils	Dual Duct Air Handler (hot water heat)
Evap Cool	**No Heating**	Indirect/Direct Evaporative Cooler (no heat)
Evap Cool	No Heating	Direct Evaporative Cooler (no heat)
Evap Cool	**Furnace**	Indirect/Direct Evaporative Cooler (furnace heat)
Evap Cool	Furnace	Direct Evaporative Cooler (furnace heat)
Evap Cool	**Elec Resist**	Indirect/Direct Evaporative Cooler (electric heat)
Evap Cool	Elec Resist	Direct Evaporative Cooler (electric heat)

Special HVAC Systems

Ground-Source Heat Pumps: these can be directly modeled using eQUEST's detailed interface, and includes a large variety of ground coupling configurations, e.g., vertical well, horizontal field, "slinky".

Dual-Fuel Cooling Plants: these can be directly modeled using eQUEST's detailed interface, including preferential loading of base equipment.

Primary/Secondary chilled water distribution systems: DOE-2.2's temperature and flow-based calculations make it much better suited than was DOE-2.1E for modeling primary/secondary distribution systems. Up to twenty secondary loops can be connected to a primary loop. Currently, primary equipment cannot be connected directly to secondary loops.

Variable Flow primary distribution systems: as above, DOE-2.2's temperature and flow-based calculations make it much better suited than was DOE-2.1E for modeling variable flow distribution systems.

Dual-Fan Dual-Duct VAV systems: dual-fan dual-duct and multi-zone systems are available in eQUEST.

Natural Ventilation: natural ventilation is available in eQUEST via the detailed interface, only for single duct DX systems. The calculation uses the Sherman-Grimsrud algorithm. Note that this does not include any mass transport (i.e., CFD), rather, it is an energy transfer algorithm only.

Custom Performance Curves: custom equipment performance curves can be modeled in eQUEST's detailed interface. The user can either specify coefficients or curve data points (up to third order polynomials). Currently, no graphics are provided to illustrate or check the curves.

Cogeneration: a wide variety of cogeneration schemes and equipment can be modeled using DOE-2.2 (accessed via eQUEST's detailed interface). These include Photovoltaics (see below) and sell back.

Thermal Energy Storage: eQUEST's TES model is best suited for empty tank chilled water tank systems. Ice TES can also be modeled. Stratified tank chilled water tank systems require significant user judgment.

Underfloor Air Distribution: Underfloor systems can be modeled reasonably well by advanced eQUEST users (i.e., requires significant user judgement and some advanced program features). To the extent that underfloor systems rely on displacement ventilation for their energy performance, eQUEST's DOE-2 loads calculations will be unable to predict the adequacy of the displacement ventilation scheme using first principles. Rather, significant user judgment will be required to model the more-or-less direct transfer of heat gain from lights, people, equipment, and solar to the unoccupied (stratified) or return air mass via convective plumes. Fortunately, the assumed split of heat gains between the occupied and unoccupied air mass can be "expressionized" in eQUEST, i.e., input using dynamic formulas rather than static numbers — this allows the user to conveniently bound the performance of the proposed underfloor displacement system by varying key system characteristics. While the thermal loss from the underfloor plenum can be approximated using DOE-2.2's duct loss modeling, the effect of any "coolth" charge to the underfloor mass is not accounted for. Contact the eQUEST developers for a paper describing the literature, data sources and suggested approach to modeling underfloor air distribution systems.

New Special System Features

Photovoltaics: a PV algorithm has recently been added to DOE-2.2. Although no interface has been provided yet in eQUEST, the PV keywords are accessible via BDL/DOS.

Energy Recovery Ventilators: a wide variety of ERV configurations and options have recently been added to DOE-2.2. No interface has been provided yet in eQUEST. The ERV keywords are accessible via BDL/DOS.

Ice Rinks and Industrial Refrigeration Systems: the ability to model complex modular configurations for refrigeration systems and ice rinks has recently been added to DOE-2.2. No interface has been provided yet in eQUEST for the new refrigeration-related keywords. These keywords are accessible via BDL/DOS.

Notable DOE-2 HVAC Omissions

Solar Thermal: currently, there is no capability to model solar thermal systems in eQUEST or DOE-2.2.

Vertical Self-Contained Fan-Powered VAV: currently, there is no capability to model fan-powered VAV systems having DX cooling coils in eQUEST or DOE-2.2. Funding is in place to model this system. Completion of this addition is expected by the end of 2001.

Steam Loops: DOE-2 has never been able to directly model steam distribution systems. HW distribution systems are used to approximate steam systems.

Plate-and-frame economizers: DOE-2 has never included the ability to model plate-and-frame type water-side economizers, either series or parallel configurations.

Two or more HVAC systems serving the same zone: DOE-2 has never been able to model the use of two or more systems to provide cooling or heating service to the same zone. The only exception is baseboard heating combined with ambient heating (e.g., reheat coils).

Comfort-controlled radiant cooling or heating systems: DOE-2 has never been able to model radiant systems other than those whose control is via a standard dry-bulb thermostat.

Water-Use and Emissions: DOE-2.2 does not currently include either water use calculations or emissions calculations. Emissions calculations are anticipated in the near future.

Controls

DOE-2 has always assumed "perfect" control where capacity and operations permit. This makes it difficult to approximate the behavior of typical "real world" control, e.g., poorly maintained or calibrated controls, sticking valves or linkages, failed actuators, etc. Indirectly, DOE-2's "perfect" control tends to be a better approximation of PID/DDC control than pneumatic controls.

Daylighting Controls: three types of daylighting controllers are provided in both eQUEST's wizard and detailed interface: stepped, dimming, dimming/off.

Demand Limiting: demand limiting capabilities are available via eQUEST's detailed interface. Given the coupling between the air-side and water-side calculations in DOE-2.2, the affect of air-side resets are passed on to chilled water resets and the affect on space temperature is determined.

Controls (continued)

Window Shades: manually or automatically operated window shades can be modeled from eQUEST's detailed interface. Triggers include transmitted solar and estimated visual discomfort glare.

Night Venting: night venting can be modeled directly from eQUEST's detailed interface.

One-Hour time step: The fixed one-hour time step that has always been built into DOE-2 makes it difficult to model many control system effects.

Optimum Start / Morning Warm-up: Optimum start is provided directly in eQUEST's detailed interface, however, DOE-2's fixed one-hour time step makes this a rather "blunt" instrument to predict the benefit of optimum start. Morning warm-up outside air strategies can be well modeled from eQUEST's detailed interface. This can also be well integrated with economizer actions.

Utility Rates

DOE-2 has long been able to model a wide variety of utility rates. Rate features that can be easily accommodated include: inclined or declining block rates, hours use (variable block) rates, time-of-use rates, ratchets, rate limiters, customer service/meter charges, taxes/surcharges, and fuel adjustments. Rate qualifiers can also be modeled which can select among several available rates, the one that applies, based on peak kW or energy. It should be comparatively rare that a DOE-2.2 user would encounter a rate feature that cannot adequately be modeled. Typically, this tends to be specialized "IF then" tests built into a rate, e.g., off-peak kW is free unless the on-peak kW is less than 25% of the off-peak kW, in which case some charge applies per off-peak kW. NOTE: currently eQUEST only comes with California utility rates predefined. Users can add their own custom rates, however, this is not a simple undertaking (i.e., requires a user to prepare a text file containing DOE-2 BDL commands describing the custom utility rate — user documentation is provided).

Energy Code Compliance

Funding has been allocated to add California Title 24 compliance analysis to eQUEST. Work on this is nearing completion. Once completed, this will permit eQUEST users to certify their building designs for Title 24 compliance. eQUEST will produce the necessary submission forms. Additionally, eQUEST will be able to automatically complete compliance runs as part of general parametric energy analyses, e.g., *Savings By Design* analysis. eQUEST implements its compliance capabilities via external rule sets, driven by a rule processor. It is expected that this capability will be extended to include other codes, such as ASHRAE 90.1.

Interoperability

eQUEST has recently added DWG import capabilities. This provides users with the ability to import DWG files, then use them as a guide to "trace" the shape of the building footprint and zoning in a drawing module.

eQUEST®

Quick Energy Simulation Tool

Introductory Tutorial

Contents

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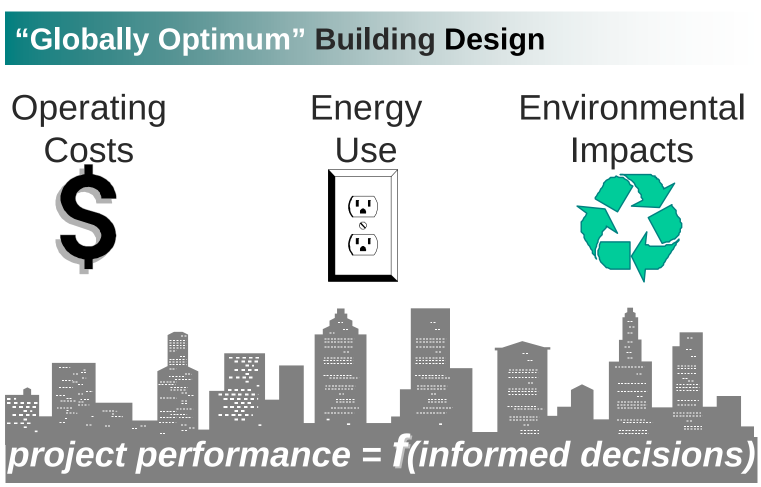
Simulation Basics

The reader who is already familiar with building energy use simulation may wish to skip this section, and continue this tutorial at the next section (Tour). For the reader who is new to the use of building energy use simulation, this section provides an overview from a "how-to" perspective. Two other Energy Design Resources (EDR) publications will also be very helpful to the new simulation practitioner, providing an overview and a perspective of the role simulation plays in the energy-efficient design process. Both are highly recommended and are briefly described below and on the next page.

Integrated Energy Design

Today's building designers must view their design responsibilities from a much broader, even global, perspective. From operating costs, to energy efficiency, to broader issues of sustainability, the quality of building design decisions can only be as good as the information entering the design process, i.e., the performance levels our building design projects ultimately realize is a function of how well informed our design decisions are.

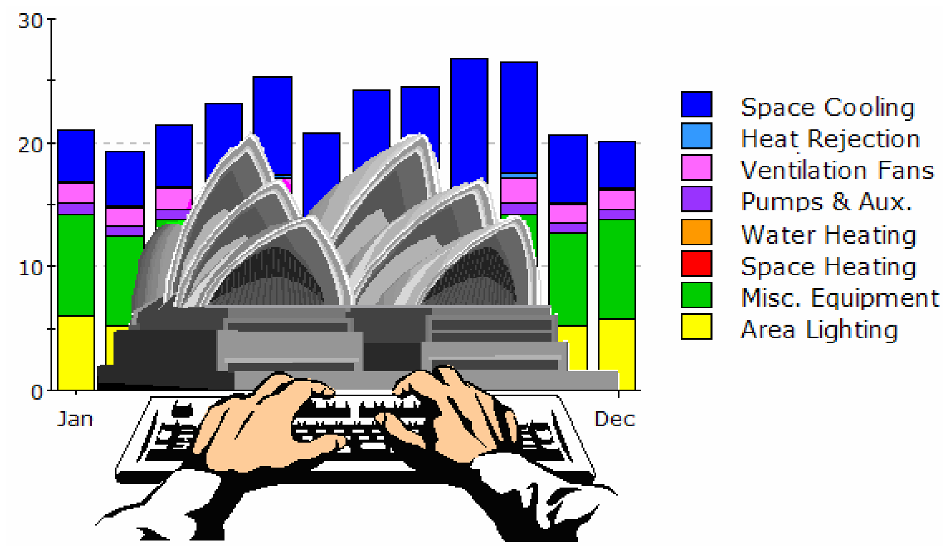


The EDR Design Brief, *Integrated Energy Design*, uses examples to describe the "whole-systems" design process necessary to realize the full potential of energy-efficient buildings. Simulation provides the performance information critical to the "whole-systems" energy-efficient building design process. The *Integrated Energy Design* EDR Design Brief is available on-line or via free download (PDF file) at:
http://www.energydesignresources.com/publications/design_briefs/db_integrated.html

Background Information

Building Simulation

In recent years, the remarkable gains in desktop computing power and simulation tool technology have placed unprecedented analytical power literally at the finger tips of building design professionals. Building designers and developers can now take their intended building designs for a "test drive" before "signing on the dotted line", something previously only possible under the most generous design budgets.



Additional introductory background to building energy use simulation is available in an EDR Design Brief entitled *Building Simulation*. Using examples, it describes what simulation is, how it can be used to greatest advantage, what simulation tools are widely used, and where to go to obtain them or more information about them. The EDR *Building Simulation* Design Brief is available on-line or via free download (PDF file) at:
http://www.energydesignresources.com/publications/design_briefs/db_buildsim.html

eQUEST = "DOE-2" + Wizards + Graphics

DOE-2-derived engine in eQUEST

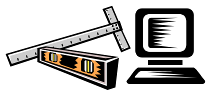
DOE-2 is the most widely recognized and respected building energy analysis program in use today. Although DOE-2 was first released in the late 1970's, it used as starting points earlier simulation tools and methods developed and funded by ASHRAE, NASA, the U.S. Postal Service, and the electric and gas utility industries. During the first half of the 1980's, it continued under DOE support, but decreasing national concern about energy created the need for industry support, which became its principal source of support through much of the 1990's. Through this long, and collaborative history, DOE-2 has been widely reviewed and validated in the public domain. The simulation "engine" within eQUEST is derived from the latest official version of DOE-2, however, eQUEST's engine extends and expands DOE-2's capabilities in several important ways, including: interactive operation, dynamic/intelligent defaults, and improvements to numerous long-standing shortcomings in DOE-2 that have limited its use by mainstream designers and buildings professionals.

eQUEST and Integrated Energy Design

While DOE-2 has long been available for designers to "test drive" the energy performance of their building designs, it has been too difficult and expensive to use for most projects. Imagine instead, a building energy simulation tool so comprehensive that it would be useful to ALL design team members, yet so intuitive ANY design team member could use it, in ANY or ALL design phases, including schematic design. *eQUEST* is well named because it provides something the buildings industry has been looking for, but until now has been unable to find … a sophisticated, yet easy-to-use building energy analysis tool… powerful enough to address every design team member's domain (e.g., architectural, lighting, mechanical) but simple enough to permit a collaborative effort by ALL design team members in ALL design phases.

eQUEST was designed to allow you to perform detailed analysis of today's state-of-the-art building technologies using today's most sophisticated building energy use simulation techniques… without requiring extensive experience in the "art" of building performance modeling. This is possible because eQUEST's DOE-2-derived engine is combined with a building creation wizard, an energy efficiency measure wizard, industry standard input defaults, and a graphical results display module. eQUEST will step you through the creation of a detailed building model, allow you to automatically perform parametric simulations of your design alternatives and provide you with intuitive graphics that compare the performance of your design alternatives. Reliable detailed simulation has never been easier. With eQUEST, you'll be able to provide professional-level results in an affordable level of effort. Imagine being able to evaluate today's newest building technologies, at the speed of today's design process. Well… imagine no longer!

Overview of the Process



eQUEST calculates hour-by-hour building energy consumption over an entire year (8760 hours) using hourly weather data for the location under consideration. Input to the program consists of a detailed description of the building being analyzed, including hourly scheduling of occupants, lighting, equipment, and thermostat settings. eQUEST provides very accurate simulation of such building features as shading, fenestration, interior building mass, envelope building mass, and the dynamic response of differing heating and air conditioning system types and controls. eQUEST also contains a dynamic daylighting model to assess the effect of natural lighting on thermal and lighting demands.

The simulation process begins by developing a "model" of the building based on building plans and specifications. A base line building model that assumes a minimum level of efficiency (e.g., minimally compliant with California Title24 or ASHRAE 90.1) is then developed to provide the base from which energy savings are estimated. Alternative analyses are made by making changes to the model that correspond to efficiency measures that could be implemented in the building. These alternative analyses result in annual utility consumption and cost savings for the efficiency measure that can then be used to determine simple payback, life-cycle cost, etc. for the measure and, ultimately, to determine the best combination of alternatives.

Building Blocks of Simulation

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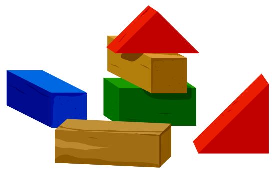


Building simulation requires that a *model* of the proposed building be created… not a physical model but a virtual model… capable of simulating the important thermodynamics of the proposed building. Experienced modelers learn to prize *parsimony* in their work… elegant simplicity capturing the essential details, and no more. Great minds, in addition to your's, have come to appreciate this aspiration — "make things as simple as possible, and no simpler" (Albert Einstein). Toward that end, the following list summarizes essential components, steps, or building blocks, in a how-to description of the process of simulation modeling.

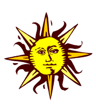
Before "building" anything, including your simulation model, first consider and collect the following…

- **Analysis Objectives (Begin with the End in Mind)…**

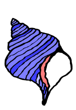
  Try to approach your simulation model with a clear understanding of the design questions you wish to answer using your simulation model. Simplifications that you build into your model will both unclutter your model so you can focus on the important issues and at the same time, limit the questions you can use your model to answer. Experience will teach you how best to strike this important balance for each new project.

- **Building Site Information and Weather Data…**

  Important building site characteristics include latitude, longitude and elevation, plus information about adjacent structure or landscape capable of casting significant shadows on your proposed (or existing) building. Your eQUEST CD (or download) comes with long-term average weather data (~30-year average) for the sixteen standard climate zones in California. For users outside of California, over 650 weather files are available via automatic download (as-needed). Some international locations are also available. Visit http://DOE2.com/download/weather/ to browse available eQUEST weather locations.

- **Building Shell, Structure, Materials, and Shades…**

  eQUEST is interested in the walls, roof, and floor of your proposed building only in so far as they transfer or store heat (or "coolth"). You will need to have some idea of the geometry (dimensions) and construction materials of each of the heat transfer surfaces in your proposed building. Only the most significant need be included (e.g., many modelers omit parapet walls or walls inclosing unconditioned spaces since they do not directly enclose conditioned space). This will include glass properties of windows and the dimensions of any window shades (e.g., overhangs and fins). eQUEST provides users with simple, user-friendly, choices for each of these.

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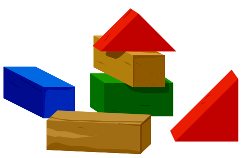
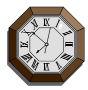
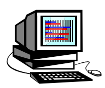


- **Building Operations and Scheduling…**



A clear understanding of the schedule of operation of the existing or proposed building is important to the overall accuracy of your simulation model. This includes information about when building occupancy begins and ends (times, days of the week, and seasonal variations such as for schools), occupied indoor thermostat setpoints, and HVAC and internal equipment operations schedules. eQUEST defaults operations schedule information based on building type.

- **Internal Loads…**



Heat gain from internal loads (e.g., people, lights, and equipment) can constitute a significant portion of the utility requirements in large buildings, both from their direct power requirements and the indirect effect they have on cooling and heating requirements. In fact, internal loads can frequently make large buildings relatively insensitive to weather. More importantly, the performance of almost all energy-efficient design alternatives will be impacted either directly or indirectly by the amount of internal load within a building. Although eQUEST contains reasonable defaults by building type, the experienced user will take care to estimate these as carefully as possible. The industry standard source for these data is the ASHRAE *Handbook of Fundamentals* (published every four years), available through ASHRAE at www.ashrae.org. Recent research into this important topic also is available from LBNL via http://eetd.lbl.gov/EA/Buildings/PubsList.

- **HVAC Equipment and Performance…**

Few model components will have as much influence on overall building energy use and the performance of most energy-efficient design alternatives as will the HVAC (Heating, Ventilating, and Air Conditioning) equipment. It follows that good information regarding HVAC equipment efficiency will be important to the accuracy of any energy use simulation. eQUEST assumes default HVAC equipment efficiencies according to California's Title 24 energy standard. Where possible, equipment efficiencies specific to each analysis should be obtained, e.g., from the building design engineers or directly from equipment manufactures. Most HVAC equipment manufactures now publish equipment performance data on their web sites. Additionally, detailed equipment performance data is also available to the public from the Air-Conditioning and Refrigeration Institute (ARI) via http://www.ari.org/directories/ and from the California Energy Commission (CEC) via http://www.energy.ca.gov/efficiency/appliances/index.html.

Building Blocks of Simulation (continued)

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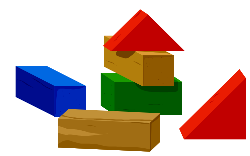
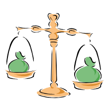


- **Utility Rates …**

A great strength of detailed energy use simulation using eQUEST is the ability to predict hourly electrical demand profiles that can then be coupled with full details of the applicable utility rates (tariffs). eQUEST comes with the principal residential and commercial electric and natural gas rates from the sponsoring California utilities. For California locations (weather file selections), eQUEST defaults the rate selection depending on climate zone and on estimated peak electrical demand. Users outside California must create their own utility rate descriptions using eQUEST's DOE-2-derived Building Description Language (BDL) and save these descriptions as text files for eQUEST's use. The syntax and structure of BDL utility rate files is explained in a file named "BDL Utility Rate Documentation.pdf" found in the "C:\Program Files\eQUEST\Rates" folder. A "Readme.txt" file in the same folder overviews the procedure.

- **Economic Parameters …**



Energy Design Resources concurs with a growing chorus including the U.S. DOE's Federal Energy Management Program (FEMP) and the National Institute of Standards and Technology (NIST) in recommending life-cycle economics above simple payback methods of economic analysis. Because energy efficiency investments usually return benefit over the entire life of the building or system, considering their life-cycle impact is most appropriate. Imagine selecting a variable rate mortgage based on no more information than the initial interest rate. While few would be comfortable ignoring the longer-range terms of any loan or investment, it is common practice among building developers and designers to recommend building efficiency investments with equal shortsightedness. A summary discussion of life-cycle costing with examples, including a comparison to simple payback is available from http://www.DOE2.com/Download/LCC/LCC-Smy2.pdf. While life-cycle economics have recently been added to eQUEST, several free life-cycle cost tools and resources are also available to the interested user. These include the *Building Life-Cycle Cost Program* from NIST (free at http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html), and *User-Friendly Life-Cycle Costing*, an Excel® form of the widely used NIST/BLCC methodology (free at http://www.doe2.com). Energy Design Resources also offers *eVALUator*, user-friendly life cycle economics tool that goes beyond traditional life-cycle cost tools by including payroll and productivity data, lease rates, and occupancy rates. *eVALUator* is available free at http://www.energydesignresources.com/tools/evaluator.html.

Data Requirements

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The images below illustrates in detail, the type of data you should either assemble prior to developing your simulation model, or confirm in the course of your modeling, and by what point in the design process each building datum (characteristic) typically becomes finalized.

Item	*Source*	*Schematic*	*Design Development*	*Construction Documents*
Architectural				
building and zone areas	plan sheets	x	x	x
envelope construction materials	wall sections		x	x
surface areas (by orientation)	building elevations	x	x	x
fenestration areas (by orientation)	building elevations	x	x	x
fenestration u-value & SC	window schedule			x
	or specifications			x
Mechanical				
HVAC zoning	HVAC plans		x	x
design flow rates	HVAC plans		x	x
equipment descriptions	equipment schedules			x
	or specifications			x
control sequences	control diagrams			x
	or specifications			x
Electrical				
lighting equipment	lighting layout		x	x
	or lighting schedule			x
Internal Loads				
peak occupancy (by zone)	owner, operator	x	x	x
peak lighting (by zone)	lighting plans		x	x
peak equipment (by zone)	mech or owner		x	x
Operations				
per zone:				
occ, lights, equip schedules	owner or operator	x	x	x
thermostat schedules	owner or operator	x	x	x
per terminal system:				
outside air operations	HVAC equip schedule			x
hot & cold deck temperatures	HVAC equip schedule			x
fan schedules	owner or operator	x	x	x
fan kW	HVAC equip schedule		x	x
per primary system:				
lock-out schedules	control sequences			x
Economic				
utility schedules (all fuels)	utility representative	x	x	x
equipment costs	designer or manufacturer		x	x
life-cycle cost parameters	owner	x	x	x

Data Requirements (continued)

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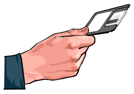

The same list of data (from previous page) is organized below to help the modeler make and manage data collection assignments to other design team members. Date columns allow more detailed data to be targeted as it becomes available/necessary.

Modeling Information Request
Project Name / Date

assignment

assignment	DATES *date1*	*date2*	*date3*	INFORMATION	
				ARCHITECTURAL	
	❑			floor plans	space layout/areas, surface orientations
	❑			elevations	surface areas (windows, doors)
		❑		building/wall/roof sections	materials composition
	❑			site plans	adjacent structures and landscape
		❑		roof plans	skylights and overhangs
	❑			gross area & net (conditioned area)	
				ENVELOPE MATERIALS	
		❑		glazing shading coefficient, u-value, frame type, interior shading	
		❑		u-values: wall, roof, ceiling, skylight, slab & spandral	
				MECHANICAL	
		❑		HVAC plans	approximate HVAC zoning layout
	❑			equipment types	
		❑		approx equipment sizes, design conditions, & efficiencies	
		❑		anticipated control sequences	
				ELECTRICAL / INTERNAL LOADS	
		❑		lighting plans	
		❑		lighting power density (by HVAC zone)	
		❑		design illuminance (by HVAC zone)	
		❑		peak occupancy (by HVAC zone)	
		❑		peak equipment (by HVAC zone)	
				OPERATIONS	
				per HVAC zone	
		❑		occupancy, lights & equipment schedules	
		❑		thermostat settings and schedules	
				per air handler	
		❑		anticipated coil leaving air temperatures	
		❑		minimum outside air	
		❑		fan schedules	
		❑		anticipated fan static & efficiency	
				central plant (if applicable)	
		❑		chilled & hot water temperatures	
		❑		equipment control sequences	
				ECONOMIC	
			❑	base case first costs (for equipment & systems affected by ECM's)	
			❑	ECM first costs	
	❑			applicable & optional utility rates	
				POTENTIAL ECM's	
	❑			envelope	
	❑			lighting	
	❑			mechanical	

HVAC Zoning

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HVAC zoning recognizes that load profiles seen by different spaces in a building differ. Identifying those areas with similar load profiles and grouping them under the same thermostat control improves comfort and may reduce energy. For example, imagine measuring indoor air temperatures at many locations throughout a building during hours when the HVAC fans are turned off. Internal gains, solar gains, and envelope gains/losses would cause the temperatures to vary with time. If, after some number of hours or days, you carefully examined the temperature histories, grouping together those that shared similar profiles, you would have effectively grouped together those areas of the building that share similar load characteristics. Each such area or "zone" could, therefore, be adequately controlled by a single thermostat. In other words, HVAC thermal zoning seeks to group together those areas (rooms) in a building that share similar load and usage characteristics, for purposes of control. Of course, this imagined procedure is not how HVAC engineers actually zone any building. Rather, the rules listed below are followed. The same rules apply when zoning a simulation model.

- when modeling existing buildings, refer to the actual zoning indicated by the HVAC plans, if available
- for new buildings and when simplifying the zoning of an existing building consider:
- magnitude and schedule of internal loads
- magnitude and schedule of solar gains
- schedule of fan system operations
- outside air requirements
- intended efficiency measures (ECM's)
- location of thermostats called out on the HVAC plans

In general, provide:

- one exterior zone per major orientation (12 to 18 feet deep)
- one internal zone per use schedule
- one plenum zone (if plenum returns) for each air handler to be modeled separately
- one zone each for special uses (e.g., conference rooms, cafeterias, etc.)
- separate ground and top floor zones

Currently, eQUEST provides the user with two automatic zoning schemes, one-zone-per-floor, and simple core-vs-perimeter zoning. Based on this user selection, eQUEST will automatically zone your model for you.

Keeping it Simple… but not too simple

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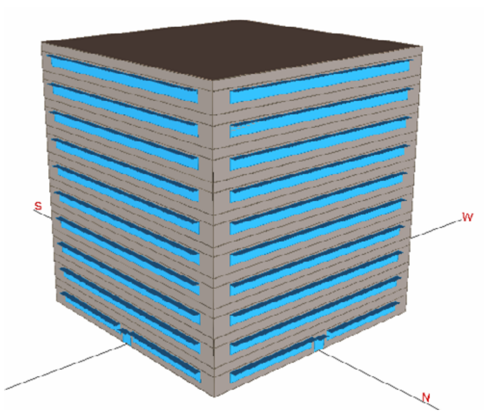
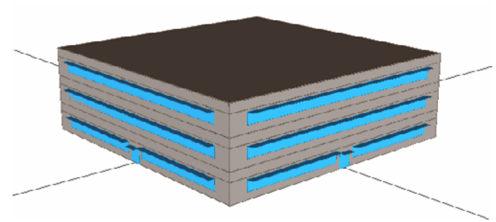
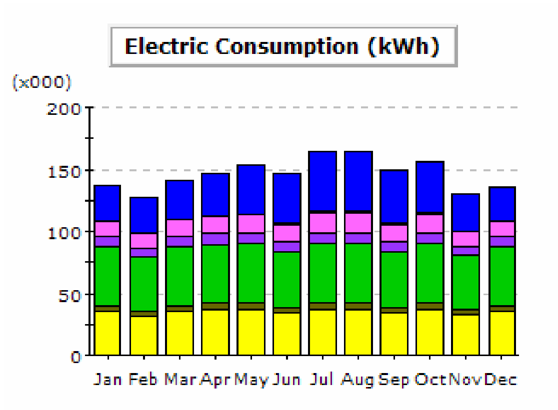
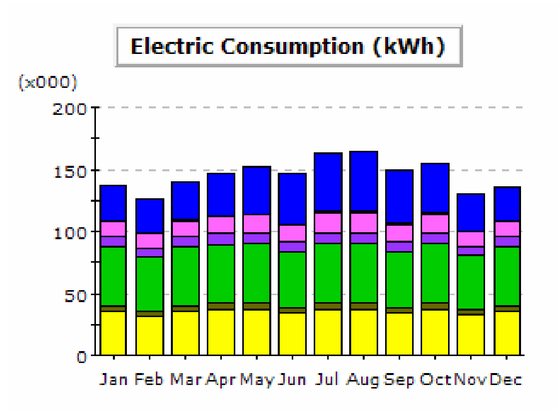
One of the most important early lessons new simulation users must learn is how to identify and avoid unnecessary detail and complexity in their simulation models. If you think about it, all simulation modeling relies on *abstraction*, i.e., simplifying our view of the model to capture only the essence of what matters. Good advice is… "Think complicated but model simply" and "Complicated models have no divine right of acceptance" (Pidd, M. 1996. "Five Simple Principles of Modeling", in *Proceeding s of the 1996 Winter Simulation Conference*.) Consider the following examples.

10-Storey High rise structure — How many floors should be modeled to predict the energy use adequately?... To evaluate preferred design alternatives? The answer may seem obvious: ALL of them, but… that does not mean all floors have to be modeled *explicitly*. Compare the results presented below from simulation runs made of the same building, using "Floor Multiplies" to approximate the full 10-story structure.









Keeping it Simple… but not too simple

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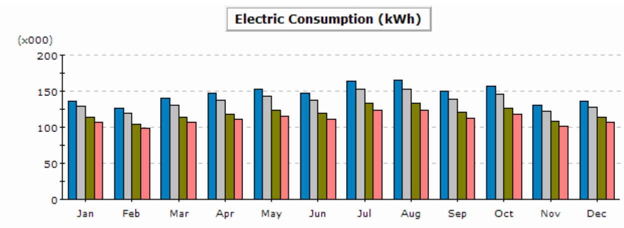
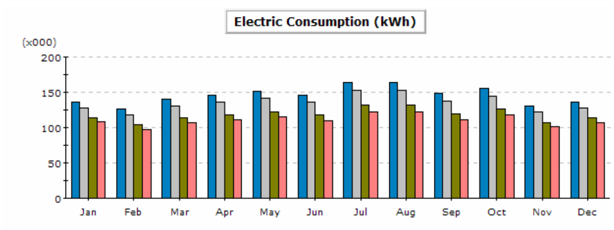
Many times, a more important concern for a model's adequacy is whether it can accurately predict the benefit (impact) due to design alternatives. The bar graphs below present monthly total electric use for each of four runs: 1) baseline (minimum code compliance), 2) window shading via horizontal overhangs, 3) side daylighting, and 4) high efficiency chiller (each run "on top of" the preceding measure). The upper graph is from the 10-story model. The lower graph is from the 3-story model using a multiplier on the middle ("typical") floor.

Results for 10-story model

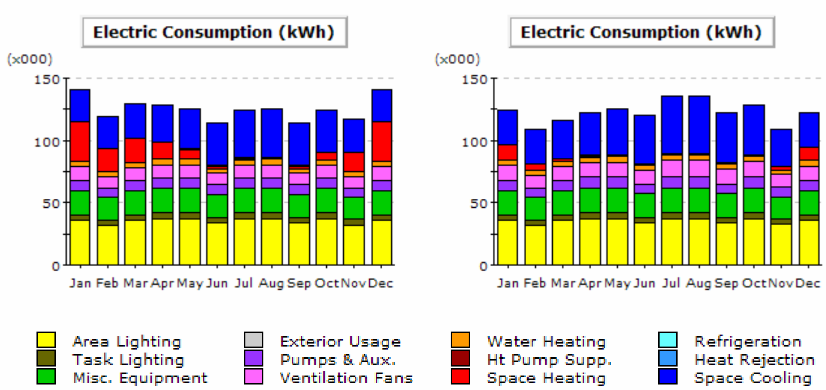


Results for 3-story model (with multiplier)



On the other hand, it is possible to over simplify a model, i.e., the results are no longer consistent with more complete or complex versions of the same model. The graph below presents results from the same building. The graph on the left presents results from a standard core vs perimeter HVAC zoning scheme while the results on the right are for the same building assuming one zone per floor. Notice that the largest difference between the two models is that the single zone-per-floor model significantly under-predicts heating electric use.

Standard Zoning **Over-Simplified Zoning**



Simplifying HVAC Zoning

In an effort to keep a simulation model as simple as possible, experienced modelers often find it possible and desirable to simplify the actual zoning (i.e., combine zones). Simplifying the HVAC zoning in a model will generally make the model smaller, and simpler to manage and maintain.

A host of reasons may cause the actual HVAC zoning to be more detailed than indicated by the rules above, or required to adequately represent the necessary thermodynamic conditions. These would include,

- Tenant and leasing flexibility may dictate that the building be divided up in a manner that facilitates flexible leasing of space assignment requirements.
- Ceiling space limitations or manufacture terminal equipment size limitations may cause a larger number of smaller units to be specified than strictly required by the rules on the previous page.
- Acoustical privacy requirements may separate supply to adjacent areas.
- Code requirements may separate supply to adjacent areas (e.g., separate return for smoking areas).

Common ways that modelers simplify the zoning and size of their models include the following.

- In multiple floor high rise-type buildings, intermediate "typical" floors are modeled as only one floor in the simulation model and a floor multiplier is applied in the model to permit the modeled typical floor to represent the true, larger, number of floors.
- All actual perimeter zones along similar orientations are combined into one zone with the same common orientation. This assumes that all of the perimeter zones so combined behave in a very similar manner.
- Separate core zones are usually combined, again, on the assumption that the separate core zones actually behave in an indistinguishable manner.

An important consequence of this type of zoning simplification is that the number of modeled HVAC air-handler systems is often smaller than the number of actual HVAC systems in the actual building. In effect, two or more actual HVAC systems are combined in the model, i.e., represented by a "composite" system whose capacity is equal to the sum of the actual systems, and whose performance characteristics (i.e., efficiency) are the average of the actual systems.

Computational Steps in eQUEST

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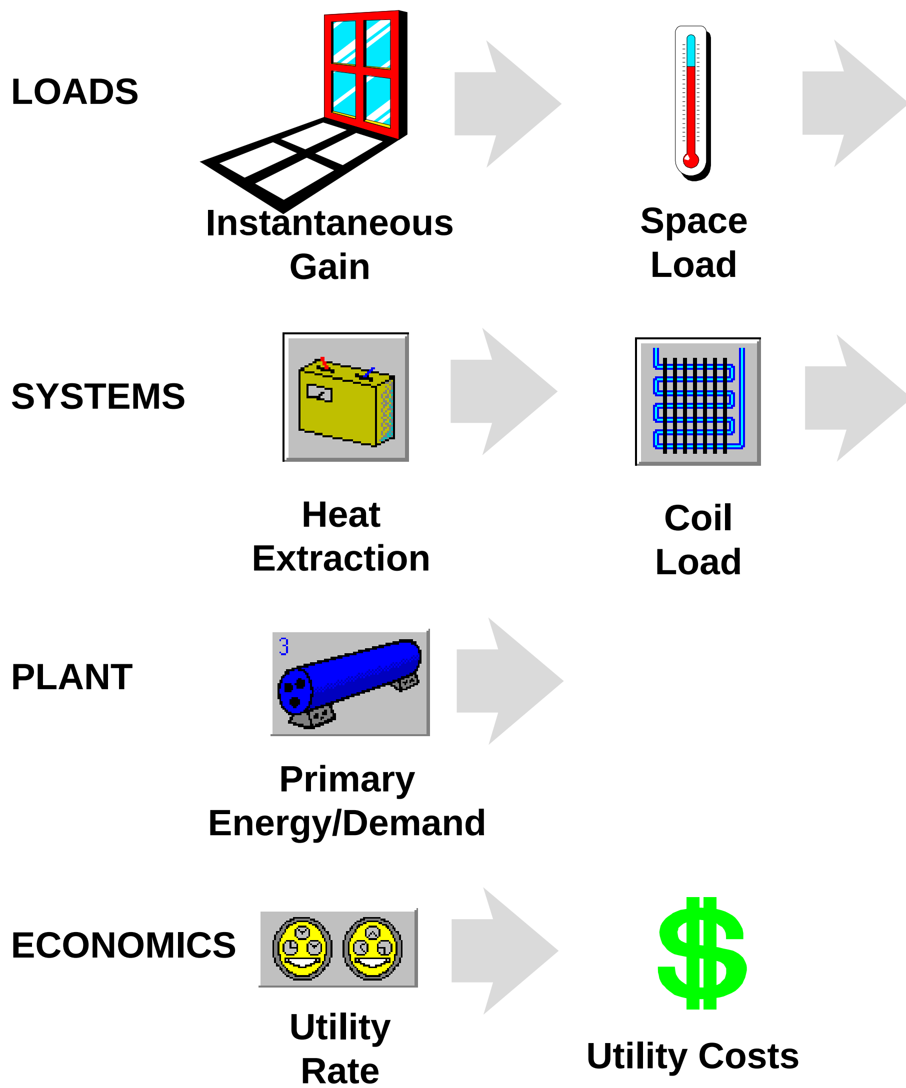
To better understand the results and limitations of eQUEST's DOE-2-derived engine, it is helpful to be familiar with the generic computational steps DOE-2 has always gone through in its simulation. The sequence illustrated below depicts seven broad steps of calculations performed hourly by eQUEST. Note that these seven steps occur within four overall areas of the program, Loads, Systems, Plant, and Economics. Understanding this sequence is important to understanding the detailed reports produced by eQUEST's DOE-2-derived engine. See the Detailed Reports section of this tutorial for a brief overview of the available detailed reports. eQUEST produces intuitive graphical summary results reports. See the Graphical Reports section for more information about eQUEST's summary reports.



Types of Heat Transfer Surfaces in DOE-2

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To better understand how an eQUEST simulation views your simulation problem, it is useful to recognize that DOE-2 has always had only four types of heat transfer surfaces on its "palette" to use to model the various types of heat transfer surfaces in your actual (proposed) building:

- light-transmitting surfaces, e.g., windows, glass block walls, sliding glass doors, skylights, etc. - DOE-2 thinks of all of these as the same type of heat transfer surface, i.e., a WINDOW.

- exterior surfaces, e.g., opaque exterior surfaces such as exterior walls, roofs, and floors, etc. - DOE-2 thinks of all of these as the same type of heat transfer surface, i.e., an EXTERIOR-WALL.

- interior surfaces, e.g., opaque interior surfaces such as interior walls, interior floors, and interior ceilings, etc. - DOE-2 thinks of all of these as the same type of heat transfer surface, i.e., an INTERIOR-WALL.

- underground surfaces, e.g., underground surfaces such as basement floors & walls, & slab-on-grade - DOE-2 thinks of all of these as the same type of heat transfer surface, i.e., an UNDERGROUND-WALL.

eQUEST automatically provides its DOE-2-derived simulation engine with the input descriptions it needs, based on your easy-to-understand building description.

Types of Internal Loads

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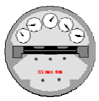
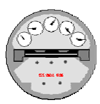
To better understand how eQUEST views your simulation problem, it is useful to recognize that there are three broadly different categories of internal loads.

1) loads seen by BOTH a thermostat and the utility meter — examples include: receptacle or "plug" loads (e.g., electric and electronic office equipment), task lighting, ambient)i.e., over-head) lighting, etc.

2) loads seen ONLY by a thermostat, not by the utility meter — examples include: occupants, process loads, propane-powered fork lifts in a warehouse, etc.



3) loads seen ONLY by the utility meter, not by any thermostat — examples include: outdoor parking lot or sign lighting, lights and plug loads in exhausted spaces

eQUEST allows users to model any of these, but supports only the more common load examples from within its Wizards.

Tour / Overview

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Start eQUEST: After installing eQUEST, begin your eQUEST session by doubling clicking on the eQUEST icon from your desk top, from your Start button (Start / Programs / eQUEST / eQUEST 3), or from Windows Explorer (the default location is "C:\Program Files\eQUEST 3").

Create a new building description using eQUEST's Wizards: From the Startup Options dialog, select "Create a New Project via the Wizard" (the default), then press OK. You are then asked which wizard you'd like to use, the Schematic Design Wizard, or the Design Development Wizard. Select to use the Schematic Design Wizard. Review or modify as many of the Schematic Design Wizard's inputs as you prefer. The wizard covers information regarding:

- general project information including building type, overall size and principal HVAC system type
- overall building geometry including footprint, floor-to-floor distance and zoning pattern
- building constructions types for walls, floors, roofs, etc.
- window and door sizes, distribution by orientation, glass type and overhangs
- "activity areas" by fraction of total building area and distribution — used to set default values for occupant density, other internal loads and ventilation requirements
- building operations schedules for occupancy, lights, and HVAC equipment
- type and area assignment for principal and alternate HVAC system types
- air-side and water-side design flow rates, capacities, power and efficiencies, setpoints, and control options
- domestic water heating type, demands, capacity, and efficiency

Press Previous Screen or Next Screen at any time to backup or skip forward through the wizard input screens. Press Finish at any time to conclude the Schematic Design Wizard.

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Use eQUEST's Schematic Design Wizard to modify an existing model: You can return to eQUEST's Schematic Design Wizard, modify your wizard inputs and regenerate your building model, provided that the original building model was generated by the wizard. Any edits made directly to the building model (see "Review or edit detailed project inputs" below) will NOT be reflected in the Schematic Design Wizard.

If you wish to save your original building model prior to making changes, then save the model by clicking the toolbar button, selecting File/Save or pressing Ctrl-S before launching the wizard. Launch the wizard by clicking on the Schematic Design Wizard button on the eQUEST analysis tool bar (near the top of the eQUEST screen). If you wish to save your modified model under a new file name, then visit the first wizard screen and modify the Project Name field prior to selecting the Finish button from the wizard. This will cause the modified model to be saved using the new project name.

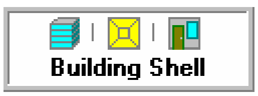
Use eQUEST's Energy Efficiency Measure (EEM) Wizard to quickly, easily and reliably explore your preferred design alternatives: After creating a new building description (i.e., using the Schematic Design Wizard) or loading an existing building description (previously created using the Schematic Design Wizard), you can launch the EEM Wizard to quickly describe up to ten design alternatives to your "base" building description. You can then automatically simulate any or all of these alternative cases and view the simulation results as either individual or comparative graphs. Advanced design simulation was never so quick, easy and reliable.

Perform a simulation: From the eQUEST analysis tool bar (near the top of the eQUEST screen), press the Run Simulation button to perform an annual simulation of the base building design description and/or of any of your design alternatives.

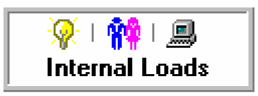
Review simulation results: From the eQUEST analysis tool bar, press the Results Review mode button to view graphic simulation output reports. From the bottom of the results tree diagram (left side of the Results View screen) select the Projects / Runs tab, then select one or more projects for which you wish to view results. Also from the bottom of the results tree diagram, select the Reports tab, then select single run or comparison reports, as preferred.

Review and/or edit detailed project inputs (advanced users): If desired (<u>not required</u>), review or even edit the complete building model prepared by eQUEST based on the wizard inputs and defaults. The model is organized into the following categories of input which are accessible from the associated icon on the project navigation bar at the top of the eQUEST Project View screen (press the Project View mode button on the analysis tool bar to select the Project View screen):

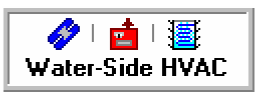
overall project info; design day and annual weather data; project report requests



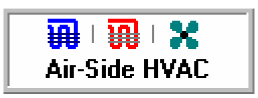
zoning; geometry and contructions for spaces, walls, windows and doors



internal loading and schedules for people. lights and equipment



water-side distribution and primary equipment



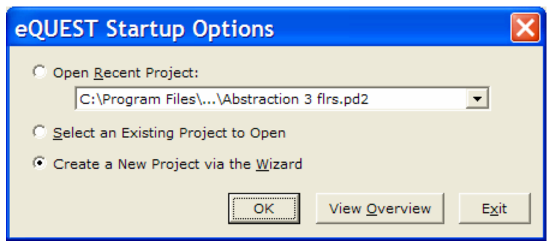
air-side distribtuion and secondary equipment

meter/sub-meter assignments; utility rate tarriffs

Accessing the detailed view of the project data will permit more detailed building descriptions; however, <u>reviewing or modifying detailed project inputs is not recommended for users unfamiliar with DOE-2</u>. New users and users unfamiliar with DOE-2 should use the eQUEST Design Wizards to modify or refine project descriptions.

Schematic Design Wizard

Begin eQUEST by doubling clicking on the eQUEST icon from your desk top, from your Start button (Start / Programs / eQUEST / eQUEST 3), or from Windows Explorer (the default location is "C:\Program Files\eQUEST"). The Startup Options Dialog is presented. Select "Create a New Project via the Wizard" (the default) and press OK.



eQUEST Startup Options Dialog

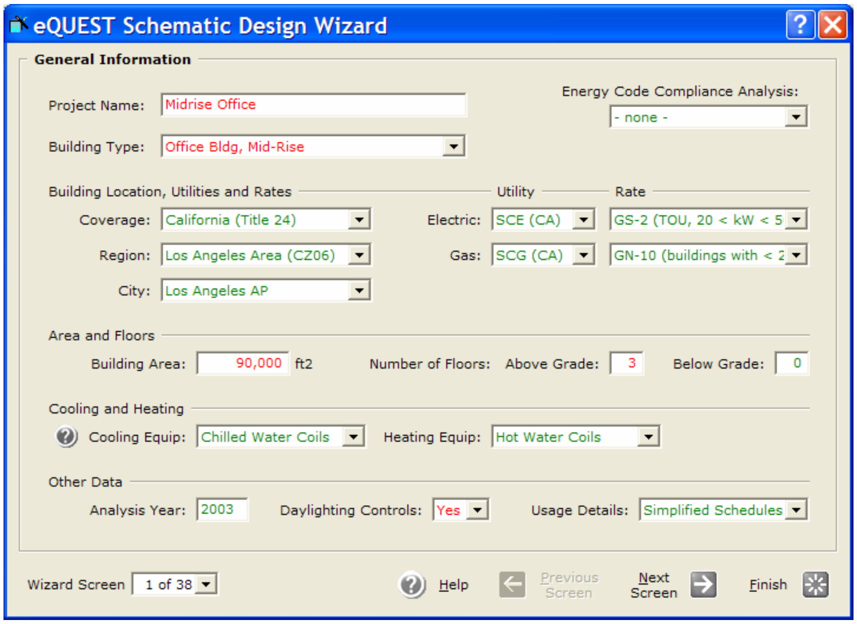
NOTES:

Three startup options are available:

1) Open a recent project. The list is maintained for projects on the local machine, listed in reverse-chronological order (most recent first). This list is maintained across program updates and re-installations.
2) Open an existing project. Selecting this option enables the user to browse his/her machine/network for an eQUEST input file. Subsequent SAVEs will store files to the "browsed" location.
3) Create a new project via the Wizards. This is the default option and eQUEST's main advantage over other modeling tools. Use this startup option to create your new eQUEST models "from scratch". The pages that follow illustrate the use of the Schematic Design Wizard.

Select to run the Schematic Design Wizard…

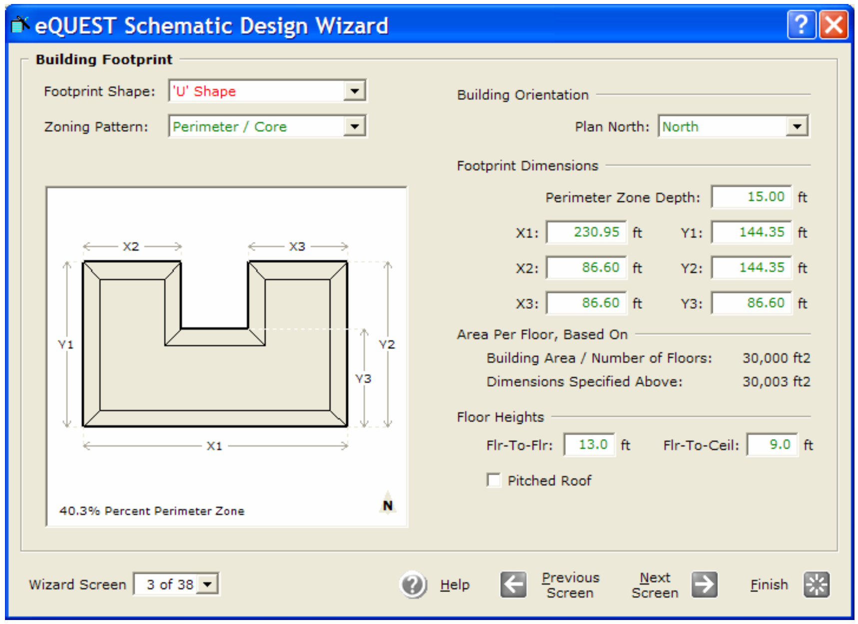
General Information



NOTES:

1) Project Name. Select a project name - used to name the project files and project folder.
2) Building Type. This selection is used to set defaults for most wizard inputs that follow, e.g., building size, HVAC system type(s), etc. <u>Changing this selection will cause user inputs entered "downstream" to be reset.</u>
3) Weather file Coverage. There are three choices: "California/Title24" (limits the choices to the 16 California climate zones), "All eQUEST Locations" (provides U.S.-wide coverage), and "User Selected" (allows the user to browse his/her machine for any DOE-2 weather files). If the selected weather file is not on the local hard drive, when the simulation is initiated, eQUEST asks permission to initiate an automatic download of the weather file from the DOE-2.com ftp site.
4) Utility/Rates. For California/Title24 coverage, eQUEST automatically selects the utility and rate based on the selected region and building size. Custom (user provided) rates can be added to the folder: C:\Program Files\eQUEST\Rates. See the Utility Charges for more info.
5) Number of Floors. <u>For # floors above grade > 3, eQUEST models only 3 floors and uses a multiplier on the middle (typical) floor.</u>
6) Cooling/Heating. Selecting the coil types will default the available HVAC system types and plant equipment (if any).
7) Daylighting. Enables/disables daylighting-related screens.
8) Usage Details. Simplified are On/Off step function schedules, Hourly Endue Profiles allow hour-by-hour variation of usage profiles.

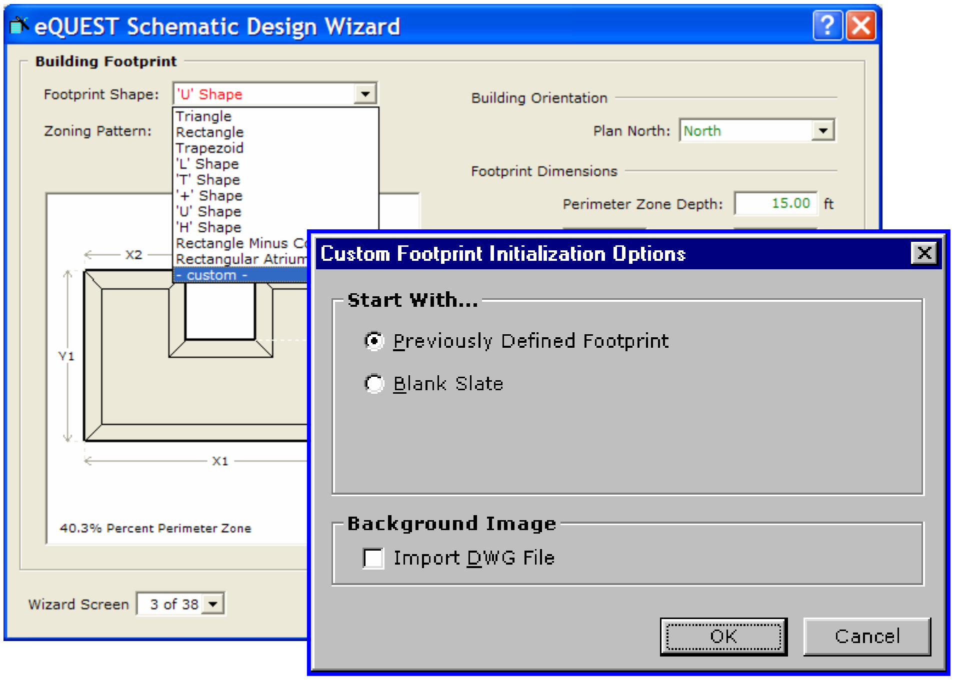
Building Footprint



NOTES:

1) Footprint Shape. Select a preferred standard building footprint shape, then edit the footprint dimensions, or select "custom" and either draw a custom footprint from scratch or customize one of the standard footprints. Note that two floor areas are reported: the first based on Bldg Area / # Floors (from previous screen) and the second based on the dimensions entered on this screen. Currently, the selected footprint shape applies to all floors in the project. This limitation will be relaxed in the future.
2) Zoning Pattern. Currently, there are three options: perimeter-vs-core, one-per-floor, and "custom". For perimeter-vs-core zoning, use Perimeter Zone Depth to alter the depth of all perimeter zones. Alternately, select "custom" and either draw a custom zoning pattern from scratch or customize one of the standard zoning patterns (see below). More detailed automatic zoning options will be available in the future.
3) Building Orientation. Note that this input describes the direction that "Plan North" faces, i.e., this is the compass direction that the top of the plan sheet actually faces. Confirm that you have selected this correctly by referring to the North arrow (true north) on the building footprint diagram.
4) Floor Heights. Note that these heights apply to all floors in the project.
5) Pitched Roof. Use this to specify a hip roof (accepts only Roof Pitch in degrees, and roof overhang projection). Gable ends and other options will be added in the future.

Customized Building Footprint

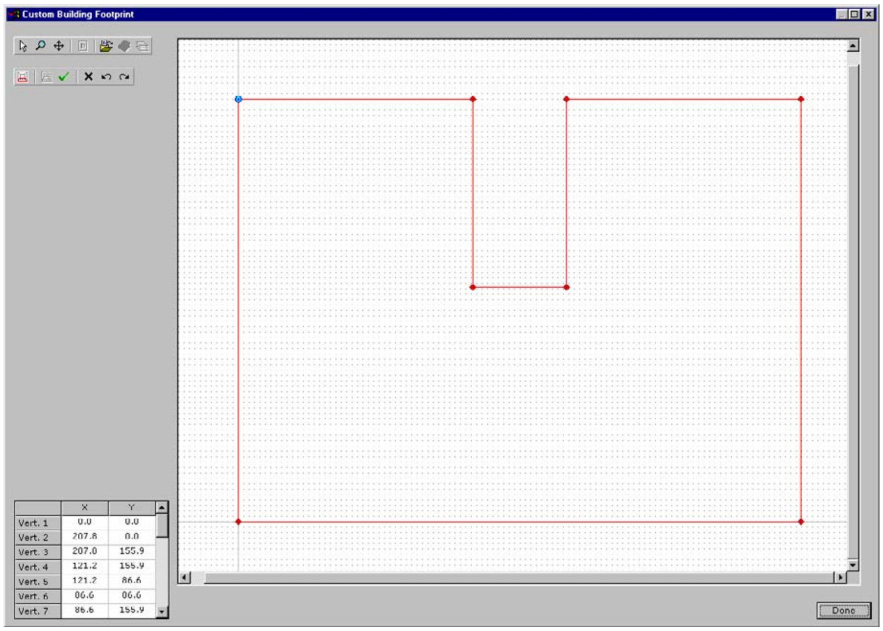


You can customize an already-selected building footprint shape (the example on this page), or you can start from scratch ("Blank Slate", an example is presented on page 24) to create a completely custom building footprint shape.

NOTES:

1) Footprint Shape (standard shapes). To customize a previously selected "standard" building footprint (any of the choices on the Footprint Shape pull-down list), from the Building Footprint screen, pull down the Footprint Shape list and select any of the standard shapes.
2) Footprint Shape (custom shapes). Having first selected a preferred standard shape and having modified its dimensions as desired, pull down the Footprint Shape list again and select "-custom-".
3) Custom Footprint Initialization Options. After selecting "custom" from the Footprint Shape list, an initialization dialog will appear. To customize a standard building footprint shape, select Start With… "Previously Defined Footprint". This will cause the Custom Building Footprint screen to be presented (see next page).

Customized Building Footprint (cont.)



NOTES:

1) Drawing Control Buttons. Use these buttons in the upper left area of the screen to select vertices, to zoom, and to pan.

2) Zoom Button. Select the zoom button then use the left mouse button to make a vertical "stroke" on the drawing image. A downward mouse stroke zooms back. An upward stroke zooms in. Zoom back to give some extra room to customize the standard shape. Pan as preferred.

3) Select vertices. Select the pointer button, then single click on any existing vertex in the drawing (do not double click). Vertices will appear in one of three colors:
   - red (i.e., not the currently selected vertex),
   - light blue (i.e., currently selected and ready to copy), or
   - yellow (i.e., currently selected and ready to move).

   Left mouse clicks toggle the selected vertex between light blue and yellow.

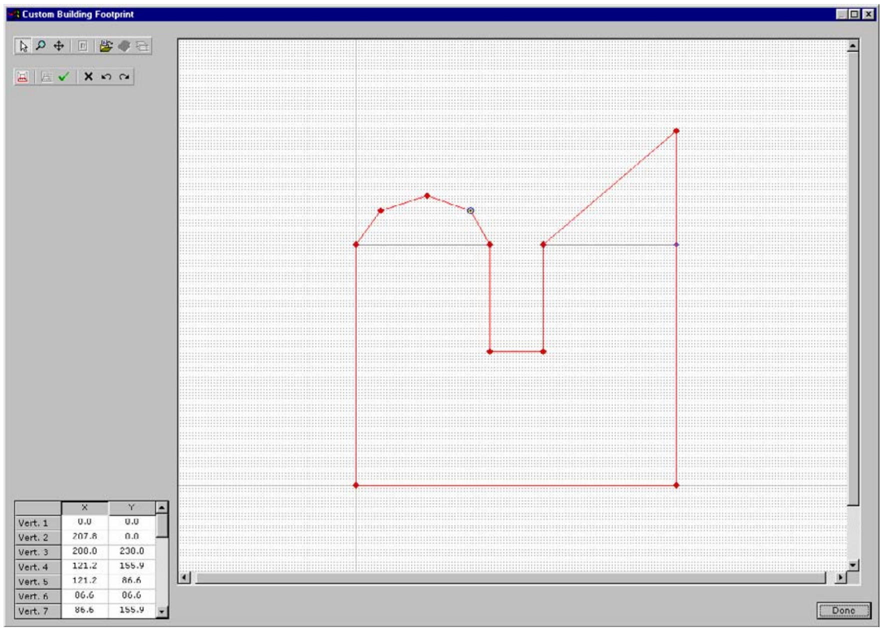
4) Move an existing vertex. Select any vertex. Make it yellow (by single clicking as needed… do not double click). Drag the yellow vertex to a new preferred location.

5) Create a new vertex (same as copy an existing vertex). Select any vertex. Make it light blue (by single clicking as needed… do not double click). Drag the light blue vertex to a new preferred location.

6) Repeat steps 2 through 5 as preferred. See notes and example image on the following page.

eQUEST

Customized Building Footprint (cont.)

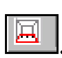


NOTES:

Rules to know regarding custom building footprints in eQUEST:

1) Maximum Number of Vertices. 120 vertices max for any one polygon.
2) Order to Create Vertices. Vertices are enumerated (and should be created) in counter-clockwise order.
3) Legal Polygon Shapes. A building footprint polygon cannot have any cutouts (i.e., no donut shapes), no line segments can cross another segment in the same polygon (e.g., no figure eight shapes).

OTHER NOTES:

4) Edit Control Buttons . Use these buttons in the upper left area of the screen to delete the currently selected vertex, to undo, and to redo the last edit operation.
5) Vertex Grid Control (spreadsheet). Use the vertex grid control in the lower left hand area of the screen to directly edit the numeric data for each vertex. This can be useful to "clean up" some vertex locations that didn't line up satisfactorily.
6) View Drawing Tablet Properties . Select this button to specify or change drawing tablet properties, e.g., view extents, grid On/Off, grid resolution, snap priority.

Importing DWG Files for Custom Footprints

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Alt. Schedules
HVAC Sys Type
Zone Temp. & Air
Packaged Equip
HVAC Fans
Fan Sch #1
Fan Sch #2
Zone Ht & Econo
Deck Resets
WSHP Equip
Chillers
Cooling Towers
CHW Control
Boilers
HW Control
DHW Equip
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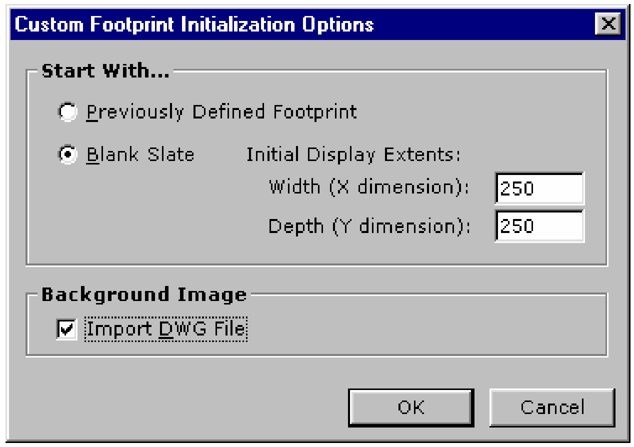


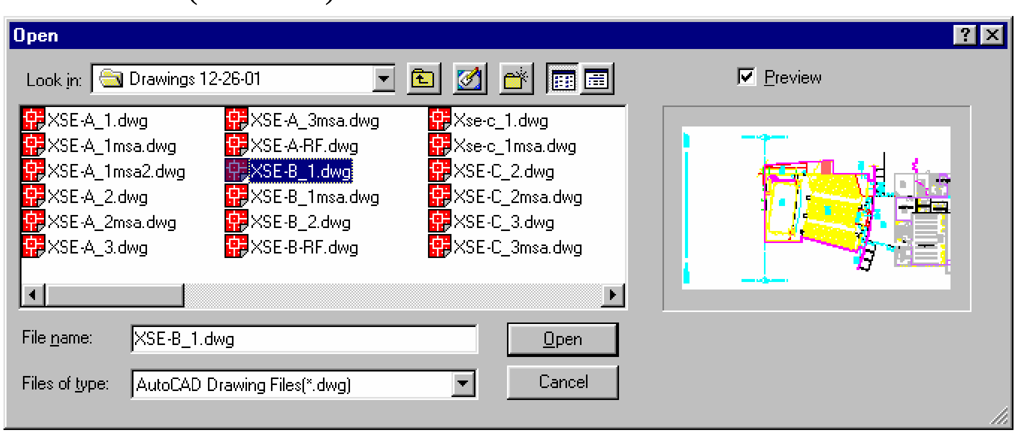
Besides customizing an already-selected building footprint shape (page 21), you can start from scratch ("Blank Slate") to create a completely custom building footprint shape. Additionally, you can base your custom footprint on any DWG file by first importing it, then "tracing" around it.

NOTES:

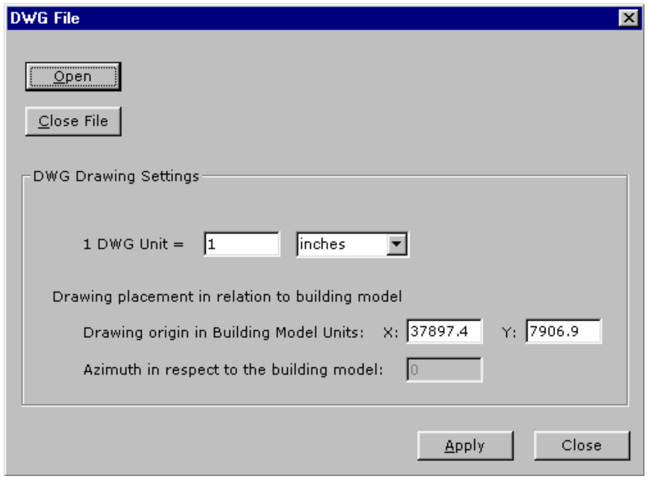
1) Custom Footprint Initialization Options. After selecting "-custom-" from the Footprint Shape list, an initialization dialog will appear. To draw a completely custom building footprint shape, select Start With… "Blank Slate".

2) Initial Display Extents. Specify the extents (in feet) of the drawing area of the Custom Building Footprint dialog screen. These can easily be changed once the drawing "tablet" is opened using the (see the View Drawing Tablet Properties button on the Custom Building Footprint dialog).

3) Background Image. Place a check mark in Import DWG File. This will cause an Open dialog to be presented. Use this to locate and import a DWG file (see below).



Importing DWG Files (cont.)



After selecting a DWG file from the Open dialog, the DWG File Open dialog will be presented (above).

"1 DWG Unit =". This is the unit conversion used in the original DWG file. It is normally sufficient to allow the settings for DWG units to default (e.g., "inches").

"Drawing origin in Building Model Units". This entry should be the world coordinates of a point in the DWG file that the user wants to coincide with the origin of the eQUEST drawing screen (i.e., eQUEST building origin). The origin of the eQUEST building will be the point on the Custom Building Footprint screen where the vertical and horizontal axes intersect (i.e., X=0, Y=0).

If the user can first open the DWG file in a CAD program, a point can be selected (e.g., the lower left hand corner of the building in plan view) as the building origin and its coordinates relative to the world coordinate system determined. The X and Y values for these world coordinates should be entered at "Drawing origin in Building Model Units".

If a user does not have a CAD program that can read a DWG file (e.g., AutoCAD™), allow this value to default.

Select Apply then Close to import the DWG file.

Importing DWG Files (cont.)

After importing the DWG file, if no image is apparent on the screen, the drawing origin coordinates (entered or defaulted) probably placed the DWG image outside the current viewing extents. To find the imported image, zoom out using the button (perhaps "way out"!). If you had to zoom "way out", the imported drawing may appear as a relatively small object.

In most cases, it will be necessary to align the DWG image with the origin on the drawing screen. To move it to the origin of the drawing screen, pan the DWG image only by selecting both the "DWG-only" button and the pan button, then pan as required.

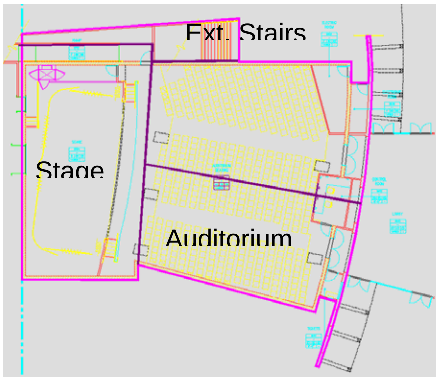
IMPORTANT NOTE!…

As you pan the DWG image to align with the eQUEST drawing screen origin, it may become necessary to readjust (i.e., zoom) the drawing screen extents. To readjust the drawing screen extents, you will want to turn OFF the DWG Drawing Only button first, then select the zoom button and adjust the zoom of the drawing image, as preferred. If you need to pan the DWG image further (to get it to align with the eQUEST drawing screen origin), select both the and the buttons again, then continue to pan as required. When you are finished adjusting the position of the DWG image relative to the drawing origin, remember to turn off the button.

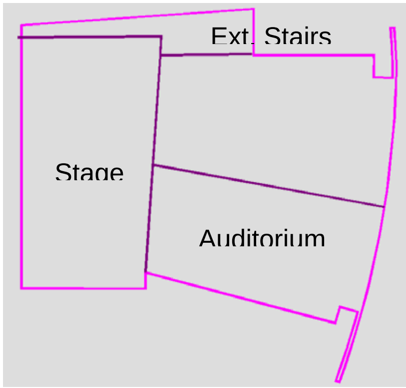
If you inadvertently use the button and the button together (i.e., by forgetting to turn off the button before zooming), this will adjust the scale of the DWG image!… which may not be what you intended. To repair an inadvertent change of scale to the DWG image, revisit the DWG Drawing Properties dialog by selecting the button, then reset the scale value for "1 DWG Unit =" to its original value (i.e., 1.0).

eQUEST

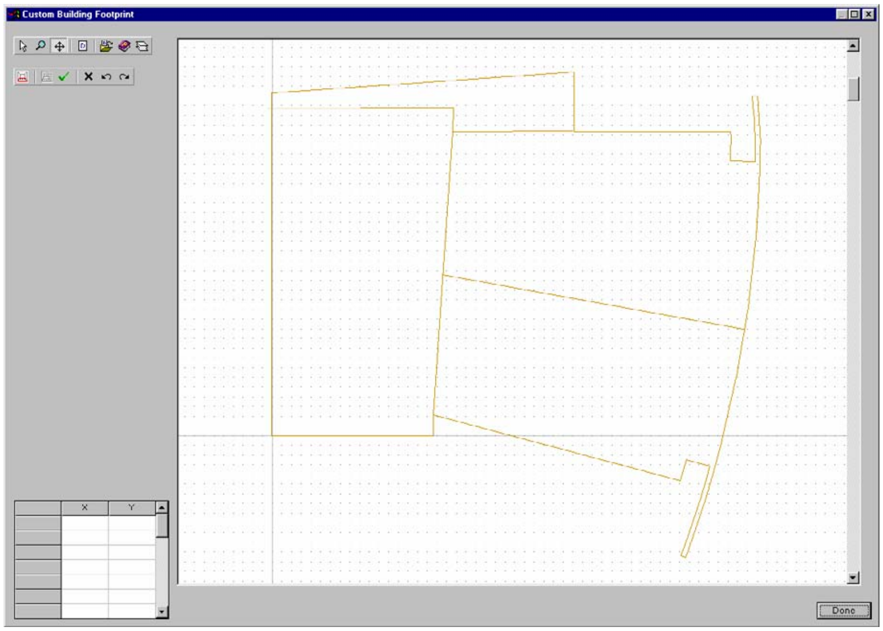
Importing DWG Files (cont.)



DWG file with exterior walls and zone boundaries traced (magenta)



Outside wall and zone boundary traces saved as separate DWG file



Separate DWG file imported with footprint and zone boundaries only

Experienced CAD users may wish to create a DWG file containing only the essential information need by eQUEST. This can be done by first tracing around the building image in a CAD program (e.g., using the PLINE command) and tracing the preferred HVAC zone boundaries then saving the footprint and zone boundaries as a separate DWG file (e.g., via the WBLOCK command in AutoCAD™)

The images on this page illustrate a DWG drawing that was first traced to identify only the building shell and HVAC zone boundaries (above left). This "tracing" was saved as a separate DWG file (above right), which was then imported to provide a cleaner image to trace in eQUEST.

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Alt. Schedules
HVAC Sys Type
Zone Temp. & Air
Packaged Equip
HVAC Fans
Fan Sch #1
Fan Sch #2
Zone Ht & Econo
Deck Resets
WSHP Equip
Chillers
Cooling Towers
CHW Control
Boilers
HW Control
DHW Equip
Utility Charges
Project Info
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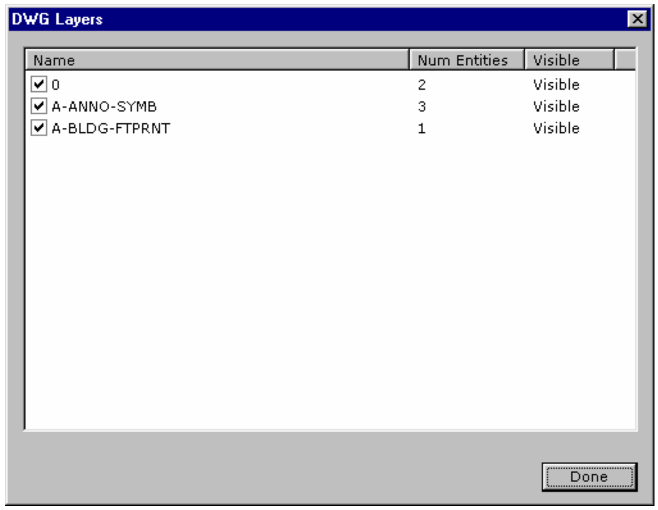
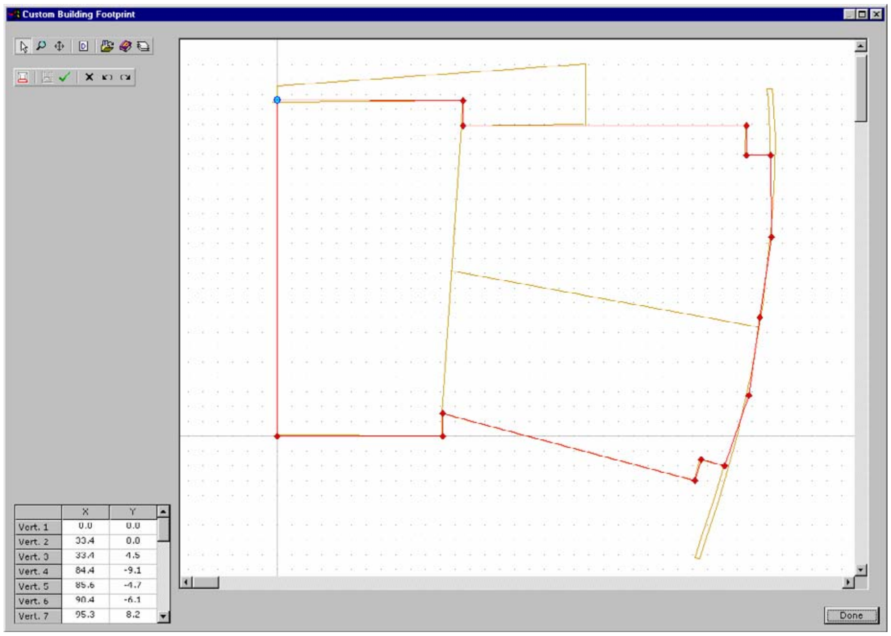


If a "full" DWG file is imported into eQUEST (not one that has been simplified as suggested on the previous page), the user may find it helpful to "turn off" the irrelevant layers to avoid clutter on the eQUEST screen before attempting to "trace" it. Do this via the drawing layers button .

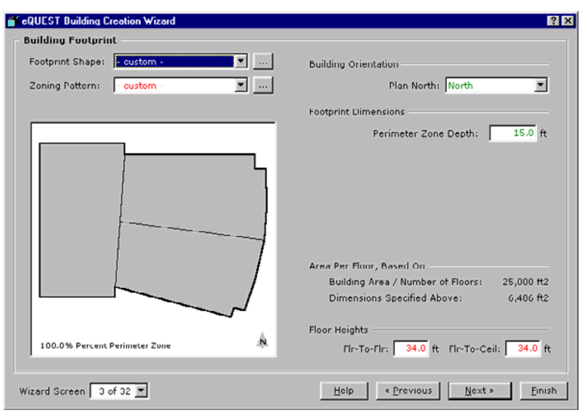
Selecting the drawing layers button will display the DWG Layers list dialog. Selecting any layer on the list will cause the DWG drawing elements assigned to the selected layer to blink on and off. This should aid the user to identify the assigned drawing elements. Uncheck any DWG drawing elements that clutter the view of the thermally significant features of the drawing, e.g., the exterior building envelope and interior partitions associated with HVAC zone boundaries.

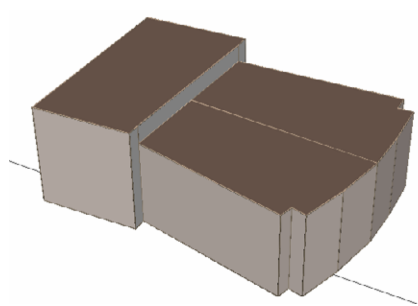
Importing DWG Files (cont.)



With the DWG file aligned in the background as desired and using conventions described previously on page 22, start by clicking on any point or vertex on the drawing screen, then trace around the imported DWG file image, proceeding in a counter clockwise order (image above).

Select the Drawing Properties button  to adjust snap options, e.g., snap ON/OFF, snap first to DWG vertices, second to eQUEST polygon vertices, etc.. Press "Done" to return to the Building Footprint wizard screen (below left, also shows custom zoning… see following pages).





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Unoccupied Loads
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Alt. Schedules
HVAC Sys Type
Zone Temp. & Air
Packaged Equip
HVAC Fans
Fan Sch #1
Fan Sch #2
Zone Ht & Econo
Deck Resets
WSHP Equip
Chillers
Cooling Towers
CHW Control
Boilers
HW Control
DHW Equip
Utility Charges
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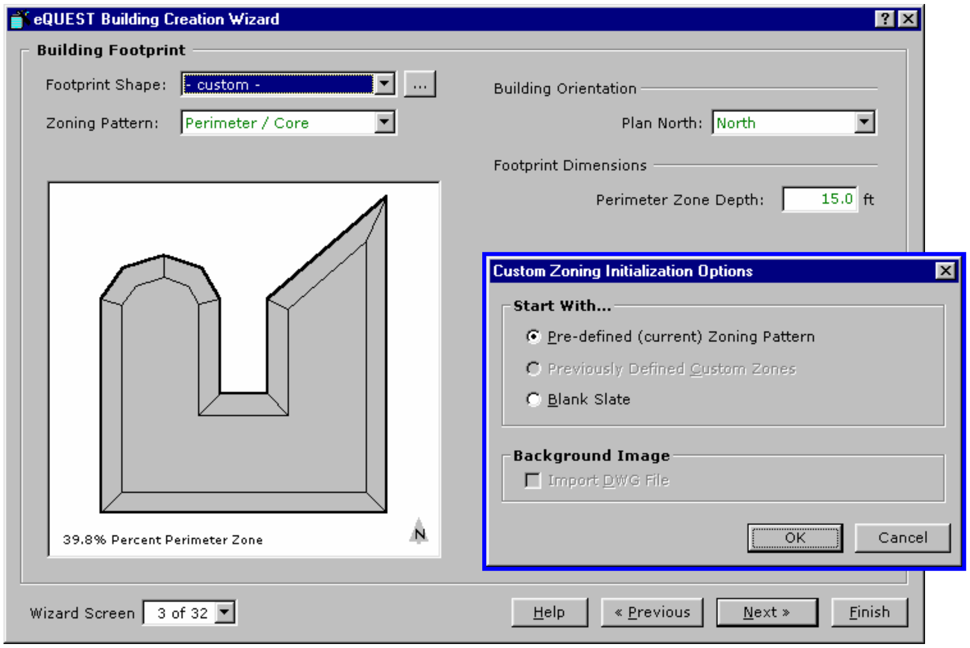
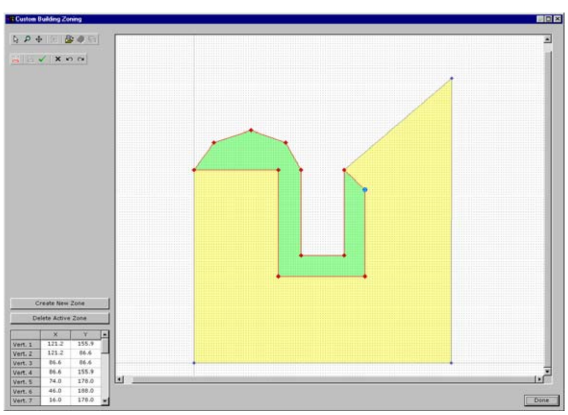
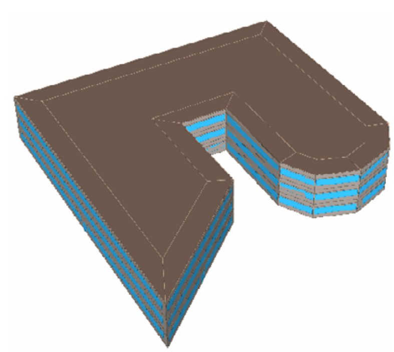
Custom HVAC Zoning

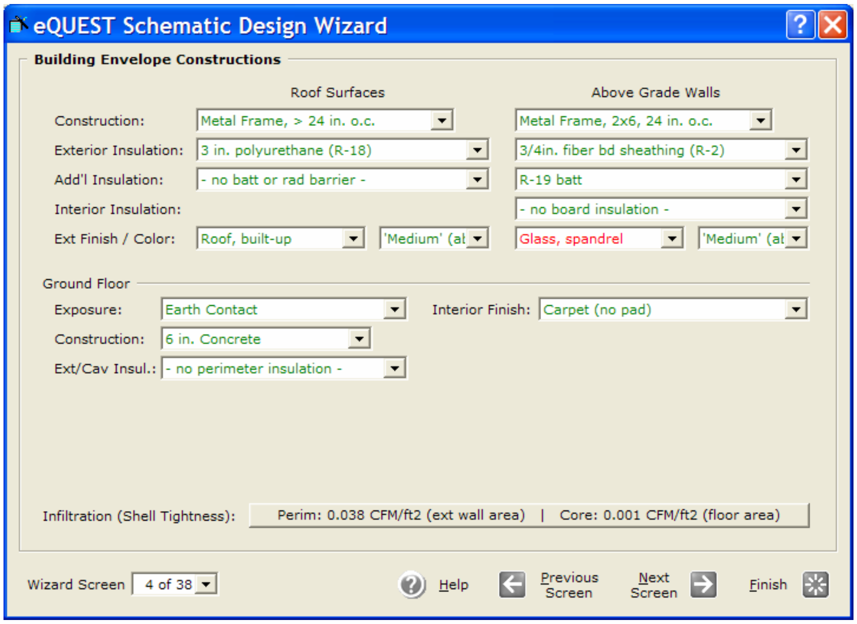


Zoning Pattern. From the Building Footprint screen, users may select either predefined HVAC zoning (e.g., perimeter-vs-core, one-per-floor) or custom HVAC zoning. As with the building footprint, predefined zoning patterns may be customized or you can start from scratch ("Blank Slate") to create a completely custom HVAC zoning plan (see below… shows one zone completed) or "trace" around an imported DWG image. Select "Create New Zone" to begin drawing or tracing each new zone.



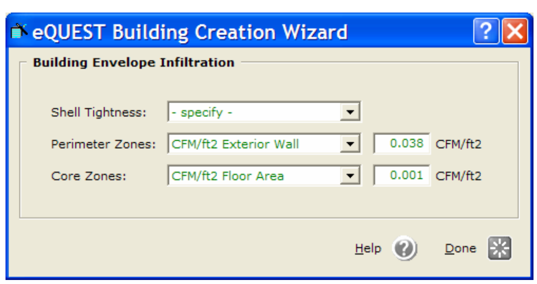


Building Envelope Constructions



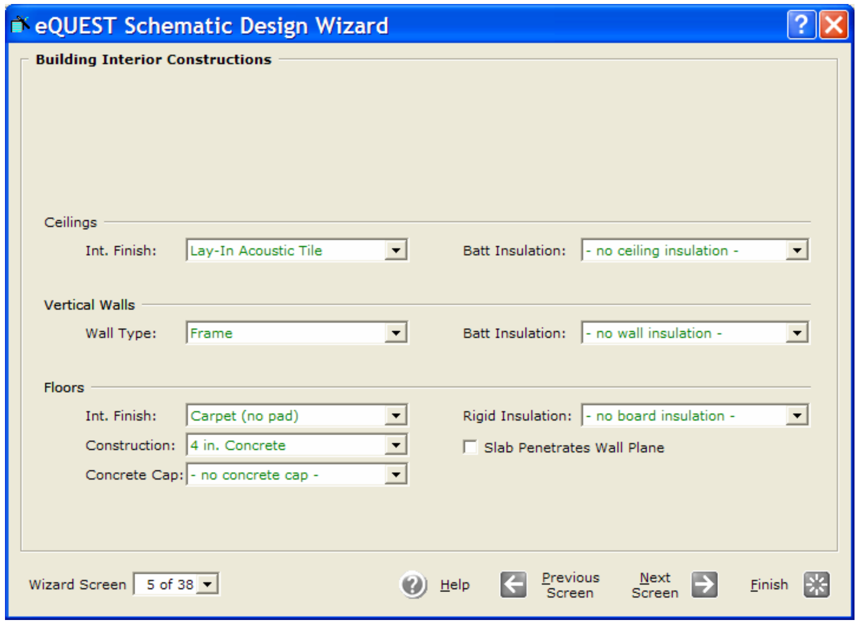
NOTES:

1) Roof Surfaces and Above Grade Walla Construction. Default constructions are based on building type (selected previously). Selections for construction constrain the available Insulation choices.
2) Roof/Wall Exterior Finish and Color. Choices for Finish and Color are used to define the ext. surface solar absorptance and ext. film resistance.
3) Ground Floor and Below Grade Wall Construction. Prior input for the number of below grade floors determines whether below-grade walls are displayed. The Ground Floor may have earth contact or may be over a crawl space, unconditioned space, or garage.
4) Infiltration. Click this report button to display the infiltration dialog. Three choices of infiltration specification are available: CFM/ft^2 of ext. wall area, CFM/ft^2 of floor area, and air changes per hour.



DOE-2 note: All constructions are "delayed" (i.e., use LAYERS commands) so that custom weighting factors may used. Two-dimensional heat transfer effects due to thermal bridging in framed surfaces and slab edge effects are accounted for using published one-dimensional approximations (i.e., from ASHRAE and LBNL).

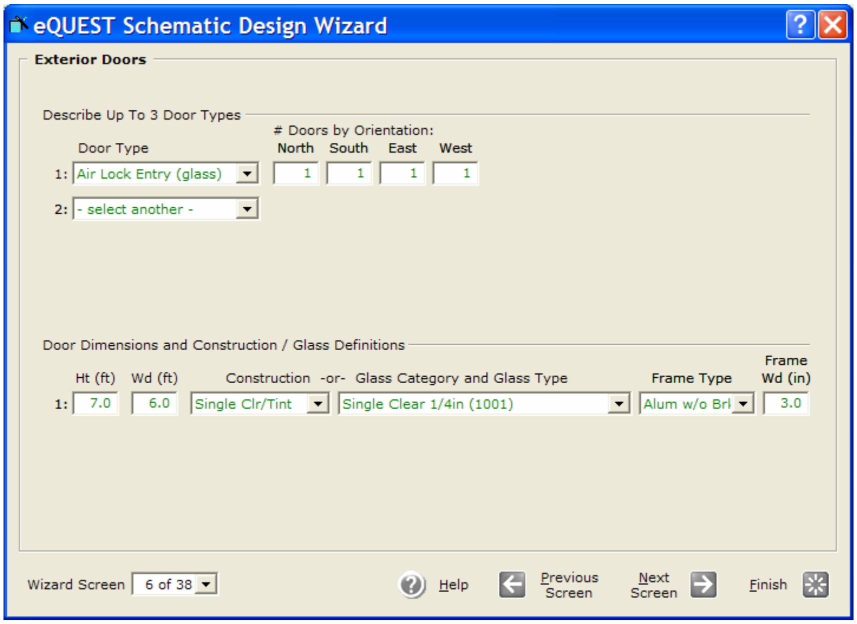
Building Interior Constructions



NOTES:

1) Building Interior Constructions. Default constructions are based on building type (selected on Screen1). Selections for interior constructions, as well as prior inputs (e.g., number of above grade floors, floor height) constrain the available Interior Finish and Insulation options.
2) Vertical walls. For open office plans, select "Air (none)".
3) Floors. Note that these are interior floors. Normally, interior floors will have no insulation applicable (see next item).
4) Slab Penetrates Wall Plane. This check box is viewable only if the Construction for the interior floors is one of the Concrete choices. If the interior concrete floors penetrate the exterior wall plane, i.e., the slab edge is exposed to outdoor ambient conditions, check this box to reveal slab edge insulation and finish options.

Exterior Doors



NOTES:

1) Door Type. Currently, six door types (i.e., categories) are available: opaque, overhead (opaque), glass, sliding/atrium glass, air lock glass entry, and glass revolving. Construction details and u-value for opaque doors are per *ASHRAE Handbook of Fundamentals*.
2) # Doors by Orientation. All doors are placed only on the ground floor and are centered along the applicable facade(s).
3) Door Construction / Glass Types / Frame Types. Opaque door type and frame type selections are per the *ASHRAE Handbook of Fundamentals*. Glass doors are from the DOE-2 glass library (see *DOE-2.2 Volume 4: Appendices* for a listing).

Up to three types of doors may be defined using eQUEST's Schematic Design Wizard.

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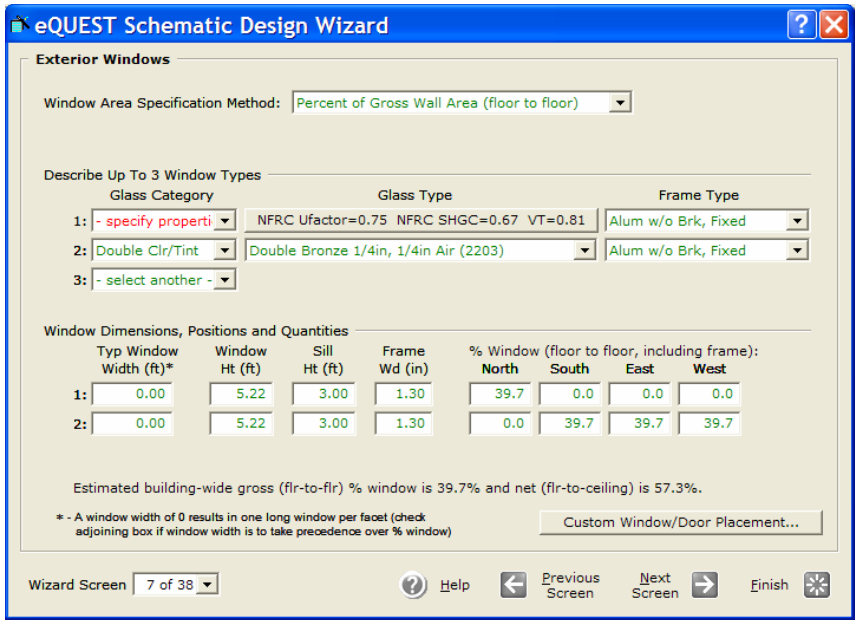
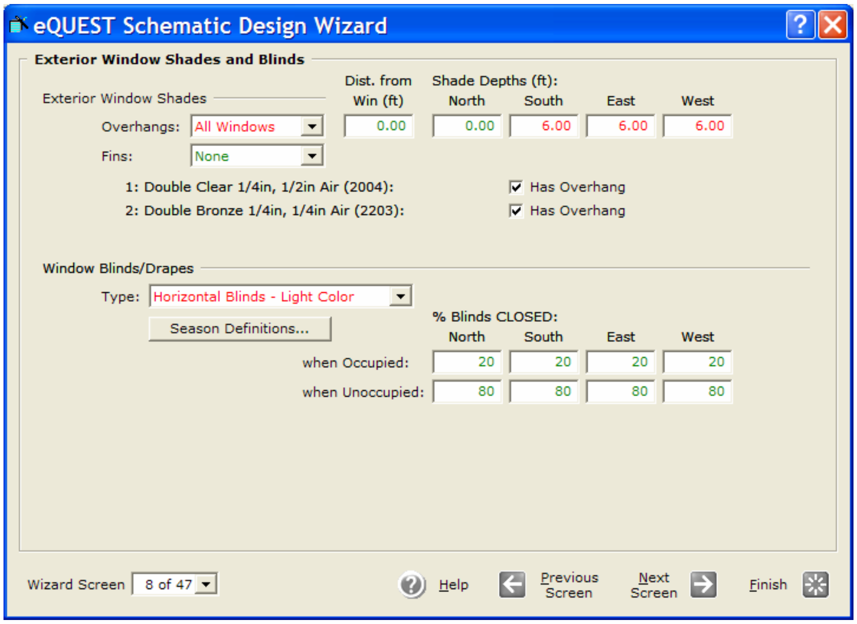
Exterior Windows



NOTES: Define up to 3 glass types.

1) Window Area Specification Method. Use this to indicated whether the window-wall ratio percentages are based on floor-to-floor (the default and applicable for most building energy codes) or floor-to-ceiling dimensions.
2) Glass Category and Type. Predefined glass categories and types are available from the DOE-2 glass library (see the *DOE-2.2 Volume 4: Appendices* or the Reference section of the eQUEST training workbook for a listing), which allows for incident angle dependencies to be fully accounted for. Select "specify properties" if you wish to define your own glass type using either NFRC SHGC and U-factor (includes frame), or ASHRAE Shading Coefficient and U-Value (normally treated as exclusive of the frame). Select "Window4/5 data" if you wish to use (i.e., import) glazing systems defined using WINDOW4 or WINDOW 5 (see http://windows.lbl.gov/software/window/window.html)
3) Frame Types. Window frame type selections are per the *ASHRAE Handbook of Fundamentals*. (When using NFRC glass properties, frames are not modeled, i.e., frame inputs are ignored).
4) % Window (i.e., glass percent of wall area), by up to five Orientations. To accommodate large WWR %'s, decrease Sill Ht. and Frame Wd., and increase Window Ht.
5) Typical Window Width. Use this to indicate multiple, identical, windows of a preferred typical width. Typical Window Width = 0 yields one long window per window type (3 max) per façade. On exterior walls where doors are also placed (centered), the window is "split" around the door(s).

Exterior Window Shades



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NOTES:

1) Exterior Window Overhangs and Fins. Select preferred placement of fins and overhangs.
2) Shade Depths. Indicate preferred overhang and/or fin depths, by orientation.
3) Distance from Window. Indicate the distance an overhang is above the top of the adjacent windows, or fins are left and right of the adjacent windows.
4) Window Blinds/Drapes. Currently, this control is only available in the Schematic Design Wizard if "Usage Details" on SD Wizard Screen #1 is set to "Hourly Enduse Profiles". Use this to specify the use of interior drapes and blind. (This control is always available in the DD Wizard.)
5) Window Blinds/Drapes Season Definitions. This button allows you to define window interior shade management using up to three seasons, which can differ from the seasons defined previously for all other building operations schedules in the project.

DOE-2 note: Overhangs are "local", i.e., modeled using the OVERHANG keywords for WINDOWs. This means their shadows are "felt" only by the windows to which they are assigned and their parent walls.

Roof Skylights

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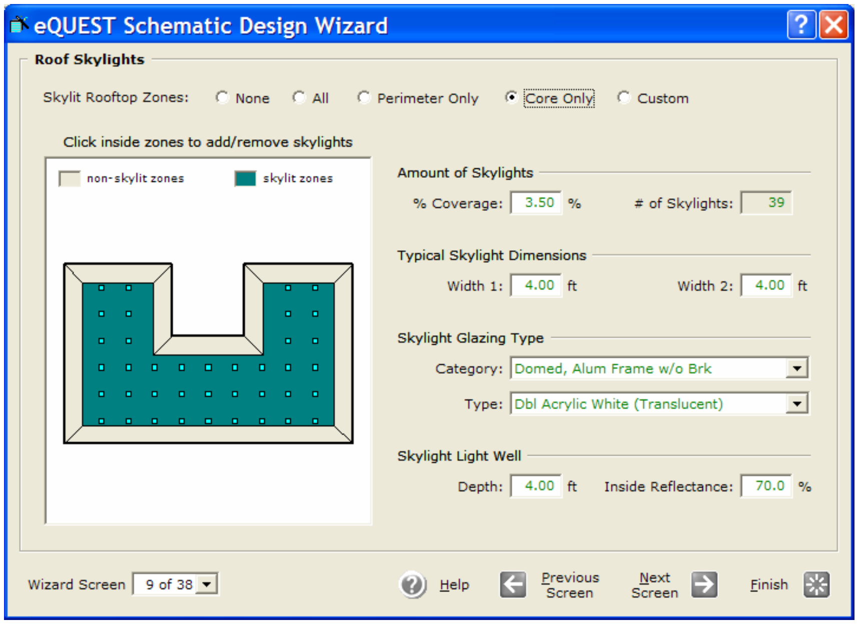


NOTES:

1) Skylit Rooftop Zones. Select from three automatic skylight zone assignments (perimeter only, core only, all) or indicate custom zone assignments.

2) Skylight layout diagram. In the skylight layout diagram, click (with left mouse button) on zones to install or uninstall skylights (acts as a toggle).

3) Typical Skylight Dimensions. Indicate/confirm the typical skylight dimensions. "Width1" is horizontal to the layout diagram. "Width2" measures along the vertical axis of the layout diagram.

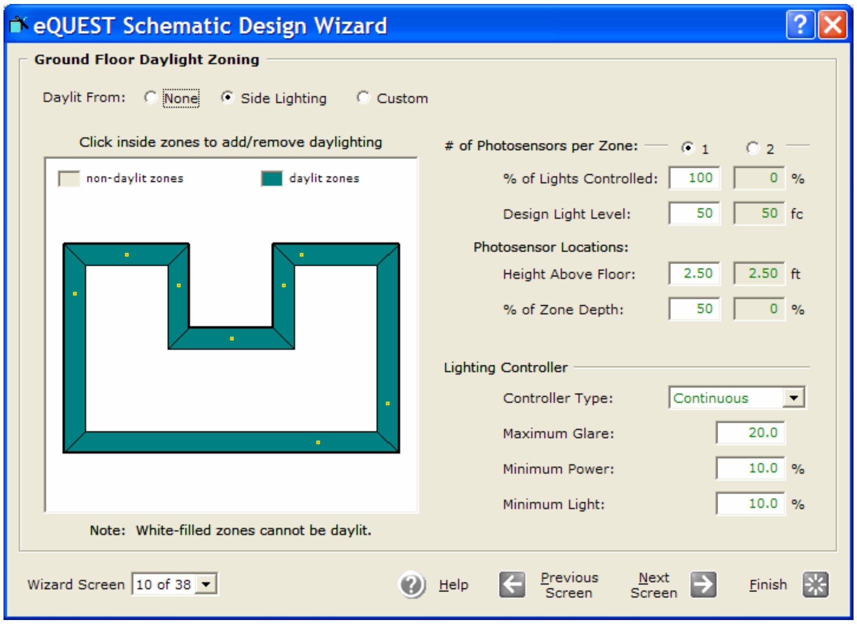
4) Amount of Skylights. Indicate percent floor area coverage by skylights. Confirm desired number.

5) Skylight Glazing Type. Skylight glazing data are from manufacturer's literature.

6) Skylight Light Well. Light wells are assumed to reduce the overall skylight transmittance. Light well depth and inside reflectance are used to revise skylight glazing properties to account for light well effects (source: IES, as described in *DOE-2.2 Volume 3: Topics*, downloadable from http://www.doe2.com).

DOE-2 note: eQUEST creates a separate WINDOW for each skylight indicated in the layout diagram. For skylights in roofs above plenums, eQUEST actually places the skylights in a dummy roof (i.e., negligible heat transfer) located at actual roof height, but assigned to the conditioned zone(s) the skylights serve.

Daylight Zoning (ground floor)

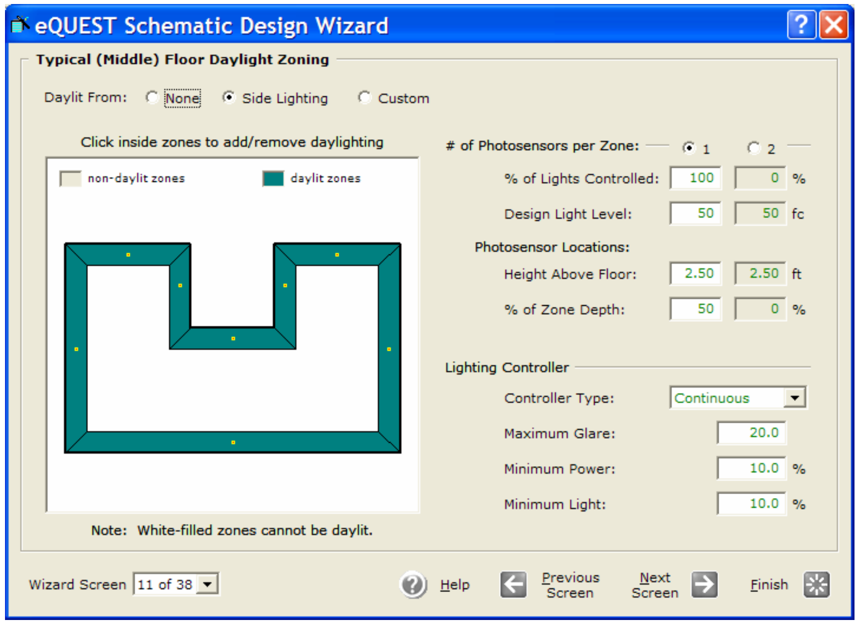


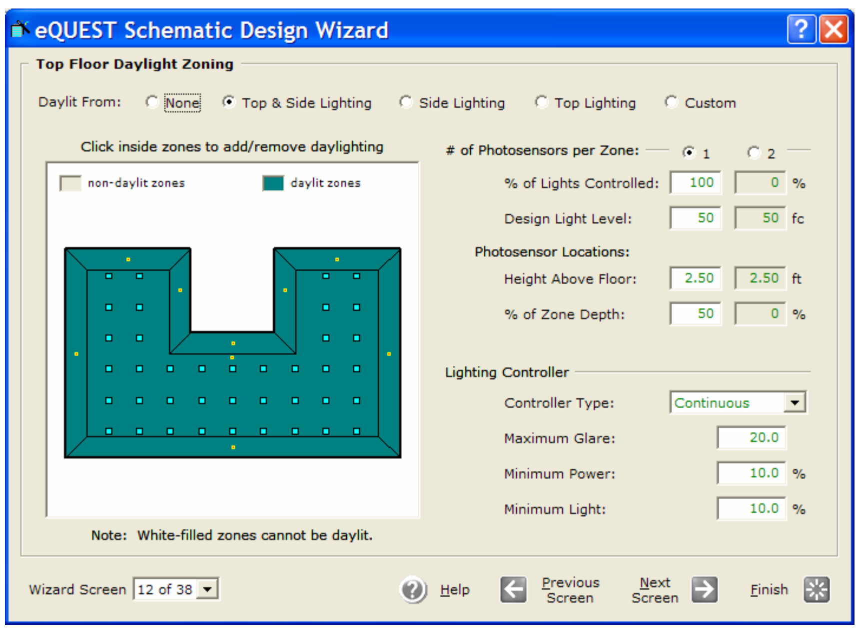
NOTES:

Up to three Daylight Zoning dialogs are available, one each for a ground floor (see above), typical (i.e., middle) floor, and top floor (see the following page) depending on the number of above grade floors entered on the first wizard screen. These daylighting dialogs are displayed only if Daylighting was selected on the General Info screen.

1) Daylit From. Select the daylighting source (side glazing and/or top glazing). Daylit from top lighting is available only for zones with roofs (i.e., top floor zones) that contain skylights.
2) Daylight layout diagram. In the daylight layout diagram, click (with left mouse button) on zones to activate or deactivate daylighting (acts as a toggle, available only on zones with glass).
3) # of Photosensors per zone. Select either one (default) or two photosensors per daylit zone.
4) % Lights Controlled and Design Light Level. Indicate the fraction of zone lighting controlled by the daylight sensors and the interior design lighting level. eQUEST will assume this lighting level results from the associated lighting power (from the Occupied Loads screen) and will supplement calculated daylight levels using artificial lights as needed.
5) Photosensor Location. Indicate photosensor placement, i.e., height above floor and % depth of zone (from zone window wall to back wall). Side-to-side placement is done automatically by eQUEST (attempts to center sensor along length of first window in zone while avoiding skylights).
6) Lighting Controller. Indicate lighting controller type and its properties.

Daylight Zoning (typical and top floors)



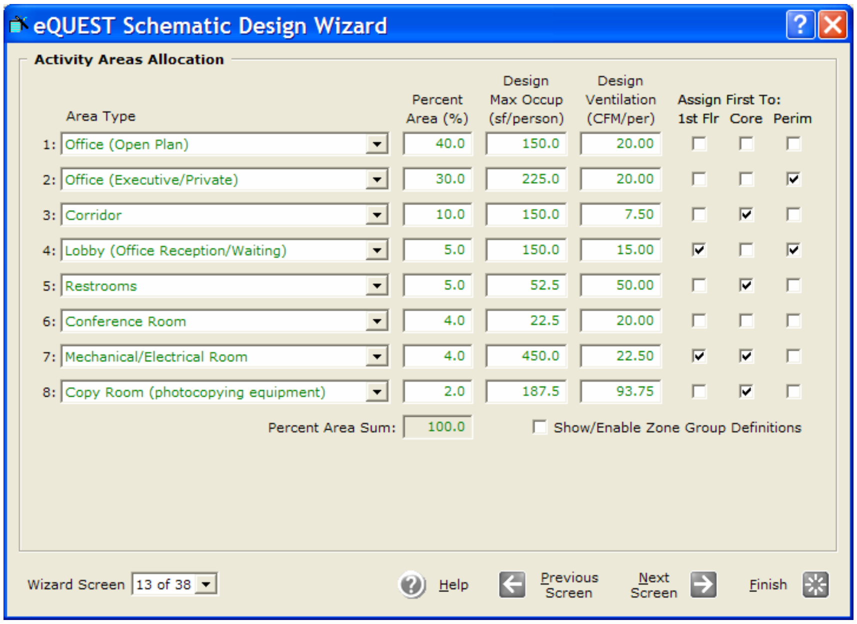


NOTES:

Inputs for these screens are identical to previous page (ground floor daylighting). Note that toplighting (e.g., for core zones) is available only in skylit areas (i.e., top floor zones with skylights).

Having viewed the daylighting screens, before proceeding further, return to the first screen, and set Daylighting to "No". Daylighting analysis will be incorporated in the EEM runs.

Activity Areas Allocation



NOTES:

eQUEST users specify internal loads (lights, people, and equipment) via "activity areas". eQUEST then allocates these loads to each HVAC zone according to default or user-specified allocations for each activity area (by % of the total building).

1) Area Types. Select activity area types from the list of available area types. This list was developed from regulatory/code sources, e.g., ASHRAE, CEC. Select up to eight area types.
2) Percent Area. Indicate a percent allocation for each activity type (must sum to 100%). Default percentages are based on selected building type.
3) Design Occupant Density and Ventilation. Indicate preferred occupancy density and outside air ventilation rates (cfm per person). Defaults are based on ASHRAE 62. Note that these entries should be considered DESIGN levels for each. If diversity is to be applied for typical (not design) operations, enter % occupancy, lights, or equipment < 100% on the Schedule Information screens (Screens # 17 and 18).
4) Assignment Priority. Use these assignment priorities to control eQUEST's allocation priorities. For example, a lobby activity area is expected to be located in perimeter zones at the ground floor. eQUEST will use these priorities but the percentage assignments will take precedence.
5) Shoe/Enable Zone Group Definitions. Thus check box is used to enable the Zone Group Definitions Screen (Screen #15). This is useful for more detailed or custom assignment of Area Types by zone. See the description of the Zone Group Definitions Screen in the DD Wizard description.

Occupied Loads by Activity Area

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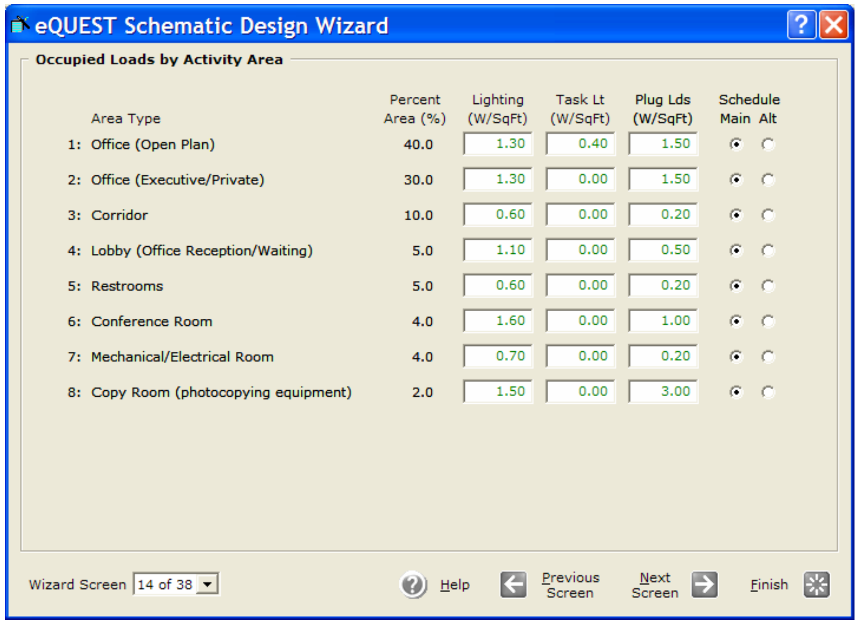
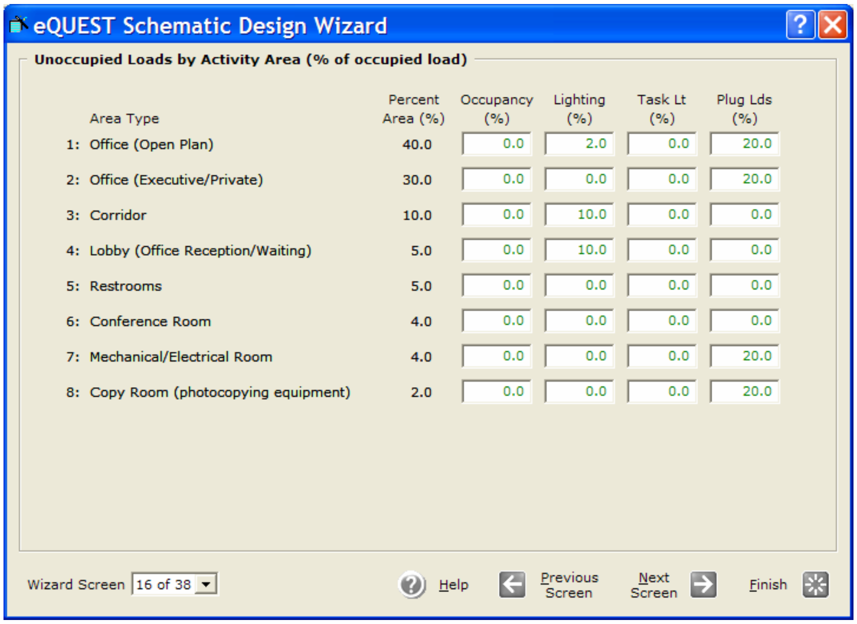


NOTES:

1) Lighting, task Lighting, Plug Loads. Indicate/confirm peak loads for lights (ambient and task) and plugs (equipment), by activity area. These loads are normally considered to be installed load. Defaults are taken from California Title24 requirements.

2) Main/Alt Schedule flag. Use these "radio buttons" as flags to indicate whether one or two usage schedules are necessary to describe building usage patterns. These schedules will be detailed on subsequent screens.

Unoccupied Loads by Activity Area



NOTES:

eQUEST usage schedules assume two levels of activity, occupied and unoccupied. Use this screen to indicate load levels during unoccupied hours as a percent of the occupied levels indicated on the previous two screens.

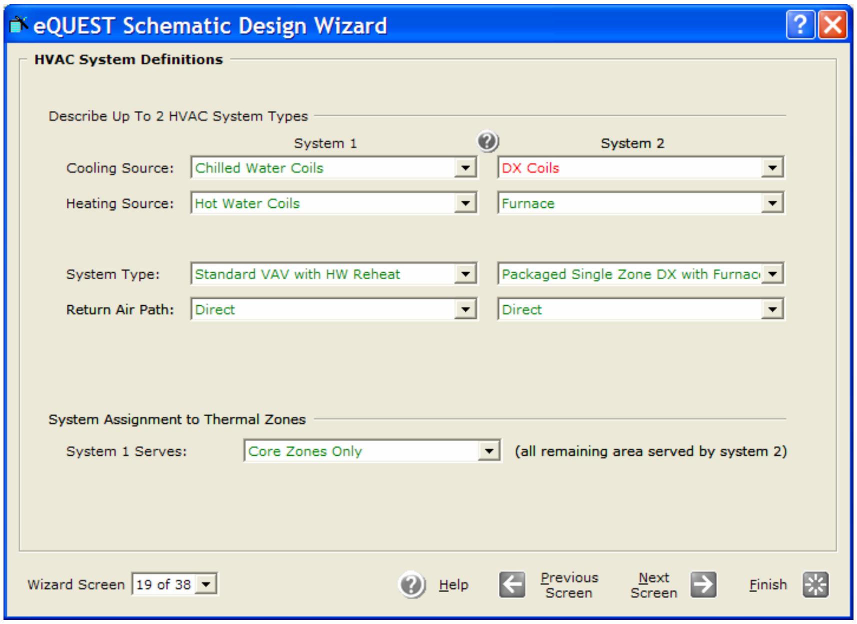
Main Schedule Information

NOTES:

eQUEST's Schematic Design Wizard permits up to two building usage schedules, a main schedule and an alternate schedule. This example employs only one schedule (i.e., no alternate schedules indicated on the Occupied Loads screen, two screens prior to this one). These building usage schedules are used to indicate to the simulation engine the appropriate level of internal load for each hour of the year.

1) Day 1 - day 3. Indicate how many day types are required to describe the building usage, e.g., one day for hospitals (each day is equally occupied), two days for office buildings (weekday and weekend days).
2) Occupancy/Lights/Equipment %. Indicate the level of load for people, lights, and equipment during occupied hours (as a percentage of installed load indicated on previous screens).
3) Second Season. Check this box if you wish to specify a second schedule season. The default second seasons are based on building type, e.g., summer for schools, December for retailers. Repeat the previous two steps as necessary.

HVAC System Definitions



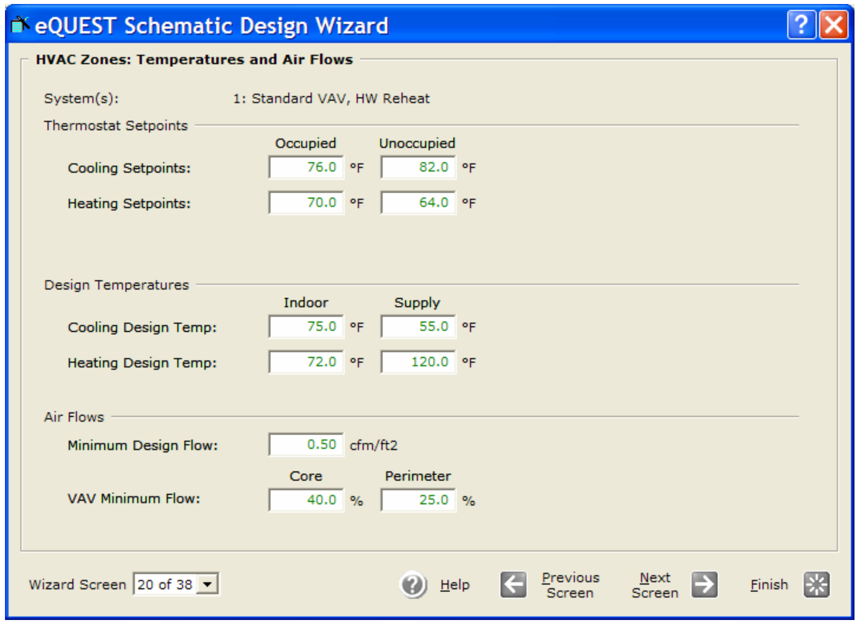
NOTES:

eQUEST's Schematic Design Wizard permits up to two HVAC system types to be described. The defaults are based on building type and heating/cooling coil types selected on the first screen.

1) Cooling/Heating Source. eQUEST's HVAC system type selections are categorized by cooling/heating coil type. Select the appropriate coil types. Defaults are taken from input for coil types on the first screen.
2) System Types. Select your preferred system type (choices are constrained by coil type selections). Default system types are based on building type.
3) Return Air Path. Select return air path (direct, plenum, ducted). eQUEST's Schematic Design Wizard constructs separate zones above ceilings if the floor-to-floor height exceeds the floor-to-ceiling height from the first screen. Whether such an above-ceiling zone is a return air plenum or an unconditioned zone is determined by input for return air path.

If two systems are input, eQUEST prompts to learn which zones are served by which system.

HVAC Zone Temperatures & Air Flows



NOTES:

eQUEST requires separate inputs for indoor thermostat setpoints and indoor design temperatures. Defaults are based on building type and California Title24.

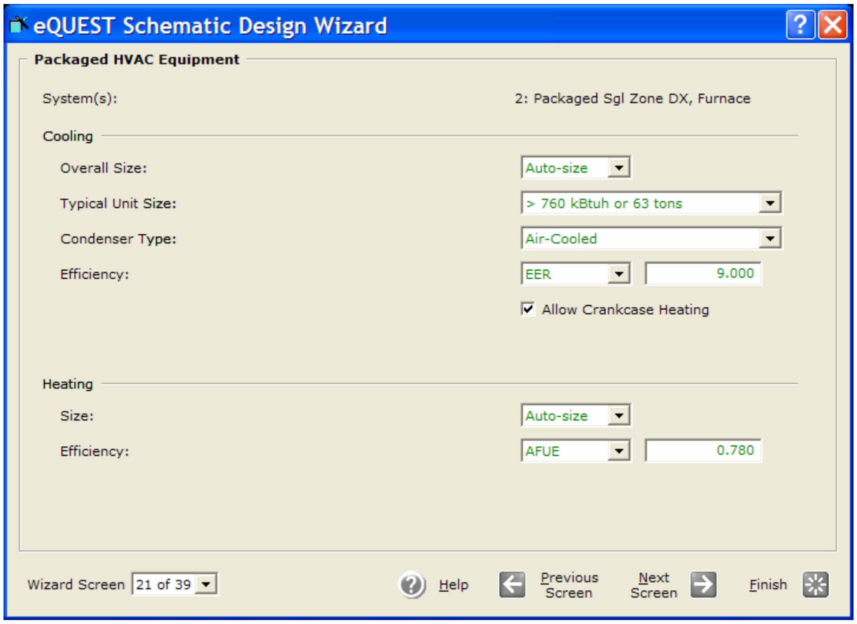
1) Thermostat Setpoints. These thermostat setpoints correspond to the hours indicated as occupied and unoccupied on previous screens.

2) Design Temperatures. Indoor design temperatures are used by eQUEST to size air flow requirements. Default values are based on building type and Title24. Supply temperatures are the temperatures of the conditioned air entering (i.e., supplied to) the zones, not the temperature of the air leaving the coils. Coil-leaving temperatures are based on a variety of factors, including fan heat gain (draw-through fans), duct losses, coil by-pass factors, mixed air temperature, and humidity control requirements. Coil-leaving temperatures are calculated by the simulation engine.

3) Air Flows. Minimum Design Flow is used to set a minimum design flow rate. This is a minimum for sizing the zone air flow. VAV Minimum Flow is used to set a minimum flow rate for VAV terminals during hourly operations.

Space is provided for temperature and air flow inputs for up to two HVAC systems.

Package HVAC Equipment

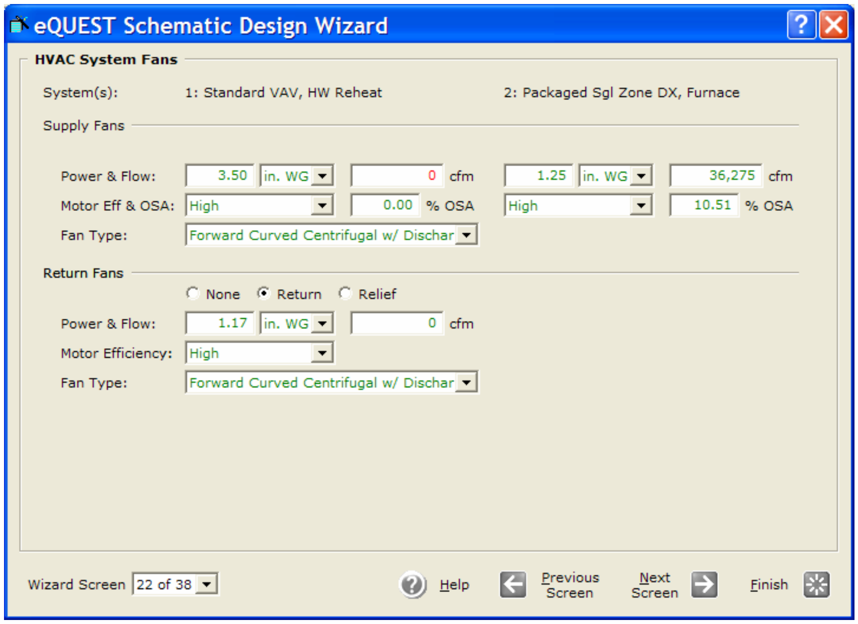


NOTES:

This Package HVAC Equipment dialog is displayed only if a package HVAC system type was selected as one of the two system types on the HVAC System Definitions screen (screen #19). In the example shown above, the package equipment controls appear only on the right side of the screen because two screens previous, on the HVAC System Definitions screen, the package system type was indicated as the second system type.

1) Overall Size. There are two choices for this input: "Auto-size" and "specify". "Auto-size" means no size is specified by the user, rather, the size of the cooling equipment is automatically determined during the simulation. "Specify" means the user inputs overall cooling capacity, in which case, a second input field is displayed in which the user indicates the total size of the package cooling equipment (in tons). Note that this is not the typical unit size of the size of any one specific unit, but rather, the sum of the anticipated tonnage for all system #2 package equipment.
2) Typical Unit Size. This input does not determine or restrict the ultimate size of any package unit, rather, it is only used to select the appropriate minim efficiency level. NOTE: the efficiency indicated or user input here will be used for ALL package systems. Use the Zone Group capabilities of the DD Wizard to get around this simplification in the Schematic Wizard.
3) Condenser Type. Water-Cooled DX systems have been added as of version 3.37. If "Water-Cooled" is selected, a separate condenser loop and tower is provided (separate from any central plant).
4) Efficiency. Used to input or indicate the efficiency of every package unit in the project (see Typical Unit Size, immediately above).

HVAC System Fans



NOTES:

In the example shown above, System Fan inputs are shown for two system types (right and left sides of the dialog), only because two system types were selected on the HVAC System Definitions screen (screen #19).

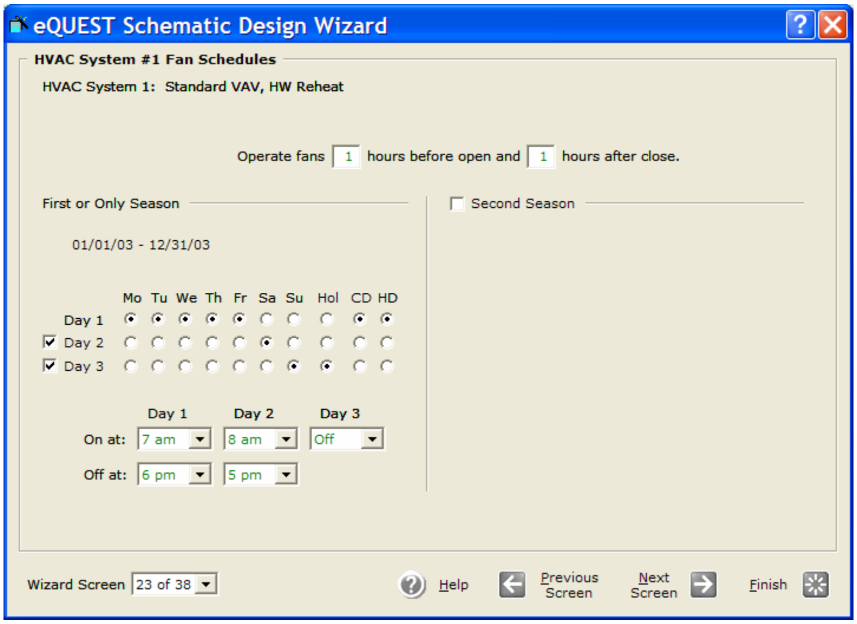
1) Fan Power. Specify total fan power (e.g., total static, not just external static). Note that while eQUEST accepts fan power inputs either in units of inches of static pressure or brake horsepower, switching units does not convert user input; rather, it resets input to the default for the selected units.

2) Fan Flow. Currently, eQUEST's Schematic Design Wizard automatically sizes fan flow based on common rules of thumb (e.g., 400 cfm/ton with sqft/ton based on building peak sensible internal load and climate zone). If the user wishes for the DOE-2 simulation engine to size the air flow using its design procedures, the user should input a "0" for fan flow.

3) Fan Motor Efficiency. Specify fan motor efficiency as "Standard", "High", or "Premium". The Energy Policy Act of 1992 (EPAct) requires that most commercial and industrial motors manufactured or imported into the U.S. after October 1997 meet or exceed a minimum standard. "High" efficiency complies with EPAct, Title24, and ASHRAE 90.1 minimum requirements. "Standard" would be appropriate only for older, existing fan motors.

4) Fan Type. Fan types input provides the simulation engine with part-load fan performance data. The fan "curves" used by eQUEST's Schematic Design Wizard are based on the CEC's ACM manual.

HVAC Fan Schedules, System 1



NOTES:

eQUEST HVAC system schedules follow the building usage schedules described previously, with the exception that their start and stop times are offset by the hours indicated at the top of the system schedule screens. A separate fan schedule is permitted for each of the two (max) HVAC systems. The first of two fan system schedule screens is shown above.

1) Fan Hours Before Open and After Close. Indicate/confirm the lead and lag times assumed for fan operations. These controls add fan operation hours before opening and after closing, as indicated (based on building usage schedules). Negative inputs are accepted. Negative inputs would turn on or off fans while occupants were still in the building.

2) Remaining inputs. Confirm all remaining fan schedule inputs. Since these values default based on the building usage schedule, normally few edits are required.

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HVAC Fan Schedules, System 2

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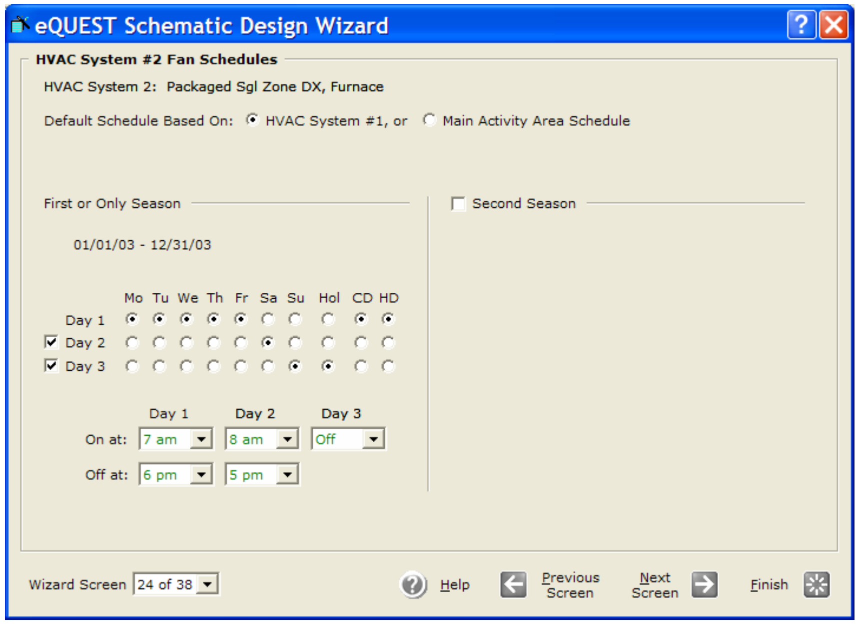


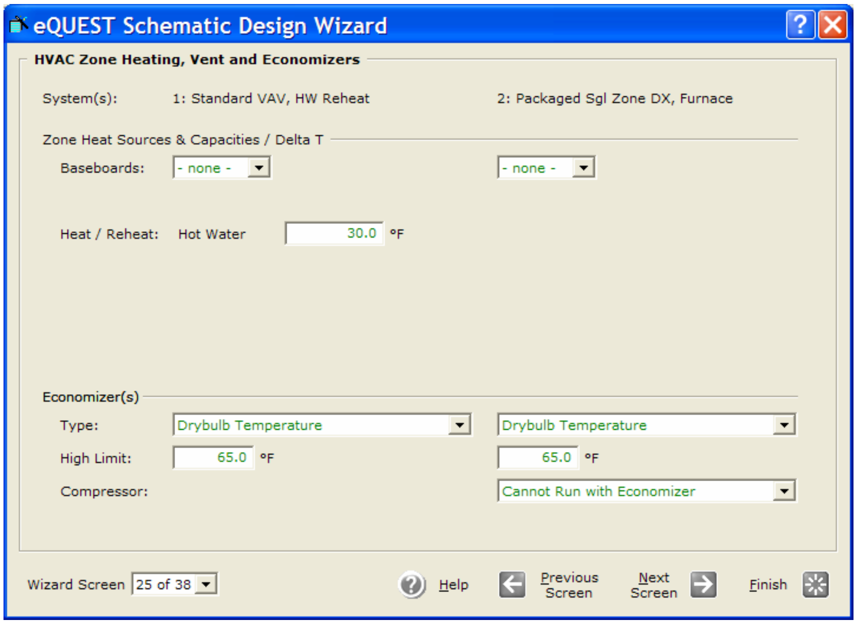
NOTES:

This second system fan schedule is available only if a second system type is input on the HVAC System Definitions screen (screen #19). By default, the second fan system schedule copies the first fan system schedule.

1) Default Schedule Based On. Indicate/confirm whether the fan schedule for the second system type defaults based on HVAC System #1. If "Main Activity Area Schedule" is selected, controls similar to the System #1 schedule screen are displayed allowing specification of fan operation lead and lag time (before and after occupancy as defined on the main Activity Area Screen).

2) Remaining inputs. Confirm all remaining fan schedule inputs. Since these values default based on the building usage schedule, normally few edits are required.

Zone Heating & Economizer



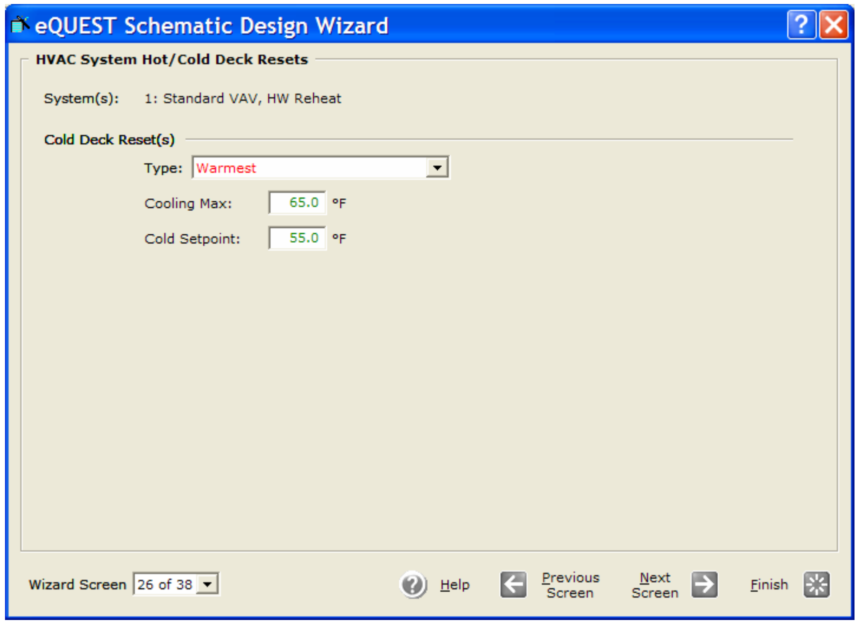
NOTES:

1) Zone Heat. Indicate whether zone baseboards are used for heating (default is no baseboards for all building types). Indicate/confirm terminal reheat delta-t (input available only for reheat-type systems).

2) Economizer. Indicate whether an air-side economizer is installed. Two air-side economizers are available: drybulb or enthalpy. A high limit economizer temperature (above which no economizer action is assumed) is also available. For DX compressor systems, a compressor lock-out option is also available.

Space is provided for zone heat and economizer inputs for up to two HVAC systems. The left side of this dialog displays inputs for HVAC System Type #1. The right side of this dialog displays inputs for HVAC System Type #2 (if selected on the HVAC System Definitions screen (screen #19).

Hot & Cold Deck Rests



NOTES:

1) Cold Deck Rest Type. Currently, there are there choices:

   "Warmest" - the cold deck is reset just enough to meet the demand of the warmest zone on the system. To implement this strategy typically requires a building automation system.

   "Outside Air Reset" - the deck is reset based on outdoor air temperature, e.g., at an outdoor high air temperature of 80F, the cold deck temperature will be reset to its minimum (e.g., 50F); at an outdoor air temperature of 60F, the cold deck temperature will be reset to its maximum (e.g., 65F) - conversely for hot decks.

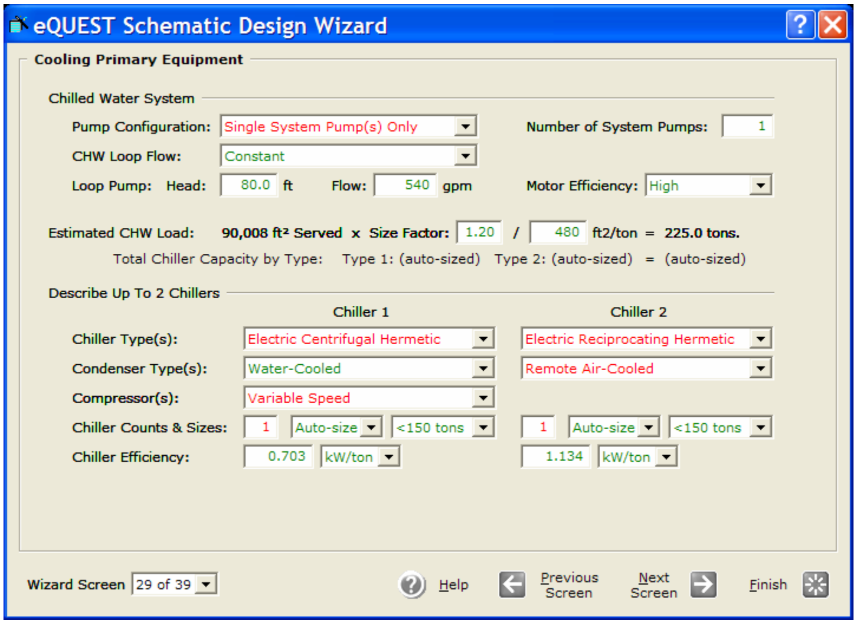
   "Constant" - no reset, i.e., constant deck temperature.

2) Cooling Max. This is the maximum cooling supply air temperature allowed under any reset control scheme.

3) Cold Setpoint. This is the minimum cooling supply air temperature allowed under any reset control scheme. It is also the fixed supply aire temperature un the "Constant" control option.

Note that these reset temperatures are supply (i.e., space-entering) temperatures, not deck-leaving temperatures. The deck leaving temperature will be calculated to provide the space-entering temperature after fan heat and duct gains, if any. Currently, by default, the Wizards assume no duct heat gain. Deck resets are not available in DOE-2 for DX equipment, hence none are shown above for HAVC System Type #2 (selected previous as System Type #2).

Cooling Primary Equipment

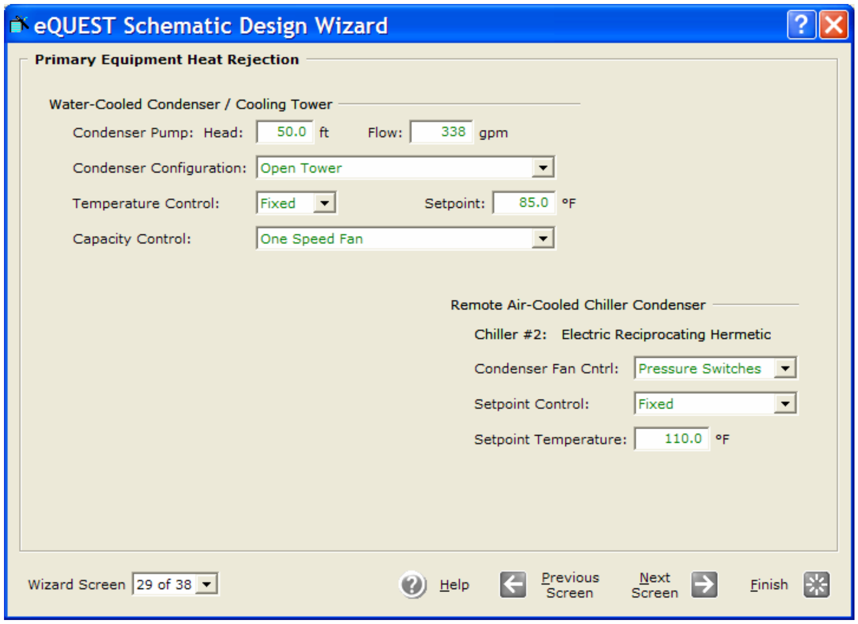


NOTES:

eQUEST's Schematic Design Wizard permits up to two types of chillers to be modeled, with multiple chillers of each type. Chiller control assumes that the first chiller(s) will lead and the second chiller(s) will lag and that when two chillers are operating, both are equally loaded (no preferential loading). <u>This Cooling Primary Equipment dialog is displayed only if a CHW-based system type was selected as one of the two system types on the HVAC System Definitions screen (screen #19).</u>

1) Pump Configuration. Select/confirm the preferred pump placement. Circulation pumps can be placed in any of three configurations: only at the loop, only at the chiller(s), at both the loop and the chiller(s).
2) CHW Loop Flow. Indicate/confirm loop as either constant or variable. If loop flow is set to variable, the Schematic Design Wizard prompts for the method of pump control (single speed, two speed, or VSD).
3) Loop Pump Head/Flow. Loop pump head defaults based on building type. Loop flow defaults using simple rules of thumb (10F water delta-t, sqft/ton based on building peak internal gain and climate zone). <u>If the user wishes for the simulation engine to size the water flow using its design procedures, input a "0" for loop pump flow</u>.
4) Chiller Count/Size/Efficiency. Chiller size defaults using simple rules of thumb (sqft/ton based on building peak internal gain and climate zone). <u>If the user wishes for the simulation engine to size the chiller using its design procedures, select "Auto-size"</u>. Chiller efficiency defaults based on chiller type and size.

Primary Equipment Heat Rejection



NOTES:

<u>This dialog is displayed only if a CHW system type was selected on the HVAC System Definitions screen (screen #19)</u>.

1) Condenser Types (previous screen). There are four choices: Water-Cooled, Packaged Air-Cooled (condenser electric is included in the chiller efficiency), Remote Air-Cooled, Remote Evap-Cooled. Which inputs are displayed on this dialog depend on the Condenser Type.

2) Condenser Pump Head/Flow. Condenser pump head defaults based on building type. Loop flow defaults using simple rules of thumb (10F water delta-t, chiller size). <u>If the user wishes for the simulation engine to size the condenser water flow using its design procedures, input a "0"</u>.

3) Condenser Configuration. Four condenser types available: open (cross-flow and counter-flow) towers, open towers with heat exchangers, fluid coolers, and dry coolers.

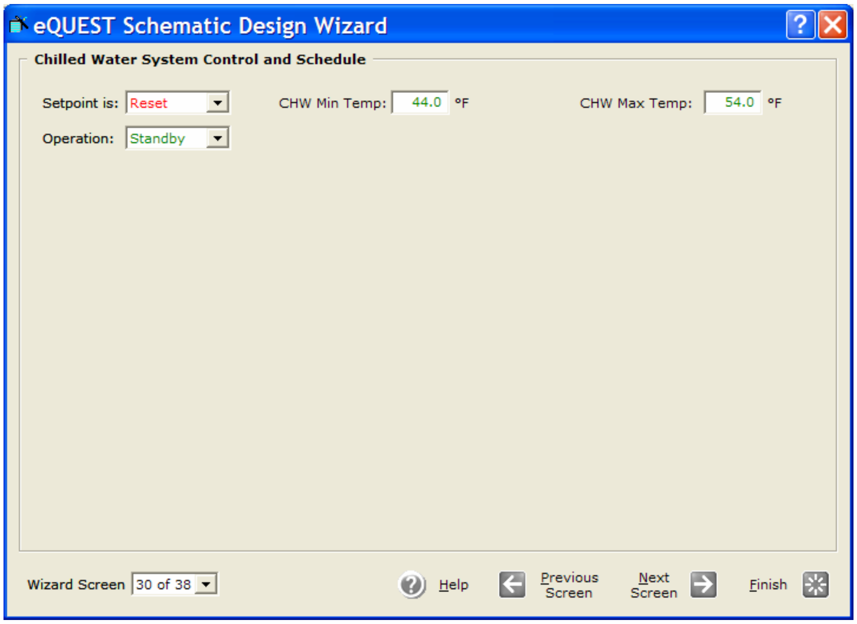
4) Temperature Control. Two condenser temperature control options are supported in the Wizards: fixed and reset. The control set point (fixed or minimum) is defaulted based on temperature control method.

5) Capacity Control. Capacity control options include: single speed (cycling), two speed, VSD, bypass, and discharge dampers.

6) Remote Air-Cooled Condensers. Inputs are provided for Condenser Fan Control, Setpoint Control, and Setpoint Temperature.

7) Remote Evaporatively-Cooled Condensers. The same inputs are provided for evaporative condensers as for air-cooled, plus Design Wetbulb.

Chilled Water System Control

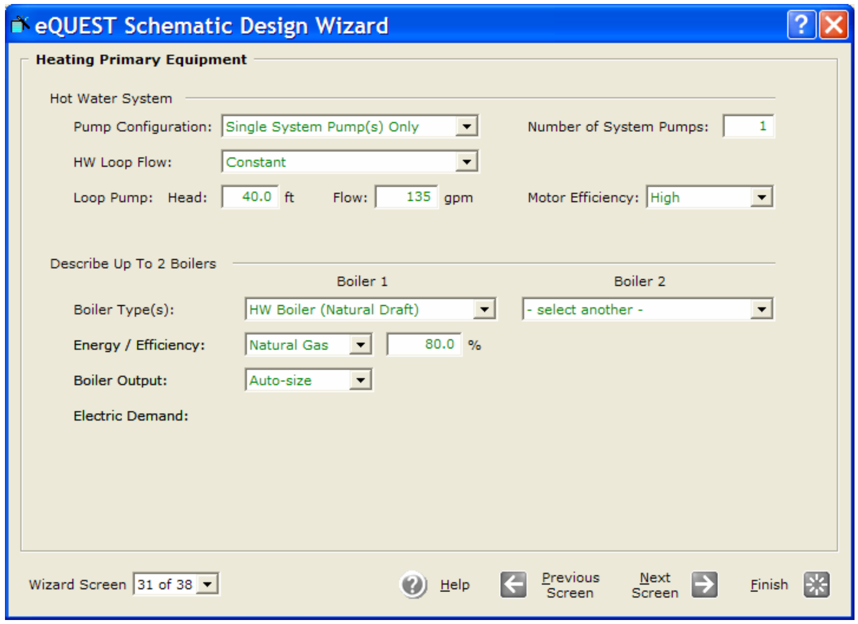


NOTES:

This CHW System Control dialog is displayed only if a CHW-based system type was selected as one of the two system types on the HVAC System Definitions screen (screen #19).

1) Setpoint is. Three CHW setpoint control options are supported: "fixed" (constant setpoint, no reset); "Reset" (reset based on load); "OA reset" (reset based on outdoor air temperatures). In the reset cases, both minimum and maximum CHW temperatures are input.
2) CHW System Operation. Three CHW system operation modes are supported: "Standby" (the default, loop operates whenever system fans are on); "Demand" (loop operates only when there is a load); "Scheduled" (scheduled either as on/off or based on outdoor air temperature, e.g., operates only during scheduled hours when outdoor temperatures exceeded the OA Temperature). The schedule corresponding to a scheduled system operation defaults to follow either the first or second HVAC system schedule, depending on which is system is cooled by CHW coils.
3) CHW Setpoints. Depending on choice of reset control, CHW setpoints are required to specify CHW min and max temperatures (Setpoint is = Reset or OA Reset), or CHW setpoint value (Setpoint is = Fixed).

Heating Primary Equipment

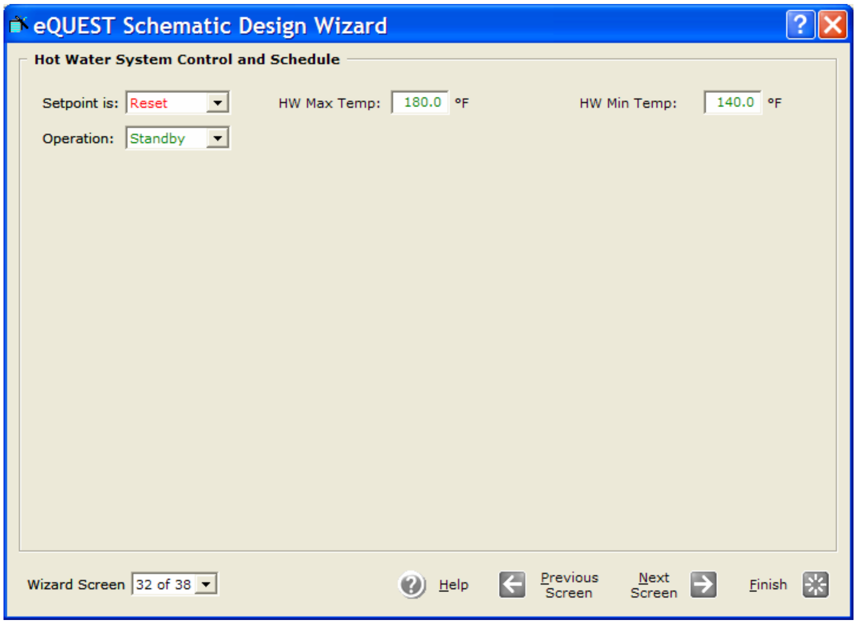


NOTES:

This dialog is displayed only if a HW system type was selected on the HVAC System Definitions screen (screen #19). eQUEST's Schematic Design Wizard permits up to two boilers to be modeled. Boiler control assumes that the first boiler will lead and the second boiler will lag and that when two boiler are operating, both are equally loaded (no preferential loading).

1) Pump Configuration. Select/confirm the preferred pump placement. Circulation pumps can be placed in any of three configurations: only at the loop, only at the boiler(s), at both the loop and the boiler(s).
2) HW Loop Flow. Indicate/confirm loop as either constant or variable. If loop flow is set to variable, the Schematic Design Wizard prompts for the method of pump control (single speed, two speed, or VSD).
3) Loop Pump Head/Flow. Loop pump head defaults based on building type. Loop flow defaults using simple rules of thumb (40F water delta-t, btu/sqft based on climate zone). If the user wishes for the simulation engine to size the water flow using its design procedures, input a "0" for loop pump flow.
4) Boiler Size/Efficiency. Boiler size defaults using simple rules of thumb (btu/sqft based on climate zone). If the user wishes for the simulation engine to size the boiler using its design procedures, input a "0" for boiler size. Boiler efficiency defaults based on boiler type.

Hot Water System Control



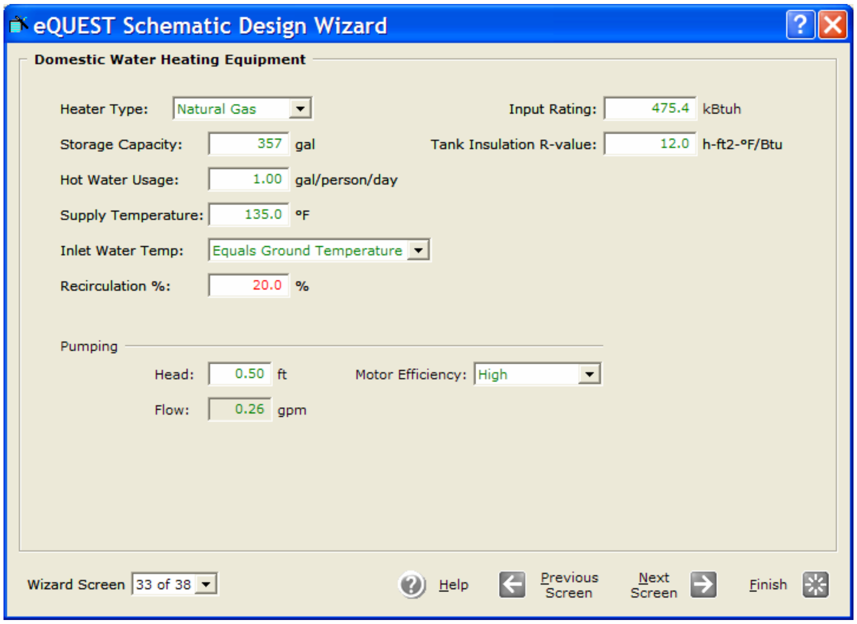
NOTES:

This CHW System Control dialog is displayed only if a CHW-based system type was selected as one of the two system types on the HVAC System Definitions screen (screen #19).

1) Setpoint is. Three HW setpoint control options are supported: "fixed" (constant setpoint, no reset); "Reset" (reset based on load); "OA reset" (reset based on outdoor air temperatures). In the reset cases, both minimum and maximum HW temperatures are input.
2) HW System Operation. Three HW system operation modes are supported: "Standby" (the default, loop operates whenever system fans are on); "Demand" (loop operates only when there is a load); "Scheduled" (scheduled either as on/off or based on outdoor air temperature, e.g., operates only during scheduled hours when outdoor temperatures are less than the OA Temperature). The schedule corresponding to a scheduled system operation defaults to follow the CHW system schedule but a "radio button" selection is available to change the default to either the first or second HVAC system schedule.
3) HW Setpoints. Depending on choice of reset control, HW setpoints are required to specify HW min and max temperatures (Setpoint is = Reset or OA Reset), or HW setpoint value (Setpoint is = Fixed).

Simulation Basics
Tour
Schematic Wizard
General Info
Bldg Footprint
Constructions
Exterior Doors
Windows
Skylights
Daylighting
Activity Areas
Occupied Loads
Unoccupied Loads
Main Schedules
Alt. Schedules
HVAC Sys Type
Zone Temp. & Air
Packaged Equip
HVAC Fans
Fan Sch #1
Fan Sch #2
Zone Ht & Econo
Deck Resets
WSHP Equip
Chillers
Cooling Towers
CHW Control
Boilers
HW Control
DHW Equip
Utility Charges
Project Info
DD Wizard
Detailed Interface
EEM Wizard
Graphical Reports
Detailed Reports

Domestic Water Heating Equipment



NOTES:

eQUEST's Wizards permit one domestic hot water tank to be modeled. Storage capacity and input rating are estimated by the Wizard using rules of thumb. <u>If the user wishes for the simulation engine to size these items using its simulation design procedures, input a "0" for each</u>. If the user selects California Title 24 compliance from the first Wizard screen, then a different pair of DHW screens are available (non-residential and residential), depending on choice of building type and activity area types.

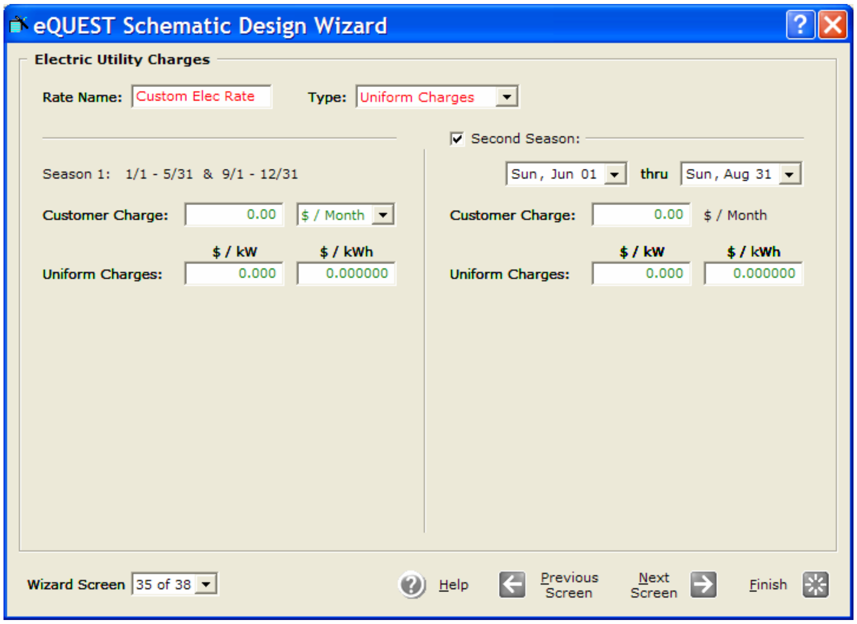
1) Hot Water Usage. Hot water usage, in gallons per person per day, defaults based on building type, per the *ASHRAE Handbook of Fundamentals*. A schedule is automatically associated with the usage whose peak rate (gals/person/hour) is also taken from the same ASHRAE source.

2) Inlet Water Temperature. Inlet water temperature accepts two inputs, "Equals Ground Temperature" and "Specify". "Equals Ground Temperature" uses ground temperature data from the weather files to estimate inlet water temperatures and typically vary by month. "Specify" allows the user to set a constant inlet water temperature all year.

3) Recirculation %. In the simulation engine, recirculation in domestic water loops is optional. Where there is no recirculation, it is assumed that local water pressure is sufficient to provide service on demand. Entering a number for Recirculation % greater than "0" (typically 10% to 30%) indicates that the loop uses pumped recirculation. If pumped recirculation is used, the user is prompted to enter pump head and motor efficiency.

4) Tank Insulation R-value. This value is used only if Storage Capacity > 0. In the Schematic Design Wizard, DHW tank stand-by losses are assumed to be lost to outdoor ambient conditions.

Electric Utility Uniform Charges



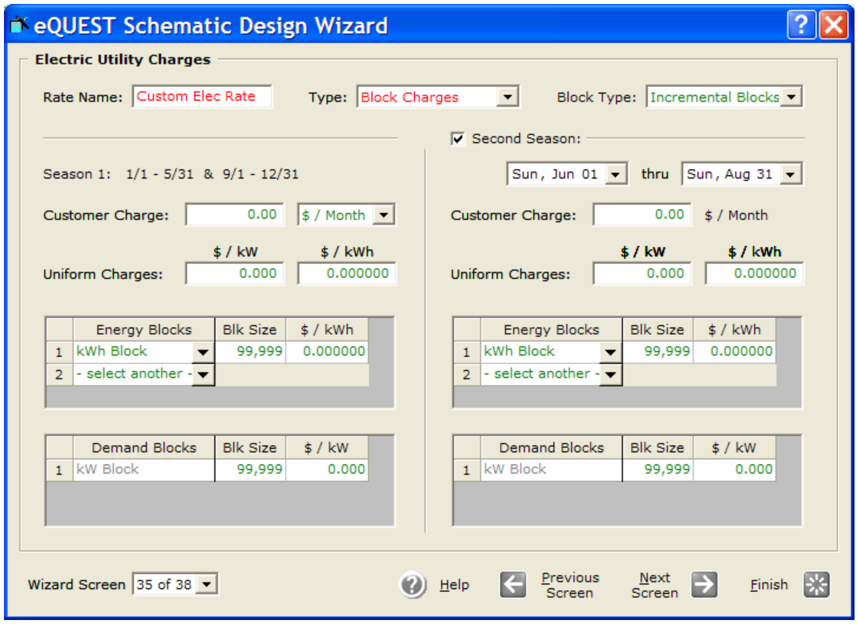
NOTES:

<u>This Electric Utility Charges dialog is displayed only if a Electric Utility Rate was selected as "Custom" on Screen #1)</u>.

1) Rate Name. It is recommended that your rate name include the name of the utility company and tariff number.
2) Type. Three choices a re possible: "Uniform Charges" (for rates that charge the same kWh charge for all kilowatt hours but which may vary seasonally… common for residential rates, <u>shown above</u>), "Block Charges" (for rates having provisions such "for consumption up to xxxxx kWh per month, the charge will be yyy $/kWh, all consumption in excess of xxxxx kWh per month will be charged at zzz $/kWh… this is the default and most common commercial/industrial rate), and "Time-of-Use Charges" (for rates whose charges vary by time of day, e.g., on-peak vs-mid-peak vs off-peak time periods… this is a less common commercial/industrial rate).
3) Customer Charge. May be specified in $ per month or $ per day.
4) Uniform Charges. Specify a peak demand or consumption charge that is constant with quantity and time, but may vary between two seasons. The units are $/kW (peak demand) and $/kWh (consumption).
5) Second Season. A second season can be selected (as displayed above).

While the screen capture shown above is for the Uniform Charge rate Type, the Customer Charge and Uniform Charges are often applicable to the other rates types (Block Charges and Time-of-Use Charges).

Electric Utility Block Charges



NOTES:

The Electric Utility Charges dialog is displayed only if a Electric Utility Rate was selected as "Custom" on Screen #1).

1) Type. <u>The screen above is for ate Type = "Block Charges"</u>. Block charge structures tend to charge less for increased "blocks" of consumption.

2) Block Type. Two selections are available.

   "Incremental Blocks" mean that the size of each successive block is stated in terms of the SIZE of the block, i.e., how many kWh are in each block, e.g., "the first x,xxx kWh's …, the next y,yyy kWh's … .

   "Cumulative Blocks" mean that the size of each successive block is stated in terms of the UPPER LIMIT of the blocks, i.e., the upper boundary of each block, e.g., "the first x,xxx kWh's …, up to y,yyy kWh's … .

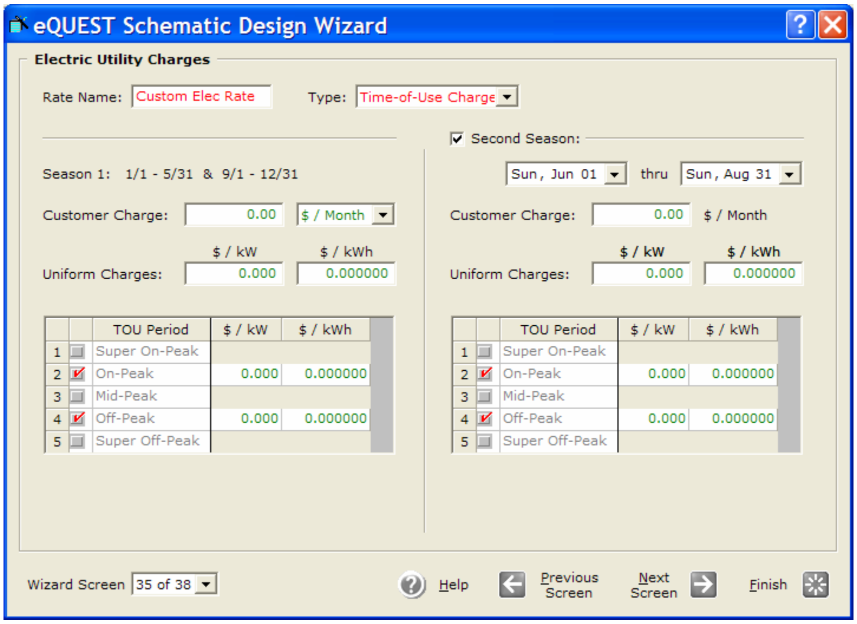
3) Energy Blocks. Two selections are available.

   "kWh Block": where energy block sizes (or upper limits) are pre-defined based on the units of energy consumed. For example, $0.07 for the first 10,000 kWh, $0.05 for the remainder.

   "kWh/kW Block": where energy block sizes (or upper limits) are based on a multiplier on peak electric demand. For example, $xxxx for the first kWh block, where the size of the first kWh block is determined by using a predefined multiplier times the peak electrical demand for each month. This type of block will tend to vary in size from one month to the next.

4) Second Season. A second season can be selected (as displayed above).

Electric Utility Time-of-Use Charges



NOTES:

The Electric Utility Charges dialog is displayed only if a Electric Utility Rate was selected as "Custom" on Screen #1).

1) Type. The screen above is for rate Type = "Time-of-Use Charges". Time-of-Use or TOU rates charge a different amount for demand and/or consumption, depending on when it is used, i.e., what time of day.

2) TOU Period. Up to five Time-of-Use periods are available to describe a TOU rate. Five choices for Electric Rate Time of Use Period are available:

   "On-Peak" Typically used to represent the most expensive electric use time period during the day, e.g., summer afternoons.

   "Off-Peak" Used to represent the least expensive electric use time period during the day, e.g., weekends and summer evenings.

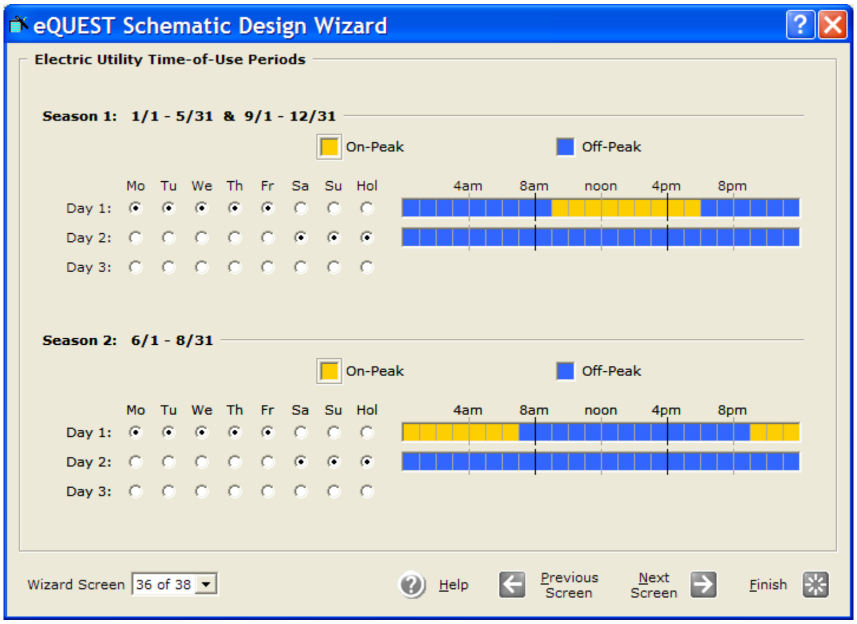
   "Mid-Peak" Used to represent the periods of the day, if any, where the cost of electric serve are higher than Off-Peak but lower than On-Peak, e.g., summer mornings.

   "Super On-Peak" Occasionally, time-of-use rates employ more than three time-of-use periods. Super On-Peak is intended to be used for rate periods more expensive than the On-Peak time period.

   "Super Off-Peak" Similar to Super On-Peak, except for rate periods less expensive than the Off-Peak time period.

3) Second Season. A second season can be selected (as displayed above).

Electric Utility Time-of-Use Periods



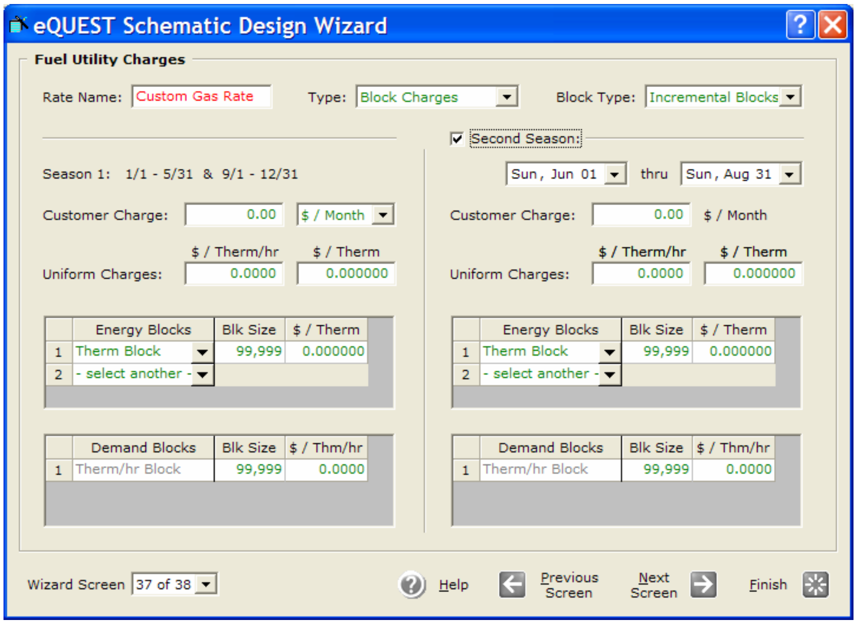
NOTES:

<u>The Electric Utility Time-of-Use Periods dialog is displayed only if the Electric Utility Rate Type was selected to be "Time-of-use Charges" on the Electric Utility Charges screen (previous screen)</u>.

1) TOU Periods Timeline. First select a TOU period by clicking on the preferred color box from the TOU legend. Then use your mouse to color the TOU timeline bar to indicate which hours are governed by which TOU period. The number of TOU colors in the legend will depend on the selection for TOU periods on the previous screen.

2) Season 2. A second season is displayed only if a second season was selected on the previous screen (as displayed above).

Fuel Utility Charges



NOTES:

<u>This Electric Utility Charges dialog is displayed only if a Gas Utility Rate was selected as "Custom" on Screen #1)</u>. This screen is identical in design to the Electric Utility Charges screen (two screens previous), except that no TOU option is available (rare for natural gas rates).

IMPORTANT NOTE:

Currently, there is no simple one stroke way to save the custom utility rates for later re-use in new wizard projects. The simplest method currently available to "save" your custom utility rates is done from within the detailed interface and requires a text editor.

See the next screen for steps to follow to save your Custom Utility rates for re-use in eQUEST Wizards.

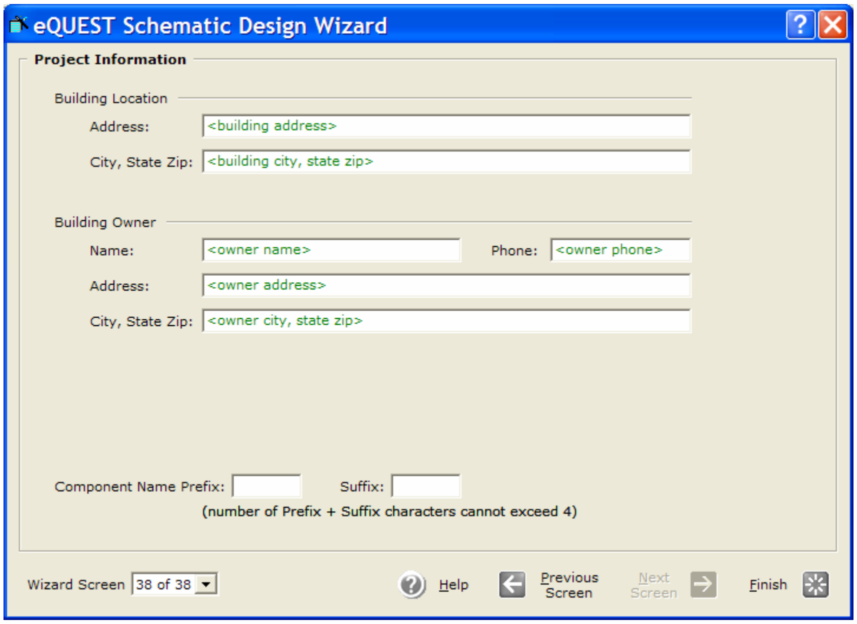
Saving Custom Utility Rates

IMPORTANT NOTE:

Currently, there is no simple one stroke way to save the custom utility rates for later re-use in new wizard projects. The simplest method currently available to “save” your custom utility rates is done from within the detailed interface and requires a text editor. The steps are:

1) Leave the Wizard, i.e., proceed to the Detailed Interface (in the Wizard, press the Finish button).
2) Once you’re in the Detailed Interface, save your file.
3) Within your project folder (c:\Program Files\eQUEST 3\Project\your project name), locate and open the project INP file (project file with INP file extension) using any text editor (e.g., Windows NotePad or WordPad).
4) In the INP file, find the BLOCK-CHARGE and UTILTY-RATE commands (always near the bottom of the INP file) and copy these into a separate text file. Be sure to include the command terminators (double periods “..”). See a file named “DOE2-BDL Utility Rate Documentation.pdf” found in the eQUEST 3\Rates folder for a detailed description of these DOE-2 BDL commands.
5) If your rates included schedules (e.g., for seasonal or time-of-use periods), you will need to find and copy all DAY-SCHEDULE-PD, WEEK-SCHEDULE-PD, and SCHEDULE-PD commands for all utility rate-related schedules. Place these at the top of the separate text file (i.e., before the BLOCK-CHARGE and UTILTY-RATE commands).
6) Name you separate text files (containing your utility rate-specific DOE-2 BDL commands) any thing you wish and use “ERT” as a file extension for the electric rates. Use “GRT” for gas rates. Select your file names to clearly identify the utility company and tariff name.
7) Place these ERT and GRT files in the eQUEST 3\Rates folder.
8) See the “Readme.txt” file in the eQUEST 3\Rates folder for more information.
9) The next time you start eQUEST, these ERT and GRT files will be selectable from within the Wizard (screen #1). Select Utility Electric or Utility Gas = “-file-” to see a listing of all the ERT and GRT files you’ve stored in the eQUEST 3\Rates folder.

Project Information



NOTES:

1) Building Owner and Building Location. Currently, the building location and building owner input on this screen is not output anywhere, therefore, it is useful only as project description information in the Wizard only.
2) Component Name Prefix and Suffix. These input fields are provided to enable Schematic Design (SD) Wizard users to prepare separate building descriptions, then compile them together into a multi-building project in the Detailed Interface. See the follow page for a description of this process.

To leave the Schematic Design Wizard and proceed to the detailed interface , click on the "Finish" button in the lower right hand portion of the screen.

After pressing the Finish button, eQUEST writes a "DOE-2" input (*.INP) file. This is a text input file containing DOE-2's BDL (Building Description Language) input language.

Multiple Buildings in the SD Wizard

DOE-2 BDL requires that every object within an INP file be uniquely named. Using the Prefix/Suffix fields on the Project Information screen (last screen in the schematic wizard), avoids redundant default component names by adding your unique characters as a prefix and/or suffix to the name of every component in the BDL input (INP) file.

Procedure:

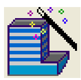
On the Project Information Screen, use the Component Name Prefix and Suffix fields to uniquely name every project component. These input fields are provided to enable Schematic Design (SD) Wizard users to prepare separate building descriptions, then compile them together into a multi-building project In the Detailed Interface. Characters input in these two fields are added as prefixes and/or suffixes to all building component names.

For example, suppose we wish to create a small two building campus for our eQUEST project. To do so, we could prepare the first building description in the Schematic Wizard, then on the Project Information Screen, enter a unique identifier in the prefis field, e.g., “Bdg1”. In this case, “Bldg1” would be added as a prefix (first four characters) to every component name in the INP file for our first building. Note that we are limited to a total of four characters (prefix + suffix). Press Finish to leave the SD Wizard and proceed to the Detailed Interface. From within the Detailed Interface), save your file (File/Save).

Start a new SD Wizard project (or return to the previous project Wizard screens). On Screen #1, name the project to reflect your second building. After describing the second building in the SD Wizard, enter “Bld2” as a prefix on the Project Information Screen. Leave the SD Wizard (proceed to the Detailed Interface) and save your file.

In the Detailed Interface, change the Mode to “Detailed Data Edit” (from the Mode menu at the top of the Detailed Interface screen). Import the first project into the second project (from the menus at the top of the Detailed Interface screen, File/Import). “Save-As” to save and rename the combined project.

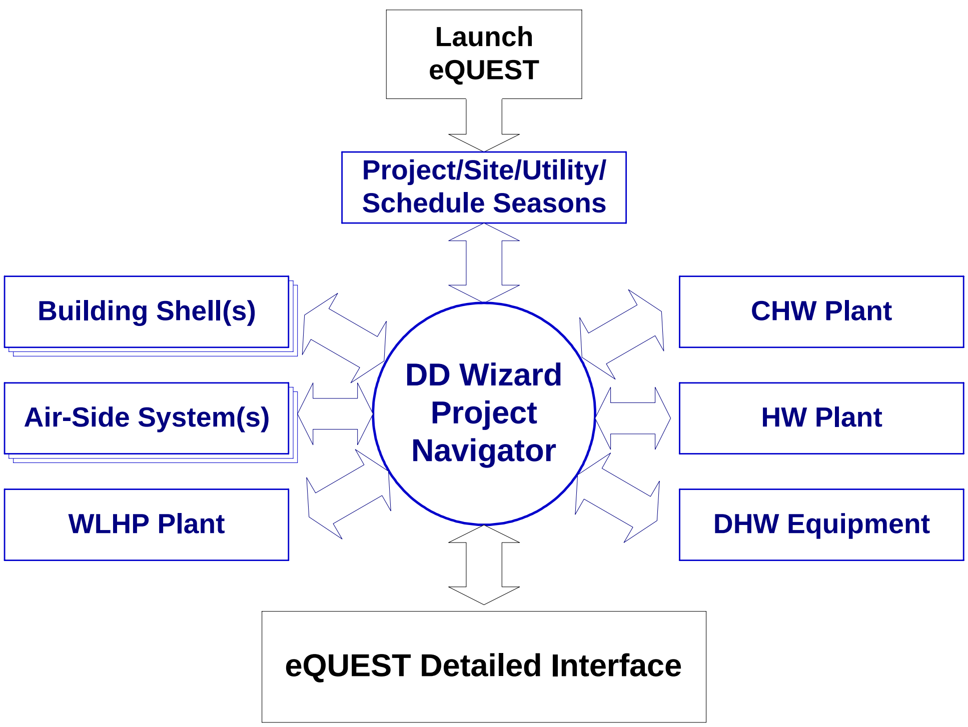
Design Development Wizard



The preceding pages have provided an overview of the Schematic Design Wizard. For more complex buildings, e.g., for buildings with floors having different shapes or for buildings that have progressed to the design development phase, the Design Development (DD) Wizard will provide additional modeling flexibility.

If the reader has not already reviewed the previous section describing the Schematic Design Wizard, it should be noted that the DD Wizard employs all of the same screens as the Schematic Design Wizard, but they are arranged somewhat differently… in a manner that allows more flexibility, plus there are a few new screens in the DD Wizard.

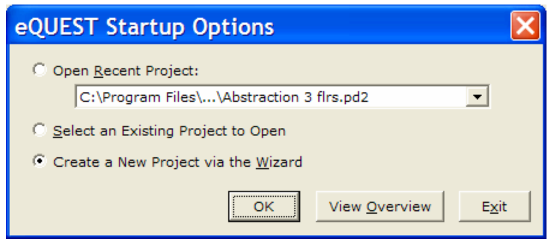
The organization of the DD Wizard groups the input screens into categories, e.g., Building Shell, Air-Side Systems, etc. The overall organization for the DD Wizard is shown below (the DD Wizard screens are shown in blue).



Currently, users can specify multiple building shell components (i.e., separate buildings, floors, wings, etc.), and multiple Air-Side HVAC Systems. The DD Wizard currently only supports one plant each for CHW, HW, WLHP, and DHW plants (multiple plants for each type are permitted in the Detailed Interface). The central screen in the DD Wizard is the Navigator, so-called because all of the other DD Wizard screen groups are connected to one another by the Navigator.

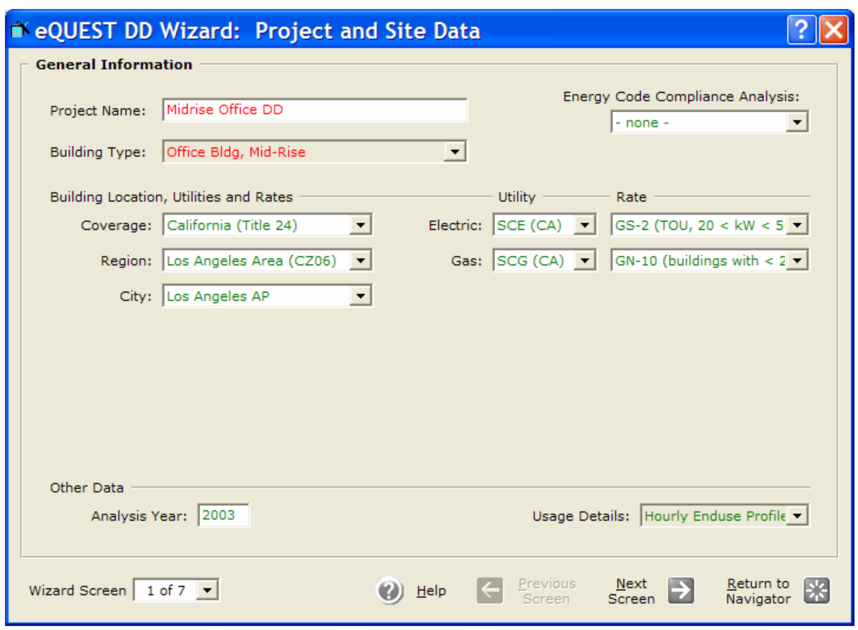
Design Development Wizard

Begin eQUEST by doubling clicking on the eQUEST icon from your desk top, or from your Start button, or from Windows Explorer. From the Startup Options Dialog, select "Create a New Project via the Wizard", and press OK.



Select to create a new project via the Wizards, then select to run the Design Development Wizard…

Project and Site Screens

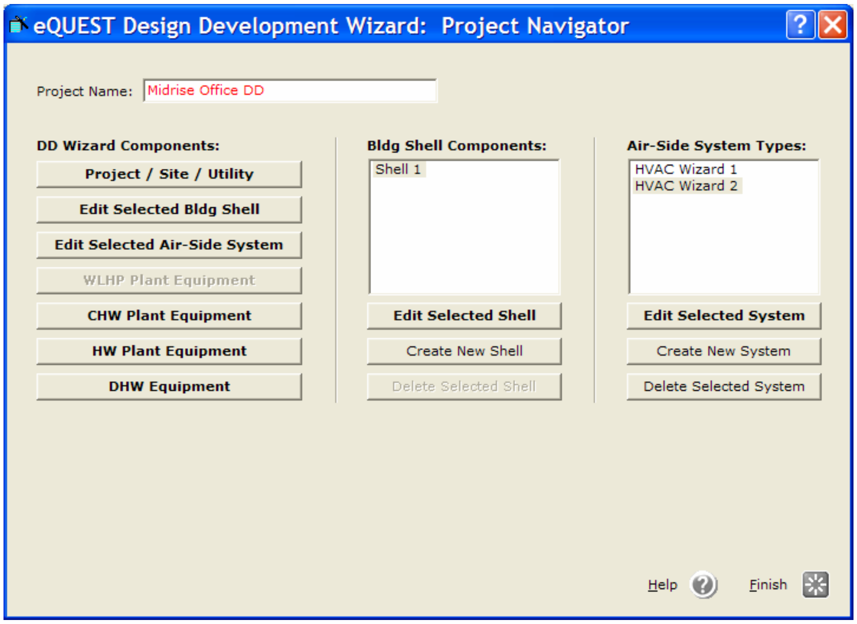


NOTES:

1) General Information screen. The information collected on this screen is identical to the General Information Screen for the Schematic Design Wizard, with the inputs for building size, number of floors, and heating/cooling source, which have been relocated to the shell and air-side system screens.

2) Note that the button in the lower right corner is not labeled "Finish" as it is in the Schematic Design Wizard. In the DD Wizard, this is labeled "Continue to Navigator" or "Return".

Project Navigator



NOTES:

The Project navigator is the “command center” for the DD Wizard. From this screen, users select which screens they wish to visit to review or specify new model information. This screen is also used to create multiple building shells and air-side systems.

Multiple building shells would be useful to define separate building floors whose shape or zoning differ from one another, or to define different wings of buildings or separate buildings (e.g., on a campus of buildings).

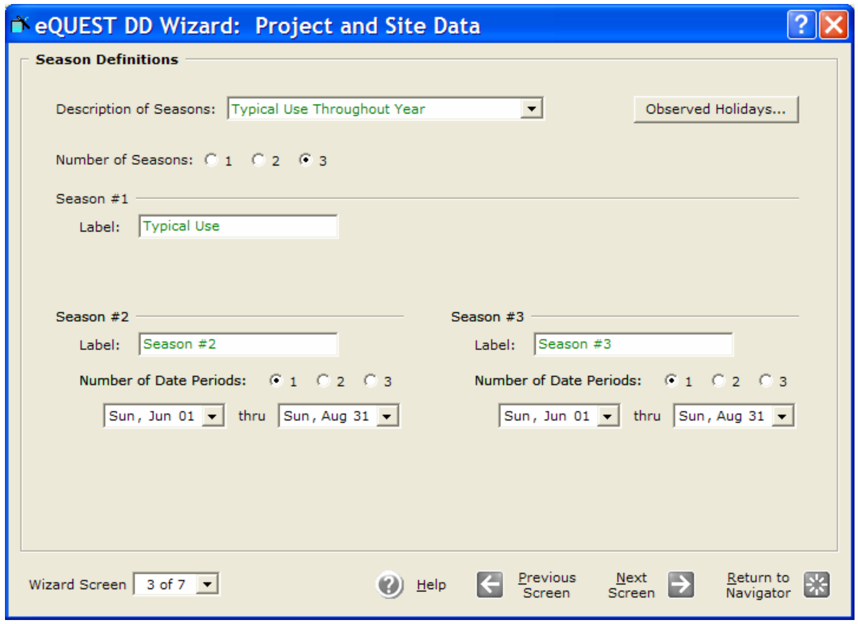
You can also create multiple air-side systems. This adds flexibility in specifying which areas of a project are served by different HVAC systems.

1) Project / Site / Utility. Use this to access General Information, Compliance Analysis Settings, Project Seasons Definitions, and Utility Charges.
2) Building Shell. Use this to access all of the screens used to define the building shell, including the building operations scheduling and internal loads (lights, plugs, and occupants).
3) Air-Side Systems. Use this to access all of the screens needed to define an air-side HVAC system.
4) WLHP Plant Equipment. Use this to access water loop heat pump equipment specifications (currently, only one plant per project).
5) CHW and HW Plant Equipment. Use this to access central cooling and heating plant equipment specifications (currently, one plant per project).
6) DHW Equipment. Use this to access domestic hot water equipment specifications (currently, only one DHW system type per project).

NOTE: Since most of the DD Wizard screens are identical to the Schematic Wizard screens described previously, only those screens that are unique to the DD Wizard or were not previously described will be included below.

Project & Site: Seasonal Definitions

Simulation Basics
Tour
Schematic Wizard
DD Wizard
Project Navigator
Project & Site
Season Definitions
Building Shell
Air-Side Systems
WLHP Systems
CHW plant Equip
HW Plant Equip
DHW Equipment
Detailed Interface
EEM Wizard
Graphical Reports
Detailed Reports

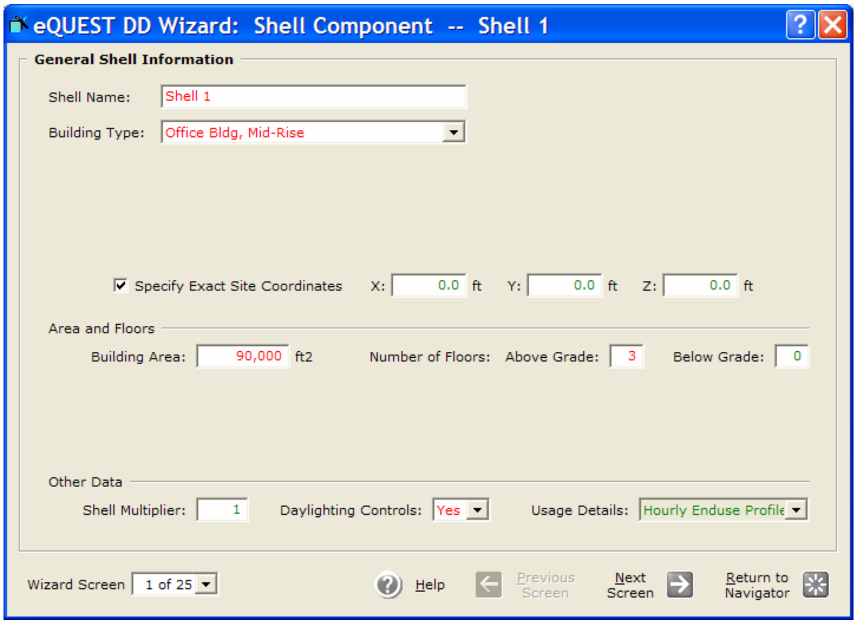


NOTES:

This screen allows the user to specify the number of seasons, up to three, to be used in the building operations schedules. This screen is always displayed in the DD Wizard, but it is only available in the SD Wizard if "Usage Details" on SD Wizard Screen #1 is set to "Hourly Enduse Profiles" (in which case, the screen illustrated above is Screen #13 in the SD Wizard.).

1) Description of Seasons. Select the option that best describes the building's operational periods or seasons. For some building types, "Typical Use Throughout Year" is the only available selection. For others there may be more than one selection for Season Description. The available selections represent preset options describing the building's operation over the course of a year. For example, for a school, the available Season Descriptions are "Year Round Classes", "Full Nine Months, Reduced Summer Session" and "Full Nine Months, No Summer Session."
2) Observed holidays. Presents a predefined list of 20 possible holiday dates, with 10 pre-selected for observance.
3) Number of season. Select 1, 2 or 3 seasons to be used in all of the building operations schedules (three seasons illustrated above). This limit of three seasons is one of convenience for use in the Wizards. In the detailed Interface, you can have up to 52 seasons in any schedule.
4) Number of Date Periods. Use these controls to specify multiple date periods though the year to be associated with any of the (up to three) seasons. Any date periods not included in Season #2 or #3, are assumed to be included in Season #1.

Building Shell: General Shell Information



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WLHP Systems
CHW plant Equip
HW Plant Equip
DHW Equipment
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EEM Wizard
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NOTES:

This screen differs slightly from its counterpart in the Schematic Wizard, in that this screen contains some of the data relocated from the DD Wizard General Information Screen (compare to SD Wizard Screen #1).

1) Shell Name. Use this field to name the currently selected shell component. A shell might be a separate building on a small campus of buildings, or a floor (or floors) with a unique common footprint, or a floor (or floors) with a unique common zoning scheme, or separate wings of a building.
2) Specify Exact Site Coordinates. This is an optional control that would generally only be invoked to help locate a shell relative to another shell in the same project.
3) Area and Floors. These inputs function in an identical manner to their counterparts in the Schematic Wizard (see SD Wizard Screen #1).
4) Shell Multiplier. Use this to implicitly model multiple shells identical to the one you are describing (see Simulation Basics at the beginning of this Tutorial, "*Keeping it Simple… but not too simple*").

Bldg Shell: Building Operations Schedule

NOTES:
Use this screen to define indicate only the occupancy start and stop times for the project (for up to three seasons as illustrated above).

1) Use. Select the use option that best describes the operational characteristics of the building for each Building Operation Season. The choices for Season Use vary by building type. For example, a building type of "Restaurant, Full Service (full menu)" has the following choices for Season Type (Use): "Closed for Business", "Low Meals Served", "Typical Meals Served" and "High Meals Served."

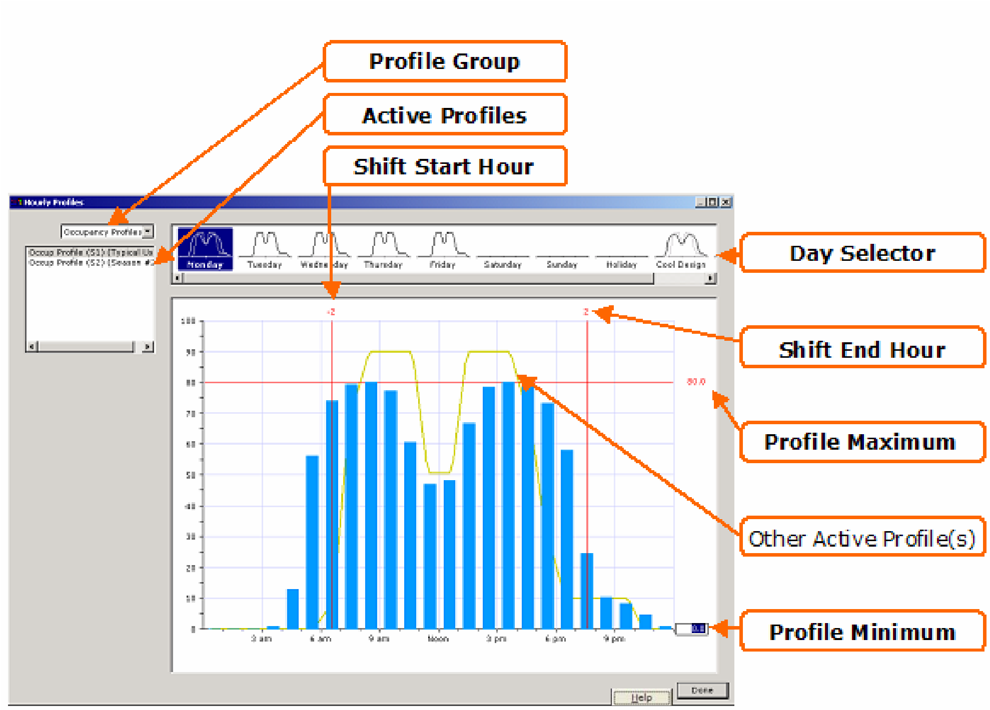
Building Shell: Activity Areas Allocation

NOTES:

This screen differs slightly from its counterpart in the Schematic Wizard, in that this screen contains assignment priority choices for Mid and Top floors. Compare to Schematic Design Wizard Screen #13(when “Usage Details” on SD Wizard Screen #1 is set to “Simplified Schedules”).

1) Show Zone Groups. For the DD Wizard, this option is selected by default. This enables the presentation of the Zone Groups screen (see two pages following).
2) Occupancy Profiles by Season. Up to three lists (one for each season) are presented at the bottom of this screen, containing a list of all seasonal profiles. The [...] button at the right lower corner of this screen, allows user access to the hourly profiles (see the following page).

Building Shell: Hourly Profiles

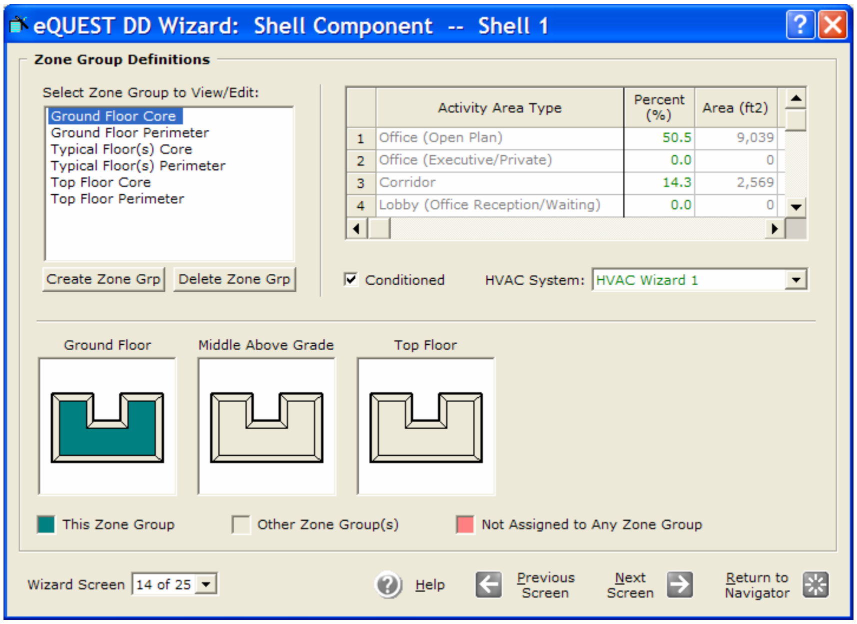


NOTES:

This dialog is available via the button at the right lower corner of the Activity Areas Allocation Screen (see previous page). This screen, allows user review and edit to the hourly profiles used for the operations schedules.

1) Profile Group. In the upper left corner of the screen, use the pull-down pick list to select the Profile Group you wish to review (e.g., occupancy, lights, office equipment, DHW usage, etc.). Since fan schedules are simple On/Off schedules, they are not available on this hourly profile dialog.
2) Active Profiles. Near the upper left corner of the screen, use the list box to select a preferred schedule season for the profile group selected in step (1).
3) Day Selector. Click on a preferred day of the week at the top of the dialog to view the detailed dialog in the main view/edit area of the dialog.
4) Profile Maximum. In the main view/edit area of the dialog, click on the red number displayed near the upper right are of the screen (right hand end of the horizontal red line). Edit this number to raise or lower the overall profile. “Profile Minimum” controls the unoccupied profile level.
5) Shift Start Hour. Edit this number (e.g., +1 or -1) to shift the start-up time for the profile. Use “Shift End Hour” similarly.
6) Other Active Profiles. Displays profiles from other seasons, for comparison.

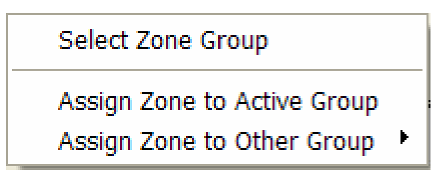
Building Shell: Zone Group Definitions



NOTES:

<u>This screen is available only if the "Show Zone Groups Screen" check box is selected on the Activity Areas Allocation screen (previous screen)</u>. This screen is used to accomplish two things: (A) assign activity area types by zone or zone group, and (B) assign air-side HVAC systems by zone or zone group.

1) Zone Groups. The list box in the upper left corner of the dialog lists predefined zone groups, e.g., ground floor core zones, second floor perimeter zones, etc. Create new zone groups or delete existing zone groups by selecting the buttons below the zone groups list box.
2) Floor Plan Views. Zone assigned to the currently selected zone group are displayed in dark green in floor plan views. Any zones not assigned to a zone group are displayed in pale red.
3) To assign or re-assign zones to zone groups, left click on a zone in any of the floor plan views, and select "Assign Zone to Active Group" or "Assign Zone to Other Group".



4) Activity Area Types. Assign or adjust activity area assignments to zone groups by editing the Percent (%) column of the Activity Area spreadsheet control in the upper right area of the dialog. %'s must sum to 100% for each zone group. The resulting area (sqft) is also reported for the selected zone group. Percent and sqft is also reported for the whole building (shell).
5) HVAC System. Assign air-side systems to zone groups by first selecting a preferred zone group then selected the preferred HVAC system.

Bldg Shell: Non-HVAC Enduses to Model

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CHW plant Equip
HW Plant Equip
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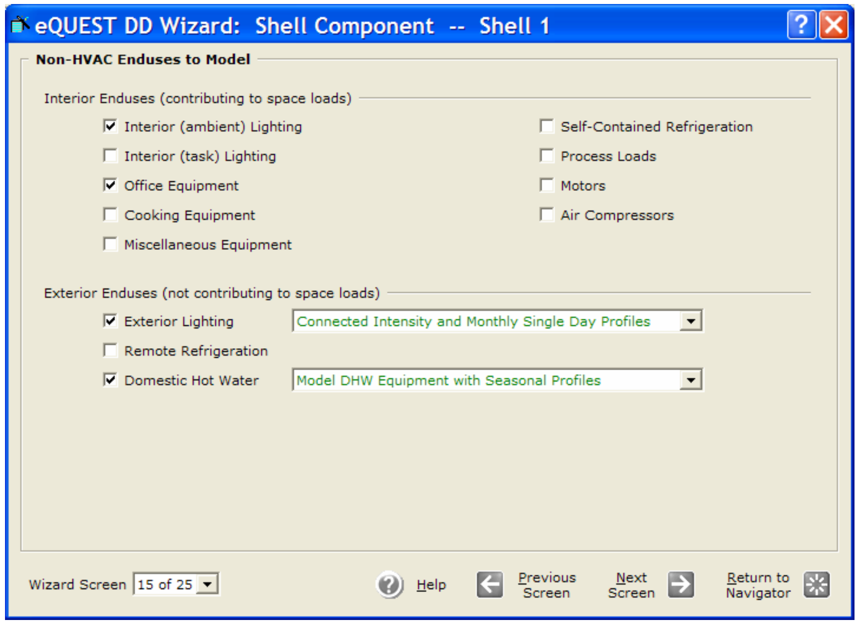
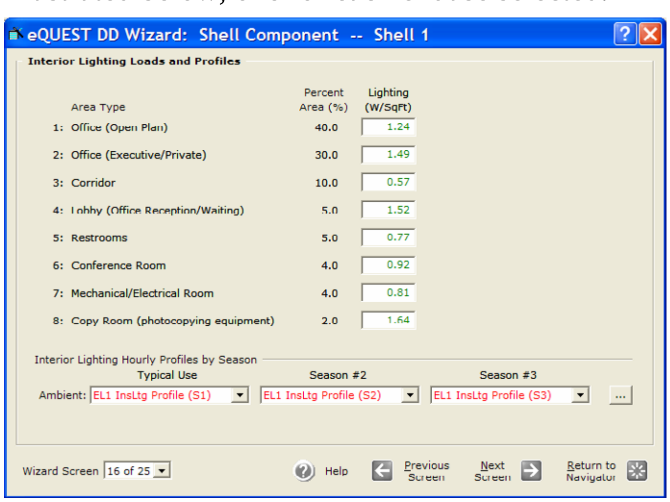


NOTES:

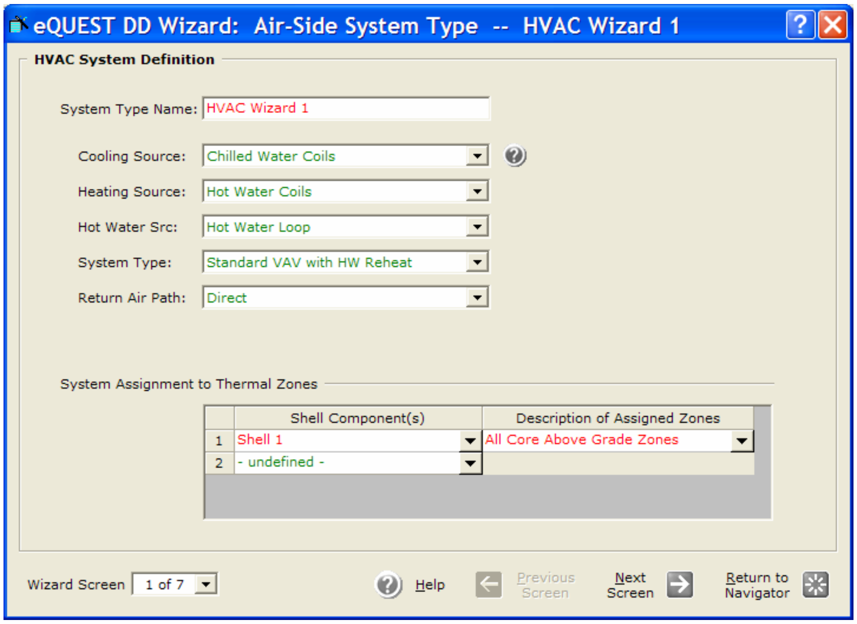
<u>This dialog is available only if Hourly Profiles are specified (default for DD Wizard, SD Wizard, Screen #1)</u>. This screen allows users to select which non-HVAC endues are to be included in the model of this building shell.

1) Interior Enduses. Check all interior enduses you desire to include in your model. "Interior" enduses are those that contribute to space thermal loads i.e., "felt" by one or more thermostats.
2) Exterior Enduses. Check all exterior enduses you desire to include in your model. "Exterior" enduses are those that do not contribute to space thermal loads i.e., are not "felt" by one or more thermostats.

Each endue selected on the screen above enables a screen such as the one illustrated below, one for each enduse selected.



Air-Side: HVAC System Definition

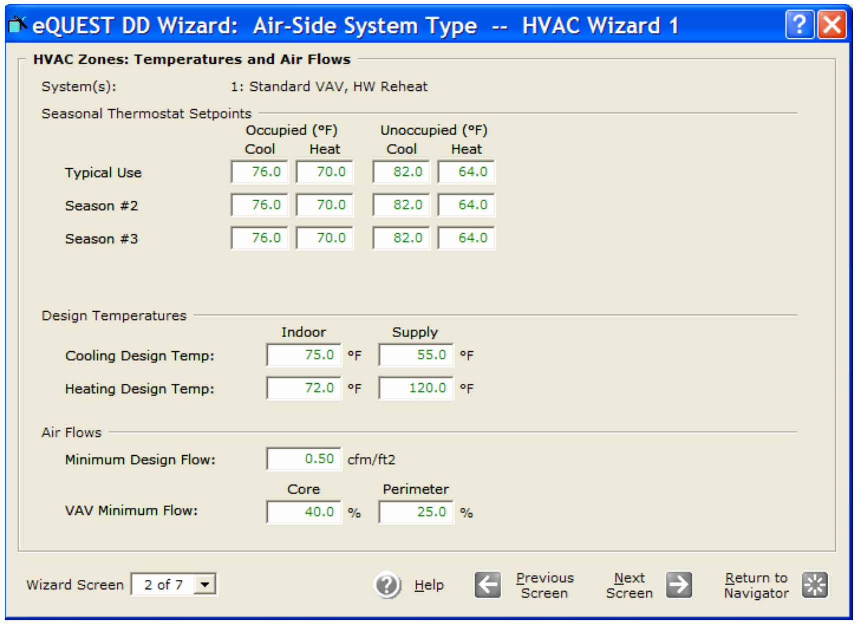


NOTES:

This screen is similar to the SD Wizard HVAC Systems Definition screen (Screen #19), except that only one system may be defined. Multiple systems are defined simply by returning to the DD Wizard Navigator and creating new systems.

1) System Assignments to Thermal Zones. This spreadsheet control provides an alternative means of assigning HVAC systems to shells.
2) The functionality of the remaining controls on this screen are consistent with those seen previously on the SD Wizard HVAC Systems Definition screen.

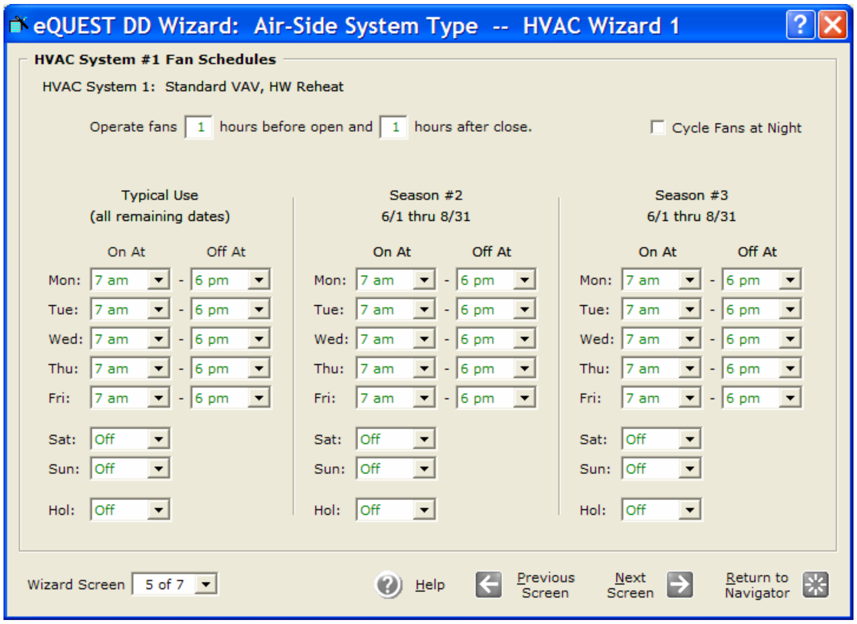
Air-Side: HVAC Zone Temps & Air Flows



NOTES:

This screen is similar to its counterpart in the Schematic Design Wizard. The only difference is the provision for seasonal thermostat setpoints (up to three seasons, the number of seasons is determined on the Project & Site Data, Season Definitions screen).

Air-Side: Fan Schedules



NOTES:

This screen is similar to the SD Wizard HVAC Systems Fans Schedule screen, except that it provides for the optional specification of up to three seasons (the SD Wizard version allows only two seasons).

Similar schedule screens are also available in the CHW Plant Equipment, HW Plant Equipment, and DHW Equipment DD Wizard modules.

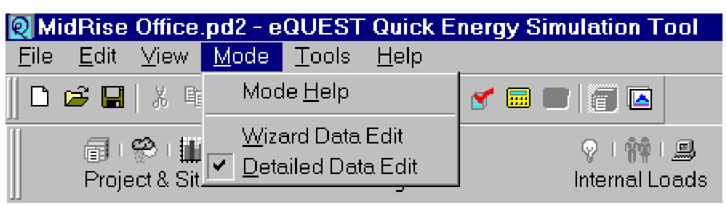
Detailed Interface

A comprehensive review of eQUEST's Detailed Interface is beyond the scope of this introductory tutorial. However, selected screen captures and brief descriptions will aid the new user to navigate and use some features of the Detailed Interface, e.g., to confirm 2-D and 3-D geometry.

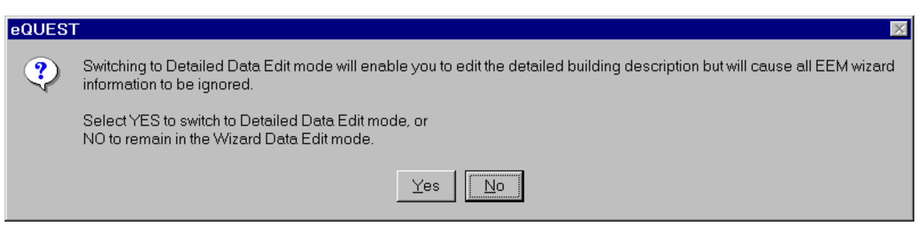
Several important buttons are found on the top tool bar of the Detailed Interface. These are briefly reviewed in this section. More information on these is found in the Tour (first) section of this tutorial.

Important Note: Although it is possible to edit any or all model inputs within the Detailed Interface, it is not recommended for beginning users. Note that any changes made within the Detailed Interface are not communicated back to the Schematic Design Wizard or to the EEM Wizard, thus, if the user returns to the Schematic Design Wizard, all edits made within the Detailed Interface will be lost, i.e., replaced by the inputs contained within the Schematic Design Wizard. Similarly, only the inputs within the Schematic Design Wizard are communicated to the EEM Wizard. Therefore, edits in the Detailed Interface are ignored in the EEM runs.

Advanced users may still find advantages to editing models directly within the Detailed Interface. To edit within the Detailed Interface, users must first change from the Wizard Data Edit mode to the Detailed Data Edit mode. This is done from the menu bar (top left area of screen). Pull down the Mode menu and select Detailed Data Edit (see below). A warning/confirmation message (see below) will be displayed to confirm the change of mode.



Detailed Interface, Mode Menu options



Warning message issued when changing from Wizard Edit mode to Detailed Edit mode

Detailed Interface

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Schematic Design Wizard: For models originally created using the Schematic Design Wizard, you can return to the Schematic Design Wizard at anytime to modify your wizard inputs and regenerate your building model. Note that any edits to the model made in the Detailed Interface will NOT be reflected in the Schematic Design Wizard.

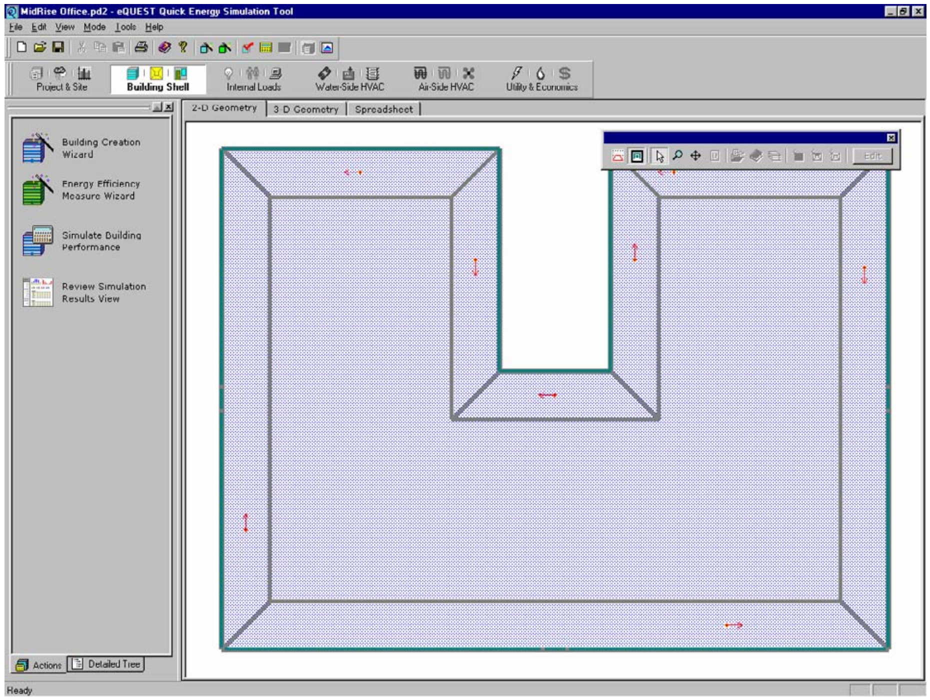
EEM (Energy Efficiency Measure) Wizard: After creating a new building description, i.e., using the Schematic Design Wizard, launch the EEM Wizard to quickly describe up to ten design alternatives to your "base" building description. You can then automatically simulate any or all of these alternative cases and view the simulation results in individual and/or comparative reports.

Perform a simulation: Press the Run Simulation button to perform an annual simulation of the base building design description and/or of any of your EEM design alternatives (created using the EEM Wizard).

Review simulation results: From the eQUEST analysis tool bar, press the Results Review mode button to view graphic simulation output reports. From the bottom of the results tree diagram (left side of the Results View screen) select the Projects / Runs tab, then select one or more projects for which you wish to view results. Also from the bottom of the results tree diagram, select the Reports tab, then select single run or comparison reports, as preferred.

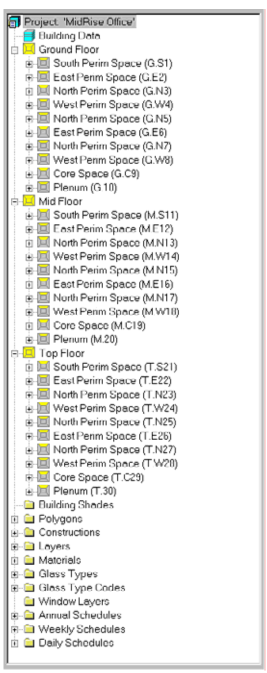
Return to the detailed Project View Mode: After reviewing simulation results, return to the detailed Project View mode, by pressing the Project View mode button on the analysis tool bar.

Building Shell Module



Building Shell Module, 2D Geometry Tab View

Component Tree



NOTES:

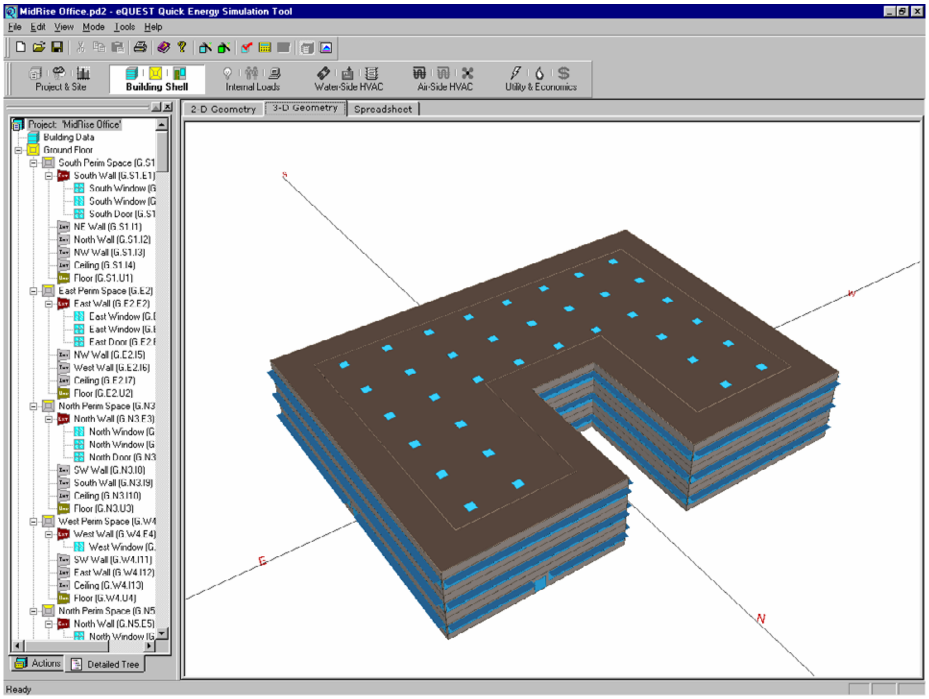
Upon exiting the Schematic Design Wizard, the user arrives at eQUEST's Detailed Interface. By default, the user is placed within the Building Shell module. All of eQUEST's Detailed View modules are accessible via the module navigation bar near the top of the screen (the large icons described on the previous page). Screens for eQUEST's Detailed View modules are divided into two main areas:

1) **Actions / Component Tree View** (two tabbed views on the left). The Actions tab contains the available actions buttons (e.g., Building Creation or Schematic Design Wizard, EEM Wizard, Run Simulations, Review Simulation Results). This view is presented by default for the Wizard Data Edit mode. The Detailed Component Tree can also be selected from the tab at the lower left area of the Actions/Tree View. The detailed component tree at left shows all major tree components for the Building Shell module (the example shown at left has been reduced to show only the principal component levels by selecting the "minus" icon at left of each component). When the user first navigates to a module, the detailed tree is fully expanded, i.e., showing all levels of components.

2) **Detailed Tab View** (detailed views on the right). The Building Shell Detailed View module currently has three tab views, "2-D Geometry", "3-D Geometry", and "Spreadsheet". The 2-D tab is shown above. The following page shows the other tab views.

eQUEST

Building Shell Module, 3D Tab View



Building Shell Module, 3D Geometry Tab View

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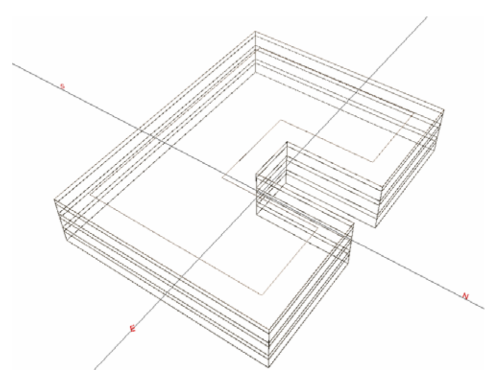
NOTES:

Change to the 3D Geometry View by clicking on the "3D Geometry" tab at the top of the detailed diagram area.

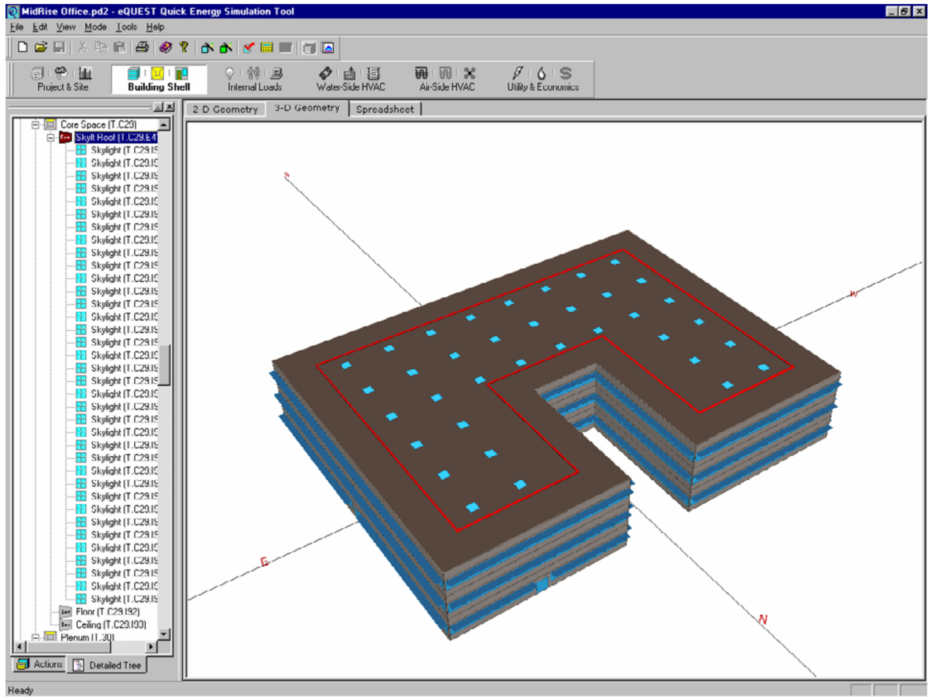


Rotate & Tilt: To rotate the 3D image, press and hold down the control key while simultaneously pressing and holding the left mouse button. After a short wait, e.g., 2 to 3 seconds, the displayed image of the building will change from solid to wire frame (see example below). With the wire frame displayed (and both the control key and left mouse button still depressed), slowly move the mouse cursor left-to-right… this will rotate the building image. Let go of the left mouse button and control key to redisplay a solid building image. Repeating the same steps, move the mouse cursor vertically on the screen to tilt the building image.

Zoom: Repeat the same steps using control-right mouse to zoom.

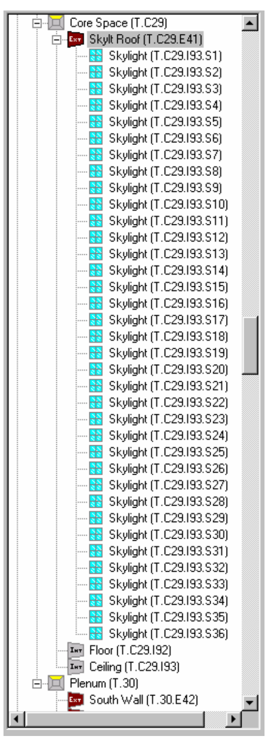
Wire Frame vs Solid View: Users may find it convenient to toggle between solid view and wire frame view. First click on the 3D view (left mouse button), then press either the "s" or "w" key to select solid or wire frame view. The wire frame view can help confirm location of interior walls.

Building Shell Module, 3D Tab View



3D Geometry Tab View, with a component (roof) selected

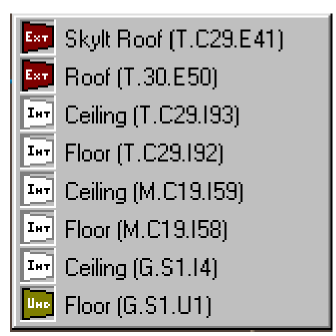
Component Tree



NOTES:

To inspect details of any building object, in solid view, click on any building object in the 3D view. An imaginary ray is traced from the observers eye through mouse cursor and the 3D image. Every surface intersected by the trace will be listed on a pop-up pick list (see example below). Select the preferred object by clicking on it from the pop-up list ("Skylit Roof (T.C29.E41)" selected in this example). The selected object will become the highlighted component in the component tree (see example at left) and will display a bold red border in the 3D view (see example above). Select the "Spreadsheet" tab to view details of the selected building component (see example on the following page).

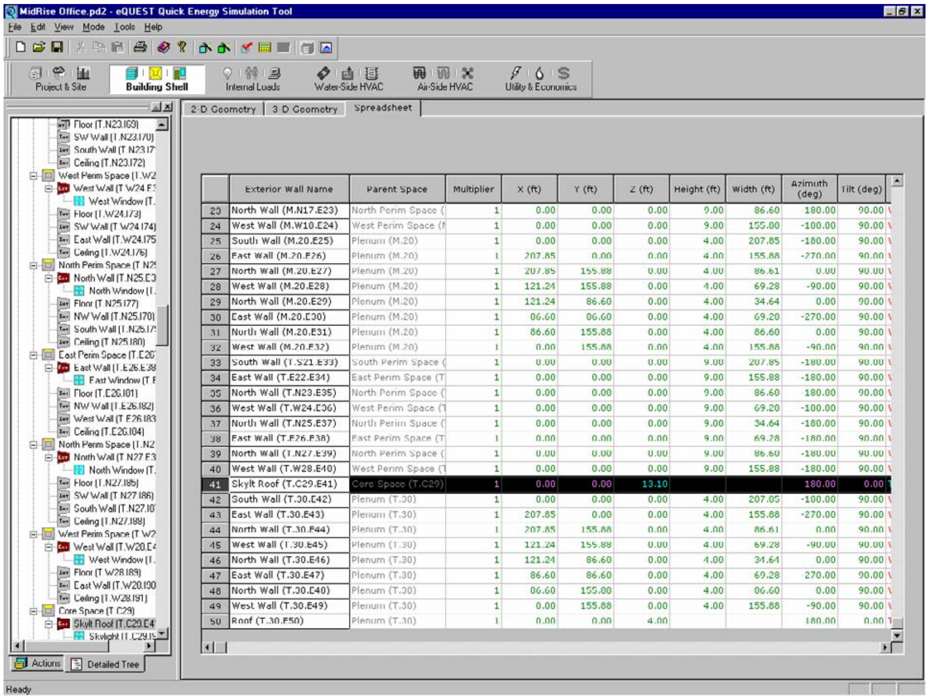
Selected objects
pop-up list



Alternately, right clicking on any component in the 3D diagram presents a quick menu similar to the one illustrated at right, but with access to detailed "Properties" for each component.

eQUEST

Building Shell Module, Spreadsheet View



Building Shell Module, Spreadsheet Tab View

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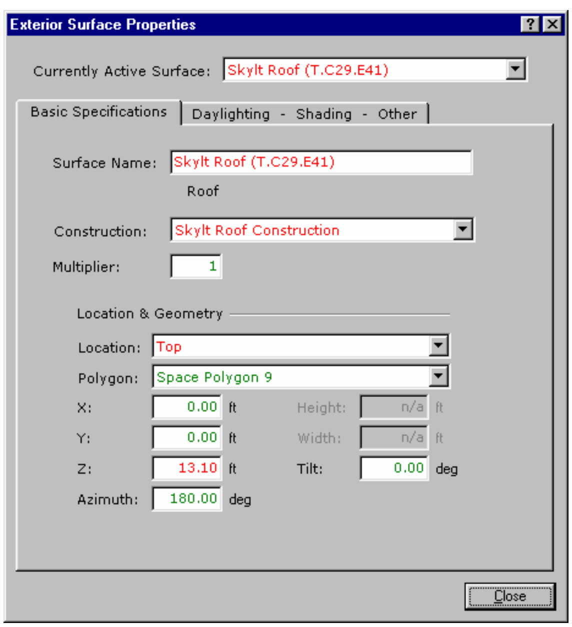
NOTES:

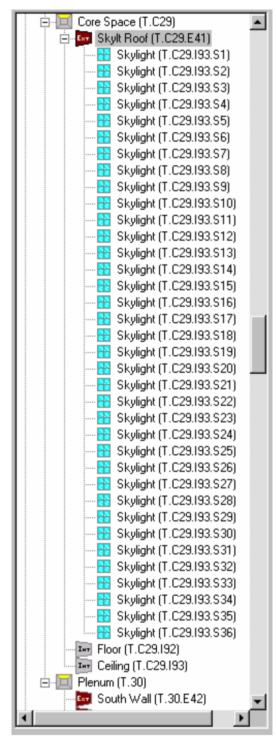
After clicking on a selected building component in the 3D view (see previous page), click on the "Spreadsheet" tab to view details of the component (see example above) — row for selected item highlighted.



Alternately, click on any item in the component tree (example at right) to display details of the selected component on the Spreadsheet tab. The item selected in the tree will also be highlighted in the 3D (example on previous page) and 2D View.

Right click on any item in the component tree, 2D View, or 3D View and select "Properties" to display a tabbed dialog of details for the selected component (example at left).

Component Tree



Project & Site Module

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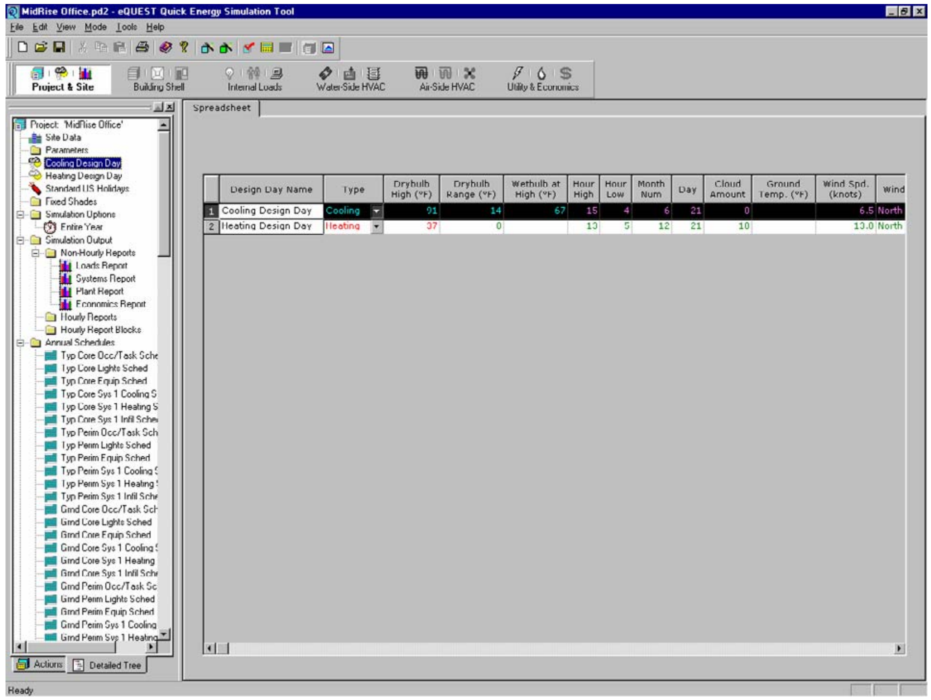
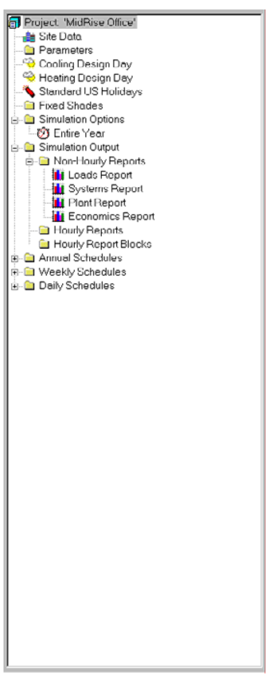


Project & Site Module, Spreadsheet Tab View

Component Tree



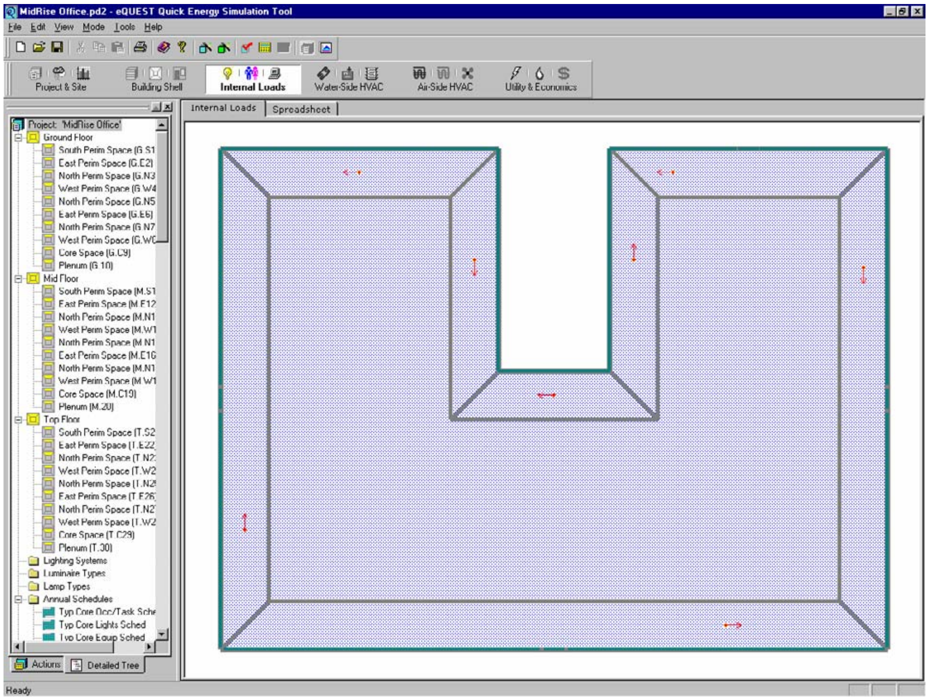
NOTES:

The Project & Site module has only one tab view, "Spreadsheet".

1) **Component Tree** (on the left). The image at left shows all major tree components for the Project and Site module (Cooling Design Day selected).

2) **Tabbed Spreadsheet View** The Project and Site Detailed View module currently has only one tab view, "Spreadsheet". This spreadsheet view is used to review/input/modify general features related to the project and site. Only like objects for the currently selected object are shown on the spreadsheet view (Cooling Design Day selected in the example above).

Internal Loads Module



Internal Loads Module

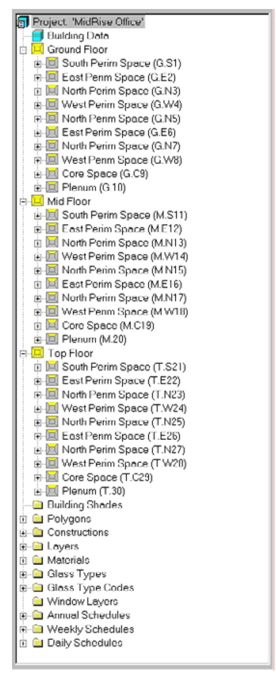
NOTES:

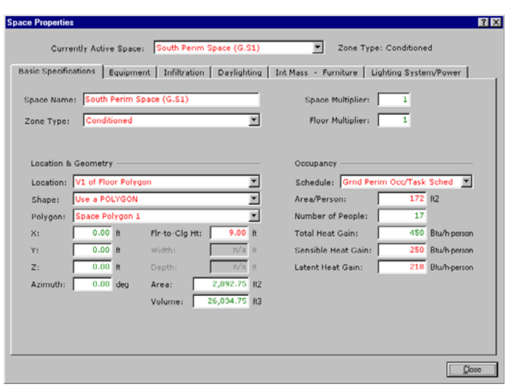
The Internal Loads module is used to set/confirm internal loads (people/lights/equipment) in eQUEST.

1) **Component Tree**. The component tree at right shows all major tree components for the Internal Loads module (the example shown at left has been reduced to show only the principal component levels). Right mouse click on any item in the tree and select properties, to display a tabbed dialog showing internal load details.

2) **Detailed Tab View**. The Internal Loads Detailed View module currently has two tab views, "Internal Loads", and "Spreadsheet".

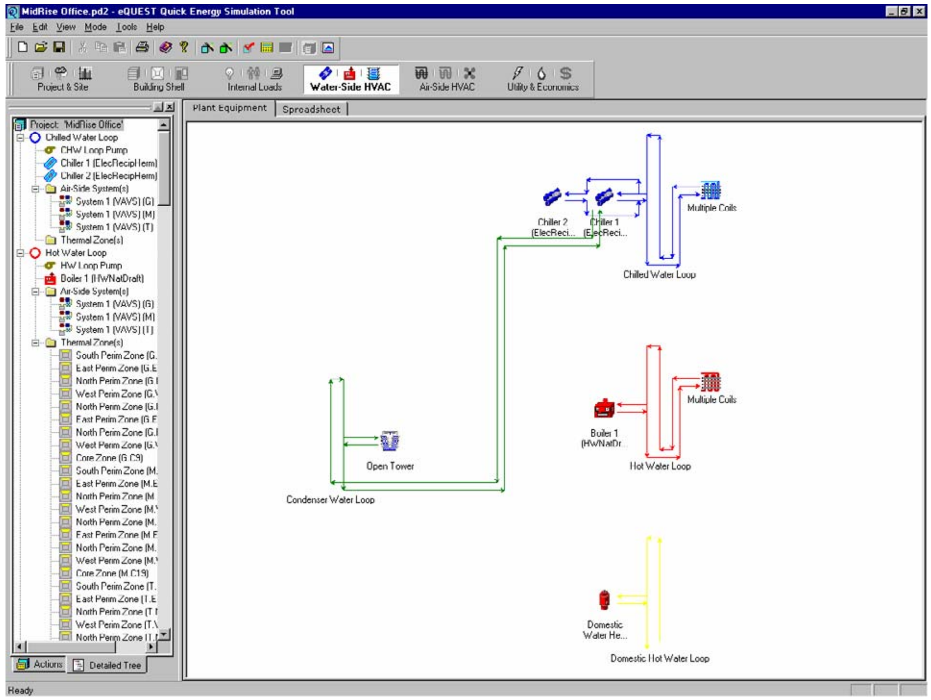
Component Tree





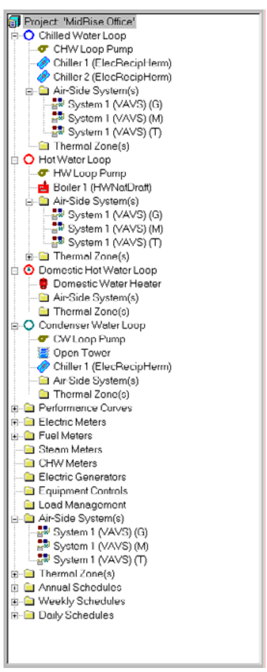
Internal Loads Tabbed Dialog

Water-Side HVAC Module



Water-Side HVAC Module, Plant Equipment Tab View

Component Tree



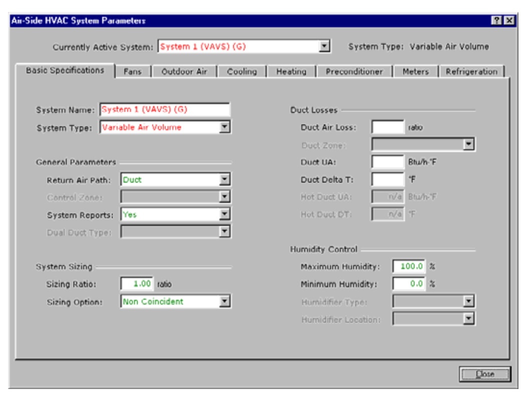
NOTES:

1) **Component Tree** (on the left). The image at left shows all major tree components for the Water-Side module.

2) **Tabbed Detailed View** The Water-Side HVAC module has two tab views: "Plant Equipment" and "Spreadsheet". These tabs are used to review/input/modify features of the project water-side.

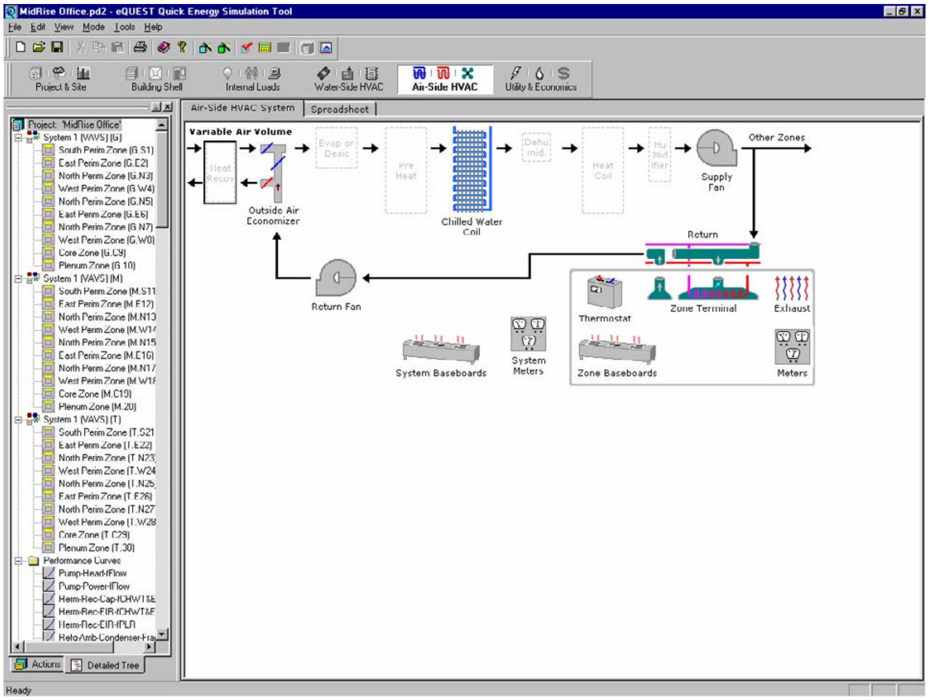
Right mouse click on any item in the component tree or Plant Equipment tab view to display a tabbed dialog providing detailed information for the selected component.

Water-Side Equipment Tabbed Dialog



 eQUEST

Air-Side HVAC Module



Air-Side HVAC Module

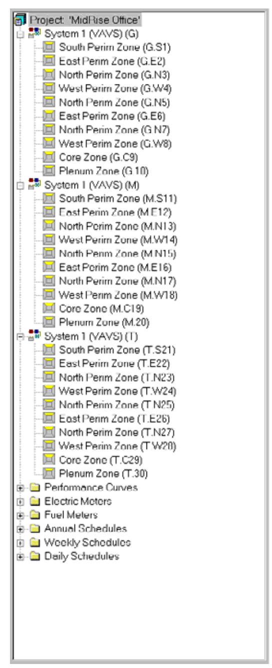
NOTES:

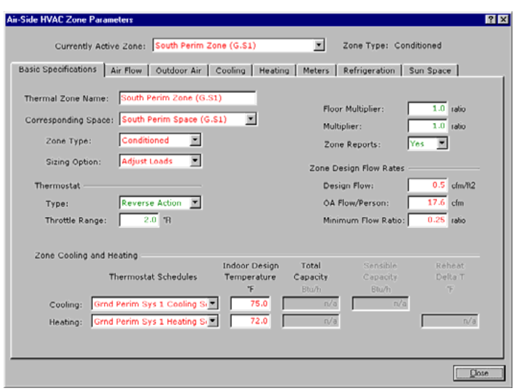
1) **Component Tree** (on the left). The image at left shows all major tree components for the Air-Side module.

2) **Detailed Tab View**. The Air-Side HVAC module has two tab views: "Air-Side HVAC System" and "Spreadsheet". These tabs are used to review/input/modify features of the project air-side equipment.

Right mouse click on any item in the component tree or Air-Side HVAC System tab view to display a tabbed dialog providing detailed information for the selected component.

Component Tree





Air-Side Equipment Tabbed Dialog

Utility & Economics Module

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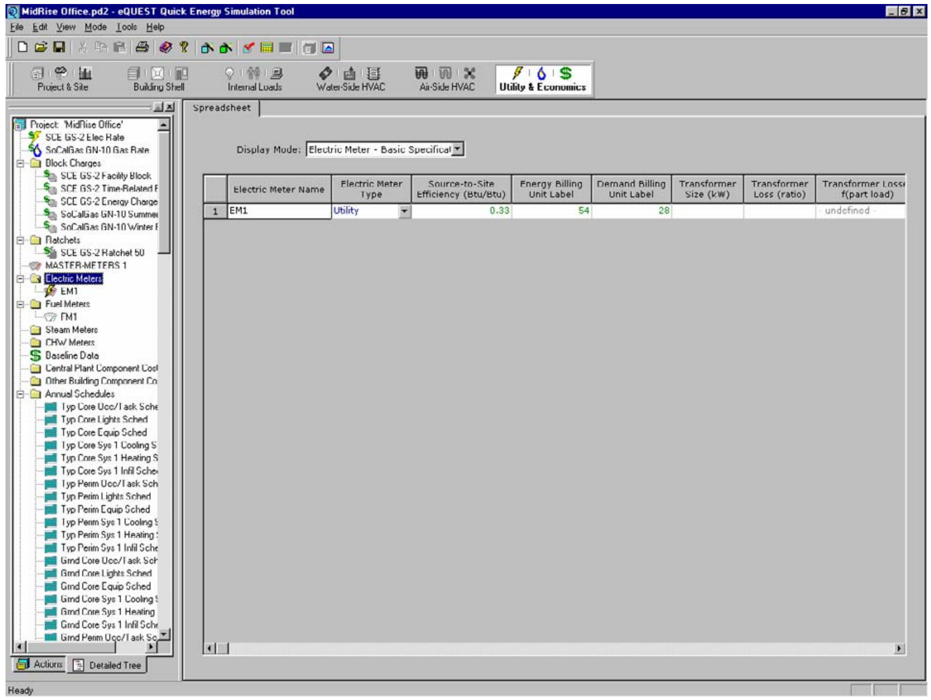
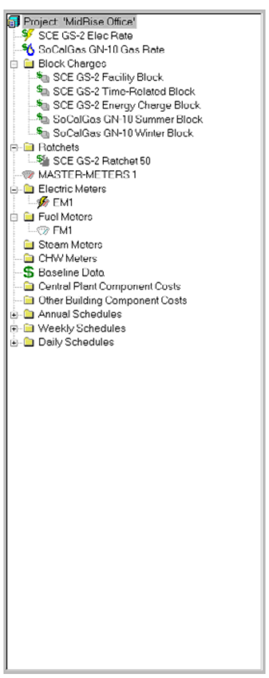


Utility & Economics Module, Spreadsheet Tab View

Component Tree



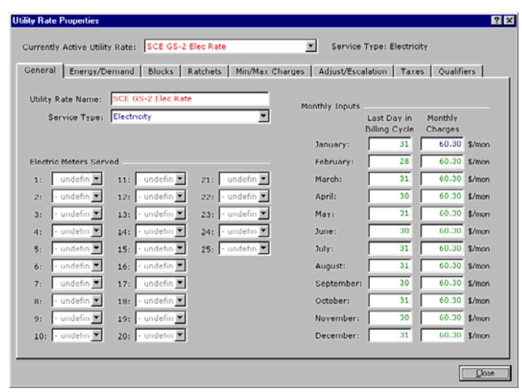
NOTES:

The Utility and Economics module has only one tab view, "Spreadsheet".

1) **Component Tree** (on the left). The image at left shows all major tree components for the Utility and Economics module.

2) **Tabbed Detailed View** The Utility and Economics Detailed View module currently has only one tab view, "Spreadsheet". This tab view is used to review/input/modify features of utility rates and life-cycle costs.

Right mouse click on any item in the component tree to display a tabbed dialog providing detailed information for the selected component.



Utility Rate Tabbed Dialog

Energy Efficiency Measures Wizard

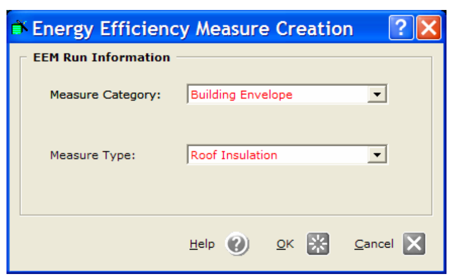
After creating a new building description using either of the Wizards, launch the EEM (Energy Efficiency Measures) Wizard, to quickly describe up to ten design alternatives to your "base" building description. You can then automatically simulate any or all of these alternative cases and view the simulation results as either individual or comparative graphs.

IMPORTANT NOTE: The EEM Wizard can only "operate on" the base building description as defined in the SD or DD Wizard (i.e., in the PD2 file). If you make modifications to your base building within the Detailed Interface, these modifications will be ignored by the EEM Wizard, and the base building used in the EEM runs will be identical to the Wizard description of the building. To make alternative runs that "operate on" the base model as defined in the Detailed Interface (i.e., in the INP file), use Parametric Runs (see next section)

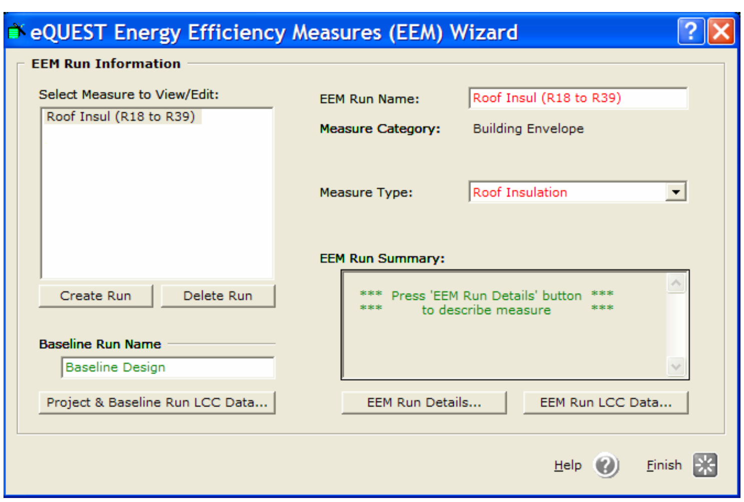
The following pages will illustrate the EEM Wizard for these EEM's.

Roof Insulation	High Efficiency Lighting
Side Daylighting	Fan VSD and Low Static
Top Daylighting	CHW Pump VSD
High Performance Daylight Glass	High Eff. WC Chillers

To begin, click the  button. This will launch the Energy Efficiency Measure Creation dialog (right). From this dialog, select the desired measure category, e.g., for increased roof insulation, select "Building Envelope". For the Measure Type, select "Roof Insulation".



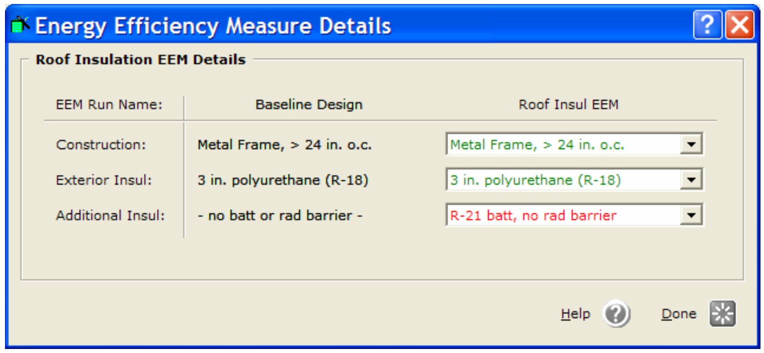
Click on OK to display the EEM Run Information screen. Specify the EEM Run Name as you prefer.



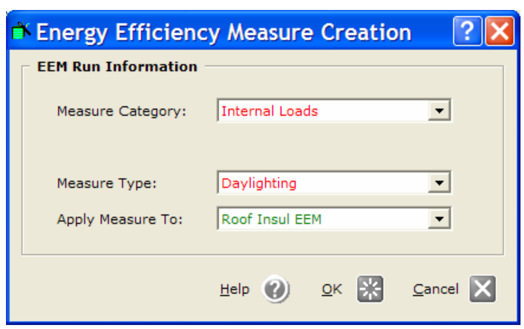
EEM Run Details Dialogs

From the EEM Run Information dialog (previous screen), select the EEM Run Details... button to display the EEM Details screen. Select a preferred roof insulation alternative. Press Done to return to the EEM Run Info screen.

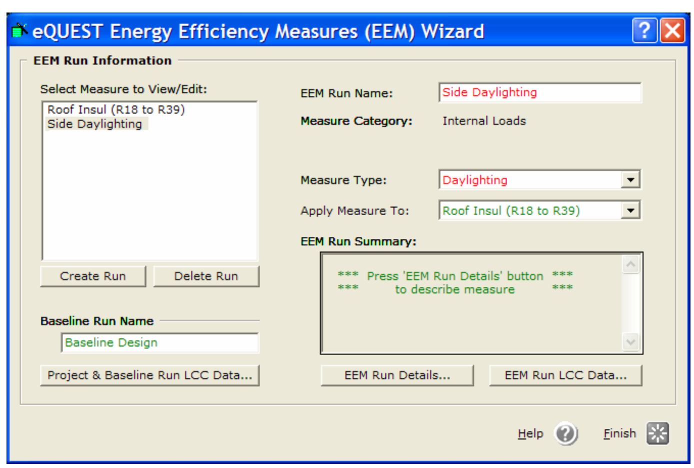
Roof Insulation EEM



From the EEM Run Information dialog (previous page), select the Create Run button to create another EEM run. To specify side daylighting, first select Measure Category = Internal Loads and Measure Type = Daylighting (see below). Note that for the second and subsequent EEM cases, an additional selection is displayed on the EEM Run Information screen. The additional selection allows the user to select which previous EEM run will serve as the base case for the new EEM case, i.e., which case it will be based on.

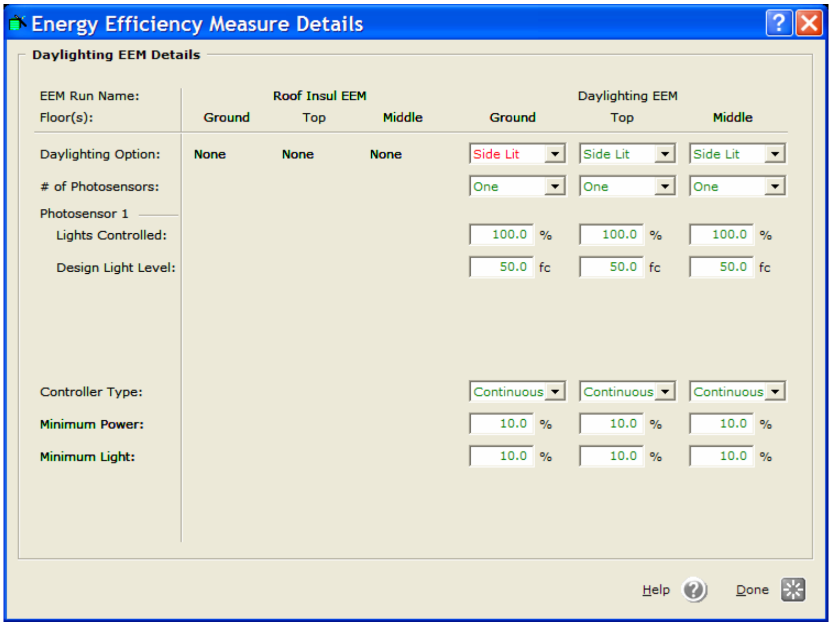


Click on OK to return to the EEM Run Information screen.



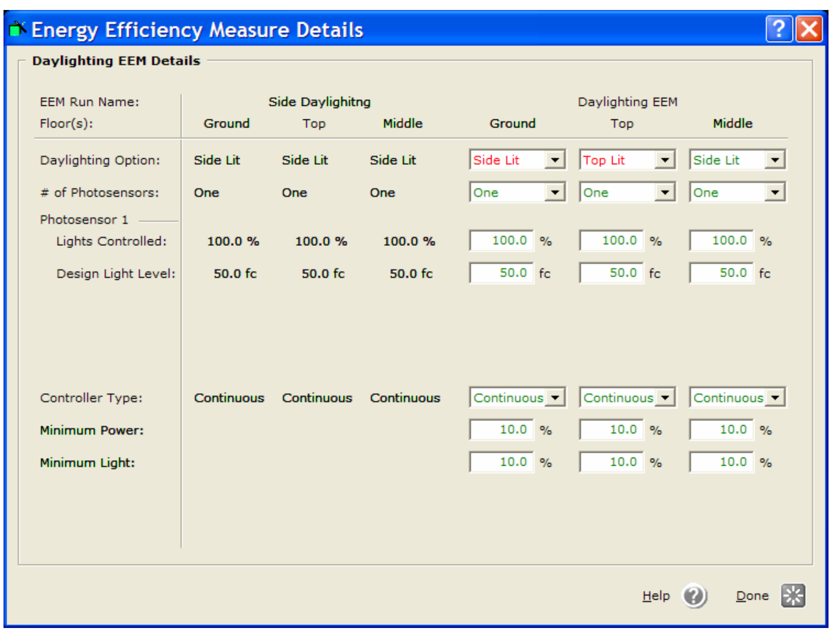
EEM Details Dialogs

From the EEM Run Information dialog (previous screen), select the EEM Run Details... button to display the EEM Details screen. Select Daylighitng Option = Side Lit. Press Done to return to the EEM Run Info screen.



Side Daylighting EEM

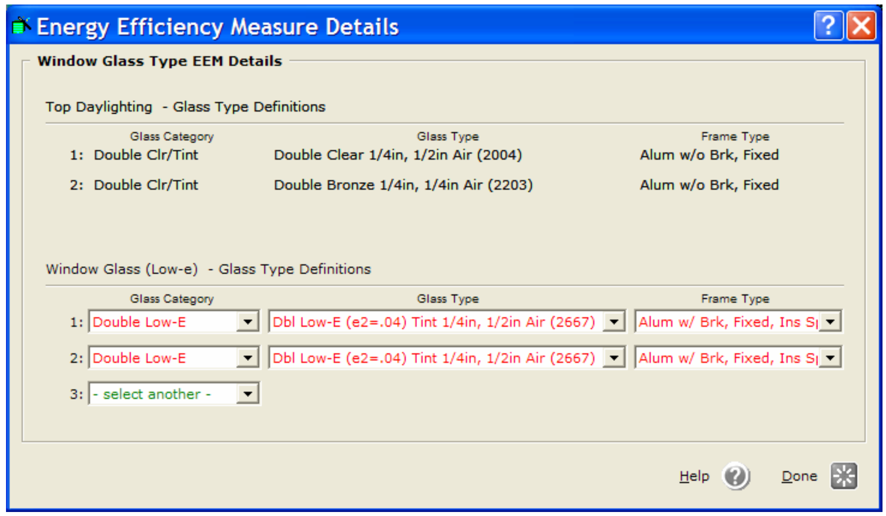
Repeat the same procedure to obtain the following EEM Details Screens.



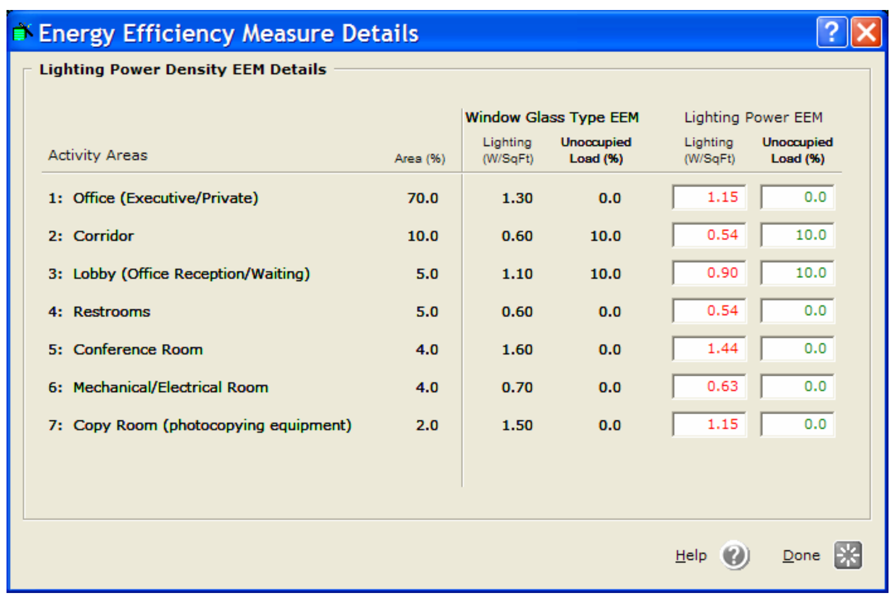
Top Daylighting EEM

EEM Details Dialogs

Simulation Basics
Tour
Schematic Wizard
DD Wizard
Detailed Interface
EEM Wizard
Roof Insulation
Side Daylighting
Top Daylighting
Glass Type
Efficient Lights
VSD Fans
CHW Pump VSD
Efficient Chillers
Run Simulations
Graphical Reports
Detailed Reports

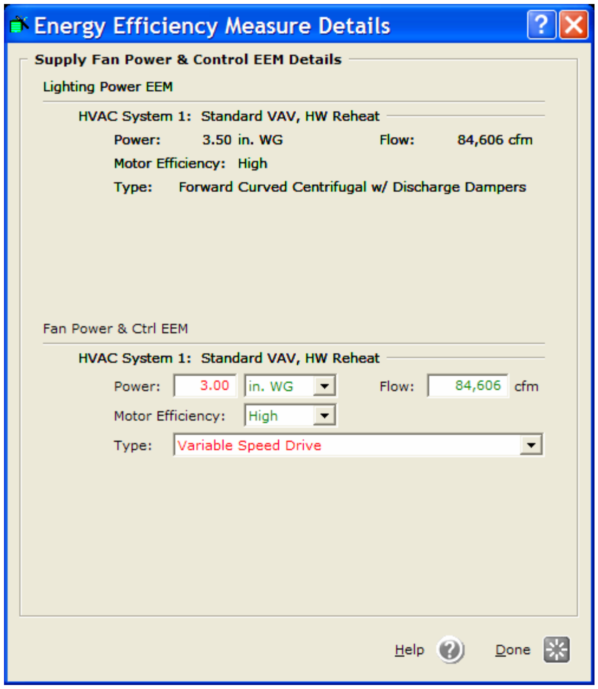


Glass Type EEM

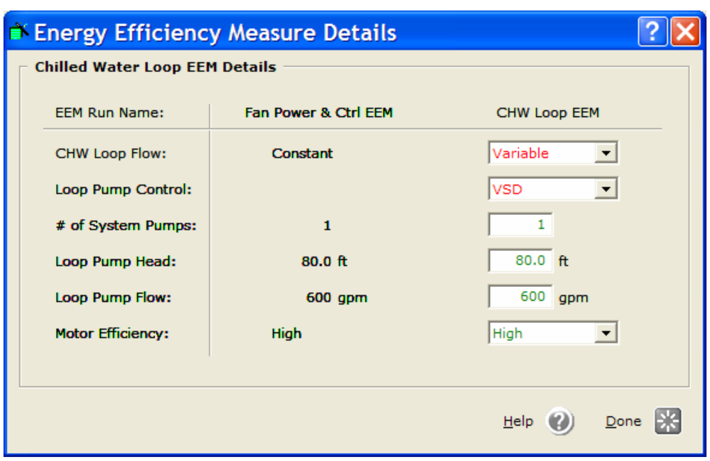


Efficient Lighting EEM

EEM Details Dialogs

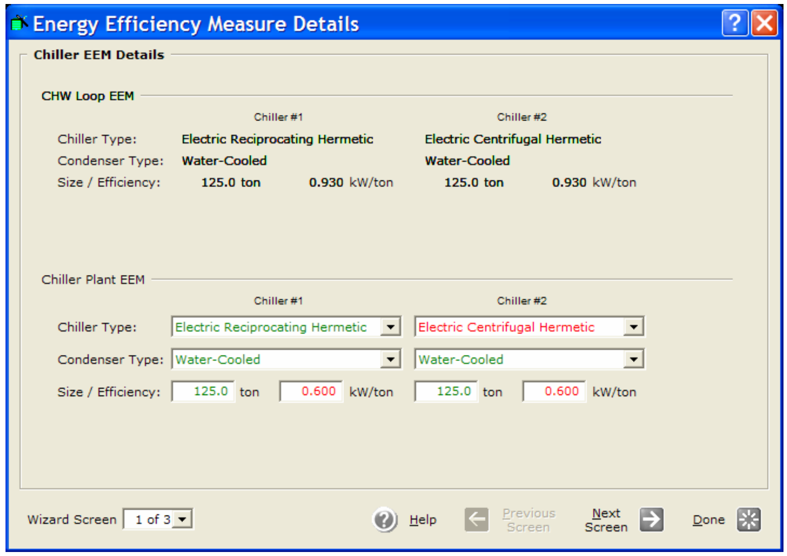


VSD Fans EEM



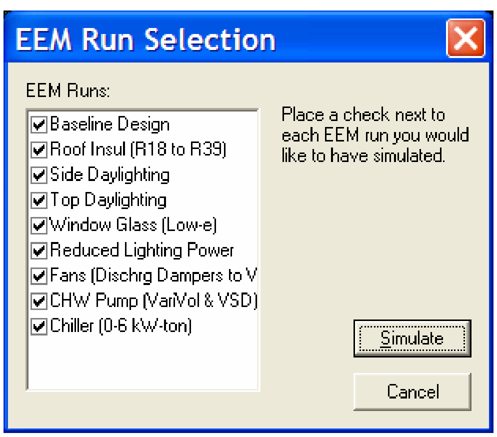
CHW Pump VSD EEM

EEM Details Dialogs

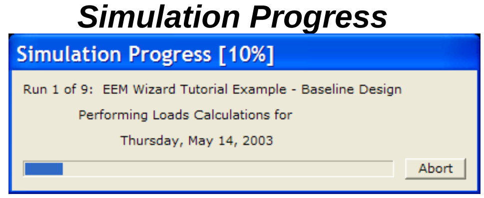


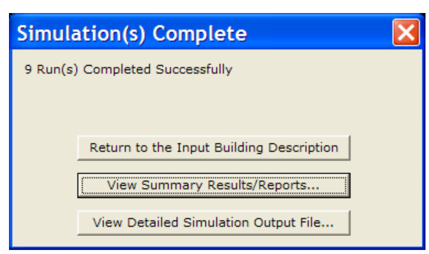
Efficient Chillers EEM

Perform a simulation: Once the descriptions of the preferred EEMs are complete, from the eQUEST analysis tool bar (near the top of the eQUEST screen), press the Run Simulation button to perform an annual simulation of the base building design description and/or of any of your design alternatives (see below). A simulation progress status dialog reports progress. Generally, simulations take less than a minute or two each to complete.



Simulation Progress





EEM Run Simulation

View Results: The EEM Wizard automatically populates two "Parametric Run" reports. View these below in the Graphical Reports section.

Parametric Runs

The Parametric Runs capability of eQUEST provides a means to define and run multiple, alternative simulation cases, where each new case is a parametric variation of the base case. This capability differs from the EEM Wizard in that the EEM Wizard operates to modify the base building as defined in the SD or DD Wizard (i.e., as contained in the PD2 file). The Parametric Run feature of eQUEST operates to modify the base building as defined in the Detailed Interface (i.e., the INP file). In general, Parametric Runs can be more detailed and flexible than the EEM Wizard, but typically requires more insight and "steps" to define. Both the EEM Wizard and Parametric Runs produce the Parametric Reports (see the Graphical Results section of this Tutorial).

IMPORTANT NOTE: Currently, the only changes that can be made to a base case model, using Parametric Runs, are changes to the attributes of existing building components (building components defined in the base case). No components may be created using Parametric Runs (see below).

Examples of alternative runs that can be made using Parametric Runs:

- ☑ Altering the efficiency, static pressure, head, operating temperature, performance curve, or other property of an HVAC system
- ☑ Altering the solar/optical properties of a user-defined glass type
- ☑ Changing the assignment of glass types to any or all windows (the glass type must have been previous "fetched" from the library)
- ☑ Altering the insulation levels in walls or roofs
- ☑ Altering the lighting power density in one or more spaces
- ☑ Altering the orientation of the building
- ☑ Enabling automatic daylighting controls
- ☑ Altering the schedule of operations for lights, people, & equipment
- ☑ Altering the geometry (i.e., dimensions, placement) of walls, roofs, building shades, etc.

Examples of alternative runs that cannot currently be made using Parametric Runs:

- ⃠ Comparing rooftop systems versus built-up systems. If the rooftop systems were the base case, defining the built-up case would require that circulation loops, pumps, and primary equipment be created. This cannot currently be done using Parametric Runs.
  ☑ Use "Save-As" to manually create and separately run the cases.
- ⃠ Changing HVAC system TYPEs using "Parameters". No DOE-2 BDL "TYPE" keyword may be changed using Parameters.
  ☑ Define Parametric Runs that directly reference BDL command/keywords (see bottom of next page, and Example 2 below).

Parametric Runs (continued)

Other examples of runs that currently cannot be made using Parametric Runs:

- ⦸ Installing skylights not included in the base case.

  ☑ Include all of the desired skylights in the base case, but dimension them to be of infinitesimal size. For the "with skylights" case, simply increase the skylight dimensions to "life size".

- ⦸ Installing Building Shades not included in the base case.

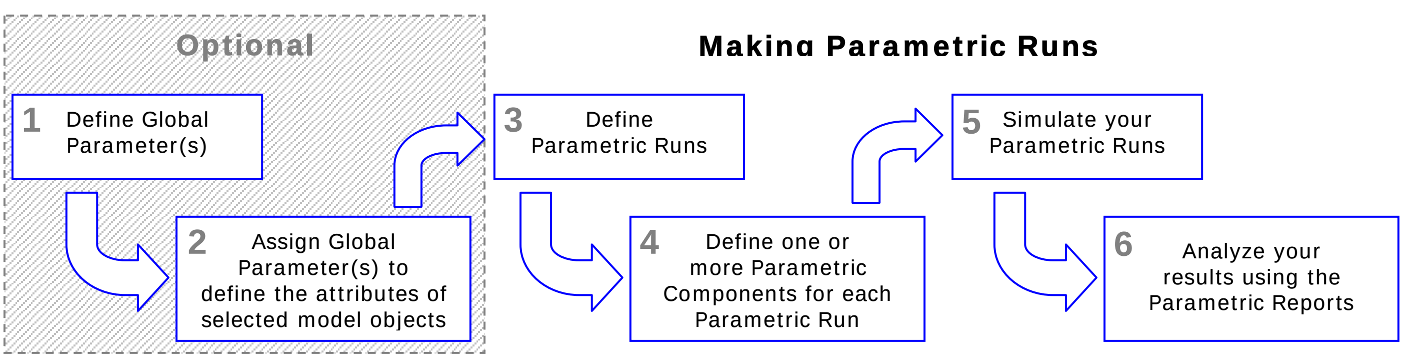
  ☑ Similar to the skylight case above, this can be accomplished by including all of the desired Building Shades in the base case, but dimension them to be of infinitesimal size (e.g., Height). For the "with shades" case, simply increase their size to "life size". Note that DOE-2 considers Fins and Overhangs to be properties of each Window, thus Fins and Overhangs can be added without resorting to the trickery of using infinitesimal dimensions in the base case.

- ⦸ Making parametric runs that involve fetching items from the BDL Library or from your User Library. Simply fetch all desired objects into the base case, then alter your assignment references to them in one or more parametric runs. This technique will work for all objects that are permitted to be unused (i.e., unassigned) during a simulation.

  ☑ Examples of objects that CAN be unassigned during a simulation include: opaque constructions, glass types, schedules, and polygons.

  ⦸ Unfortunately, not all objects can remain unassigned during a simulation. Examples of objects that CANNOT remain unassigned during a simulation include: Spaces and Zones, HVAC Systems, and primary equipment (Loops, Pumps, Chillers, Boilers, etc.).

Making Parametric Runs involves up to six steps, depending on your preferred approach (see diagram below). In one approach, you first define global "parameters", then assign them to selected objects, then define parametric runs and parametric "components" that use your global parameters to alter each parametric run. Global parameters are not actually required to make parametric runs, hence, in the alternative approach, you only define parametric runs and parametric "components" for each run, which reference BDL commands and keywords directly.



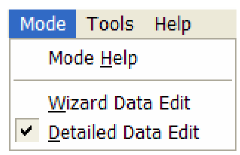
Step 1: Defining Global Parameters

In the following examples, we will create Parametric Runs for some the EEM cases used in the previous section (those with asterisks below, see the preceding EEM Wizard section).

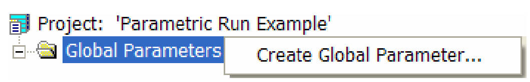
Roof Insulation*	High Efficiency Lighting
Side Daylighting*	Fan VSD and Low Static
Top Daylighting*	CHW Pump VSD
High Performance Daylight Glass*	High Eff. WC Chillers

As the following examples will illustrate, the use of global parameters is optional, however, their use is recommended in many cases, particularly when the parameter is a numeric quantity. When the parameter is a BDL code word (e.g., symbolic strings such as "SENSIBLE-WHEEL" or "ENTHALPY-WHEEL") or user-defined name (i.e., u-name, e.g., the name of a user-defined Schedule or Construction), many users find it more convenient to forgo the use of Parameters. IMPORTANT NOTE: before starting this example, turn ON daylighting in the Wizard and add skylights (see the daylighting parametric examples below).

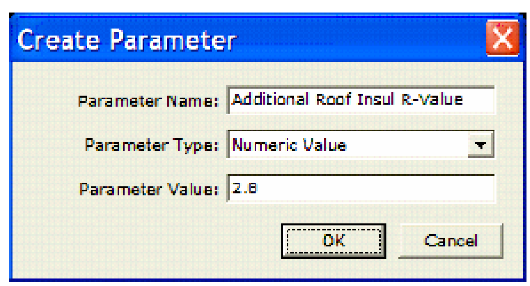
The first example defines a global parameter that specifies the added roof insulation for the roof insulation EEM. To start, confirm that the mode is set to "Detailed Data Edit".

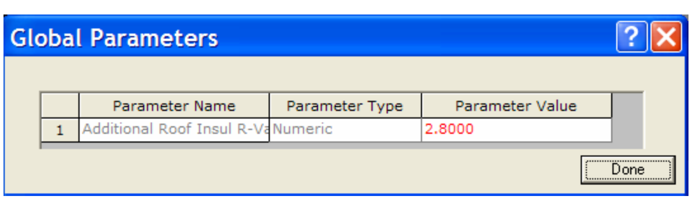


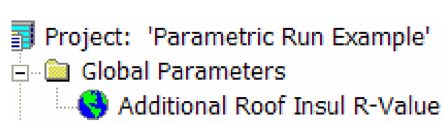
Next, create the desired global parameter(s) by right clicking on the "Global Parameter" folder on the component tree (from within any eQUEST program module). Select "Create Global Parameter".



At the Create Parameter dialog, name the global parameter as preferred (32 characters max). Select Parameter Type = "Numeric Value". Specify Parameter Value = 2.8 (the air cavity R-Value, i.e., no batt insulation). Before pressing "OK", copy the name of the parameter for later use (highlight the parameter name and press Ctrl-C). After you press "OK" on the Create Parameter dialog, the Global Parameters dialog is displayed (abbreviated example below left) and the parameter is added to the Component Tree (below right). Edit any global parameter by double clicking the component tree.

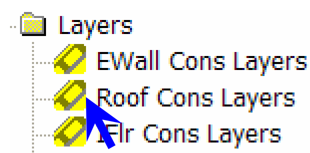




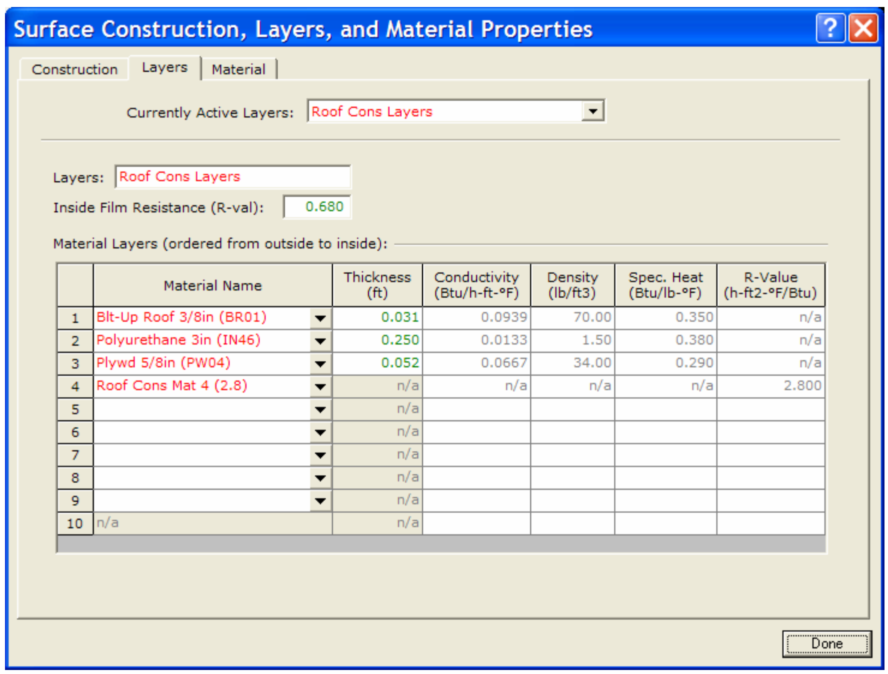


Step 2: Assigning Global Parameters

Having DEFINED the first global parameter in this example, you must also ASSIGN the parameter to a selected BDL Keyword (i.e., to a selected eQUEST Detailed Interface input.



For the first example, the Roof Insulation EEM upgrade, the global parameter will be assigned to the roof Layers description, to specify the amount of additional insulation included in the roof construction. From the Component Tree in the Building Shell module, double click on the Roof Construction Layer. This will display the Construction Layers Properties dialog (below).

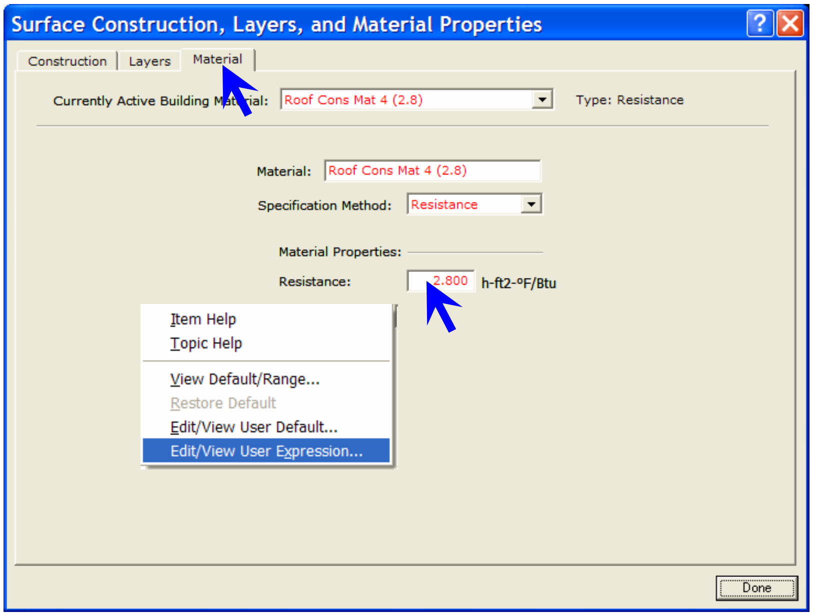


The Roof Insulation EEM from the EEM Wizard section added additional insulation as a batt below the roof deck. The base case roof construction layers (see above), included a pure resistance ("Roof Cons Mat 4 (2.8)", R-2.8) as the effective attic air resistance (from ASHRAE *Fundamentals*, 1997, pg 24.13, Table5, with 0.1 cfm/sf natural venting, attic temperature = 80F, sol-air temperature =120F, no radiant barrier, and ceiling resistance ~ R-10). This value will be replaced with the newly-defined global parameter.

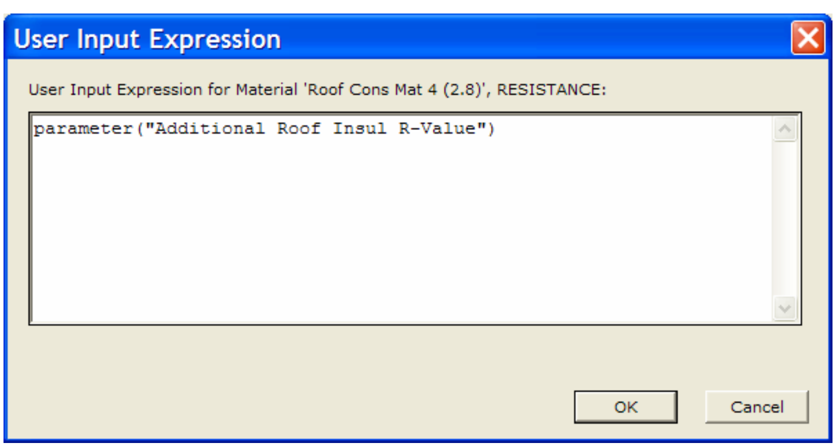
Note that the top-down order of the materials in the Construction Layer Properties dialog (above) is from outside to inside, i.e., the inner-most "material" (i.e., in this case, a pure resistance) is the bottom-most material listed above.

Step 2: Assigning Global Parameters (cont.)

On the Construction Layers Properties dialog (previous page), click on the "Material" tab (see below). At the top of the dialog (below), select the Currently Active Building Material = "Roof Cons Mat 4 (2.8)".



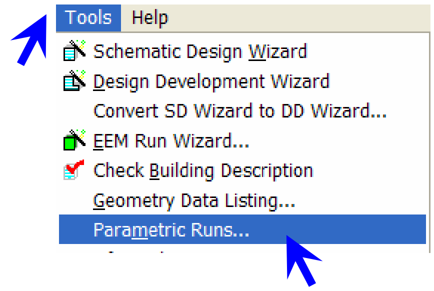
Right click on the "Resistance" input field to display the "Quick Menu", and select the bottom item, "Edit/View User Expression". This displays the User Input Expression dialog below (initially blank). As shown below, type in the word "parameter", followed by an open and close parenthesis surrounding two double quotes. Place the curser between the double quotes and press Ctrl-V (to paste in the name of the global parameter copied previously). Confirm that your input matches below. Press OK and confirm the Resistance on the Construction Materials Properties dialog reports "2.8" (i.e., the value of the global parameter defined previously). Note that the magenta font indicates that the value for the input is derived from an *expression*, i.e., in this case, assigning a global parameter to the input. Confirm that changing the value of the global parameter will report a changed value for Resistance on this dialog.

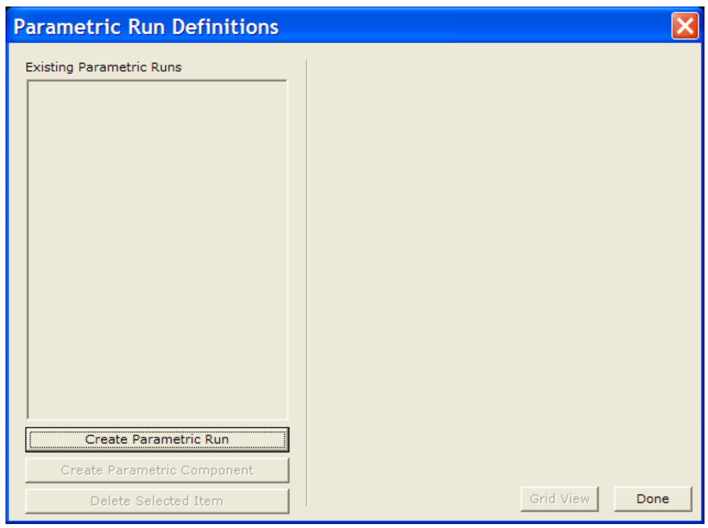


Step 3: Defining Parametric Runs

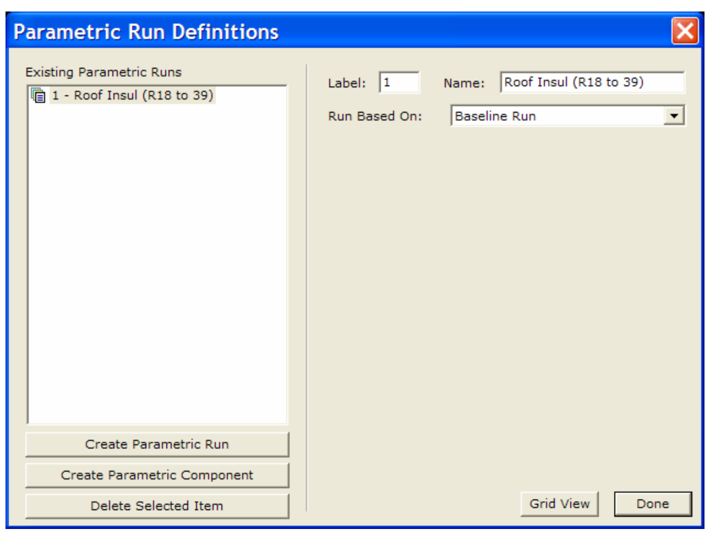
Having defined and assigned our first global parameter, we can now create a Parametric Run.

Pull down the Tools menu in eQUEST's Detailed Interface (from any program module) and select "Parametric Runs". This displays the Parametric Run Definition dialog (below).



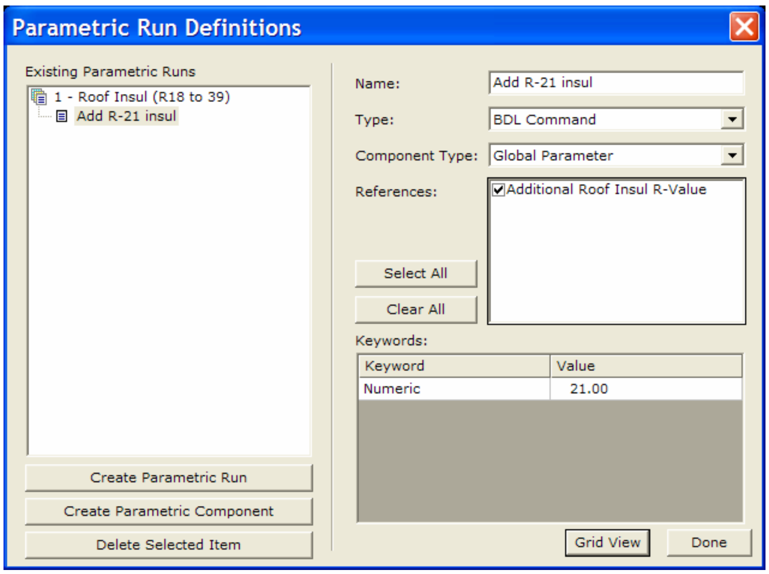


Select "Create Parametric Run" (see example below). Rename the first parametric run "Roof Insul (R18 to 39)" (matches the name used in the corresponding EEM Wizard example, see previous section).



Step 4: Defining Parametric Components

Having created and named a "Parametric Run", we must now define what gets altered by the parametric run, i.e., we must define one or more "Parametric Components". To do this, on the lower left corner of the Parametric Run Definitions dialog, click on "Create Parametric Component". This displays an alternate view of the Parametric Run Definition dialog (example below).



1) Name. Name the parametric component as preferred (32 char max, each name must be globally unique).

2) Type. Select Type = "BDL Command" (currently, the only choice).

3) Component Type. From the Component Type list, select "Global Parameter". Note that the only component types that appear on this list are components found in the base model, i.e., if global parameters had not yet been defined, "Global Parameters" would not have been on the list.

4) References. The References window will list all components of the type indicated. In this example, since only one global parameter has been defined thus far, it is the only item listed. Place a check mark in the box to the left by clicking on it.

5) Value. Change the base case value for this parameter from R-2.8 (the value of the attic air effective resistance alone) to R-21 (attic air resistance of 3.4, from ASHRAE *Fundamentals*, 1997, pg 24.13, Table5, with 0.1 cfm/sf nat. vent., attic temp. = 80F, sol-air temp. = 120F, no radiant barrier, and ceiling R-Value ~20 + R-17.6 effective batt R-Value for >24" o.c., wood framing, from ASHRAE Standard 90.1.). Press Done.

This completes the steps necessary to define a Parametric Run for the first example EEM, increased roof insulation. Before this parametric run is simulated and its results examined, we will set up Parametric Runs for the EEM cases.

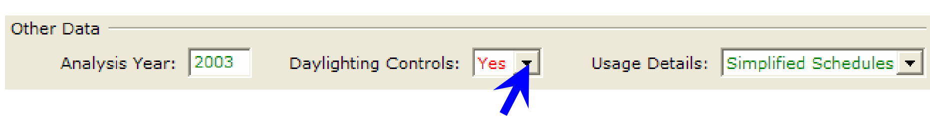
Parametric Example 2: Side Daylighting

For this example, we will model side daylighting, i.e., automatic lighting dimming controls in perimeter spaces having vertical windows. Although this example could be accomplished using Global Parameters, for the purpose of illustrating an alternative procedure, this parametric case will be illustrated without using global parameters.

Even without using global parameters to make a daylighting case, there are at least two approaches worth contrasting. In one approach (i.e., the "brute force" approach), we could include all input mods as separate Parametric Components for our parametric daylighting run (e.g., sensor types, sensor location for each space, design illuminace levels, etc. … a lot of inputs!).

In an alternative approach, we allow the Wizard to do much of the work for us by temporarily turning "On" daylighting in the base building description (i.e., from with in the Wizard). This will cause the Wizard to automatically place all of the daylighting-related inputs into the base case. We could even adjust or fine tune these, as necessary, in the Detailed Interface. As a part of setting up a Parametric Run for daylighting, we would then manually turn "Off" daylighting in the base case for all of the daylit spaces (i.e., DAYLIGHTING = YES manually changed to NO in the Detailed Interface for each daylit space). For this approach, in our Parametric Run for the daylighting parametric case, we would only need one Parametric Component, in which we would toggle DAYLIGHTING = NO to YES for our selected spaces. All of the other daylighting-related inputs (placed in the model by the Wizard), would be "dormant" during the base run. Using this second approach (the smart approach), we greatly reduce our work in setting up parametric daylighting runs.

1) In the Wizard, confirm that daylighting was turned ON (the example below is from the Schematic Design Wizard).

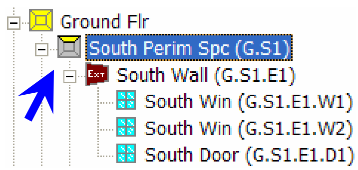


WARNING: if you make this change in the Wizard <u>after</u> making changes in the Detailed Interface (as we did in the improved roof insulation parametric run in the previous example), the changes made in the Detailed Interface will be overwritten when you exit the Wizard. If you must return to the Wizard to turn ON daylighting, you will have to repeat the steps from the previous roof insulation example.

2) In the Detailed Interface, confirm the daylighting features (sensor placement, design illuminance levels, controller type, etc.) placed in the model by the Wizard. Adjust or refine these as preferred.

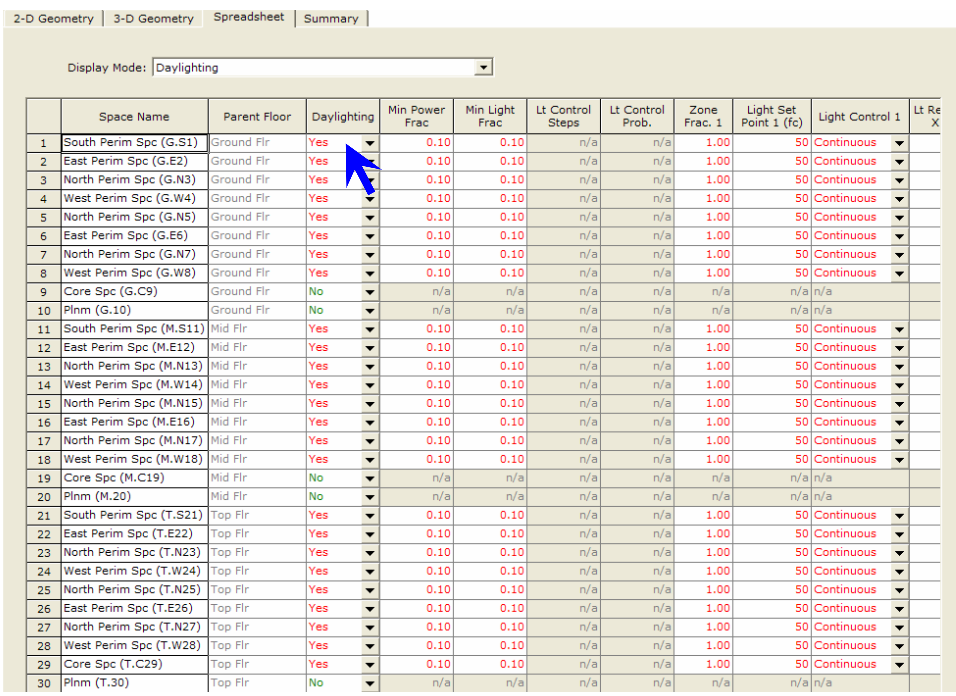
Parametric Example 2: Side Daylighting (pg 2 of 3)

3) From the Building Shell module in the Detailed Interface, select any Space



4) In the main view area, select the Spreadsheet tab Spreadsheet.

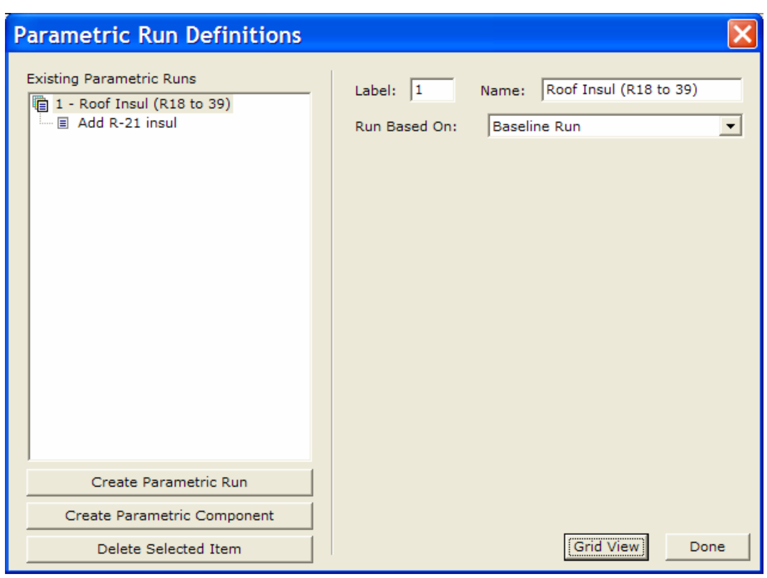
5) On the Spreadsheet view, at the top, select Display Mode = Daylighting.



	Space Name	Parent Floor	Daylighting	Min Power Frac	Min Light Frac	Lt Control Steps	Lt Control Prob.	Zone Frac. 1	Light Set Point 1 (fc)	Light Control 1	Lt Re X
1	South Perim Spc (G.S1)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
2	East Perim Spc (G.E2)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
3	North Perim Spc (G.N3)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
4	West Perim Spc (G.W4)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
5	North Perim Spc (G.N5)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
6	East Perim Spc (G.E6)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
7	North Perim Spc (G.N7)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
8	West Perim Spc (G.W8)	Ground Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
9	Core Spc (G.C9)	Ground Flr	No	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
10	Plnm (G.10)	Ground Flr	No	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
11	South Perim Spc (M.S11)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
12	East Perim Spc (M.E12)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
13	North Perim Spc (M.N13)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
14	West Perim Spc (M.W14)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
15	North Perim Spc (M.N15)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
16	East Perim Spc (M.E16)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
17	North Perim Spc (M.N17)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
18	West Perim Spc (M.W18)	Mid Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
19	Core Spc (M.C19)	Mid Flr	No	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
20	Plnm (M.20)	Mid Flr	No	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
21	South Perim Spc (T.S21)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
22	East Perim Spc (T.E22)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
23	North Perim Spc (T.N23)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
24	West Perim Spc (T.W24)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
25	North Perim Spc (T.N25)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
26	East Perim Spc (T.E26)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
27	North Perim Spc (T.N27)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
28	West Perim Spc (T.W28)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
29	Core Spc (T.C29)	Top Flr	Yes	0.10	0.10	n/a	n/a	1.00	50	Continuous	
30	Plnm (T.30)	Top Flr	No	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

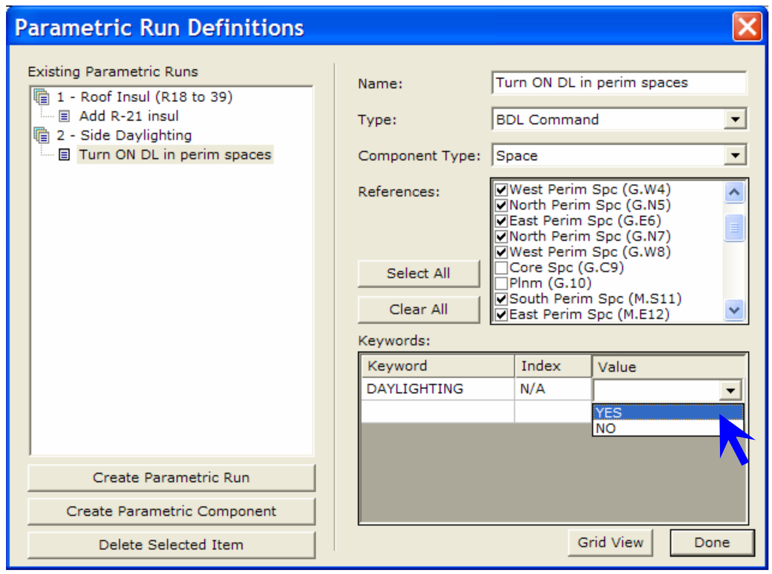
6) Under the Daylighting column (third column from left), change any one of the "Yes" inputs to "No", then copy the "No" input by pressing Ctrl-C. Paste "No" into each of the remaining Daylighting "Yes" cells, one at a time, by pressing Ctrl-V for each. This turns daylighting off in the base case.

7) At the top of the Detailed Interface screen, select Parametric Runs from the Tools menu. This displays the Parametric Run Definitions dialog.



Parametric Example 2: Side Daylighting (pg 3 of 3)

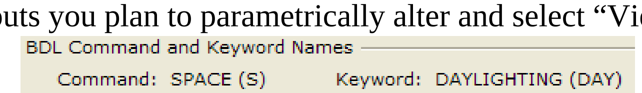
8) On the Parametric Run Definitions dialog, select “Create Parametric Run”. Rename this second parametric run “Side Daylighting”.
9) Run Based On. Select Run Based On = “Roof Insul (R18 to 29)”. This will cause this second parametric case to be run “on top of” the first parametric case, i.e., the results of the second parametric run will include both improved roof insulation AND Side Daylighting.
10) In the lower left hand corner of the Parametric Run Definitions dialog, select “Create Parametric Component” (see example below).



11) Name. Name the parametric component as preferred.
12) Component Type. From the list, select “Space” (see note below).
13) References. Having selected Component Type = “Space”, the list of references contains all of the Spaces in the model. Remove the check marks for all but the perimeter spaces. If you select a space without windows, you will encounter a runtime error. Double check your choices!
14) Keyword. This lists ALL of the BDL keywords for the Space command (a lot!). Scroll down this list to find the DAYLIGHTING keyword. WARNING: currently these keyword lists are NOT alphabetized!
15) Value. Change the base value for DAYLIGHTING from NO to YES.

This completes defining a Parametric Run for the side daylighting EEM.

IMPORTANT NOTE: defining parametric runs without using global parameters requires that we directly reference BDL commands and keywords. To learn what BDL commands and keywords you should look for on the Component Type list (commands) and keyword lists, within the Detailed Interface, right click on the inputs you plan to parametrically alter and select “View Default/Range” (see example at right).



Parametric Example 3: Top Daylighting

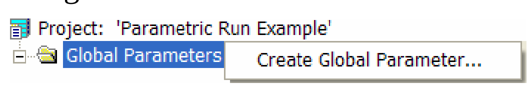
For this example, we will model top daylighting, i.e., automatic lighting dimming controls in the top floor core space (served by skylights). This example will use a global parameter (similar to the first parametric example) and direct references to BDL Command/Keywords (similar to the second parametric example). Like the previous side daylighting parametric example, we will toggle ON daylighting in the top floor core space (the Wizard placed the other daylighting-related keywords to the model).

The global parameter will be included only to illustrate a commonly useful "trick". Unlike the EEM Wizard counterpart to this example, we will eliminate skylights from the base case (the EEM Wizard top lighting example included skylights in the base case, i.e., only added controls in the EEM case).

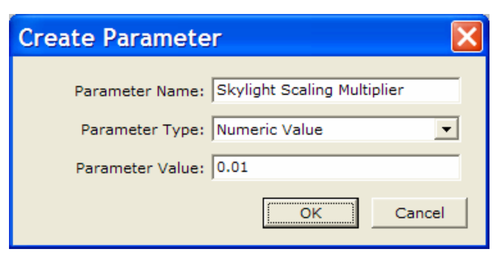
From earlier discussion, the reader will recall that Parametric Runs cannot be used to actually create new model components, e.g., can't create skylights; therefore, we will allow the wizard to place skylights in the base model and we will add a global parameter to make it easy to minimize the size of all skylights during the base run. During the parametric run, we will return the skylights to their original size.

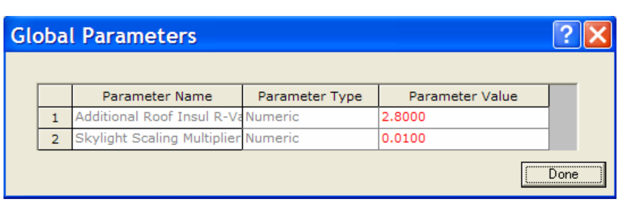
1) Confirm that your base case model includes skylights. WARNING: if you must return to the Wizard to add skylights to the base case, your changes to-date in the Detailed Interface will be overwritten when you exit the Wizard. If you must return to the Wizard to add skylights, you will have to repeat the steps from the previous two parametric examples!

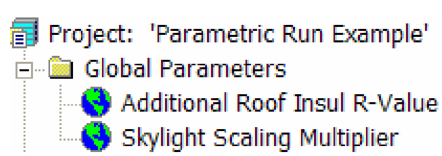
2) Create a global parameter by right clicking on the "Global Parameter" folder on the component tree. Select "Create Global Parameter".



3) At the Create Parameter dialog, name the global parameter as preferred (32 characters max). Select Parameter Type = "Numeric Value". Specify Parameter Value = 0.01 (this will serve as a multiplier to minimize the size of the skylights). Before pressing "OK", copy the name of the parameter for later use (highlight the parameter name and press Ctrl-C). After you press "OK" on the Create Parameter dialog, the Global Parameters dialog is displayed (abbreviated example below left) and the parameter is added to the Component Tree (below right). Edit any global parameter by double clicking the component tree.



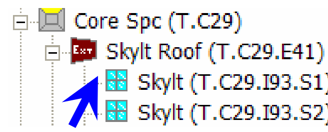




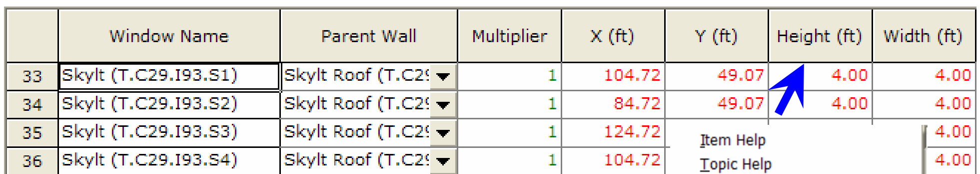
Parametric Example 3: Top Daylighting (pg 2 of 4)

Having DEFINED the global parameter in this example (i.e., "Skylight Scaling Multiplier"), you must also ASSIGN the parameter to each skylight to be used to scale the skylight dimensions. For this example, the global parameter will be assigned to HEIGHT and WIDTH of <u>each</u> skylight.

4) From the Component Tree in the Building Shell module, select any skylight.

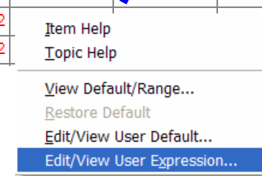


5) In the main view area, select the Spreadsheet tab Spreadsheet and scroll the rows to locate the skylights. Identify the skylights by their names in the first column of the spreadsheet (partial view shown below).

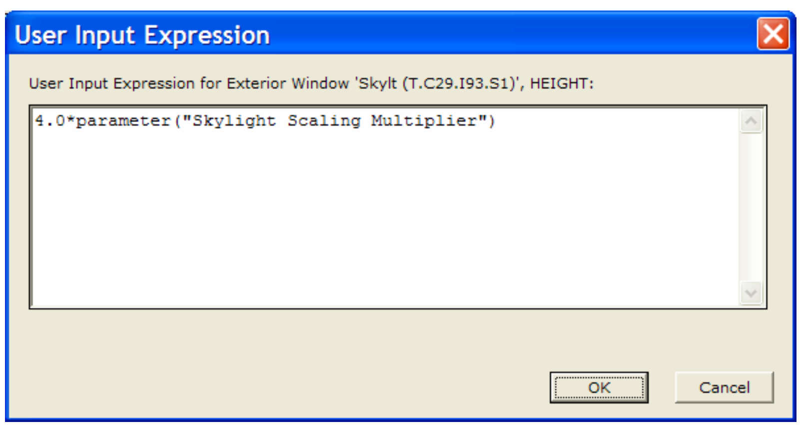


	Window Name	Parent Wall	Multiplier	X (ft)	Y (ft)	Height (ft)	Width (ft)
33	Skylt (T.C29.I93.S1)	Skylt Roof (T.C2!	1	104.72	49.07	4.00	4.00
34	Skylt (T.C29.I93.S2)	Skylt Roof (T.C2!	1	84.72	49.07	4.00	4.00
35	Skylt (T.C29.I93.S3)	Skylt Roof (T.C2!	1	124.72			4.00
36	Skylt (T.C29.I93.S4)	Skylt Roof (T.C2!	1	104.72			4.00

6) Right click on the Height for any skylight to display the "Quick Menu", and select the bottom item, "Edit/View User Expression".



7) This displays the User Input Expression dialog below (initially blank). As illustrated below, and similar to the first parameter example, type in an expression that references the "Skylight Scaling Multiplier" and multiplies the parameter times the original HEIGHT of the skylight (i.e., 4.0 feet).



8) Press OK and confirm the Height for the skylight (i.e., 4 * 0.01 = 0.04). (The magenta font indicates that the value is derived from an expression.)

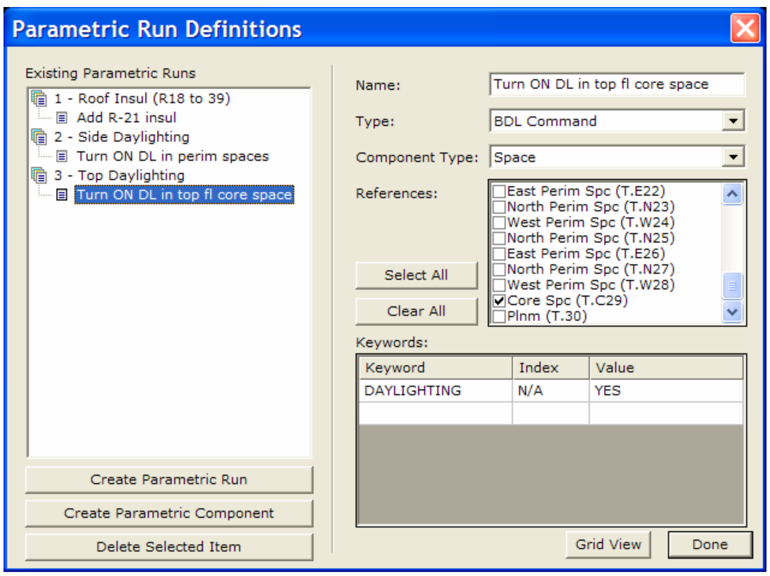
9) Copy this expression to the other HEIGHT cells (only for skylights), one at a time, by first pressing Ctrl-C, then Ctrl-V for each cell.

10) Repeat steps (7) through (9) for the skylight WIDTH cells in the Window spreadsheet.

This will allow the skylights to be toggled "On" by setting the parameter ="1".

Parametric Example 3: Top Daylighting (pg 3 of 4)

11) At the top of the Detailed Interface screen, select Parametric Runs from the Tools menu. This displays the Parametric Run Definitions dialog.
12) On the Parametric Run Definitions dialog, select "Create Parametric Run". Rename this third parametric run "Top Daylighting".
13) Run Based On. Select Run Based On = "Side Daylighting". This will cause this third parametric case to be run "on top of" the side daylighting case, i.e., the results of the top daylighting parametric run will include the modifications from the two preceding parametric cases.
14) In the lower left hand corner of the Parametric Run Definitions dialog, select "Create Parametric Component" (see example below).

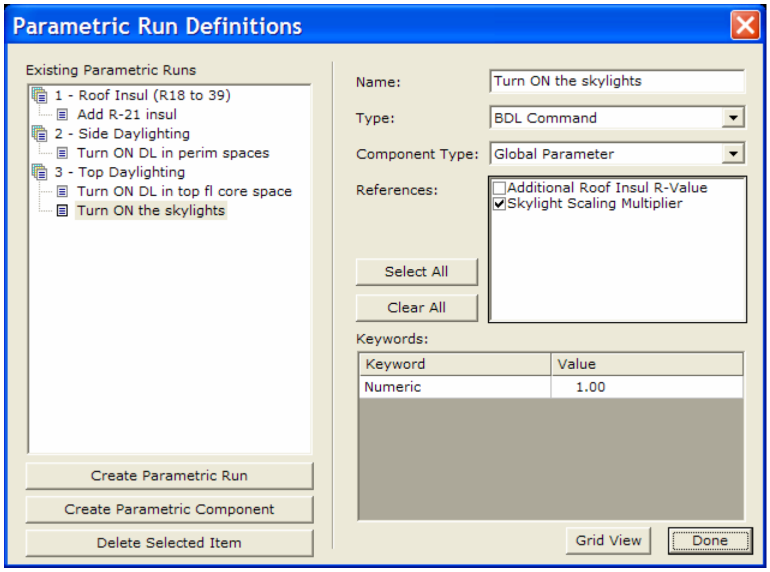


15) Name. Name the parametric component as preferred.
16) Type. Select Type = "BDL Command".
17) Component Type. From the list, select "Space". WARNING: currently this list of commands is NOT alphabetized!
18) References. Having selected Component Type = "Space", the list of references contains all of the Spaces in the model. "Clear All", then place a check mark in the box for the top floor core space ONLY. If you select a space without windows (or skylights), you will encounter a runtime error.
19) Keyword. This lists ALL of the BDL keywords for the Space command. Scroll down this list to find the DAYLIGHTING keyword. WARNING: currently these keyword lists are NOT alphabetized!
20) Value. Change the base value for DAYLIGHTING from NO to YES.

This completes defining the first of two Parametric Components. The second Parametric Component is necessary to turn "On" the skylights, i.e., literally, to resize the skylights from infinitesimal size to normal size.

Parametric Example 3: Top Daylighting (pg 4 of 4)

21) To define a second Parametric Component for this top daylighting parametric run, on the Parametric Run Definitions dialog, select “Create Parametric Component”. This displays a new Parametric Run Definitions dialog (see below).



22) Name. Name this parametric component as preferred.

23) Type. Select Type = “BDL Command”.

24) Component Type. From the list, select “Global Parameter”.

25) References. Having selected Component Type = “Global Parameter”, the list of references contains all of the global parameters defined thus far (i.e., only two). From the list, select (i.e., check) the newly created global parameter, “Skylight Scaling Factor”.

26) Value. Change the parameter value from 0.01 to 1.0.

This completes defining a Parametric Run for the top daylighting EEM.

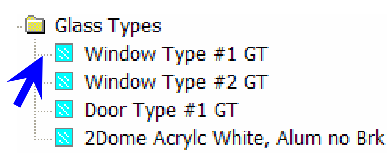
Parametric Example 4: Hi Perf Glazing

For this example, we will model glazing upgrades where two types of base glass, double clear and double bronze, are replaced with a double low-e glass. Window frames are also upgraded from aluminum without thermal breaks to aluminum with thermal breaks and insulated glass spacers.

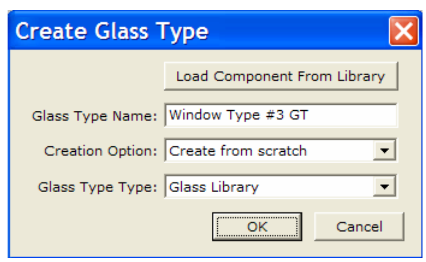
This example will use two global parameters: one numeric parameter (to specify the conductivity of the window frame) and one symbolic parameter (to specify the glass type for the windows). The example will also demonstrate the use of user-defined default expressions to globally assign the parameters to windows.

One of the current limitations of Parametric Runs in eQUEST is that parametrics cannot fetch items from the eQUEST library. This is not a serious limitation because the desired items simply need to be manually fetched into the base case file before running parametrics.

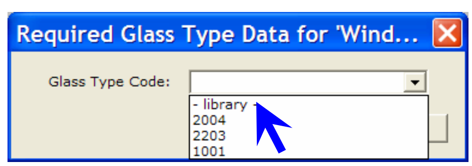
1) Fetch the same glass type from the glass library as was used in the EEM Wizard example, i.e., double low-e (glass-type-code 2667). To do this, we create a new glass type. Start by right clicking on any existing glass type in the component tree (from within the Building Shell modelue). From the Quick Menu, select "Create another Glass Type".



2) On the Create Glass Type dialog, specify a name for the new glass type and indicate that it will come from the Glass Library. Select a name that is similar to the other glass names. Later, this will make it easier to modify the symbolic parameter.

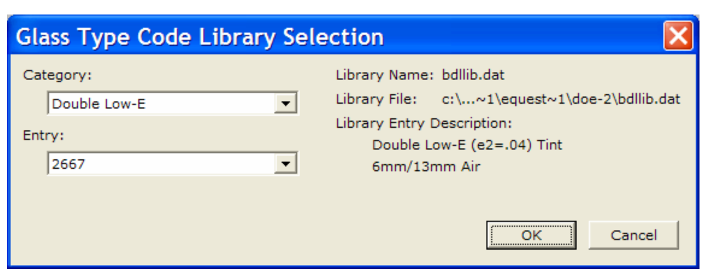


3) From the Required Glass Type Data dialog, select "library" (indicates that the new glass type will be fetched from the Glass Library).

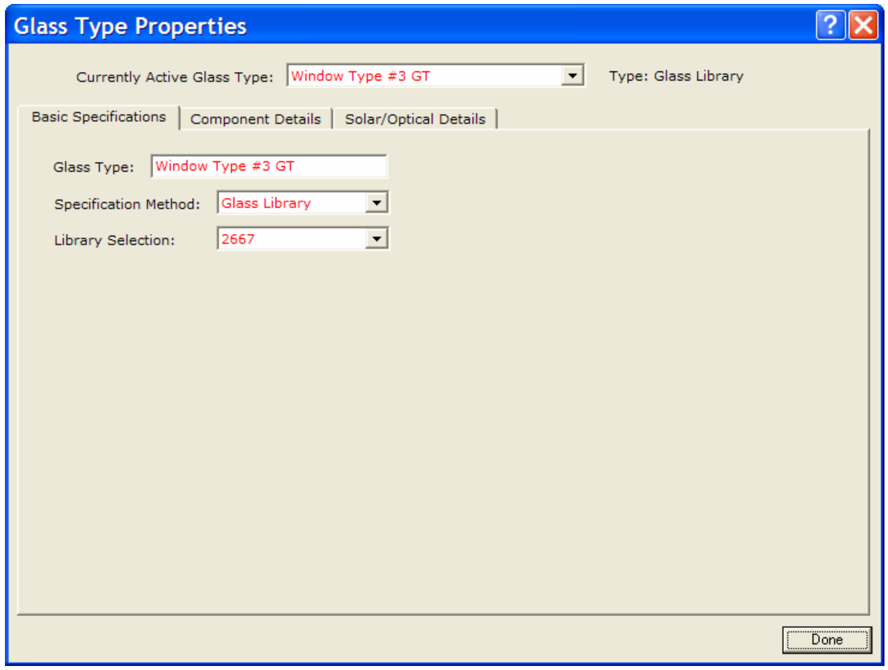


4) At the Glass Library Selection dialog, specify the Category = "Double Low-E" and the library Entry = "2667".

5) Click OK to display the Glass Type Properties dialog for the new glass type (see next page).



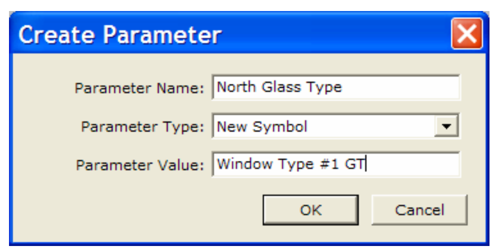
Parametric Example 4: Hi Perf Glazing (pg 2 of 6)



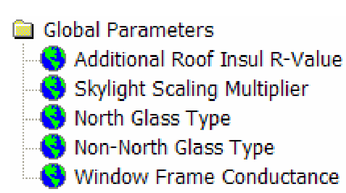
6) Press "Done" to compete the process of creating a new glass type (i.e., in this case, fetching a new glass type from the Glass Library).

7) Create a global parameter by right clicking on the "Global Parameter" folder on the component tree. Select "Create Global Parameter".

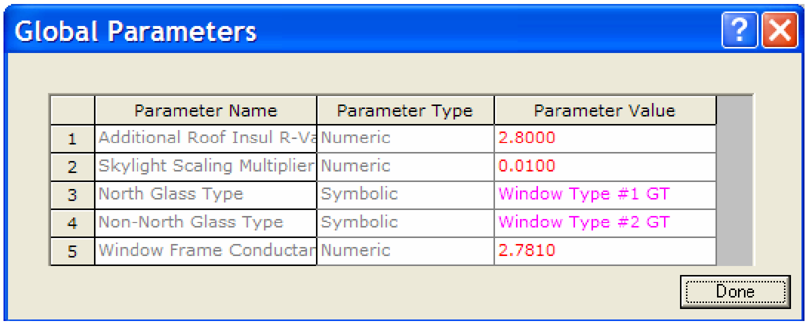
8) At the Create Parameter dialog, name the global parameter as preferred (32 char max). Since this first parameter will identify the glass type of the north-facing glass, name it "North Glass Type". Select the Parameter Type = "New Symbol". For the Parameter Value, use the name of the base case north-facing glass type (spelling must match exactly).



9) Repeat steps (7) and (8) to create a symbolic parameter for the non-north glass and a numeric parameter for window frame conductance (see example at right and next page). For the base frame conductance, use 2.781 Btu/hr·ft^2·°F. This is from ASHRAE *Fundamentals*, 1997, pg 29.5, Table 2, for double pane, fixed glass, aluminum frame without thermal break, which yields 1.80 Btu/hr·ft^2·°F. Since DOE-2 adds an exterior film resistance (depends on hourly wind speed and direction), the frame conductance must have the film resistance at 15 mph (i.e., R-0.196) removed (frame conductance w/o ext. film resistance = 2.781 Btu/hr·ft^2·°F).



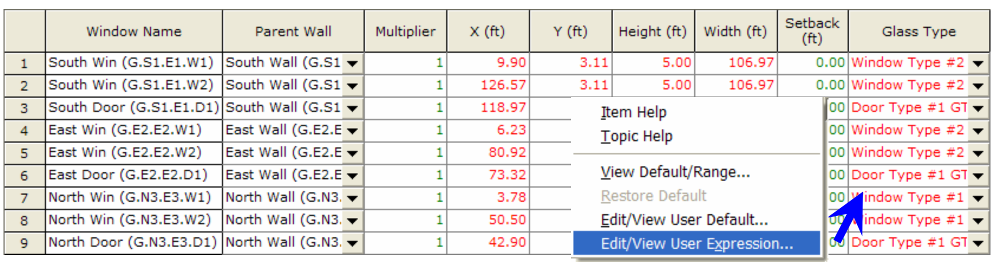
Parametric Example 4: Hi Perf Glazing (pg 3 of 6)



Having DEFINED the global parameters for this example (i.e., "North Glass Type", "Non-North Glass Type", and "Window Frame Conductance") we must also ASSIGN the parameters to each window and frame in the project.

10) In the Building Shell module, select any north-facing window from the Component Tree, from the 2-D view, or from the 3-D view.

11) In the main view area, select the Spreadsheet tab. The row containing the selected window will be highlighted (partial view shown below).



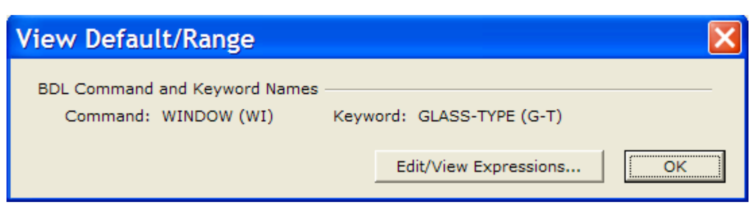
12) In the spreadsheet, right click on any north-facing window to display the "Quick Menu", and select "Edit/View User Expression".

13) This displays the User Input Expression dialog. Type in an expression that assigns the "North Glass Type" parameter to the window glass type (see example text below). Since "North Glass Type" is a symbolic, rather than a numeric parameter, the Symbol Index function, is required.

```
SymIndex(#pa("North Glass Type"),"WINDOW","GLASS-TYPE")
```

The "SymIndex" function takes three arguments: 1) the name of the glass type (in this case, a parameter where "#pa" is an abbreviation for "parameter"), 2) the BDL command, and 3) the BDL keyword for glass type.

To learn what BDL command and keyword are the correct arguments for any expression function, right click on the input item (in this case, Glass Type) and select "View Default/Range" (abbreviated example at right).



Parametric Example 4: Hi Perf Glazing (pg 4 of 6)

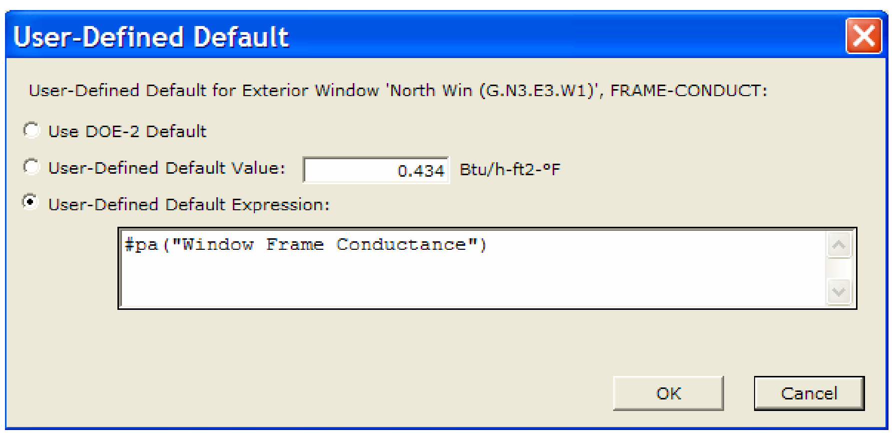
14) Copy this expression to all other north-facing windows. Within the spreadsheet, select the Glass Type input you just edited (should be displayed in magenta font), then press Ctrl-C to copy the contents of the cell, then paste the expression into the Glass Type input for each north-facing window (one at a time, cannot paste to multiple cells).

15) Repeat steps (10) through (14) to assign the "Non-North Glass Type" parameter to all remaining windows (do not assign it to the glass doors, see the example expression text below).

```
SymIndex(#pa("Non-North Glass Type"),"WINDOW","GLASS-TYPE")
```

In assigning the "Window Frame Conductance" parameter, we will use a method that illustrates user-defined default expressions. A user-defined default may be used for almost any input in eQUEST's detailed interface, but in general, only one user-defined default is permitted for each input (i.e., BDL keyword). This means that once default value is user defined for an eQUEST input, it applies globally to all inputs to that type. Of course, standard user input always overrides any default, BDL or user-defined. Therefore, user-defined defaults are most useful when a single default value is likely to be globally useful for all or most of the instances of a BDL keyword.

16) Define a user default for Frame Conductance. Do this by selecting any window (via the Window Properties dialog of the spreadsheet), then right clicking to display the quick menu. Select "Edit/View User Default" (the second item from the bottom of the Quick Menu). This will display the User-Define Default dialog (below, initially blank).



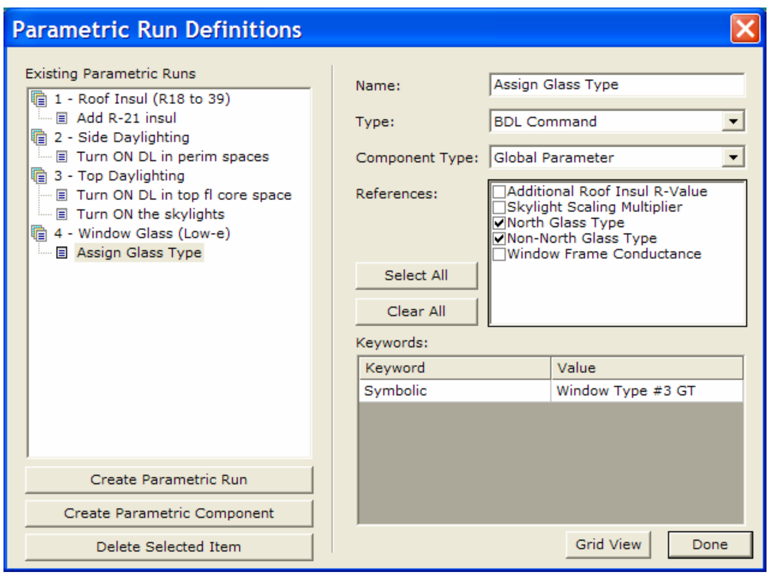
17) As shown above, assign the "Window Frame Conductance" to the Fame-Conductance BDL keyword. Be sure to also select the third radio button from the top, "User-Defined Default Expression". Press OK.

18) Right click the same input again, but this time select "Restore Default" from the Quick Menu. This action removes the user input (red font) value and allows the user-defined default to apply. If you have done this correctly, the value will display in blue font.

Parametric Example 4: Hi Perf Glazing (pg 5 of 6)

Having defined and assigned the necessary parameters, we must now define the Parametric Runs for this high performance glass case. To do this, we will need to define two Parametric Components, one for the symbolic parameters ("North Glass Type" and "Non-North Glass Type"), and a separate one for the numeric parameter ("Window Frame Conductance").

19) From the Tools menu, select "Parametric Runs". This displays the Parametric Run Definitions dialog.
20) On the Parametric Run Definitions dialog, select "Create Parametric Run". Rename this fourth parametric run "Window Glass (Low-e)".
21) Select Run Based On = "Top Daylighting". This will cause this fourth parametric case to be run "on top of" the three preceding parametric cases.
22) In the lower left hand corner of the Parametric Run Definitions dialog, select "Create Parametric Component" (example below).

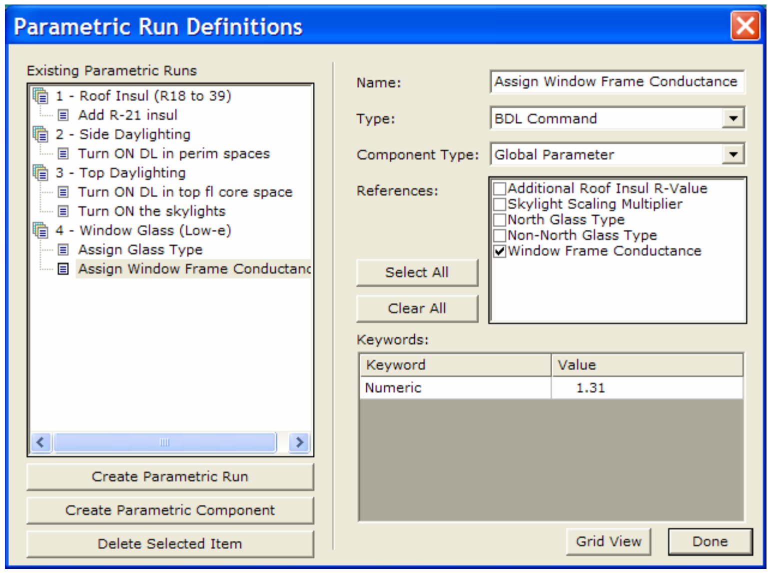


23) Name. Name the parametric component as preferred.
24) Type. Select Type = "BDL Command".
25) Component Type. From the list, select "Global Parameter"
26) References. Having selected Component Type = "Global Parameter", the list of references contains all of the global parameters defined thus far. Select (i.e., check) "North Glass Type" and "Non-North Glass Type".
27) Value. Change the value for both parameters to "Window Type #3 GT" (no typos! In this example changing a single digit to "3" is easy).

This completes defining the first of two Parametric Components. The second Parametric Component is necessary to turn "On" the skylights, i.e., literally, to resize the skylights from infinitesimal size to normal size.

Parametric Example 4: Hi Perf Glazing (pg 6 of 6)

To define a second Parametric Component for this high performance glass parametric run, on the Parametric Run Definitions dialog, select "Create Parametric Component". This displays a new Parametric Run Definitions dialog (see below).



28) Name. Name this parametric component as preferred.

29) Type. Select Type = "BDL Command".

30) Component Type. From the list, select "Global Parameter".

31) References. Having selected Component Type = "Global Parameter", the list of references contains all of the global parameters defined thus far. From the list, select (i.e., check) "Window Frame Conductance".

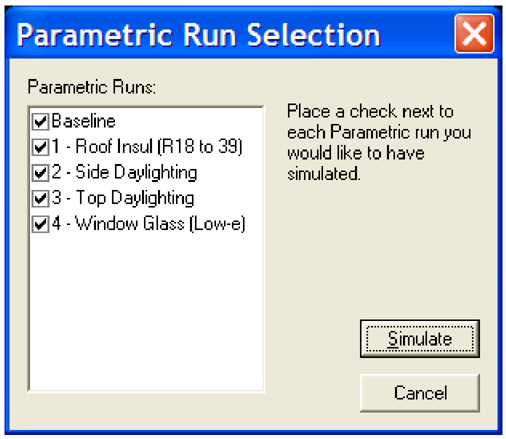
32) Value. Change the parameter value from 2.781 Btu/hr·ft^2·°F to 1.306 Btu/hr·ft^2·°F (note that this currently displays to only two decimals above). Btu/hr·ft^2·°F. From ASHRAE *Fundamentals*, 1997, pg 29.5, Table 2, for double pane fixed glass, with aluminum frame with thermal break and insulated spacer, the overall conductance is 1.04 Btu/hr·ft^2·°F. Since DOE-2 adds an exterior film resistance each hour (based on hourly wind speed and direction), we remove the DOE-2-calculated exterior film resistance at 15 mph (R-0.196) which yields 1.306 Btu/hr·ft^2·°F.

This completes defining a Parametric Run for the high performance glass case.

Step 5: Run Parametric Simulations

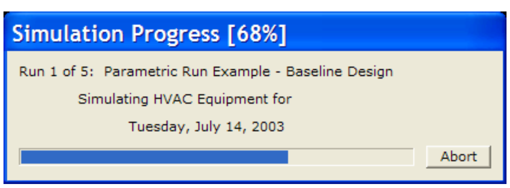
Having defined four parametric runs, for the purposes of this example, we will now step through the process of conducting parametric simulations and reviewing parametric simulation results.

1) When you are ready to sun your parametric simulations, click on the calculator button, on the tool bar at the top of the Detailed Interface screen. The Parametric Run Selection dialog will be presented (see figure below).



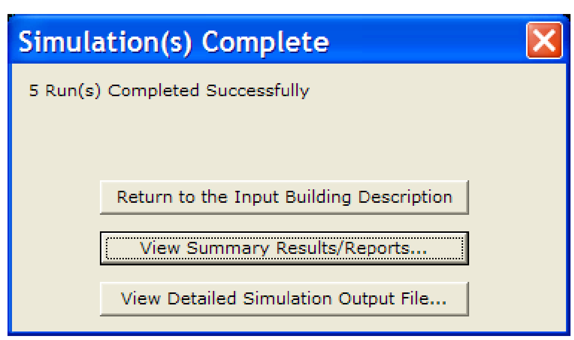
2) From the Parametric Run Selection dialog, select which runs you prefer to simulate (i.e., place a check mark in each run you select). In our example, we will be simulating one baseline and four alternatives, for a total of five runs. When you have selected the cases you wish to simulate, press the Simulate button.

3) If you have not saved your project, you will be prompted to save it.



4) During the simulations, a series of Simulation Progress dialogs (one for each of the simulation runs) are displayed, showing the progress of each simulation (see figure above).

5) When all runs are completed, a dialog like the one shown at right is displayed. Click on "View Summary Results/Reports" to navigate into the Results module.



Step 6: Analysize Parametric Simulation Results

1) Selecting "View Summary Results/Reports" on the Simulations Complete dialog (see previous page), navigates you into the Results module.

2) Alternately, you may navigate into the Results module at any time by clicking on the button on the tool bar at the top of the Detailed Interface screen. For a general description of the Results module, see the next section, Graphical Reports.

3) The most informative summary of parametric simulation results is provided in two Parametric Run Reports, the Annual Building Summary and the Annual Enduse Summary. Access these by selecting the Reports tab at the lower left corner of the Results module screen.

4) From the Reports "tree" (figure at right), select Annual Building Summary report or Annual Enduse Summary report.

Parametric Run Reports
- Annual Building Summary
- Annual Enduse Summary

5) The first of two pages from the Annual Building Summary report, "Annual Energy and Demand", is shown below (reduced image shown). See the description of this report in the next section (Graphical Reports).

6) The parametric report format provides a powerful quality control opportunity. By reporting the incremental and cumulative savings for each run, by enduse, the impacts of each run on each endue can be closely scrutinized. For example, in the figure below, the daylighting runs yielded large direct benefit to lighting energy (reduction), with additional secondary benefit to HVAC electric (reduced cooling), and a small HVAC gas (heating) penalty. Note also, the low-e glass run resulted in a small penalty to the daylighting savings and a large benefit to cooling (reduced HVAC electric). This resulted from a reduction in solar and visible transmission due to the altered glass properties.

Annual Energy and Demand

		Ann. Source Energy		Annual Site Energy		Lighting	HVAC Energy			Peak	
		Total Mbtu	EUI kBtu/sf/yr	Elect kWh	Nat Gas Therms	Electric kWh	Electric kWh	Nat Gas Therms	Total Mbtu	Elect kW	Cooling Tons
Annual Energy USE or DEMAND											
0	Base Design	10,022	100.21	964,415	1,475	276,763	318,243	7	1,087	472	223
1	0+Roof Insul (R18 to 39)	10,039	100.38	966,138	1,472	276,763	319,967	4	1,092	472	222
2	1+Side Daylighting	8,810	88.08	846,017	1,475	180,533	296,074	7	1,011	421	212
3	2+Top Daylighting	8,428	84.26	808,649	1,479	144,967	294,272	11	1,005	405	215
4	3+Window Glass (Low-e)	8,275	82.74	793,820	1,476	145,916	278,494	8	951	391	195
Incremental SAVINGS	(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)										
1	0+Roof Insul (R18 to 39)	-17	-0.17 (-0%)	-1,723 (-0%)	3 (0%)	0 (0%)	-1,724 (-1%)	3 (42%)	-6 (-1%)	1 (0%)	1 (1%)
2	1+Side Daylighting	1,230	12.29 (12%)	120,121 (12%)	-3 (-0%)	96,230 (35%)	23,892 (8%)	-3 (-37%)	81 (7%)	50 (11%)	10 (4%)
3	2+Top Daylighting	382	3.82 (4%)	37,368 (4%)	-5 (-0%)	35,567 (13%)	1,802 (1%)	-5 (-67%)	6 (1%)	16 (3%)	-3 (-1%)
4	3+Window Glass (Low-e)	152	1.52 (2%)	14,829 (2%)	3 (0%)	-950 (-0%)	15,778 (5%)	3 (45%)	54 (5%)	14 (3%)	20 (9%)
Cumulative SAVINGS	(values (and % savings) are relative to the Base Case, negative entries indicate increased use)										
1	0+Roof Insul (R18 to 39)	-17	-0.17 (-0%)	-1,723 (-0%)	3 (0%)	0 (0%)	-1,724 (-1%)	3 (42%)	-6 (-1%)	1 (0%)	1 (1%)
2	1+Side Daylighting	1,212	12.12 (12%)	118,398 (12%)	0 (0%)	96,230 (35%)	22,169 (7%)	0 (5%)	76 (7%)	51 (11%)	11 (5%)
3	2+Top Daylighting	1,594	15.94 (16%)	155,766 (16%)	-4 (-0%)	131,796 (48%)	23,971 (8%)	-4 (-62%)	81 (7%)	67 (14%)	8 (4%)
4	3+Window Glass (Low-e)	1,747	17.46 (17%)	170,595 (18%)	-1 (-0%)	130,847 (47%)	39,749 (12%)	-1 (-17%)	136 (12%)	82 (17%)	28 (13%)

Graphical Reports

Simulation Basics
Tour
Schematic Wizard
DD Wizard
Detailed Interface
EEM Wizard
Graphical Reports
Detailed Reports

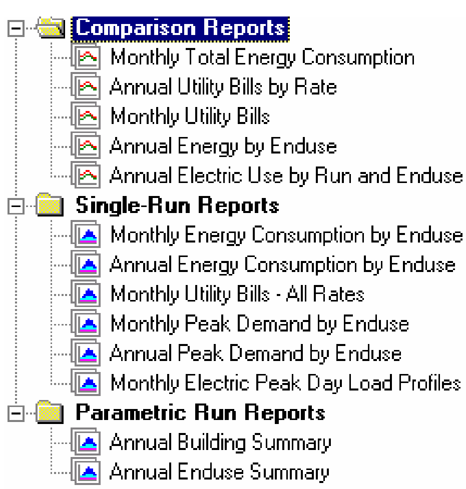
Review simulation results: After all of the simulation runs have completed, from the eQUEST analysis tool bar, press the Results Review mode button to view graphic simulation output reports. From the bottom of the results tree diagram (left side of the Results View screen) select the Projects / Runs tab, then select one or more projects for which you wish to view results. Also from the bottom of the results tree diagram, select the Reports tab, then select single run or comparison reports, as preferred.

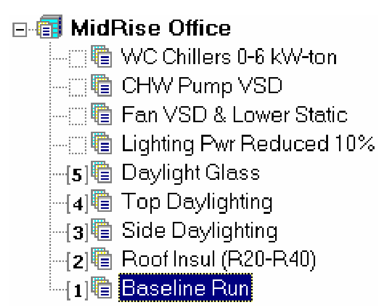
Important Note: To successfully view eQUEST reports, the computer you are using to view results must have a printer driver installed.

The illustration below shows the current Report Tree, accessed by clicking the Reports tab at the bottom left area of the screen. Note that half of the available reports are designed to display results for single runs. The other half of the available reports are designed to compare several runs (i.e., EEM's).

Whether single-run or comparison reports are selected, you must also select the run (single-run report) or runs (comparison report) to be displayed from the project tree (accessed by clicking the Projects / Runs tab at the bottom left area of the screen). In the case of comparison reports, the project tree includes a "plot order" designation (see example, below right). Clicking on the plot order designation acts as a toggle to include or exclude the selected run from the currently selected comparison report.

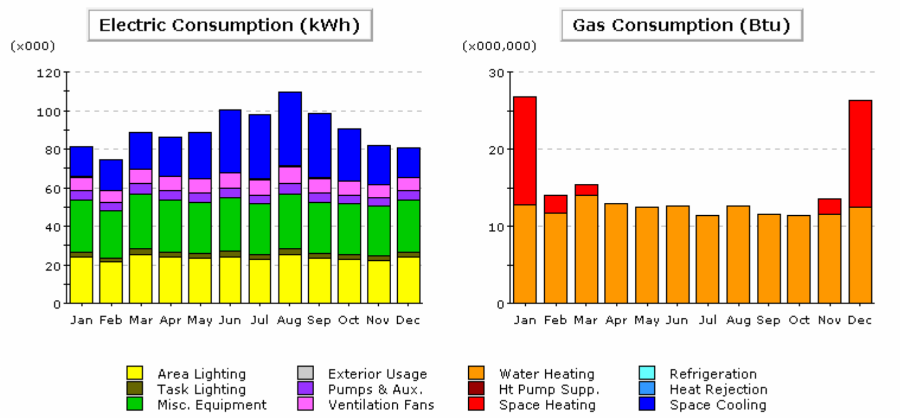
Examples of all of the available graphical reports are presented on the following pages.





Monthly Energy Consumption by End Use

(Single-Run Report)



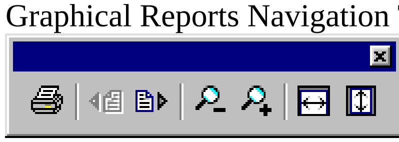
Electric Consumption (kWh x000)

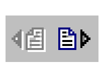
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	15.7	16.0	19.2	20.0	23.9	32.7	33.5	38.5	33.4	27.0	20.4	14.9	295.2
Heat Reject.	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.2	0.1	0.0	2.2
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	6.8	6.1	7.3	7.1	7.1	7.9	7.7	8.6	7.6	7.1	6.5	6.7	86.5
Pumps & Aux.	5.0	4.4	5.2	5.0	4.8	5.0	4.8	5.2	4.8	4.8	4.6	5.0	58.6
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	27.3	24.3	28.9	27.3	26.6	27.7	26.1	28.9	26.6	26.1	25.5	27.3	322.6
Task Lights	2.6	2.3	2.8	2.6	2.6	2.7	2.5	2.8	2.6	2.5	2.5	2.6	31.0
Area Lights	23.9	21.3	25.2	23.9	23.2	24.2	22.9	25.2	23.2	22.9	22.3	23.9	282.1
Total	81.3	74.6	88.7	85.9	88.3	100.6	97.9	109.6	98.6	90.6	81.7	80.4	1,078.1

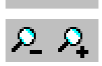
Gas Consumption (Btu x000,000)

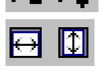
Jan	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	14.02	2.43	1.36	-	-	-	-	-	-	-	1.99	13.75	33.55
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	12.79	11.64	13.97	12.88	12.40	12.62	11.40	12.66	11.60	11.36	11.49	12.51	147.31
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	26.81	14.07	15.33	12.88	12.40	12.62	11.40	12.66	11.60	11.36	13.47	26.26	180.87

Graphical Reports Navigation Tool Bar



 Next page / Previous page

 Zoom in / Zoom out

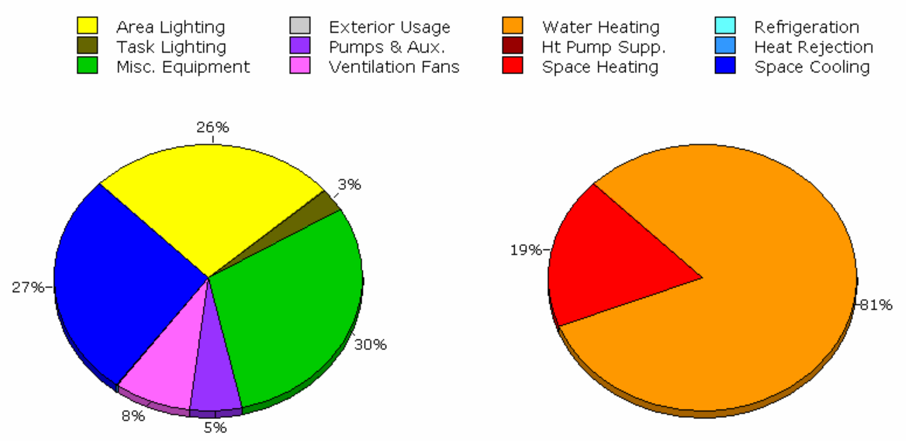
 Size to fit window Width / Height

eQUEST

Annual Energy Consumption by End Use
(Single-Run Report)

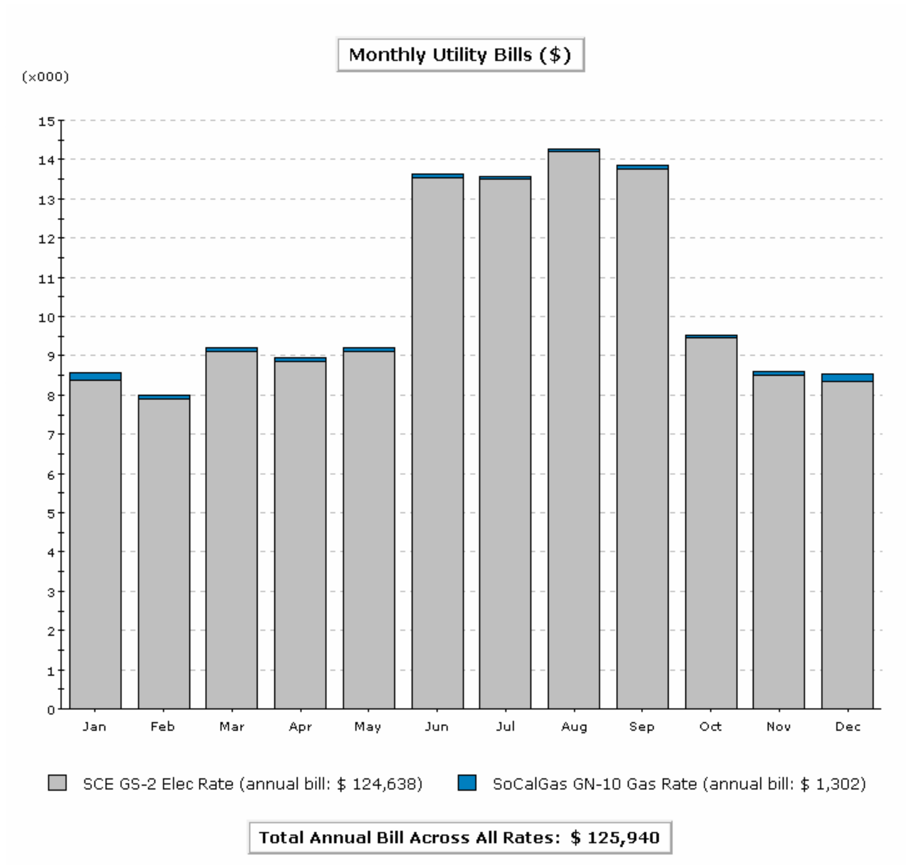
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	295.2	-	-	-
Heat Reject.	2.2	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	33.55	-	-
HP Supp.	-	-	-	-
Hot Water	-	147.31	-	-
Vent. Fans	86.5	-	-	-
Pumps & Aux.	58.6	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	322.6	-	-	-
Task Lights	31.0	-	-	-
Area Lights	282.1	-	-	-
Total	1,078.1	180.87	-	-



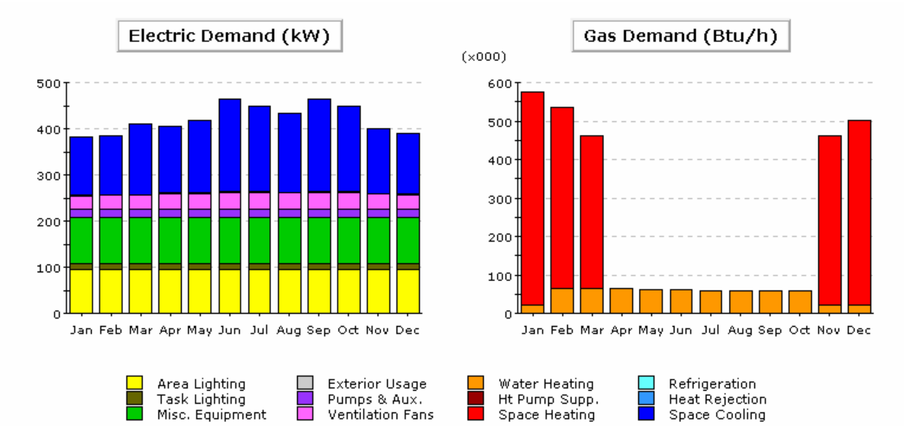
Electricity **Natural Gas**

Monthly Utility Bills, All Rates
(Single-Run Report)



Monthly Peak Demand by End Use

(Single-Run Report)



Electric Demand (kW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	127.0	129.7	152.2	145.0	155.8	200.0	185.3	170.5	201.0	185.0	139.7	131.4	1,922.6
Heat Reject.	0.8	0.9	2.0	0.9	2.0	3.5	2.9	2.3	3.5	2.9	1.4	0.8	23.8
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	30.2	30.6	31.1	35.5	34.4	36.2	35.9	35.7	36.2	35.8	33.3	32.4	407.3
Pumps & Aux.	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	216.4
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	1,179.0
Task Lights	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	155.5
Area Lights	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3	95.3	1,144.0
Total	382.6	385.7	409.9	406.0	416.7	464.3	448.6	433.1	465.3	448.2	399.0	389.2	5,048.7

Gas Demand (Btu/h x000)

Jan	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	553.4	471.7	396.2	-	-	-	-	-	-	-	440.0	479.9	2,341.2
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	22.3	64.5	64.6	64.2	62.6	61.0	59.5	58.7	58.7	59.4	21.3	21.9	618.7
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	575.7	536.3	460.8	64.2	62.6	61.0	59.5	58.7	58.7	59.4	461.3	501.8	2,959.9

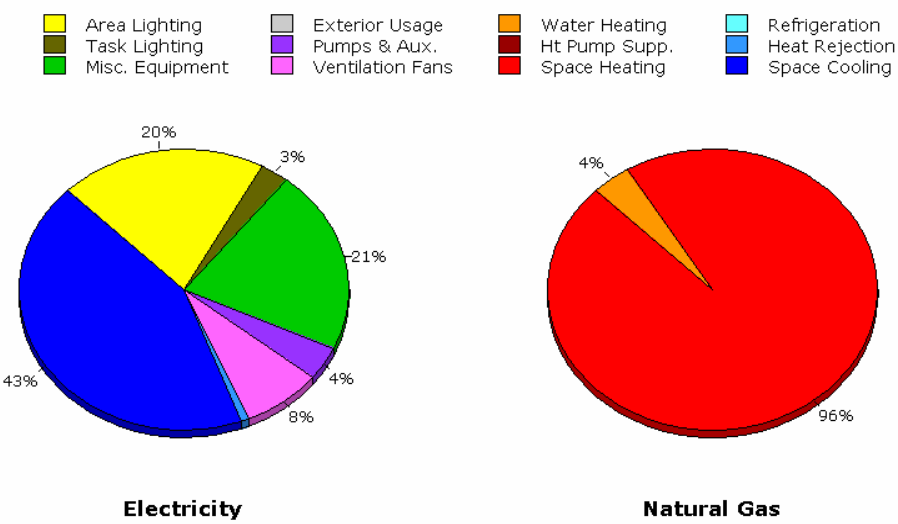
Annual Peak Demand by End Use

(Single-Run Report)

Simulation Basics
Tour
Schematic Wizard
DD Wizard
Detailed Interface
EEM Wizard
Graphical Reports
Single Run Reports:
Mnthly Energy, End Use
Ann. Energy, End Use
Mnthly Utility Bills
Mnthly Peak, End Use
Ann. Peak, End Use
Peak Day Profile
Comparison Reports:
Mnthy Total Energy
Ann. Utility Bills
Mnthly Utiltiy Bills
Ann. Energy, End Use
Ann. Electric Use
Parametric Run Reports:
Annual Building Summary
Annual Enduse Summary
Detailed Reports

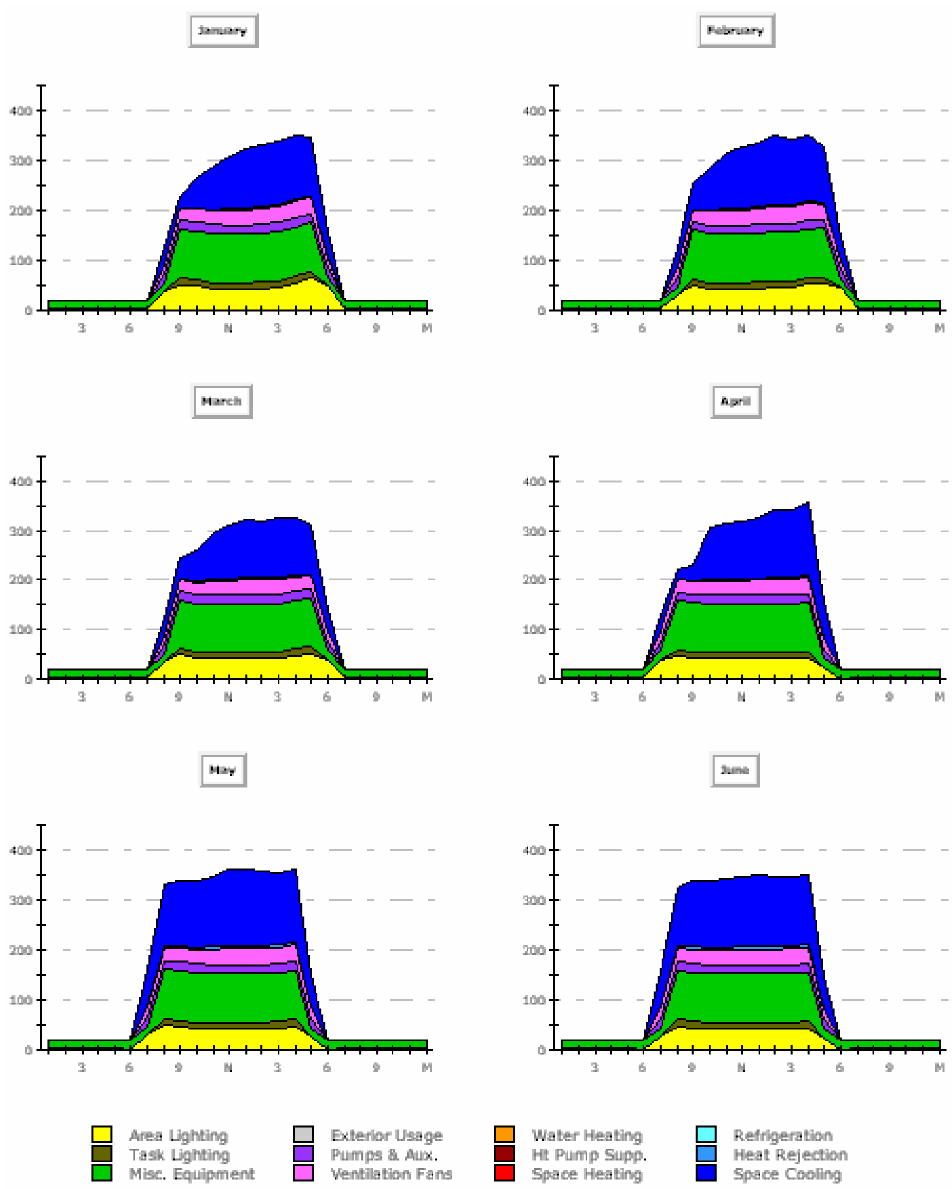
Annual Peak Demand by Enduse

	Electricity kW	Natural Gas Btu/h (x000)	Steam Btu/h	Chilled Water Btu/h
Space Cool	200.95	-	-	-
Heat Reject.	3.55	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	553.44	-	-
HP Supp.	-	-	-	-
Hot Water	-	22.26	-	-
Vent. Fans	36.21	-	-	-
Pumps & Aux.	18.04	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	98.25	-	-	-
Task Lights	12.96	-	-	-
Area Lights	95.34	-	-	-
Total	465.29	575.70	-	-



Monthly Peak Day Electric Load Profiles

(Single-Run Report)



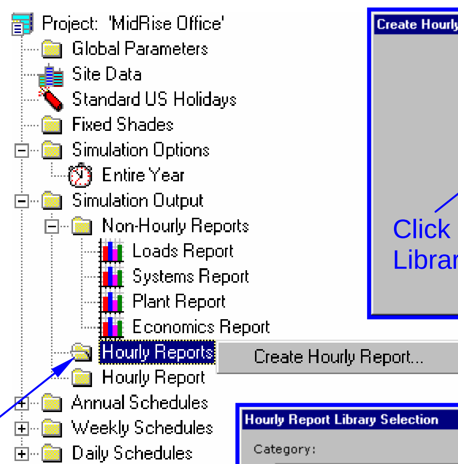
Important Notes:

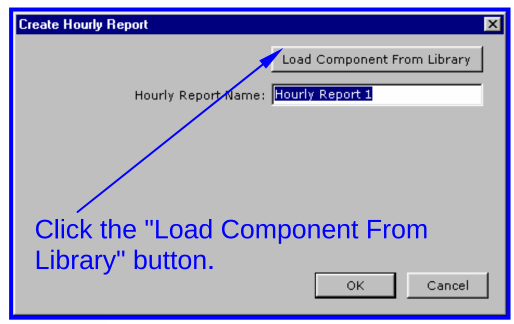
1) To be able to view Monthly Peak Day Electric Load Profiles report, you must first load the hourly reporting variables used to populate the peak day profiles on this report. This is done from the Building Description area of eQUEST's detailed interface. Start at the Component Tree in the Project & Site module (see the following page).
2) Specifying hourly reporting will increase the size of the detailed results SIM file by ~4 MB.
3) This is a 2 page report. Page 2 reports peak profiles for July through December

Monthly Peak Day Electric Load Profiles

(Single-Run Report)

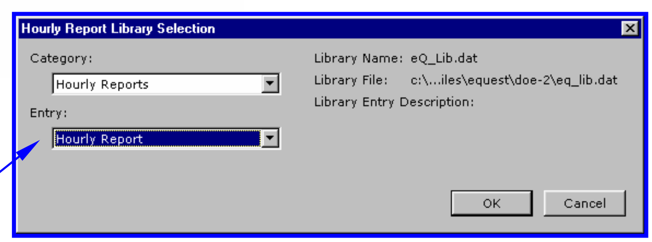
To load the hourly reporting variables used to populate the peak day profiles on Monthly Peak Day Electric Load Profiles report, in the Building Description area of eQUEST's detailed interface, go to the Component Tree in the Project & Site module. Right click on "Hourly Reports" and select "Create Hourly Reports". From the "Create Hourly Reports" dialog, click the "Load Component From Library" button. On the "Hourly Report Selection" dialog, select both the "Category" and "Entry" to be "Hourly Reports" (currently the only choices), then click "OK" (twice). This will display the "Hourly Results Selection" dialog. You may be interested to review these variable selections, but NO changes should be made.



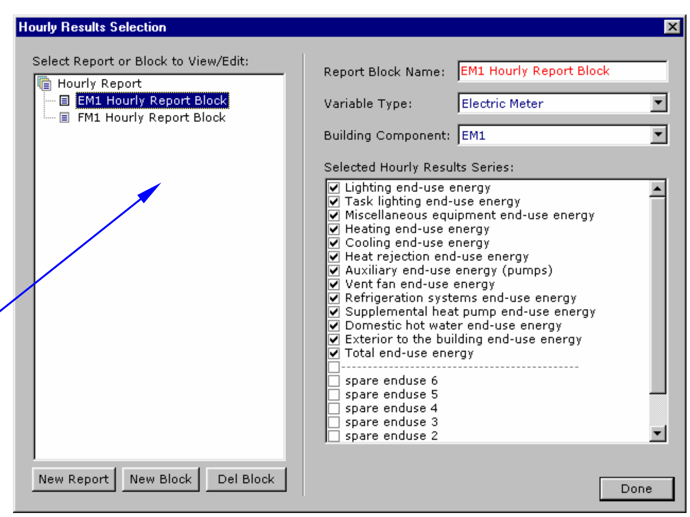


Click the "Load Component From Library" button.

Right click "Hourly Reports" then select "Create Hourly Report".



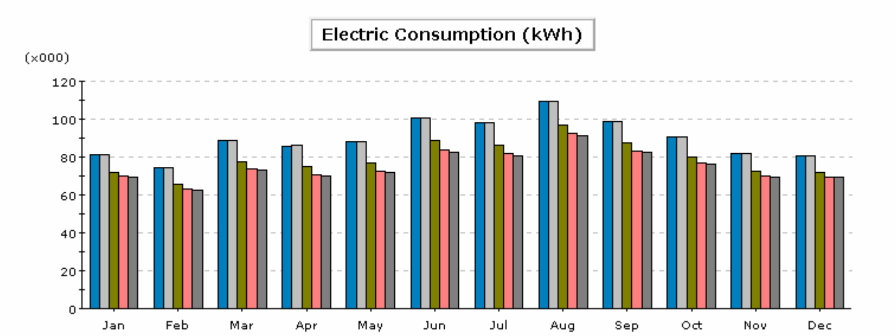
Select "Hourly Reports" for both the "Category" and "Entry".



You may be interested to review these variable selections, but make NO changes (none required).

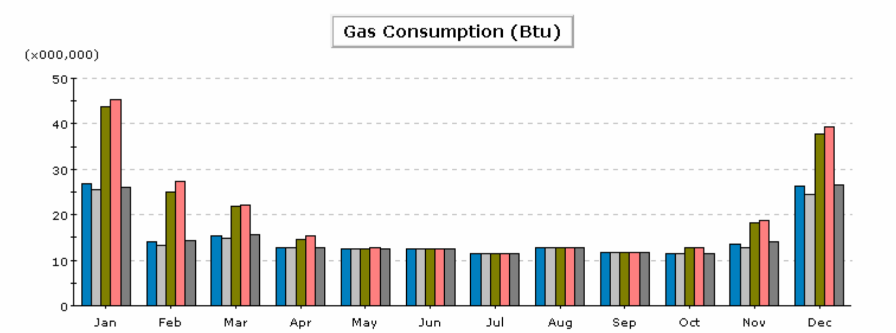
Monthly Total Energy Consumption

(Comparison Report)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	81.3	74.6	88.7	85.9	88.3	100.6	97.9	109.6	98.6	90.6	81.7	80.4	1,078.1
Run 2.	81.4	74.7	88.8	86.0	88.4	100.6	97.8	109.6	98.6	90.7	81.9	80.5	1,078.8
Run 3.	72.1	65.6	77.3	74.7	77.1	88.5	86.4	97.0	87.2	80.0	72.6	71.6	950.1
Run 4.	70.1	63.0	73.7	70.7	72.6	83.7	82.0	92.4	83.2	76.6	70.2	69.5	907.7
Run 5.	69.6	62.5	73.3	70.1	71.9	82.7	80.9	91.0	82.4	76.0	69.7	69.1	899.1

1. MidRise Office - Baseline Run (07/09/00 @ 08:25)
2. MidRise Office - Roof Insul (R20-R40) (07/09/00 @ 08:26)
3. MidRise Office - Side Daylighting (07/09/00 @ 08:27)
4. MidRise Office - Top Daylighting (07/09/00 @ 08:28)
5. MidRise Office - Daylight Glass (07/09/00 @ 08:28)

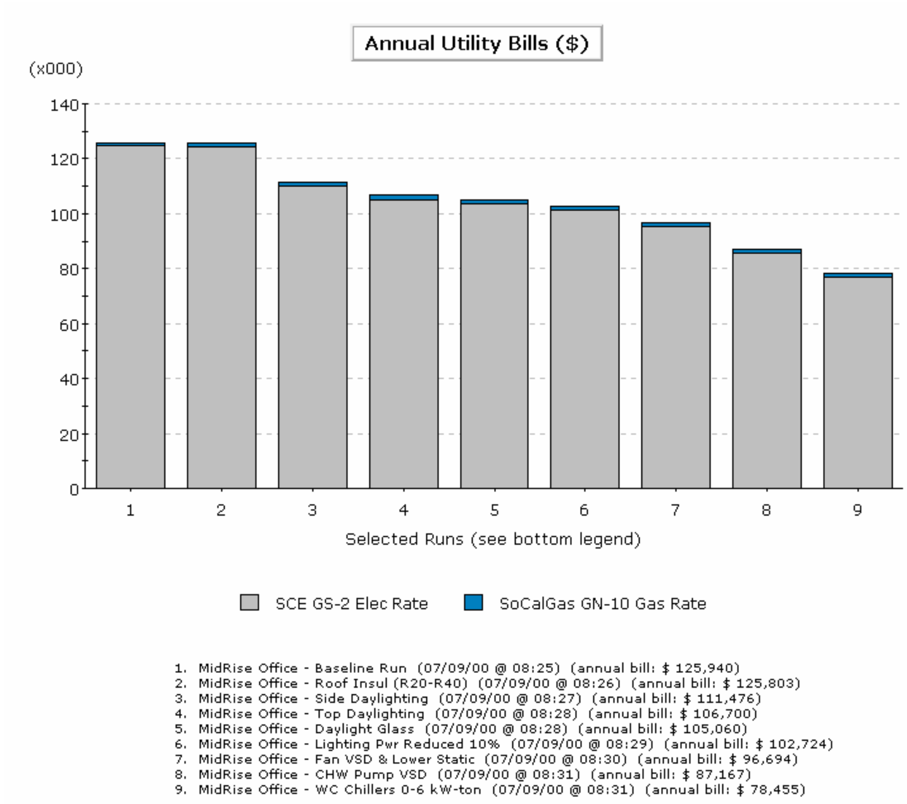


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	26.81	14.07	15.33	12.88	12.40	12.62	11.40	12.66	11.60	11.36	13.47	26.26	180.87
Run 2.	25.46	13.26	14.93	12.88	12.40	12.62	11.40	12.66	11.60	11.36	12.88	24.50	175.94
Run 3.	43.66	25.11	21.76	14.60	12.40	12.62	11.40	12.66	11.60	12.86	18.36	37.77	234.79
Run 4.	45.40	27.32	22.24	15.37	12.78	12.62	11.40	12.66	11.60	12.87	18.65	39.36	242.26
Run 5.	25.92	14.34	15.69	12.88	12.40	12.62	11.40	12.66	11.60	11.36	14.14	26.51	181.53

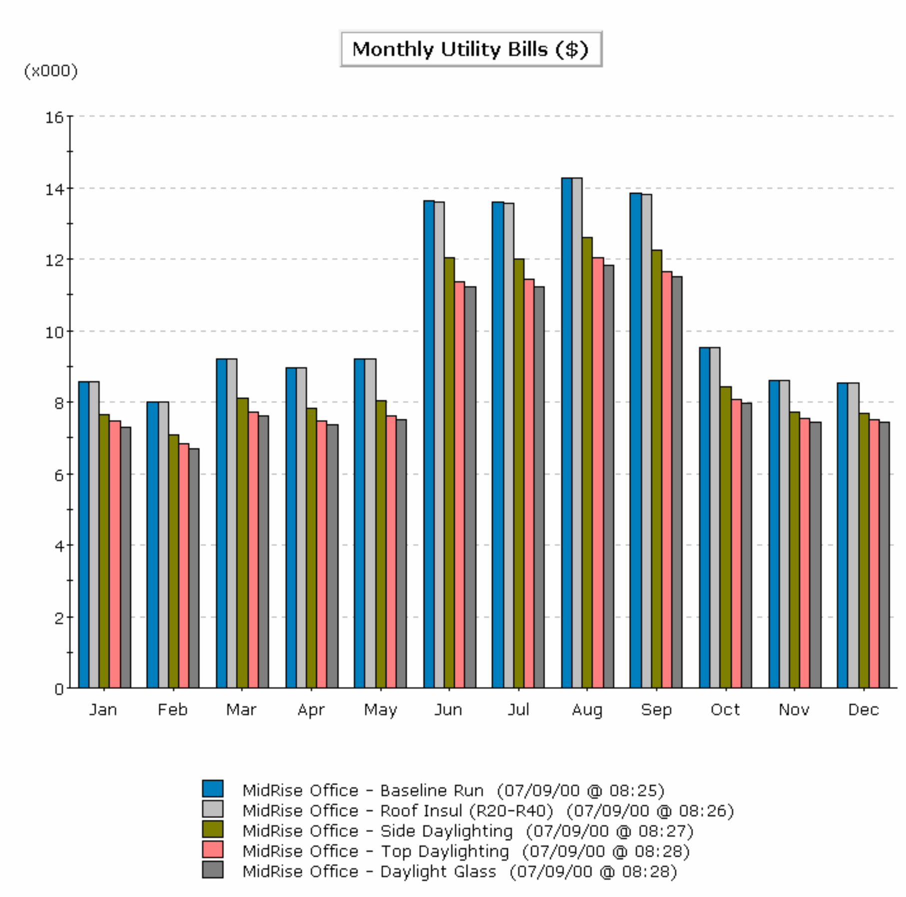
Simulation Basics
Tour
Schematic Wizard
DD Wizard
Detailed Interface
EEM Wizard
Graphical Reports
Single Run Reports:
Mnthly Energy, End Use
Ann. Energy, End Use
Mnthly Utility Bills
Mnthly Peak, End Use
Ann. Peak, End Use
Peak Day Profile
Comparison Reports:
Mnthy Total Energy
Ann. Utility Bills
Mnthly Utiltiy Bills
Ann. Energy, End Use
Ann. Electric Use
Parametric Run Reports:
Annual Building Summary
Annual Enduse Summary
Detailed Reports

Annual Utility Bills by Rate

(Comparison Report)

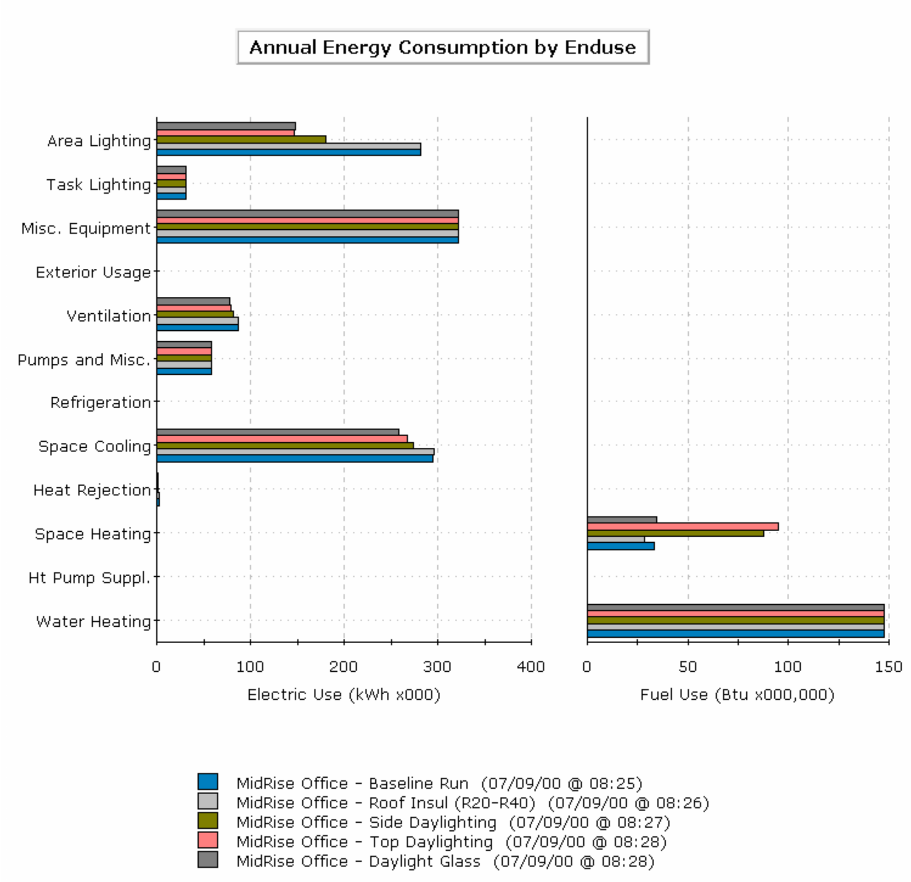


Monthly Utility Bills
(Comparison Report)



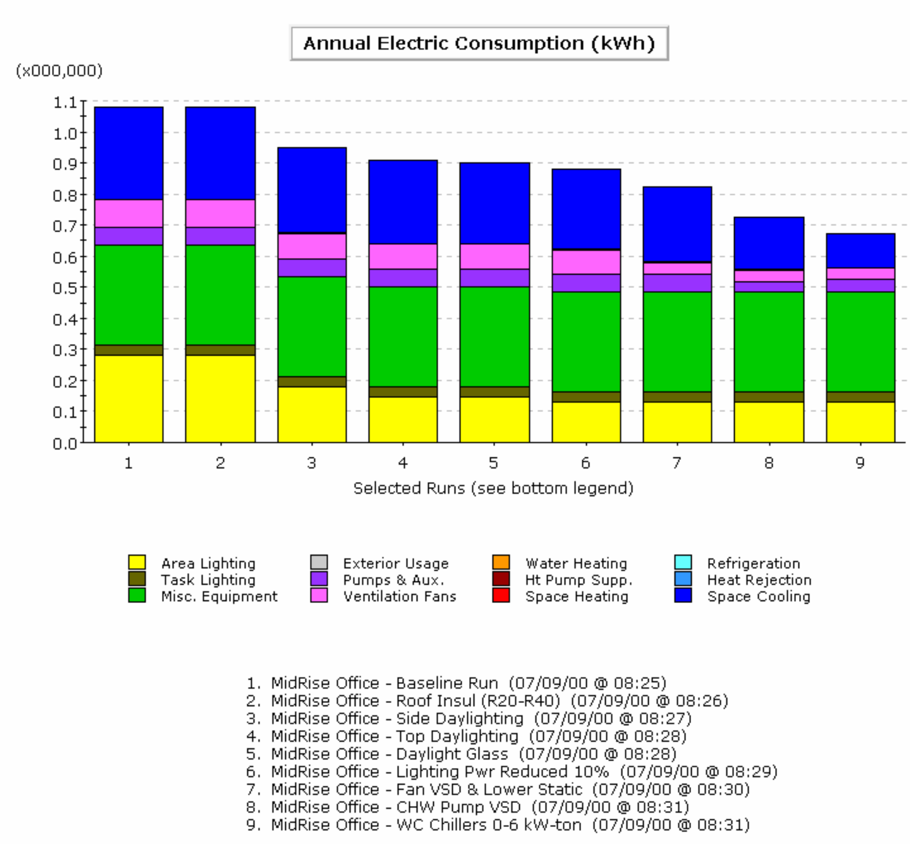
Annual Energy by End Use

(Comparison Report)



Annual Electric Use by Enduse

(Comparison Report)



Annual Building Summary

page 1 of 2

Annual Energy and Demand

(Parametric Report)

Annual Energy and Demand

		Ann. Source Energy		Annual Site Energy		Lighting	HVAC Energy			Peak	
		Total Mbtu	EUI kBtu/sf/yr	Elect kWh	Nat Gas Therms	Electric kWh	Electric kWh	Nat Gas Therms	Total Mbtu	Elect kW	Cooling Tons
Annual Energy USE or DEMAND											
0	Base Design	10,099	100.97	971,867	1,480	276,763	325,695	12	1,113	477	227
1	0+Roof Insul (R18 to R39)	10,116	101.14	973,577	1,474	276,763	327,405	6	1,118	476	226
2	1+Side Daylighting	8,888	88.87	853,636	1,479	180,533	303,694	11	1,038	428	218
3	2+Top Daylighting	8,428	84.26	808,650	1,479	144,967	294,274	11	1,005	405	215
4	3+Window Glass (Low-e)	8,291	82.90	795,344	1,475	145,916	280,018	7	956	392	195
5	4+Reduced Lighting Power	8,079	80.77	774,600	1,476	128,778	276,411	7	944	384	193
6	5+Fans (Dischrg Dampers to VSDs)	7,504	75.03	718,506	1,476	128,778	220,317	8	753	367	187
7	6+CHW Pump (VariVol & VSD)	7,137	71.36	682,659	1,476	128,778	184,470	8	630	355	187
8	7+Chiller (0-6 kW-ton)	6,832	68.31	652,860	1,476	128,778	154,670	8	529	326	187
Incremental SAVINGS	**(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)**										
1	0+Roof Insul (R18 to R39)	-17	-0.17 (-0%)	-1,709 (-0%)	6 (0%)	0 (0%)	-1,710 (-1%)	6 (49%)	-5 (-0%)	1 (0%)	1 (0%)
2	1+Side Daylighting	1,228	12.27 (12%)	119,940 (12%)	-5 (-0%)	96,230 (35%)	23,711 (7%)	-5 (-41%)	80 (7%)	49 (10%)	8 (4%)
3	2+Top Daylighting	461	4.61 (5%)	44,986 (5%)	-0 (-0%)	35,567 (13%)	9,420 (3%)	-0 (-2%)	32 (3%)	22 (5%)	3 (1%)
4	3+Window Glass (Low-e)	137	1.37 (1%)	13,306 (1%)	4 (0%)	-950 (-0%)	14,256 (4%)	4 (33%)	49 (4%)	13 (3%)	19 (9%)
5	4+Reduced Lighting Power	212	2.12 (2%)	20,744 (2%)	-0 (-0%)	17,139 (6%)	3,607 (1%)	-0 (-2%)	12 (1%)	8 (2%)	2 (1%)
6	5+Fans (Dischrg Dampers to VSDs)	574	5.74 (6%)	56,094 (6%)	-0 (-0%)	0 (0%)	56,095 (17%)	-0 (-3%)	191 (17%)	17 (4%)	7 (3%)
7	6+CHW Pump (VariVol & VSD)	367	3.67 (4%)	35,847 (4%)	0 (0%)	0 (0%)	35,847 (11%)	0 (0%)	122 (11%)	12 (2%)	0 (0%)
8	7+Chiller (0-6 kW-ton)	305	3.05 (3%)	29,800 (3%)	0 (0%)	0 (0%)	29,800 (9%)	0 (0%)	102 (9%)	29 (6%)	0 (0%)
Cumulative SAVINGS	**(values (and % savings) are relative to the Base Case, negative entries indicate increased use)**										
1	0+Roof Insul (R18 to R39)	-17	-0.17 (-0%)	-1,709 (-0%)	6 (0%)	0 (0%)	-1,710 (-1%)	6 (49%)	-5 (-0%)	1 (0%)	1 (0%)
2	1+Side Daylighting	1,211	12.10 (12%)	118,231 (12%)	1 (0%)	96,230 (35%)	22,001 (7%)	1 (8%)	75 (7%)	50 (10%)	9 (4%)
3	2+Top Daylighting	1,671	16.71 (17%)	163,217 (17%)	1 (0%)	131,796 (48%)	31,422 (10%)	1 (6%)	107 (10%)	72 (15%)	12 (5%)
4	3+Window Glass (Low-e)	1,808	18.08 (18%)	176,523 (18%)	5 (0%)	130,847 (47%)	45,677 (14%)	5 (39%)	156 (14%)	85 (18%)	32 (14%)
5	4+Reduced Lighting Power	2,020	20.20 (20%)	197,267 (20%)	4 (0%)	147,986 (53%)	49,284 (15%)	4 (37%)	169 (15%)	93 (19%)	34 (15%)
6	5+Fans (Dischrg Dampers to VSDs)	2,595	25.94 (26%)	253,361 (26%)	4 (0%)	147,986 (53%)	105,379 (32%)	4 (34%)	360 (32%)	110 (23%)	40 (18%)
7	6+CHW Pump (VariVol & VSD)	2,962	29.61 (29%)	289,208 (30%)	4 (0%)	147,986 (53%)	141,226 (43%)	4 (34%)	482 (43%)	122 (26%)	40 (18%)
8	7+Chiller (0-6 kW-ton)	3,267	32.66 (32%)	319,008 (33%)	4 (0%)	147,986 (53%)	171,025 (53%)	4 (34%)	584 (52%)	151 (32%)	40 (18%)

These reports are produced automatically for EEM or Parametric simulation runs. Each page of the parametric results reports are divided vertically into three sections which report: 1) total, 2) incremental or 3) cumulative results. One row per case (run). All are annual results.

1) The upper third reports total annual results for energy, demand, and utility costs for each case.
2) The middle third reports *incremental* annual savings for each case. The incremental savings reports the impact (i.e., benefit or penalty) associated with each case. This is calculated by subtracting the results for the current case from the results for the previous case.
3) The bottom third of each table reports *cumulative* annual savings for each package of measures, i.e., the cumulative savings assume that the parametric cases were run on top of previous cases and report the benefit or penalties associated with the growing package of efficiency measures, relative to the Base Case. This is calculated by subtracting the annual results for each case from the annual results for the Base Case.

IMPORTANT NOTE: If all EEM runs were run on top of the Base Case, i.e., not on top of other EEM cases, the cumulative and incremental results will be identical.

DOE-2 Note: Total annual energy results are from the DOE-2 BEPU report. Demand results are from the DOE-2 PS-E report. Utility costs results are from the DOE-2 ES-E report. Peak cooling load is from the DOE-2 SS-D report.

 eQUEST

Annual Building Summary

page 2 of 2

Annual Costs

(Parametric Report)

Annual Costs

		Annual Utility Cost					Incentives		LCC
		Electric kWh($)	Electric kW($)	Electric Total($)	Nat Gas Total($)	Total ($)	Owner ($)	Design Team ($)	Total (PV$)
Annual COST									
0	Base Design	$ 127,881	$ 68,202	$ 199,667	$ 1,255	$ 200,922	--	--	$ 3,326,820
1	0+Roof Insul (R18 to R39)	$ 128,066	$ 68,217	$ 199,867	$ 1,251	$ 201,118	--	--	$ 3,330,152
2	1+Side Daylighting	$ 111,737	$ 60,327	$ 175,648	$ 1,254	$ 176,902	--	--	$ 2,926,619
3	2+Top Daylighting	$ 105,500	$ 57,411	$ 166,494	$ 1,254	$ 167,748	--	--	$ 2,774,097
4	3+Window Glass (Low-e)	$ 103,521	$ 55,739	$ 162,844	$ 1,252	$ 164,096	--	--	$ 2,713,281
5	4+Reduced Lighting Power	$ 100,806	$ 54,426	$ 158,817	$ 1,252	$ 160,069	--	--	$ 2,646,184
6	5+Fans (Dischrg Dampers to VSDs)	$ 93,245	$ 51,025	$ 147,854	$ 1,252	$ 149,106	--	--	$ 2,463,520
7	6+CHW Pump (VariVol & VSD)	$ 88,524	$ 49,242	$ 141,350	$ 1,252	$ 142,602	--	--	$ 2,355,151
8	7+Chiller (0-6 kW-ton)	$ 84,202	$ 45,299	$ 133,084	$ 1,252	$ 134,336	--	--	$ 2,217,424
Incremental SAVINGS	**(values are relative to previous measure (% savings are relative to base case cost), negative entries indicate increased cost)**								
1	0+Roof Insul (R18 to R39)	$ -185	$ -15	$ -200	$ 4	$ -196	--	--	$ -3,333
2	1+Side Daylighting	$ 16,329	$ 7,890	$ 24,219	$ -3	$ 24,216	--	--	$ 403,533
3	2+Top Daylighting	$ 6,237	$ 2,916	$ 9,154	$ 0	$ 9,154	--	--	$ 152,522
4	3+Window Glass (Low-e)	$ 1,979	$ 1,672	$ 3,650	$ 2	$ 3,652	--	--	$ 60,816
5	4+Reduced Lighting Power	$ 2,715	$ 1,313	$ 4,027	$ 0	$ 4,027	--	--	$ 67,097
6	5+Fans (Dischrg Dampers to VSDs)	$ 7,561	$ 3,401	$ 10,963	$ 0	$ 10,963	--	--	$ 182,664
7	6+CHW Pump (VariVol & VSD)	$ 4,721	$ 1,783	$ 6,504	$ 0	$ 6,504	--	--	$ 108,369
8	7+Chiller (0-6 kW-ton)	$ 4,322	$ 3,943	$ 8,266	$ 0	$ 8,266	--	--	$ 137,727
Cumulative SAVINGS	**(values (and % savings) are relative to the Base Case, negative entries indicate increased cost)**								
1	0+Roof Insul (R18 to R39)	$ -185	$ -15	$ -200	$ 4	$ -196	--	--	$ -3,333
2	1+Side Daylighting	$ 16,144	$ 7,875	$ 24,019	$ 1	$ 24,020	--	--	$ 400,201
3	2+Top Daylighting	$ 22,381	$ 10,791	$ 33,173	$ 1	$ 33,174	--	--	$ 552,723
4	3+Window Glass (Low-e)	$ 24,360	$ 12,463	$ 36,823	$ 3	$ 36,826	--	--	$ 613,539
5	4+Reduced Lighting Power	$ 27,075	$ 13,776	$ 40,850	$ 3	$ 40,853	--	--	$ 680,636
6	5+Fans (Dischrg Dampers to VSDs)	$ 34,636	$ 17,177	$ 51,813	$ 3	$ 51,816	--	--	$ 863,300
7	6+CHW Pump (VariVol & VSD)	$ 39,357	$ 18,960	$ 58,317	$ 3	$ 58,320	--	--	$ 971,669
8	7+Chiller (0-6 kW-ton)	$ 43,679	$ 22,903	$ 66,583	$ 3	$ 66,586	--	--	$ 1,109,395

See previous page for an explanation of the format of this parametric report.

Annual Enduse Summary

page 1 of 4

Annual Electric Energy by Enduse

(Parametric Report)

Annual Electric Energy by Enduse

	Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
Annual Energy USE (kWh)											
0 Base Design	276,763	0	369,410	0	168,708	3,474	61,622	91,891	0	0	971,867
1 0+Roof Insul (R18 to R39)	276,763	0	369,410	0	169,758	3,483	61,660	92,505	0	0	973,577
2 1+Side Daylighting	180,533	0	369,410	0	153,200	2,884	60,793	86,817	0	0	853,636
3 2+Top Daylighting	144,967	0	369,410	0	146,511	2,644	60,400	84,719	0	0	808,650
4 3+Window Glass (Low-e)	145,916	0	369,410	0	133,057	2,112	59,607	85,242	0	0	795,344
5 4+Reduced Lighting Powe	128,778	0	369,410	0	130,171	2,025	59,464	84,752	0	0	774,600
6 5+Fans (Dischrg Dampers	128,778	0	369,410	0	119,680	1,719	58,719	40,199	0	0	718,506
7 6+CHW Pump (VariVol & \	128,778	0	369,410	0	113,751	1,616	28,903	40,199	0	0	682,659
8 7+Chiller (0-6 kW-ton)	128,778	0	369,410	0	84,382	1,522	28,566	40,199	0	0	652,860

Incremental SAVINGS (MWh) **(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)**

	Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1 0+Roof Insul (R18 to R39)	0.00 (0%)	--	0.00 (0%)	--	-1.05 (-1%)	-0.01 (-0%)	-0.04 (-0%)	-0.61 (-1%)	--	--	-1.71 (-0%)
2 1+Side Daylighting	96.23 (35%)	--	0.00 (0%)	--	16.56 (10%)	0.60 (17%)	0.87 (1%)	5.69 (6%)	--	--	119.94 (12%)
3 2+Top Daylighting	35.57 (13%)	--	0.00 (0%)	--	6.69 (4%)	0.24 (7%)	0.39 (1%)	2.10 (2%)	--	--	44.99 (5%)
4 3+Window Glass (Low-e)	-0.95 (-0%)	--	0.00 (0%)	--	13.45 (8%)	0.53 (15%)	0.79 (1%)	-0.52 (-1%)	--	--	13.31 (1%)
5 4+Reduced Lighting Powe	17.14 (6%)	--	0.00 (0%)	--	2.89 (2%)	0.09 (3%)	0.14 (0%)	0.49 (1%)	--	--	20.74 (2%)
6 5+Fans (Dischrg Dampers	0.00 (0%)	--	0.00 (0%)	--	10.49 (6%)	0.31 (9%)	0.75 (1%)	44.55 (48%)	--	--	56.09 (6%)
7 6+CHW Pump (VariVol & \	0.00 (0%)	--	0.00 (0%)	--	5.93 (4%)	0.10 (3%)	29.82 (48%)	0.00 (0%)	--	--	35.85 (4%)
8 7+Chiller (0-6 kW-ton)	0.00 (0%)		0.00 (0%)		29.37 (17%)	0.09 (3%)	0.34 (1%)	0.00 (0%)			29.80 (3%)

Cumulative SAVINGS (MWh) **(values (and % savings) are relative to the Base Case, negative entries indicate increased use)**

	Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1 0+Roof Insul (R18 to R39)	0.00 (0%)	--	0.00 (0%)	--	-1.05 (-1%)	-0.01 (-0%)	-0.04 (-0%)	-0.61 (-1%)	--	--	-1.71 (-0%)
2 1+Side Daylighting	96.23 (35%)	--	0.00 (0%)	--	15.51 (9%)	0.59 (17%)	0.83 (1%)	5.07 (6%)	--	--	118.23 (12%)
3 2+Top Daylighting	131.80 (48%)	--	0.00 (0%)	--	22.20 (13%)	0.83 (24%)	1.22 (2%)	7.17 (8%)	--	--	163.22 (17%)
4 3+Window Glass (Low-e)	130.85 (47%)	--	0.00 (0%)	--	35.65 (21%)	1.36 (39%)	2.02 (3%)	6.65 (7%)	--	--	176.52 (18%)
5 4+Reduced Lighting Powe	147.99 (53%)	--	0.00 (0%)	--	38.54 (23%)	1.45 (42%)	2.16 (4%)	7.14 (8%)	--	--	197.27 (20%)
6 5+Fans (Dischrg Dampers	147.99 (53%)	--	0.00 (0%)	--	49.03 (29%)	1.75 (51%)	2.90 (5%)	51.69 (56%)	--	--	253.36 (26%)
7 6+CHW Pump (VariVol & \	147.99 (53%)	--	0.00 (0%)	--	54.96 (33%)	1.86 (53%)	32.72 (53%)	51.69 (56%)	--	--	289.21 (30%)
8 7+Chiller (0-6 kW-ton)	147.99 (53%)	--	0.00 (0%)	--	84.33 (50%)	1.95 (56%)	33.06 (54%)	51.69 (56%)	--	--	319.01 (33%)

For an explanation of this parametric report format, see the Annual Building Summary (page 1 of 2).

Annual Enduse Summary

page 2 of 4

Elec. Coincident Peak Demand by Enduse (Parametric Report)

Annual Electric Coincident Peak Demand by Enduse

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
Annual Energy Coincident Demand (kW)												
0	Base Design	105.9	0.0	109.2	0.0	175.2	9.0	25.1	52.6	0.0	0.0	477.1
1	0+Roof Insul (R18 to R39	105.9	0.0	109.2	0.0	174.4	9.0	25.1	52.6	0.0	0.0	476.3
2	1+Side Daylighting	66.3	0.0	109.2	0.0	168.5	8.8	25.1	49.6	0.0	0.0	427.5
3	2+Top Daylighting	47.3	0.0	109.2	0.0	166.3	8.8	25.1	48.5	0.0	0.0	405.1
4	3+Window Glass (Low-e)	58.3	0.0	109.2	0.0	141.1	5.0	25.1	53.6	0.0	0.0	392.3
5	4+Reduced Lighting Powe	50.6	0.0	109.2	0.0	139.7	4.5	25.1	55.2	0.0	0.0	384.3
6	5+Fans (Dischrg Dampers	50.6	0.0	109.2	0.0	135.8	4.4	25.0	42.0	0.0	0.0	366.9
7	6+CHW Pump (VariVol &	51.5	0.0	109.2	0.0	134.6	4.8	15.9	39.4	0.0	0.0	355.3
8	7+Chiller (0-6 kW-ton)	51.5	0.0	109.2	0.0	105.9	4.6	15.7	39.4	0.0	0.0	326.3
Incremental SAVINGS (kW)	**(values are relative to previous measure (% savings are relative to base case demand), negative entries indicate increased demand)**											
1	0+Roof Insul (R18 to R39	0.00 (0%)	--	0.00 (0%)	--	0.82 (0%)	0.02 (0%)	0.01 (0%)	-0.00 (-0%)	--	--	0.85 (0%)
2	1+Side Daylighting	39.60 (37%)	--	0.00 (0%)	--	5.91 (3%)	0.19 (2%)	-0.00 (-0%)	3.06 (6%)	--	--	48.76 (10%)
3	2+Top Daylighting	19.06 (18%)	--	0.00 (0%)	--	2.20 (1%)	0.07 (1%)	0.00 (0%)	1.06 (2%)	--	--	22.40 (5%)
4	3+Window Glass (Low-e)	-11.02 (-10%)	--	0.00 (0%)	--	25.22 (14%)	3.76 (42%)	0.00 (0%)	-5.12 (-10%)	--	--	12.83 (3%)
5	4+Reduced Lighting Powe	7.67 (7%)	--	0.00 (0%)	--	1.41 (1%)	0.49 (5%)	0.00 (0%)	-1.58 (-3%)	--	--	7.99 (2%)
6	5+Fans (Dischrg Dampers	0.00 (0%)	--	0.00 (0%)	--	3.90 (2%)	0.14 (2%)	0.09 (0%)	13.23 (25%)	--	--	17.36 (4%)
7	6+CHW Pump (VariVol &	-0.86 (-1%)	--	0.00 (0%)	--	1.19 (1%)	-0.38 (-4%)	9.12 (36%)	2.58 (5%)	--	--	11.66 (2%)
8	7+Chiller (0-6 kW-ton)	0.00 (0%)	--	0.00 (0%)	--	28.64 (16%)	0.18 (2%)	0.18 (1%)	0.00 (0%)	--	--	29.01 (6%)
Cumulative SAVINGS (kW)	**(values (and % savings) are relative to the Base Case, negative entries indicate increased demand)**											
1	0+Roof Insul (R18 to R39	0.00 (0%)	--	0.00 (0%)	--	0.82 (0%)	0.02 (0%)	0.01 (0%)	-0.00 (-0%)	--	--	0.85 (0%)
2	1+Side Daylighting	39.60 (37%)	--	0.00 (0%)	--	6.73 (4%)	0.21 (2%)	0.01 (0%)	3.05 (6%)	--	--	49.61 (10%)
3	2+Top Daylighting	58.67 (55%)		0.00 (0%)		8.93 (5%)	0.28 (3%)	0.01 (0%)	4.12 (8%)			72.01 (15%)
4	3+Window Glass (Low-e)	47.65 (45%)	--	0.00 (0%)	--	34.16 (19%)	4.04 (45%)	0.01 (0%)	-1.01 (-2%)	--	--	84.84 (18%)
5	4+Reduced Lighting Powe	55.31 (52%)	--	0.00 (0%)	--	35.57 (20%)	4.53 (50%)	0.01 (0%)	-2.58 (-5%)	--	--	92.83 (19%)
6	5+Fans (Dischrg Dampers	55.31 (52%)	--	0.00 (0%)	--	39.47 (23%)	4.67 (52%)	0.10 (0%)	10.64 (20%)	--	--	110.19 (23%)
7	6+CHW Pump (VariVol &	54.46 (51%)	--	0.00 (0%)	--	40.66 (23%)	4.28 (47%)	9.22 (37%)	13.23 (25%)	--	--	121.85 (26%)
8	7+Chiller (0-6 kW-ton)	54.46 (51%)	--	0.00 (0%)	--	69.30 (40%)	4.47 (49%)	9.40 (37%)	13.23 (25%)	--	--	150.86 (32%)

For an explanation of this parametric report format, see the Annual Building Summary (page 1 of 2).

Annual Enduse Summary

page 3 of 4

Elec. Non-Coincident Peak Demand by Enduse (Parametric Report)

Annual Electric Non-Coincident Peak Demand by Enduse

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
Annual Energy Non-Coincident Demand (kW)												
0	Base Design	105.9	0.0	109.2	0.0	175.2	9.0	25.1	56.7	0.0	0.0	477.1
1	0+Roof Insul (R18 to R39)	105.9	0.0	109.2	0.0	174.4	9.0	25.1	57.0	0.0	0.0	476.3
2	1+Side Daylighting	103.7	0.0	109.2	0.0	168.5	8.8	25.1	55.7	0.0	0.0	427.5
3	2+Top Daylighting	103.4	0.0	109.2	0.0	166.3	8.8	25.1	55.2	0.0	0.0	405.1
4	3+Window Glass (Low-e)	104.0	0.0	109.2	0.0	152.5	8.1	25.1	55.6	0.0	0.0	392.3
5	4+Reduced Lighting Powe	91.6	0.0	109.2	0.0	151.1	8.1	25.1	55.2	0.0	0.0	384.3
6	5+Fans (Dischrg Dampers	91.6	0.0	109.2	0.0	146.4	7.9	25.0	42.0	0.0	0.0	366.9
7	6+CHW Pump (VariVol & \	91.6	0.0	109.2	0.0	145.0	7.8	17.4	42.0	0.0	0.0	355.3
8	7+Chiller (0-6 kW-ton)	91.6	0.0	109.2	0.0	114.0	7.5	17.2	42.0	0.0	0.0	326.3
Incremental SAVINGS (kW)	**(values are relative to previous measure (% savings are relative to base case demand), negative entries indicate increased demand)**											
1	0+Roof Insul (R18 to R39)	0.00 (0%)	--	0.00 (0%)	--	0.82 (0%)	0.02 (0%)	0.01 (0%)	-0.25 (-0%)	--	--	0.85 (0%)
2	1+Side Daylighting	2.20 (2%)	--	0.00 (0%)	--	5.91 (3%)	0.19 (2%)	-0.00 (-0%)	1.31 (2%)	--	--	48.76 (10%)
3	2+Top Daylighting	0.34 (0%)	--	0.00 (0%)	--	2.20 (1%)	0.07 (1%)	0.00 (0%)	0.47 (1%)	--	--	22.40 (5%)
4	3+Window Glass (Low-e)	-0.57 (-1%)	--	0.00 (0%)	--	13.83 (8%)	0.62 (7%)	0.00 (0%)	-0.39 (-1%)	--	--	12.83 (3%)
5	4+Reduced Lighting Powe	12.38 (12%)	--	0.00 (0%)	--	1.43 (1%)	0.05 (1%)	0.00 (0%)	0.39 (1%)	--	--	7.99 (2%)
6	5+Fans (Dischrg Dampers	0.00 (0%)	--	0.00 (0%)	--	4.63 (3%)	0.18 (2%)	0.09 (0%)	13.23 (23%)	--	--	17.36 (4%)
7	6+CHW Pump (VariVol & \	0.00 (0%)	--	0.00 (0%)	--	1.41 (1%)	0.06 (1%)	7.58 (30%)	0.00 (0%)	--	--	11.66 (2%)
8	7+Chiller (0-6 kW-ton)	0.00 (0%)	--	0.00 (0%)	--	31.02 (18%)	0.31 (3%)	0.18 (1%)	0.00 (0%)	--	--	29.01 (6%)
Cumulative SAVINGS (kW)	**(values (and % savings) are relative to the Base Case, negative entries indicate increased demand)**											
1	0+Roof Insul (R18 to R39)	0.00 (0%)	--	0.00 (0%)	--	0.82 (0%)	0.02 (0%)	0.01 (0%)	-0.25 (-0%)	--	--	0.85 (0%)
2	1+Side Daylighting	2.20 (2%)	--	0.00 (0%)	--	6.73 (4%)	0.21 (2%)	0.01 (0%)	1.06 (2%)	--	--	49.61 (10%)
3	2+Top Daylighting	2.55 (2%)	--	0.00 (0%)	--	8.93 (5%)	0.28 (3%)	0.01 (0%)	1.53 (3%)	--	--	72.01 (15%)
4	3+Window Glass (Low-e)	1.97 (2%)	--	0.00 (0%)	--	22.76 (13%)	0.90 (10%)	0.01 (0%)	1.14 (2%)	--	--	84.84 (18%)
5	4+Reduced Lighting Powe	14.35 (14%)	--	0.00 (0%)	--	24.19 (14%)	0.96 (11%)	0.01 (0%)	1.53 (3%)	--	--	92.83 (19%)
6	5+Fans (Dischrg Dampers	14.35 (14%)	--	0.00 (0%)	--	28.82 (16%)	1.14 (13%)	0.10 (0%)	14.76 (26%)	--	--	110.19 (23%)
7	6+CHW Pump (VariVol & \	14.35 (14%)	--	0.00 (0%)	--	30.23 (17%)	1.20 (13%)	7.68 (31%)	14.76 (26%)	--	--	121.85 (26%)
8	7+Chiller (0-6 kW-ton)	14.35 (14%)	--	0.00 (0%)	--	61.25 (35%)	1.51 (17%)	7.86 (31%)	14.76 (26%)	--	--	150.86 (32%)

For an explanation of this parametric report format, see the Annual Building Summary (page 1 of 2).

Annual Enduse Summary

page 4 of 4

Annual Fuel Energy by Enduse

(Parametric Report)

Annual Fuel Energy by Enduse

	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Ht Pump Supp	Dom Ht Wtr	Exterior Usage	Total
Annual Energy USE (MBtu)										
0 Base Design	0.0	1.2	0.0	0.0	0.0	0.0	0.0	146.8	0.0	148.0
1 0+Roof Insul (R18 to R39)	0.0	0.6	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.4
2 1+Side Daylighting	0.0	1.1	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.9
3 2+Top Daylighting	0.0	1.1	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.9
4 3+Window Glass (Low-e)	0.0	0.7	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.5
5 4+Reduced Lighting Powe	0.0	0.7	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.6
6 5+Fans (Dischrg Dampers	0.0	0.8	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.6
7 6+CHW Pump (VariVol & V	0.0	0.8	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.6
8 7+Chiller (0-6 kW-ton)	0.0	0.8	0.0	0.0	0.0	0.0	0.0	146.8	0.0	147.6
Incremental SAVINGS (MBtu) (values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)										
1 0+Roof Insul (R18 to R39)	--	0.58 (49%)	--	--	--	--	--	0.00 (0%)	--	0.58 (0%)
2 1+Side Daylighting	--	-0.49 (-41%)	--	--	--	--	--	0.00 (0%)	--	-0.49 (-0%)
3 2+Top Daylighting	--	-0.02 (-2%)	--	--	--	--	--	0.00 (0%)	--	-0.02 (-0%)
4 3+Window Glass (Low-e)	--	0.39 (33%)	--	--	--	--	--	0.00 (0%)	--	0.39 (0%)
5 4+Reduced Lighting Powe	--	-0.02 (-2%)	--	--	--	--	--	0.00 (0%)	--	-0.02 (-0%)
6 5+Fans (Dischrg Dampers	--	-0.03 (-3%)	--	--	--	--	--	0.00 (0%)	--	-0.03 (-0%)
7 6+CHW Pump (VariVol & V	--	0.00 (0%)	--	--	--	--	--	0.00 (0%)	--	0.00 (0%)
8 7+Chiller (0-6 kW-ton)	--	0.00 (0%)	--	--	--	--	--	0.00 (0%)	--	0.00 (0%)
Cumulative SAVINGS (MBtu) (values (and % savings) are relative to the Base Case, negative entries indicate increased use)										
1 0+Roof Insul (R18 to R39)	--	0.58 (49%)	--	--	--	--	--	0.00 (0%)	--	0.58 (0%)
2 1+Side Daylighting	--	0.09 (8%)	--	--	--	--	--	0.00 (0%)	--	0.09 (0%)
3 2+Top Daylighting	--	0.07 (6%)	--	--	--	--	--	0.00 (0%)	--	0.07 (0%)
4 3+Window Glass (Low-e)	--	0.46 (39%)	--	--	--	--	--	0.00 (0%)	--	0.46 (0%)
5 4+Reduced Lighting Powe	--	0.44 (37%)	--	--	--	--	--	0.00 (0%)	--	0.44 (0%)
6 5+Fans (Dischrg Dampers	--	0.40 (34%)	--	--	--	--	--	0.00 (0%)	--	0.40 (0%)
7 6+CHW Pump (VariVol & V	--	0.40 (34%)	--	--	--	--	--	0.00 (0%)	--	0.40 (0%)
8 7+Chiller (0-6 kW-ton)	--	0.40 (34%)	--	--	--	--	--	0.00 (0%)	--	0.40 (0%)

For an explanation of this parametric report format, see the Annual Building Summary (page 1 of 2).

Detailed Reports

In addition to the graphical reports presented in the previous pages, eQUEST also produces a full set of DOE-2's detailed reports (i.e., in a 132-column text format). Additional detailed reports have also been added to eQUEST's DOE-2-derived engine to address past DOE-2 reporting shortcomings. While new and intermittent users may find the volume and detail of the detailed reports daunting, they contain a wealth of data invaluable for many analyses. Detailed reports are contained for each run in a text file having an "SIM" file extension (e.g., "project1.sim"). These detailed results files are stored in the directory for your project, e.g., c:\program files\equest\projects\project1.

Although it is beyond the scope of this introductory tutorial to provide a thorough introduction to eQUEST's detailed reports, the matrices on the following pages will provide the new user with a "table of contents" to eQUEST's extensive detailed reporting. Read down the left side of each matrix to find information items of interest, then read across (to the right) to find which detailed reports contain the information of interest. A bullet or letter in the columns indicates for each information item (row), which "DOE-2" report (column) pertains. For more detailed information regarding these "DOE-2" reports, see *DOE-2.2 Volume 4: Appendices*, downloadable from http://www.doe2.com.

A versatile text editor is an essential tool necessary to conveniently review and search the Detailed Reports. Although software such as Microsoft Word or Microsoft WordPad can bee used, they have several drawbacks. Many other versatile text editors are widely available. Three that seem especially well suited for use with Detailed Reports are:

CodeWright , http://www.starbase.com/ (license fee required)
Boxer, http://www.boxersoftware.com/ (free 60-day demo, then license fee)
NoteTabLite, http://www.notetab.com/ (freeware)

"DOE-2" LOADS Reports

LOADS SUMMARY REPORTS

		Space Peak Loads	Space Peak Load Components	Bldg Peak Load Components	Building Monthly Loads	Space Monthly Load Components	Bldg Monthly Load Components	Space Daylighting Summary	Space Energy Reduction by Daylight	Bldg Energy Reduction by Daylight	Daylight Illuminance Frequency	Space Inputs Fuel Summary	Window Management & Solar
	Bldg Level Info	LS-A		LS-C	LS-D		LS-F			LS-I		LS-K	
	Space Level Info	LS-A	LS-B			LS-E		LS-G	LS-H		LS-J	LS-K	LS-L
THERMAL LOAD	Total (Sens&Lat) Heat/Cool Space Load		*P*	*P*		*T*	*T*						
	Sensible Heat/Cool Space Load	*P*	*P*	*P*	*P/T*	*T*	*T*						
	Latent Cooling Space Load		*P*	*P*		*T*	*T*						
	Heat/Cool Space Load Components		*P*	*P*		*T*	*T*						
	Heat/Cool Peak Hour, Date, OA	■	■	■									
ELECTRIC ENERGY	Total (Lights/Plugs/Process)				*P/T*								
	Lights											*T*	
	Equipment / Plugs											*T*	
	Process Electric											*T*	
OTHER ENERGY	Process Fuel											*T*	
	Domestic Hot Water											*T*	
	Solar Gain												*P/T*
DAYLIGHTING	% Lighting Reduction							■					
	% Lighting Reduction Scatter Plot								■	■			
	Ave. Daylight Illuminance							■					
	Ave. Glare Index							■					
	% Hrs. Glare Too High							■					
	Frequency of Illuminance Levels										■		
OTHER	Floor Area & Volume		■	■									
	Weather File Name	■	■	■	■	■	■	■	■	■	■	■	■
	DESIGN-DAY reports provided ①	■	■	■	■	■	■	■	■	■	■	■	■

Notes:
T = Total energy or Total load reported for these items
P = Peak demand or Peak load reported for these items

Duplicate reports are provided for each LOADS report (if DESIGN-DAYs are used) where the first set of reports provides results for the design day conditions. A complete second set reports the annual simulation results.

Left-to-right order of report columns above corresponds to top-down order of reports printed in the "DOE-2" output files

"DOE-2" SYSTEM Reports

NOTES:
T = Total energy or Total load reported for these items
P = Peak demand or Peak load reported for these items

SYSTEMS SUMMARY REPORTS

		SS-D Building HVAC Load Summary	SS-E Building HVAC Load Hours	SS-M Building HVAC Fan Electric	SS-P ① Bldg HVAC Equip. Performance	SS-A System Loads Summary	SS-B System Loads Summary	SS-C System Load Hours	SS-H System Utility Energy Use	SS-I Sensible/Latent Summary	SS-J Peak Heating & Cooling	SS-K Space Temperature Summary	SS-R Zone Performance Summary	SS-L Fan Electric Energy Use	SS-N Relative Humidity Summary	SS-P ② System Heat/Cool Performance	SS-Q HP Heat/Cool Performance	SS-G Zone Loads Summary	SS-F Zone Demand Summary	SS-O Space Temperature Summary
		BUILDING				AIR HANDLER												ZONE		
THERMAL ENERGY	Total (Sens&Lat) Heat/Cool Coil Load	P/T			P/T	P/T				P	P					P/T	T	P/T		
	Sensible Heat/Cool Coil Load									T										
	Latent Heat/Cool Coil Load									T										
	Zone Coil Heat/Cool Load						P/T													
	Baseboard Heat						P/T												P/T	
	Pre-heat						P/T													
	Heat/Cool Addition/Extraction																		T	
	Cooling Peak Hour, Date, OA	■			■	■				■	■					■		■		
	Heating Peak Hour, Date, OA	■			■	■					■					■		■		
	Heat/Cool Peak Load Hourly Profile										P									
	Max Daily Integrated Cooling Load	P									P									
	Heat Coincident w Cool Peak		P					P												
	Natural Ventilation Cooling ③						P/T													
ELECTRIC ENERGY	Total Elec (LOADS + Fans, DX, Reheat)	P/T			T	P/T										T		P/T		
	Total Elec Coincident w Cool Peak		P					P												
	Heating/Cooling Elec Use				P/T				P/T							P/T				
	Fan Total Elec				P/T				P/T							P/T	T			
	Fan Elec for H/C/Coincident/Float			T										T						
	Fan Elec for Supply/Return/Hot Deck													T						
	Auxiliary/Fan/Pump Elec				P/T		P/T									P/T	T			
OTHER ENERGY	Heating/Cooling Fuel Use				T				P/T							T				
	Waste Heat																T			
HOURS	Hours Heat/Cool/Float/Available		■					■									■			
	Fan Hours		■					■						■						
	Hours Night Venting/Night Cycle On		■					■												
	Hours Loads Not Met												■						■	
	Zone Hrs at Max Demand												■						■	
	Hours at RH ranges														■				■	
SPACE TEMPERATURE	Average (H/C/Fans On/Off)											■								
	Min / Max																		■	
	Indoor/Outdoor Temp. Delta											■								
	Scatter Plot																			■
OTHER	Air Flow				■						P					■				
	Heat/Cool Capacity				■											■				
	Heat/Cool E-I-R				■											■	■			
	Relative Humidity Scatter Plot														■					
	Sensible Heat Ratio									■	■									
	Delta Humidity Ratio											■								
	Equipment Part Load Ratio				■								■	■		■				
	Weather File Name	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	DESIGN-DAY report provided										■									

"DOE-2" PLANT Reports

PLANT SUMMARY REPORTS

			PS-A Plant Energy Utilization	PS-B Utility & Fuel Use Summary	PS-C Equipment Loads & Energy Use	PS-D Circulation Loop Loads	PS-E Energy End-Use, by Utility Type	PS-F Energy End-Use, by Utility Meter	BEPS Building Energy Performance	BEPU Building Utility Performance	PS-H Loads & Energy Use, by Plant Component
THERMAL LOAD	**by Total Plant**	Cooling & Heating	T								
		Waste Heat Recovery	T								
	by Plant Equipment ①	Circulation Loop Loads				P/T					P/T
		Boilers, Chillers, Pumps, Towers, etc. Loads			P/T						P/T
		Equipment Capacity									P
		Equipment Part Load Ratio			■	■					■
		Loads Not Satisfied (Loops only)				P/T					P/T
		Thermal Losses (Loops & Pumps only)				P/T					P/T
UTILITY ENERGY	**by Total Plant, Site**	Annual	T						T	T	
		Monthly	T								
		Energy Use Intensity (EUI)							T	T	
		Total Electric & Total Fuel Use	T				T				
		Electric Generation Fuel Use	T								
	by Total Plant, Source	Annual	T						T		
		Monthly									
	by Utility Type ②	Annual		P/T			P/p/T				
		Monthly		P/T			P/p/T				
	by Utility Meter ③	Annual		P/T				P/p/T	T	T	
		Monthly		P/T				P/p/T			
	by End Use	Annual, by utility type					P/p/T				
		Monthly, by utility type					P/p/T				
		Annual, by utility meter						P/p/T	T	T	
		Monthly, by utility meter						P/p/T			
		Cooling & Heating (only) Input	T								
	by Plant Equipment ①	Boilers, Chillers, Pumps, Towers, etc.			P/T						P/T
HOURS		Hour & Date of Peak		■	■	■	■	■			■
		Equipment Operations Hours			■	■					■
		% Hours Outside Throttling Range							■	■	
		% Hours Loads Not Met							■	■	

NOTES:
T = Total energy or Total load reported for these items
P = Peak demand (COINCIDENT) reported for these items
P = NON-COINCIDENT Peak demand reported for these items

"DOE-2" ECONOMICS Reports

Simulation Basics
Tour
Schematic Wizard
DD Wizard
Detailed Interface
EEM Wizard
Graphical Reports
Detailed Reports
LOADS Reports
SYSTEM Reports
PLANT Reports
Econo. Reports

NOTES:
T = Total energy or Total costs reported for these items
P = Peak demand or Peak demand costs reported for these items

ECONOMICS SUMMARY REPORTS

			ES-A Annual Operations Costs & Savings	ES-B Life-Cycle Non-Energy Costs	ES-C Energy Savings & Life-Cycle Costs	ES-D Energy Cost Summary	ES-E ① Utility Rate Summary	ES-F ② Block Charges & Ratchets, by Utility Rate	ES-G Summary of Pollutants	ES-H Pollutant Production, by Block Charge
ANNUAL Results	**by Utility Rate** ①	Energy Use				*T*				
		Total Utility Costs ($)				*T*	*T*			
		Total Utility Costs ($/sqft)				*T*				
		Total Utility Costs (ave $/billing unit)				*T*				
		Component Charges					*P/T*			
		Metered & Billing Use					*P/T*			
	by Block or TOU Charge ②	Total Utility Costs ($)						*T*		
		Component Charges						*P/T*		
		Pollutant Production							*T*	*T*
MONTHLY Results	**by Utility Rate** ①	Total Utility Costs ($)					*T*			
		Component Charges					*P/T*			
	by Block or TOU Charge ②	Total Utility Costs ($)						*T*		
		Component Charges						*P/T*		
		Pollutant Production							*T*	*T*
LIFE-CYCLE Results	**Costs**	Installation, Repair, Replacement		*T*	*T*					
		Energy	*T*		*T*					
		Operations	*T*		*T*					
	Savings	Energy	*T*		*T*					
		Operations	*T*		*T*					
		Energy + Operations	*T*		*T*					
	Investment Statistics	Discounted Payback			*T*					
		S-I-R, cost			*T*					
		S-I-R, energy			*T*					

7TH AND LANE

INDEX:	ARCHITECTURAL		DATE:
COVER SHEET			01/24/01
A001	MAP:	VICINITY	01/24/01
	KEY:	NOTES	
	KEY:	ARCHITECTURAL SYMBOLS	
	DIAGRAMS:	COMMON RECREATION AREA	
	DATA:	PROJECT	
A002	NOTES:	GENERAL	01/24/01
A003	DIAGRAMS:	AREA SEPARATION	01/24/01
		OCCUPANCY SEPARATION	
		STRUCTURAL BUILDING OVERHANG	
A004	DOCUMENTS:	RECORD	01/24/01
A010	CALCULATIONS:	ENERGY	01/24/01
A011	CALCULATIONS:	ENERGY	01/24/01
A100	PLAN:	SITE	01/24/01
A200	PLAN:	GARAGE LEVEL P4/P3	01/24/01
A201	PLAN:	GARAGE LEVEL P2/P1	01/24/01
A202	PLAN:	LEVEL 1/ LEVEL 2	01/24/01
A203	PLAN:	LEVEL 3	01/24/01
A204	PLAN:	LEVELS 4–6	01/24/01
A205	PLAN:	LEVEL 7	01/24/01
A206	PLAN	ROOF	01/24/01
A220	PLANS:	UNITS A, B, C, D	01/24/01
A221	PLANS:	UNITS E, F, G, H	01/24/01
A222	PLANS:	UNITS H-BF, J, K, M	01/24/01
A223	PLANS:	UNITS L, N, C-BF, J-BF	01/24/01
A240	TYPES:	WINDOWS	01/24/01
A241	DETAILS:	WINDOWS	01/24/01
A250	TYPES:	DOORS	01/24/01
A251	TYPES:	DOORS	01/24/01
A252	DETAILS:	DOORS	01/24/01
A300	ELEVATION:	EAST	01/24/01
A301	ELEVATION:	SOUTH	01/24/01
A302	ELEVATION:	WEST	01/24/01
A303	ELEVATION:	NORTH	01/24/01
A304	ELEVATION:	SOUTHEAST	01/24/01
A310	SECTION:	A–A	01/24/01
A311	SECTION:	B–B	01/24/01
A312	SECTION:	C–C	01/24/01
A500	ELEVATION:	INTERIORS, KITCHEN/BATHROOMS	01/24/01
A700	PLANS & SECTION:	STAIR A	01/24/01
A701	PLANS & SECTION:	STAIR B	01/24/01
A702	PLANS & SECTION:	STAIR C	01/24/01
A703	PLANS & SECTION:	STAIR D	01/24/01
A704	PLANS & SECTION:	STAIR E & ELEVATOR	01/24/01
A705	PLAN & SECTION:	STAIR F	01/24/01
A710	DETAILS:	STAIR & ELEVATOR	01/24/01
A800	DETAILS:		01/24/01
A801	DETAILS:		01/24/01
A802	DETAILS:		01/24/01
A803	DETAILS:		01/24/01
A804	DETAILS:		01/24/01
A805	DETAILS:		01/24/01
A806	DETAILS:		01/24/01
A900	TYPES:	WALLS	01/24/01
A901	TYPES:	WALLS & FLOORS	01/24/01

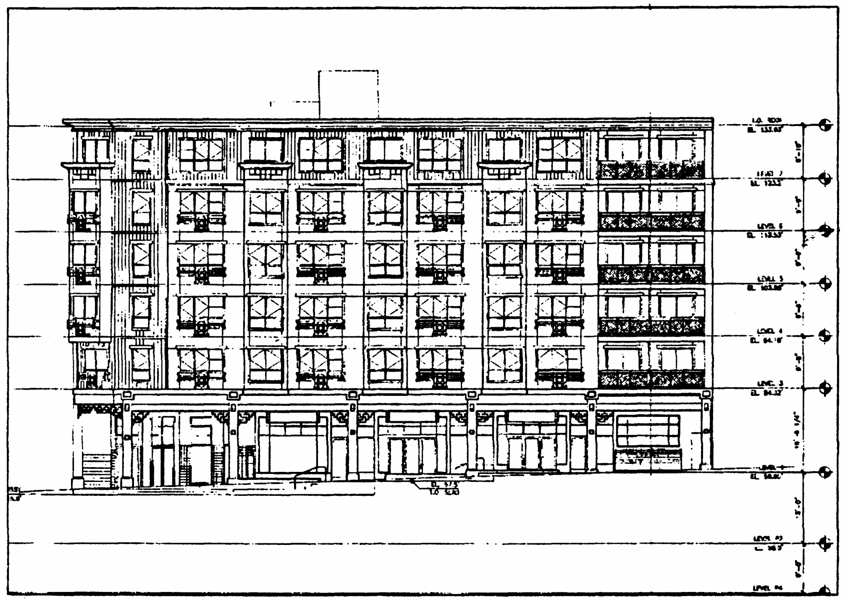
INDEX:	STRUCTURAL		DATE:
S1	NOTES	STRUCTURAL	01/24/01
S2	PLAN	FOUNDATION	01/24/01
S3	PLAN	LEVEL P2/P1 PT	01/24/01
S4	PLAN	LEVEL P2/P1 REINFORCING	01/24/01
S5	PLAN	LEVEL 1 & 2 PT	01/24/01
S6	PLAN	LEVEL 1 & 2 REINFORCING	01/24/01
S7	PLAN	LEVEL 3 PT	01/24/01
S8	PLAN	LEVEL 3 REINFORCING	01/24/01
S9	PLAN	SHEARWALL & HOLDDOWNS	01/24/01
S9A	PLAN	SHEARWALL & HOLDDOWNS	01/24/01
S10	PLAN	LEVEL 4 FRAMING	01/24/01
S11	PLAN	LEVEL 5 FRAMING	01/24/01
S12	PLAN	LEVEL 6–7 FRAMING	01/24/01
S13	PLAN	ROOF FRAMING	01/24/01
S14	DETAILS	PT	01/24/01
S15	DETAILS	PT	01/24/01
S16	DETAILS	CONCRETE	01/24/01
S17	DETAILS	CONCRETE	01/24/01
S18	DETAILS	WOOD	01/24/01
S19	DETAILS	MISCELLANEOUS	01/24/01
SS1	PLAN	SHORING	01/24/01
SS2	ELEVATIONS	SHORING	01/24/01
SS3	ELEVATIONS	SHORING	01/24/01
SS4	DETAILS	SHORING	01/24/01

INDEX:	CIVIL (STREET IMPROVEMENTS)		DATE:
C1	NOTES	GENERAL	09/08/00
	KEY	VICINITY MAP	
C2	PLAN:	ALLEY GRADING AND PAVING	09/08/00
		GRADING AND DRAINAGE PLAN	
C3	SECTION:	ALLEY GRADING AND PAVING	09/08/00
		PROFILES AND SECTIONS	

INDEX:	CIVIL		DATE:
C1	NOTES	GENERAL	5/22/00
	KEY	VICINITY MAP	
C2	PLAN:	HORIZONTAL CONTROL PLAN	5/22/00
C3	PLAN:	T.E.S.C. PLAN	5/22/00
C4	PLAN:	GRADING & DRAINAGE	5/22/00
C5	PLAN:	UTILITIES	5/22/00
C6	DETAILS	EROSION CONTROL (BMP)	5/22/00
C7	DETAILS	DRAINAGE	5/22/00

INDEX:	LANDSCAPE		DATE:
L1.0	PLAN:	PLANTING, BASE LEVEL	12/29/00
L1.1	PLAN:	PLANTING, THIRD LEVEL	12/29/00
L2.0	PLAN:	STREET LEVEL IRRIGATION	12/11/00
L2.1	PLAN:	THIRD LEVEL IRRIGATION	5/22/00
L2.2	LEGEND & DETAILS:	IRRIGATION	5/22/00
L3.0	PLAN:	STREET LEVEL LAYOUT	12/11/00
L3.1	PLAN:	3RD LEVEL LAYOUT	5/22/00

INDEX:	SURVEY		DATE:
1 of 1	PLAN:	TOPOGRAPHIC SURVEY	12/14/99



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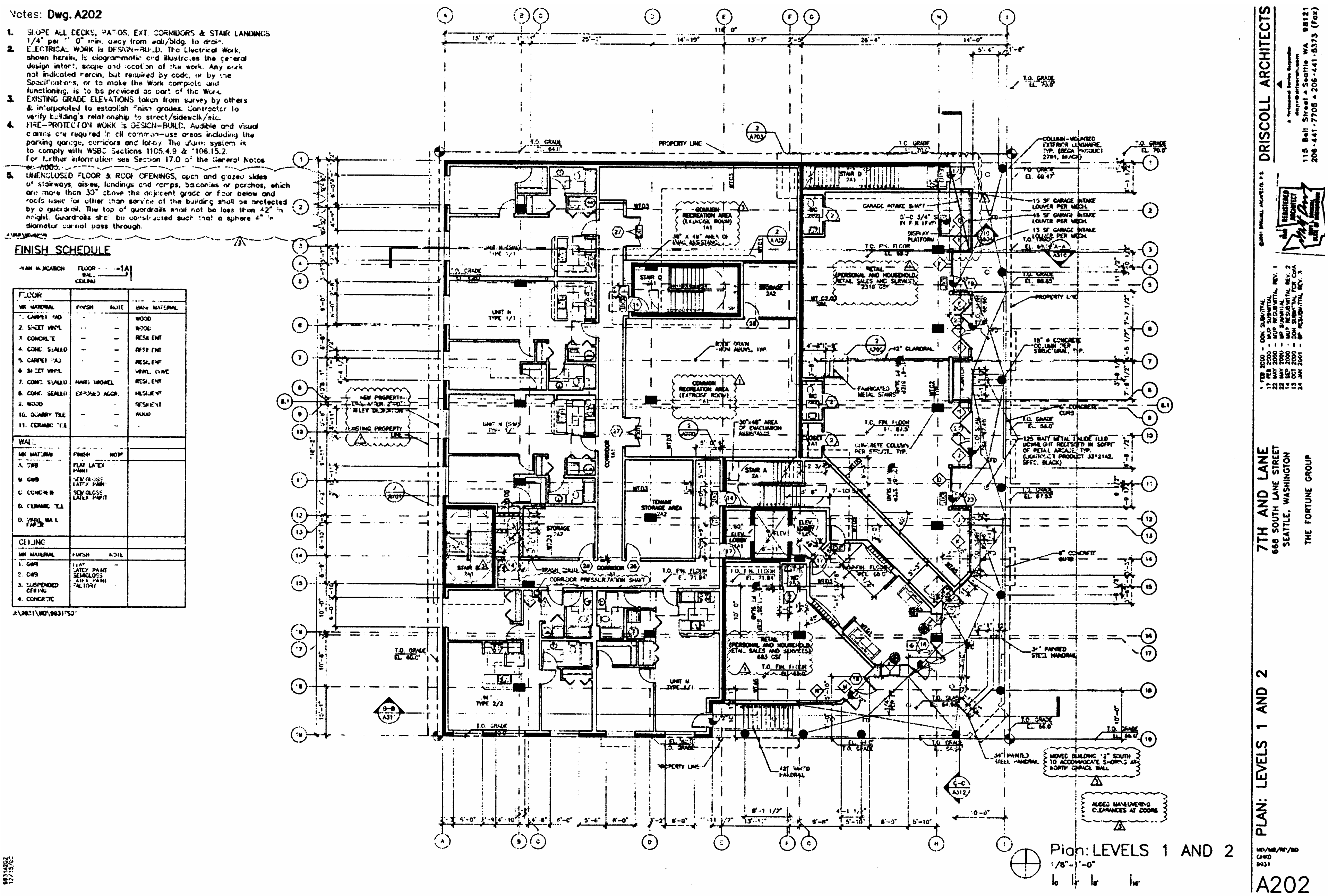
COVER SHEET

9931CDV
01/24/01



eQUEST Hands-On Example **Mixed Use, Retail /Multi-Family Residential**

Notes: **Dwg. A203**

1. SLOPE ALL DECKS, PATIOS, EXT. CORRIDORS & STAIR LANDINGS 1/4" per 1'-0" min. away from wall/bldg. to drain
2. ELECTRICAL WORK is DESIGN—BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope and location of the work. Any work not indicated herein, but required by code, or by the Specifications, or to make the Work complete and functioning, is to be provided as part of the Work.
3. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
4. FIRE-PROTECTION WORK is DESIGN-BUILD. Audible and visual alarms are required in all common-use areas including the parking garage, corridors and lobby. The alarm system is to comply with WSBC Sections 1105.4.9 & 1106.15.2. For further information see Section 17.0 of the General Notes on A003.
5. UNENCLOSED FLOOR & ROOF OPENINGS, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30" above the adjacent grade or floor below and roofs used for other than service of the building shall be protected by a guardrail. The top of guardrails shall not be less than 42" in height. Guardrails shall be constructed such that a sphere 4" in diameter cannot pass through.

FINISH SCHEDULE

PLAN INDICATION FLOOR — 1A1 WALL CEILING

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	–	–	WOOD
2. SHEET VINYL	–	–	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	–	VINYL, COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–		WOOD
11. CERAMIC TILE	–	–	
WALL			
MK MATERIAL	FINISH	NOTE	
A. GWB	FLAT LATEX PAINT	–	
B. GWB	SEMIGLOSS LATEX PAINT	–	
C. CONCRETE	SEMIGLOSS LATEX PAINT	–	
D. CERAMIC TILE			
D. VINYL WALL PAPER			
CEILING			
MK MATERIAL	FINISH	NOTE	
1. GWB	FLAT LATEX PAINT	–	
2. GWB	SEMIGLOSS LATEX PAINT	–	
3. SUSPENDED CEILING	FACTORY	–	
4. CONCRETE			

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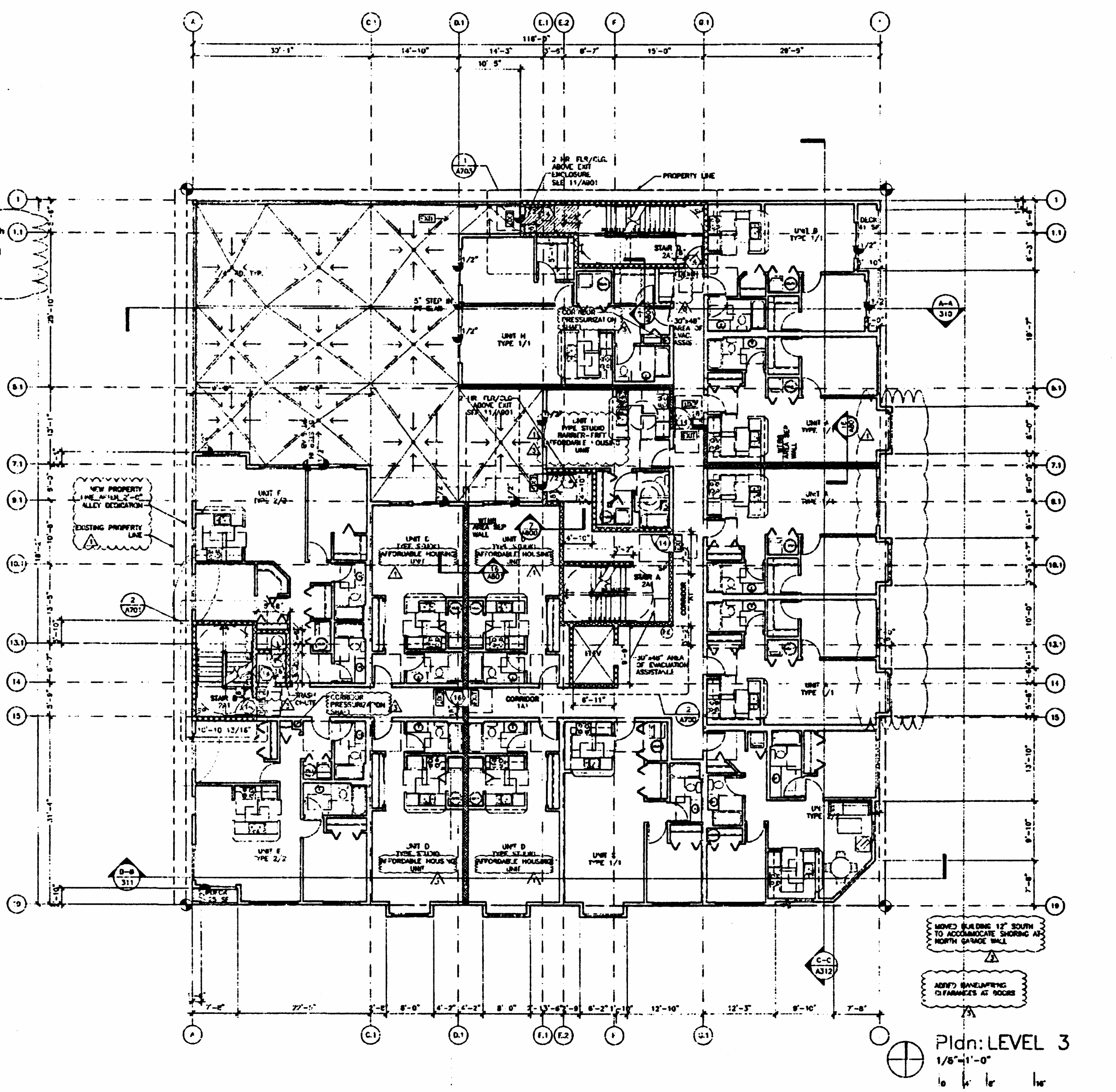

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22 MAY 2000 – MUP RESUBMITTAL REV. 1
22 MAY 2000 – BP SUBMITTAL
14 SEP 2000 – MUP RESUBMITTAL REV. 2
13 OCT 2000 – DON SUBMITTAL FOR CofA
24 JAN 2001 – BP RESUBMITTAL REV. 3

PLAN: LEVEL 3

MD/MB/RP/BD
CHKD:
9931

A203

9931A203
12/15/00

Notes: Dwg. A024

1. SLOPE ALL DECKS, PATIOS, EXT. CORRIDORS & STAIR LANDINGS 1/4" per 1'-0" min. away from wall/bldg. to drain.
2. ELECTRICAL WORK is DESIGN-BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope and location of the work. Any work not indicated herein, but required by code, or by the Specifications, or to make the Work complete and functioning, is to be provided as part of the Work.
3. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
4. FIRE-PROTECTION WORK is DESIGN-BUILD. Audible and visual alarms are required in all common-use areas including the parking garage, corridors and lobby. The alarm system is to comply with WSBC Sections 1105.4.9 & 1106.15.2. For further information see Section 17.0 of the General Notes ~~on A003.~~
5. UNENCLOSED FLOOR & ROOF OPENINGS, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30" above the adjacent grade or floor below and roofs used for other than service of the building shall be protected by a guardrail. The top of guardrails shall not be less than 42" in height. Guardrails shall be constructed such that a sphere 4" in diameter cannot pass through.

FINISH SCHEDULE

PLAN INDICATION: FLOOR → 1A, WALL, CEILING

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	–	–	WOOD
2. SHEET VINYL	–	–	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	–	VINYL, COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	–	–
WALL			
MK MATERIAL	FINISH	NOTE	
A. GWB	FLAT LATEX PAINT	–	
B. GWB	SEMI GLOSS LATEX PAINT	–	
C. CONCRETE	SEMIGLOSS LATEX PAINT	–	
D. CERAMIC TILE			
D. VINYL WALL PAPER			
CEILING			
MK MATERIAL	FINISH	NOTE	
1. GWB	FLAT LATEX PAINT	–	
2. GWB	SEMIGLOSS LATEX PAINT	–	
3. SUSPENDED CEILING	FACTORY	–	
4. CONCRETE			

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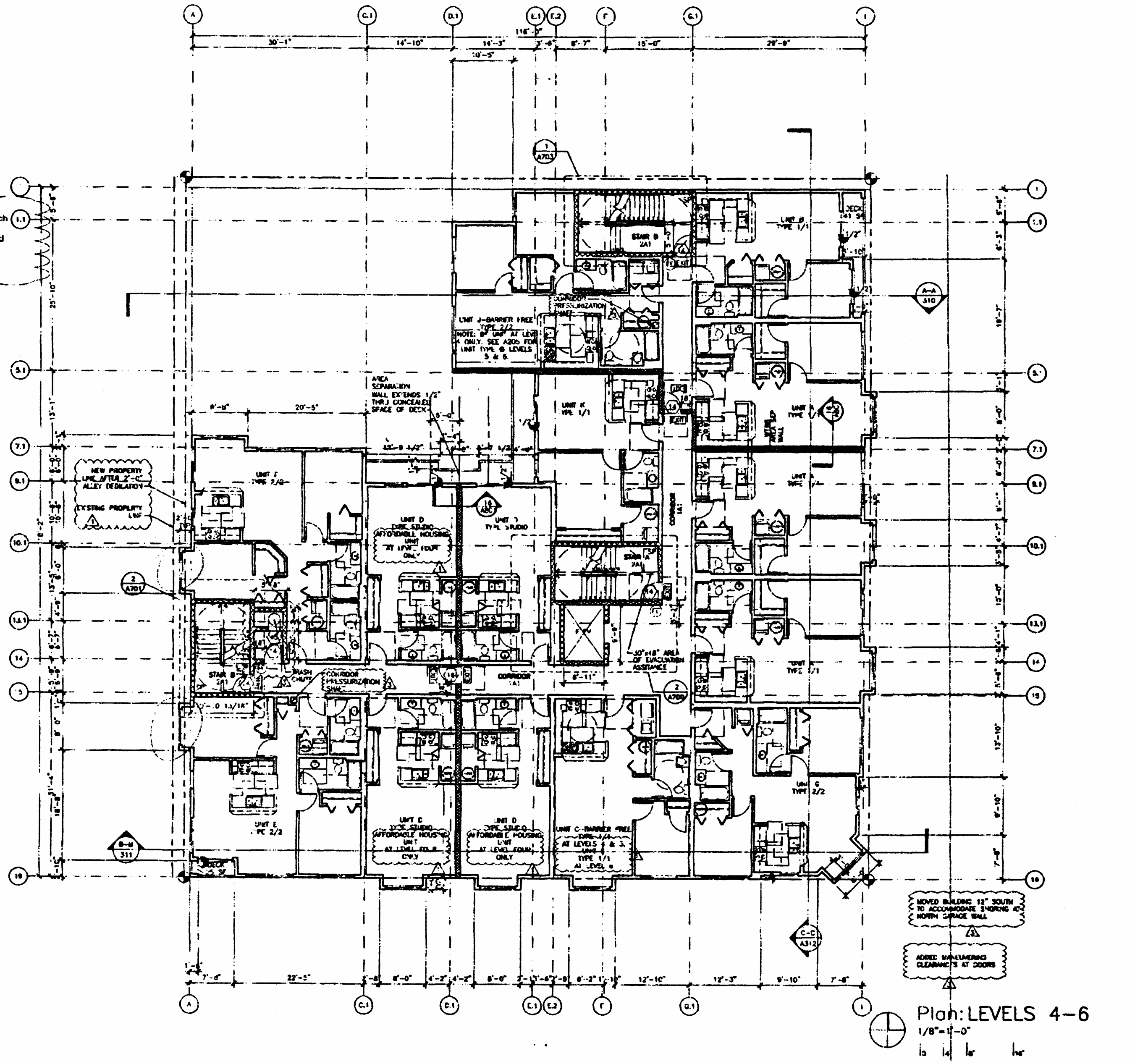

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22 MAY 2000 – BP SUBMITTAL
14 SEP 2000 – MUP RESUBMITTAL REV. 2
13 OCT 2000 – DON SUBMITTAL FOR CofA
24 JAN 2001 – BP RESUBMITTAL REV. 3

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PLAN: LEVELS 4-6

A204

Notes: **Dwg. A205**

1. SLOPE ALL DECKS, PATIOS, EXT. CORRIDORS & STAIR LANDINGS 1/4" per 1'-0" min. away from wall/bldg. to drain.
2. ELECTRICAL WORK is DESIGN-BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope and location of the work. Any work not indicated herein, but required by code, or by the Specifications, or to make the Work complete and functioning, is to be provided as part of the Work.
3. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
4. FIRE-PROTECTION WORK is DESIGN-BUILD. Audible and visual alarms are required in all common-use areas including the parking garage, corridors and lobby. The alarm system is to comply with WSBC Sections 1105.4.9 & 1106.15.2. For further information see Section 17.0 of the General Notes on A005.
5. UNENCLOSED FLOOR & ROOF OPENINGS, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30" above the adjacent grade or floor below and roofs used for other than service of the building shall be protected by a guardrail. The top of guardrails shall not be less than 42" in height. Guardrails shall be constructed such that a sphere 4" in diameter cannot pass through.

FINISH SCHEDULE

PLAN INDICATION: FLOOR — 1A1; WALL; CEILING

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	-	-	WOOD
2. SHEET VINYL	–	–	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	–	VINYL COMP
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	-	

WALL		
MK MATERIAL	FINISH	NOTE
A. GWB	FLAT LATEX PAINT	–
B. GWB	SEMIGLOSS LATEX PAINT	–
C. CONCRETE	SEMIGLOSS LATEX PAINT	–
D. CERAMIC TILE		
D. VINYL WALL PAPER		

CEILING		
MK MATERIAL	FINISH	NOTE
1. GWB	FLAT LATEX PAINT	-
2. GWB	SEMIGLOSS LATEX PAINT	–
3. SUSPENDED CEILING	FACTORY	–
4. CONCRETE		

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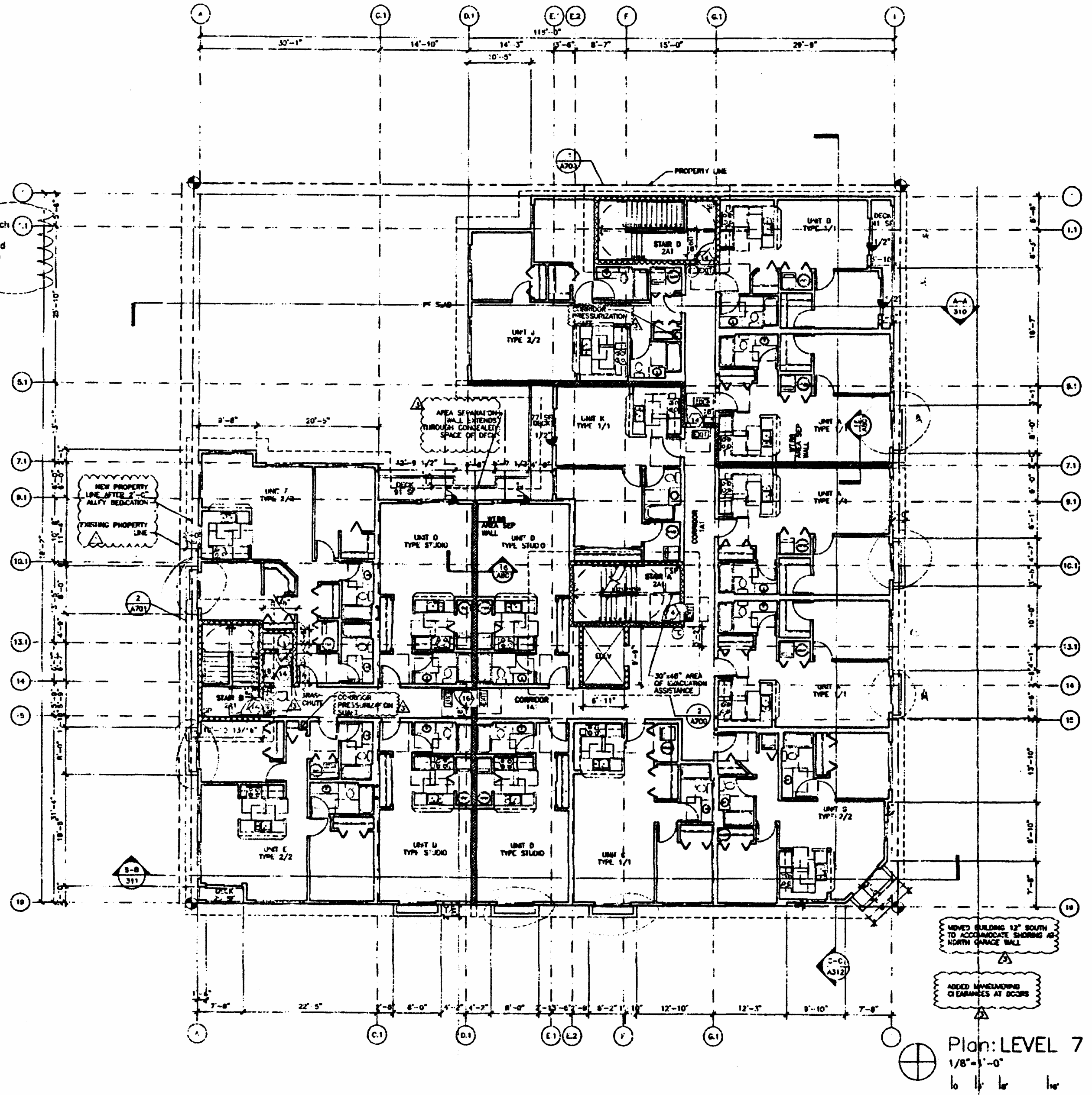

Plan: LEVEL 7
1/8"=1'-0"

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PLAN: LEVEL 7

A205

eQUEST Hands-On Example *Mixed Use, Retail /Multi-Family Residential*

Notes: Dwg. A205

1. SLOPE ALL DECKS, PATIOS, EXT. CORRIDORS & STAIR LANDINGS 1/4" per 1'-0" min. away from wall/bldg. to drain
2. ELECTRICAL WORK is DESIGN-BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope and location of the work. Any work not indicated herein, but required by code, or by the Specifications, or to make the Work complete and functioning, is to be provided as part of the Work
3. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
4. FIRE-PROTECTION WORK is DESIGN-BUILD. Audible and visual alarms are required in all common-use areas including the parking garage, corridors and lobby. The alarm system is to comply with WSBC Sections 1105.4.9 & 1106.15.2. For further information see Section 17.0 of the General Notes ~~on A005~~
5. UNENCLOSED FLOOR & ROOF OPENINGS, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30" above the adjacent grade or floor below and roofs used for other than service of the building shall be protected by a guardrail. The top of guardrails shall not be less than 42" in height. Guardrails shall be constructed such that a sphere 4" in diameter cannot pass through.

FINISH SCHEDULE

PLAN INDICATION: FLOOR / WALL / CEILING → 1A1

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	–	-	WOOD
2. SHEET VINYL	–	-	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	--	VINYL, COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	–	-

WALL		
MK MATERIAL	FINISH	NOTE
A. GWB	FLAT LATEX PAINT	–
B. GWB	SEMIGLOSS LATEX PAINT	–
C. CONCRETE	SEMIGLOSS LATEX PAINT	--
D. CERAMIC TILE		
D. VINYL WALL PAPER		

CEILING		
MK MATERIAL	FINISH	NOTE
1. GWB	FLAT LATEX PAINT	–
2. GWB	SEMIGLOSS LATEX PAINT	–
3. SUSPENDED CEILING	FACTORY	–
4. CONCRETE		

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ROOF VENTING REQUIREMENTS

ROOF # 1:
ROOF AREA: 2,067 SF
ROOF VENTILATING REQ'D: 6.89 SF
ROOF VENTILATORS: 7
ROOF VENTILATING PROVIDED: 7 SF

ROOF # 2:
ROOF AREA: 1,530 SF
ROOF VENTILATING REQ'D: 5.27 SF
ROOF VENTILATORS: 6
ROOF VENTILATING PROVIDED: 6 SF

ROOF # 3:
ROOF AREA: 1,716 SF
ROOF VENTILATING REQ'D: 5.72 SF
ROOF VENTILATORS: 6
ROOF VENTILATING PROVIDED: 6 SF

ROOF # 4:
ROOF AREA: 1,310 SF
ROOF VENTILATING REQ'D: 4.37 SF
ROOF VENTILATORS: 5
ROOF VENTILATING PROVIDED: 5 SF

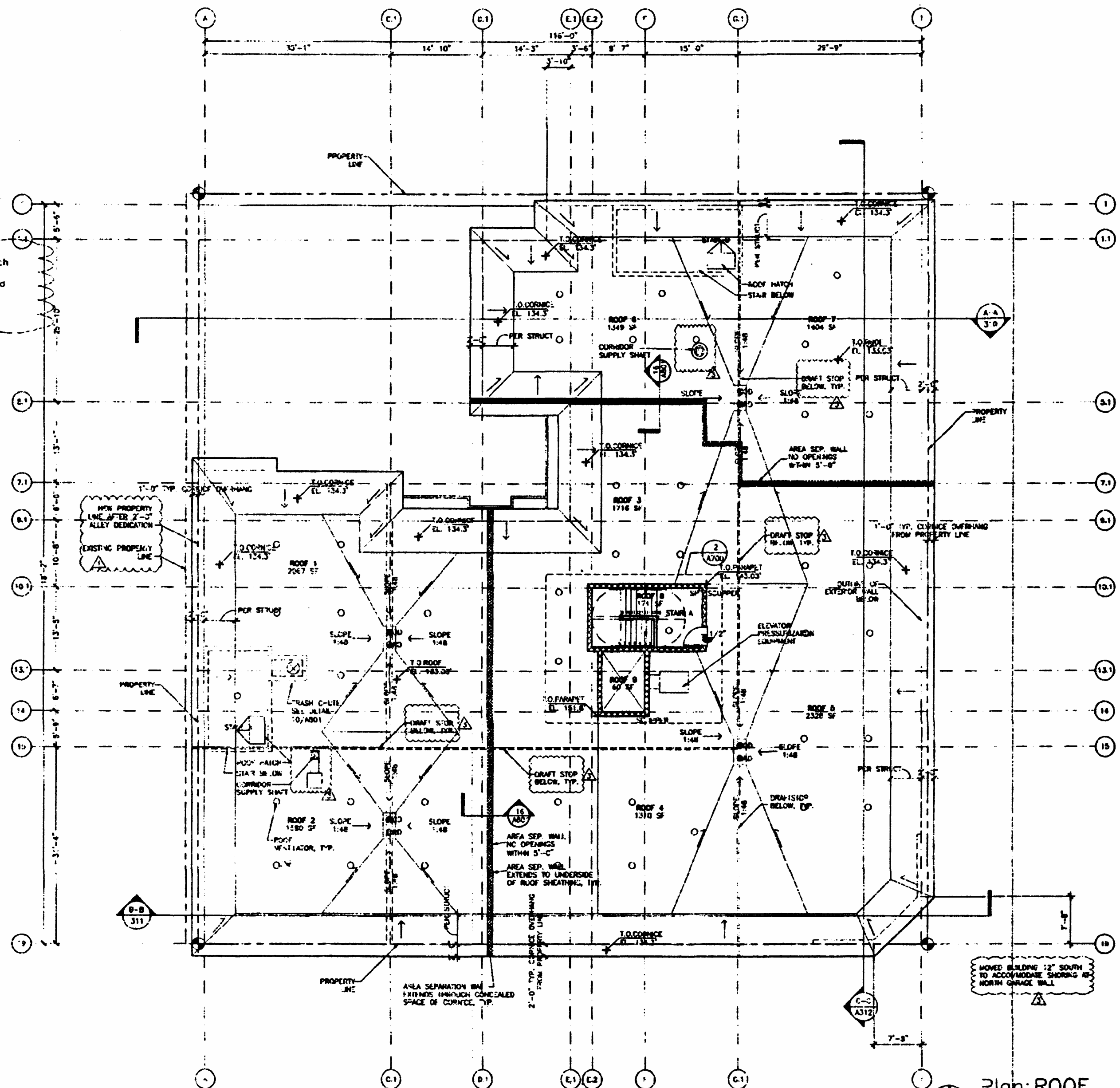
ROOF # 5:
ROOF AREA: 2,328 SF
ROOF VENTILATING REQ'D: 7.76 SF
ROOF VENTILATORS: 8
ROOF VENTILATING PROVIDED: 8 SF

ROOF # 6:
ROOF AREA: 1,349 SF
ROOF VENTILATING REQ'D: 4.5 SF
ROOF VENTILATORS: 5
ROOF VENTILATING PROVIDED: 5 SF

ROOF # 7:
ROOF AREA: 1,404 SF
ROOF VENTILATING REQ'D: 4.68 SF
ROOF VENTILATORS: 5
ROOF VENTILATING PROVIDED: 5 SF

ROOF # 8:
ROOF AREA: 171 SF
ROOF VENTILATING REQ'D: .57 SF
ROOF VENTILATORS: 1
ROOF VENTILATING PROVIDED: 1 SF

ROOF # 9:
ROOF AREA: 60 SF
ROOF VENTILATING REQ'D: .2 SF
ROOF VENTILATORS: 1
ROOF VENTILATING PROVIDED: 1 SF



Plan: ROOF
1/8" = 1'-0"

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REGISTERED ARCHITECT
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22 MAY 2000 - BP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - TCN SUBMITTAL FOR QA
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PLAN: ROOF

4D/MB/JM/WP/DD
CHKD:
9931

A206

9931A206
12/5/00

Notes: **Dwg. A220**

1. For WALL TYPES; see DWG. A900.
2. For DOOR SCHEDULE and DOOR TYPES; see DWG. A250.
3. For WINDOW SCHEDULE and WINDOW TYPES; see DWG. A210.
4. For GENERAL NOTES; see DWG. A002.
5. For INTERIOR ELEVATIONS; see Dwgs. A500.
6. ELECTRICAL WORK is DESIGN--BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
7. MECHANICAL WORK is DESIGN-BUILD. The Mechanical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
8. "(oh)" indicates opposite hand.

FINISH SCHEDULE

PLAN INDICATION: FLOOR / WALL / CEILING → 1A1

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	–	–	WOOD
2. SHEET VINYL	–	–	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	–	VINYL, COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	–	–

WALL		
MK MATERIAL	FINISH	NOTE
A. GWB	FLAT LATEX PAINT	-
B. GWB	SEMIGLOSS LATEX PAINT	–
C. CONCRETE	SEMIGLOSS LATEX PAINT	–
D. CERAMIC TILE		
D. VINYL WALL PAPER		

CEILING		
MK MATERIAL	FINISH	NOTE
1. GWB	FLAT LATEX PAINT	-
2. GWB	SEMIGLOSS LATEX PAINT	–
3. SUSPENDED CEILING	FACTORY	-
4. CONCRETE		

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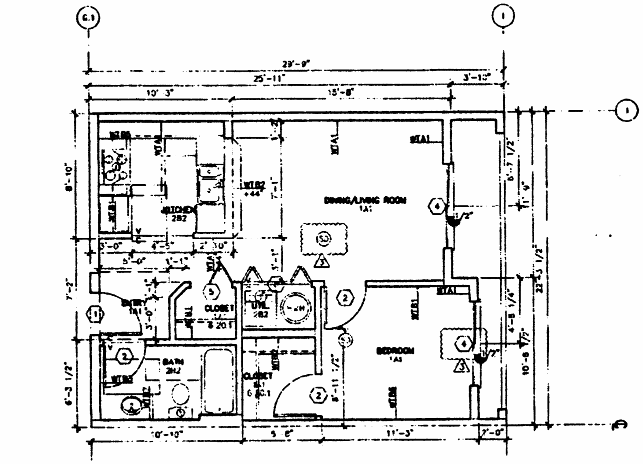
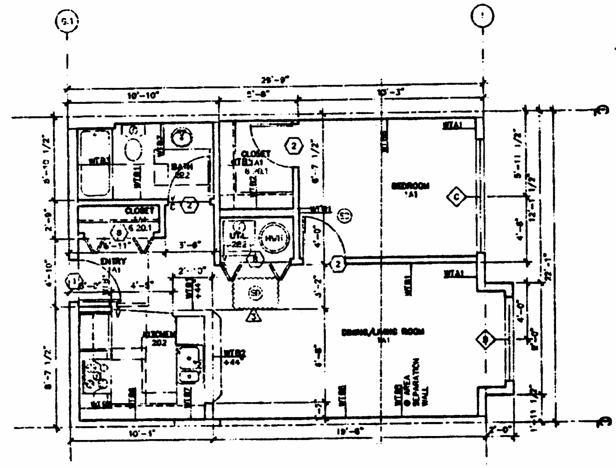
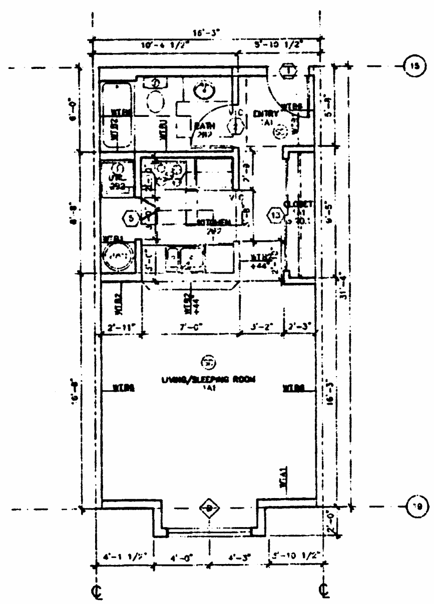


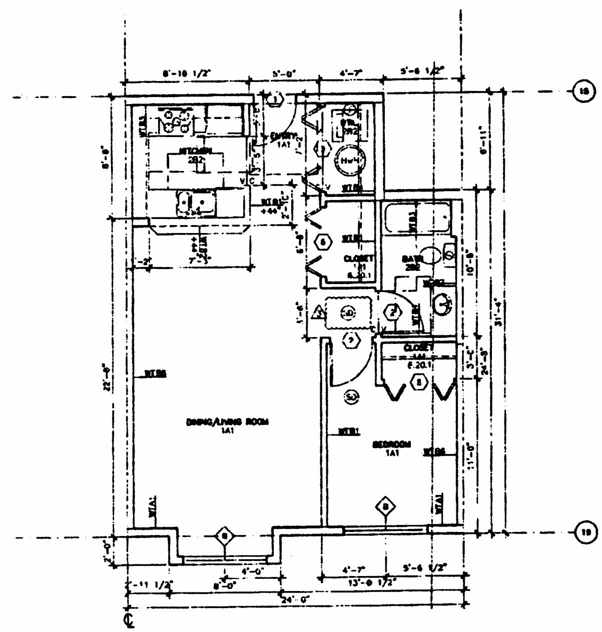
Plan: UNIT B
1/4"=1'-0"



Plan: UNIT A
1/4"=1'-0"



Plan: UNIT D
1/4"=1'-0"



Plan: UNIT C
1/4"=1'-0"

DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206-441-7705 • 206-441-5573 (fax)

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP

PLANS:
UNIT A; UNIT B
UNIT C; UNIT D

A220

Notes: **Dwg. A221**

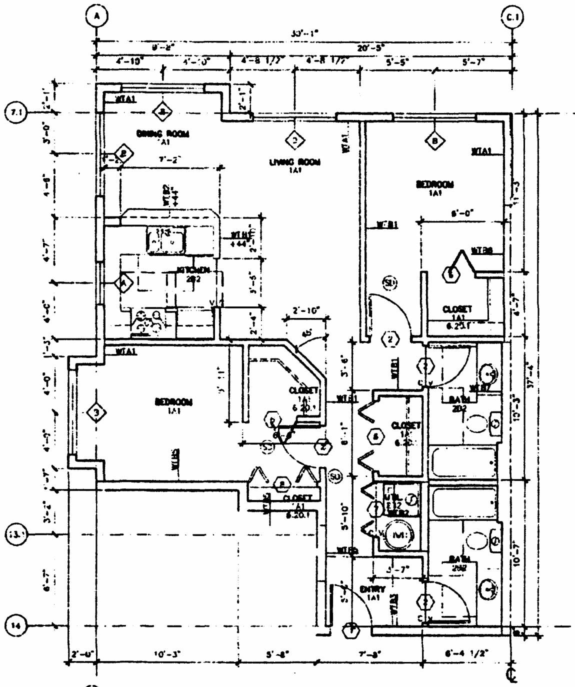
1. For WALL TYPES; see DWG. A900.
2. For DOOR SCHEDULE and DOOR TYPES; see DWG. A250.
3. For WINDOW SCHEDULE and WINDOW TYPES; see DWG. A240.
4. For GENERAL NOTES; see DWG. AC02.
5. For INTERIOR ELEVATIONS; see Dwgs. A500.
6. ELECTRICAL WORK is DESIGN-BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
7. MECHANICAL WORK is DESIGN-BUILD. The Mechanical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
8. "(oh)" indicates opposite hand.

FINISH SCHEDULE

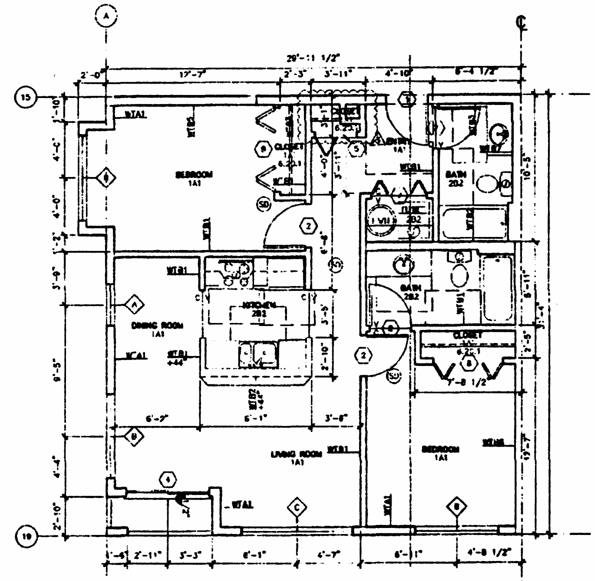
PLAN INDICATION: FLOOR / WALL / CEILING → 1A

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD		-	WOOD
2. SHEET VINYL	–	-	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	–	RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	-	–	VINYL COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	–	–
WALL			
MK MATERIAL	FINISH	NOTE	
A. GWB	FLAT LATEX PAINT	–	
B. GWB	SEMIGLOSS LATEX PAINT	-	
C. CONCRETE	SEMIGLOSS LATEX PAINT	–	
D. CERAMIC TILE			
D. VINYL WALL PAPER			
CEILING			
MK MATERIAL	FINISH	NOTE	
1. GWB	FLAT LATEX PAINT	–	
2. GWB	SEMIGLOSS LATEX PAINT	–	
3. SUSPENDED CEILING	FACTORY	-	
4. CONCRETE			

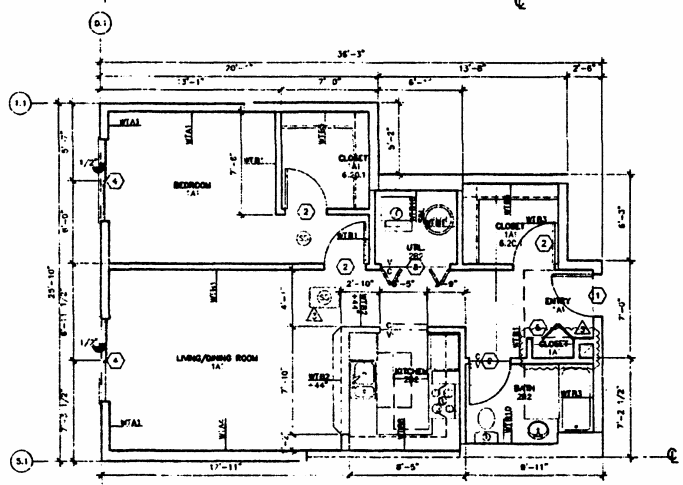
A:\9031\WB\9031FS01



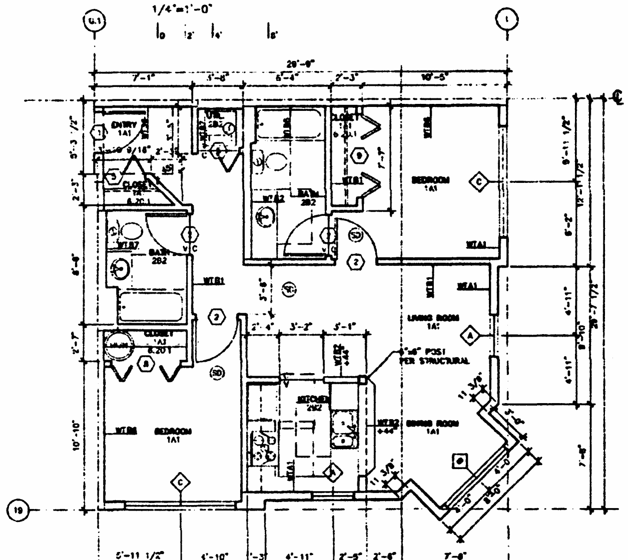
Plan: UNIT F
1/4"=1'-0"



Plan: UNIT E
1/4"=1'-0"



Plan: UNIT H
1/4"=1'-0"



Plan: UNIT G
1/4"=1'-0"

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON

THE FORTUNE GROUP

1 FEB 2000 - DON SUBMITTAL
17 FEB 2000 - MUP SUBMITTAL
22 MAY 2000 - MUP RESUBMITTAL REV. 1
22 MAY 2000 - BP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - DON SUBMITTAL FOR CofA
24 JAN 2001 - BP RESUBMITTAL REV. 3

DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206-441-7705 • 206-441-5373 (fax)

PLANS:
UNIT E; UNIT F
UNIT G; UNIT H

A221

Notes: Dwg. A222

1. For WALL TYPES; see DWG. A900.
2. For DOOR SCHEDULE and DOOR TYPES; see DWG. A250.
3. For WINDOW SCHEDULE and WINDOW TYPES; see DWG. A240.
4. For GENERAL NOTES; see DWG. A002.
5. For INTERIOR ELEVATIONS; see Dwgs. A500.
6. ELECTRICAL WORK is DESIGN-BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
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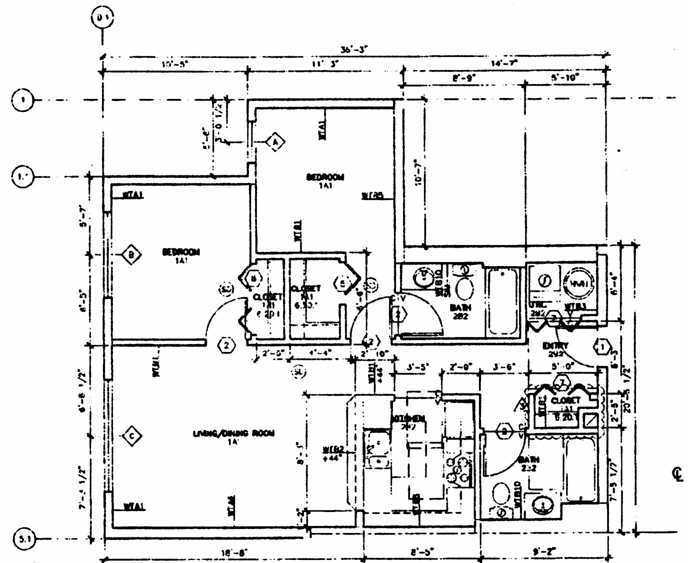
8. "(o-h)" indicates opposite hand.

FINISH SCHEDULE

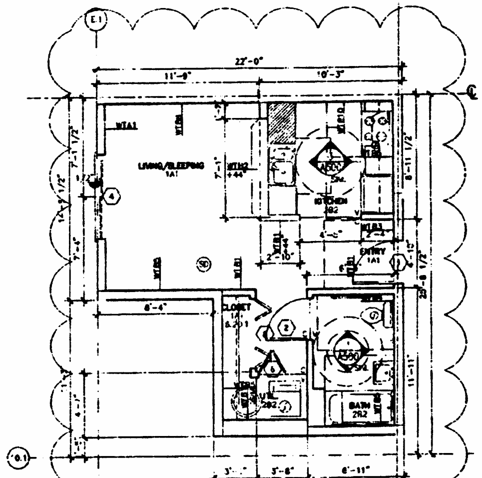
PLAN INDICATION: FLOOR / WALL / CEILING → 1A1

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1. CARPET PAD	–	–	WOOD
2. SHEET VINYL	–	–	WOOD
3. CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–		RESILIENT
5. CARPET PAD	–	–	RESILIENT
6. SHEET VINYL	–	–	VINYL COVE
7. CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10. QUARRY TILE	–		WOOD
11. CERAMIC TILE	–	–	–
WALL			
MK MATERIAL	FINISH	NOTE	
A. GWB	FLAT LATEX PAINT	–	
B. GWB	SEMIGLOSS LATEX PAINT	–	
C. CONCRETE	SEMIGLOSS LATEX PAINT	–	
D. CERAMIC TILE			
D. VINYL WALL PAPER			
CEILING			
MK MATERIAL	FINISH	NOTE	
1. GWB	FLAT LATEX PAINT	–	
2. GWB	SEMIGLOSS LATEX PAINT	–	
3. SUSPENDED CEILING	FACTORY	–	
4. CONCRETE			

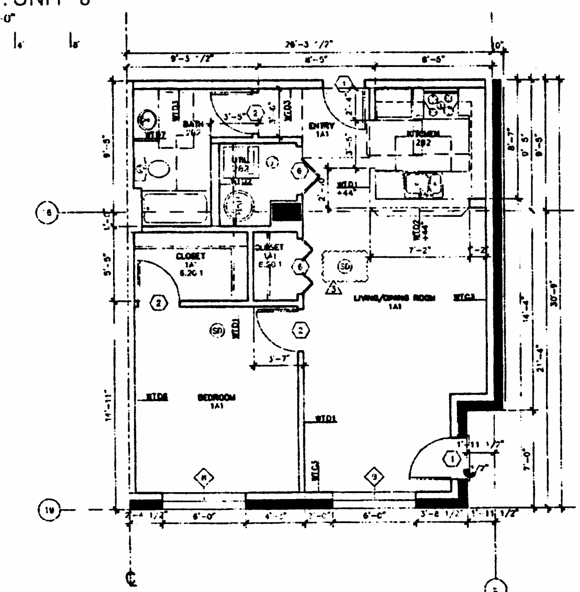
J:\9931\WB\9931FS01



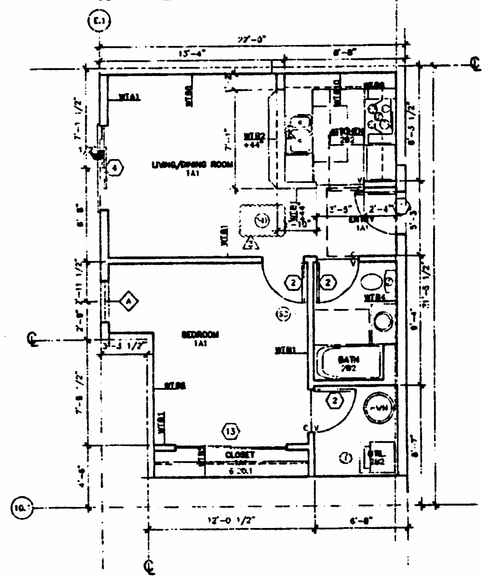
Plan: UNIT J
1/4"=1'-0"



Plan: UNIT I (BARRIER-FREE)
1/4"=1'-0"



Plan: UNIT M
1/4"=1'-0"



Plan: UNIT K
1/4"=1'-0"

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1 FEB 2000 – DON SUBMITTAL
17 FEB 2000 – MUP SUBMITTAL
22 MAY 2000 – MUP RESUBMITTAL REV. 1
22 MAY 2000 – BP SUBMITTAL
13 OCT 2000 – MUP RESUBMITTAL REV. 2
14 SEP 2000 – DON SUBMITTAL FOR CUA
24 JAN 2001 – BP RESUBMITTAL REV 3

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SEATTLE, WASHINGTON
THE FORTUNE GROUP

PLANS:
UNIT I-BF; UNIT J
UNIT K; UNIT M

9931

A222

Notes: **Dwg. A223**

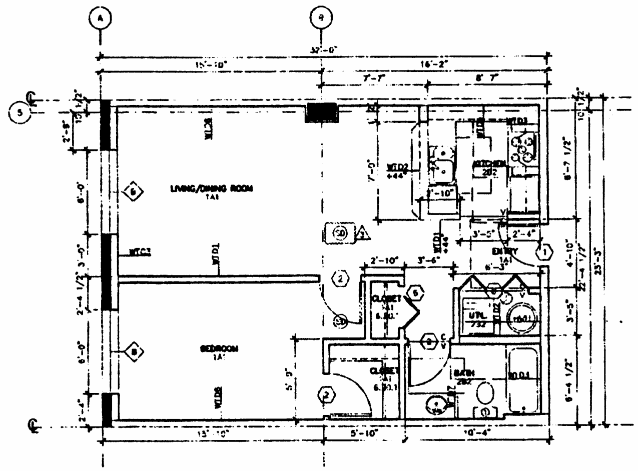
1. For WALL TYPES; see DWG. A900.
2. For DOOR SCHEDULE and DOOR TYPES; see DWG. A250.
3. For WINDOW SCHEDULE and WINDOW TYPES; see DWG A240.
4. For GENERAL NOTES; see DWG. A002.
5. For INTERIOR ELEVATIONS; see Dwgs. A500.
6. ELECTRICAL WORK is DESIGN–BUILD. The Electrical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
7. MECHANICAL WORK is DESIGN–BUILD. The Mechanical Work, shown herein, is diagrammatic and illustrates the general design intent, scope, and location of the work. Any work, not indicated herein, but required by code, or by the Specifications, or to make the Work complete, and functioning, is to be provided as part of the Work.
8. "(oh)" indicates opposite hand.

FINISH SCHEDULE

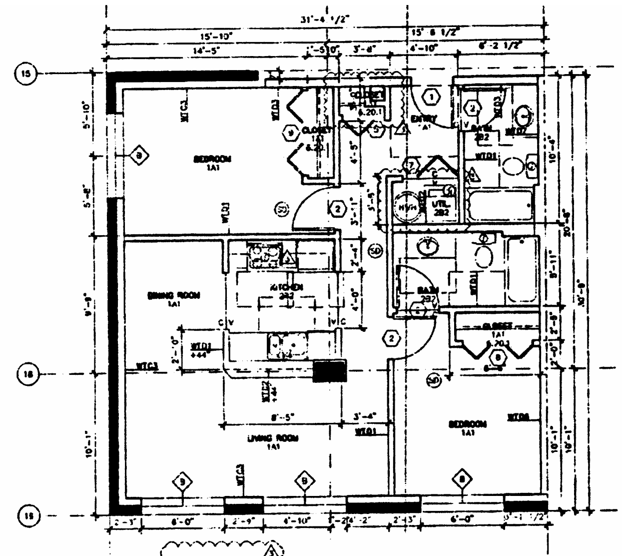
PLAN INDICATION: FLOOR → 1A1; WALL; CEILING

FLOOR			
MK MATERIAL	FINISH	NOTE	BASE MATERIAL
1 CARPET PAD	–	–	WOOD
2. SHEET VINYL	–	–	WOOD
3 CONCRETE	–	–	RESILIENT
4. CONC. SEALED	–	-	RESILIENT
5. CARPET PAD	–	-	RESILIENT
6. SHEET VINYL	-	-	VINYL, COVE
7 CONC. SEALED	HARD TROWEL		RESILIENT
8. CONC. SEALED	EXPOSED AGGR.		RESILIENT
9. WOOD	–	–	RESILIENT
10 QUARRY TILE	–	–	WOOD
11. CERAMIC TILE	–	–	–
WALL			
MK MATERIAL	FINISH	NOTE	
A. GWB	FLAT LATEX PAINT	-	
B. GWB	SEMI-GLOSS LATEX PAINT	–	
C. CONCRETE	SEMIGLOSS LATEX PAINT	–	
D. CERAMIC TILE			
C. VINYL WALL PAPER			
CEILING			
MK MATERIAL	FINISH	NOTE	
1. GWB	FLAT LATEX PAINT		
2. GWB	SEMIGLOSS LATEX PAINT	–	
3. SUSPENDED CEILING	FACTORY	–	
4. CONCRETE			

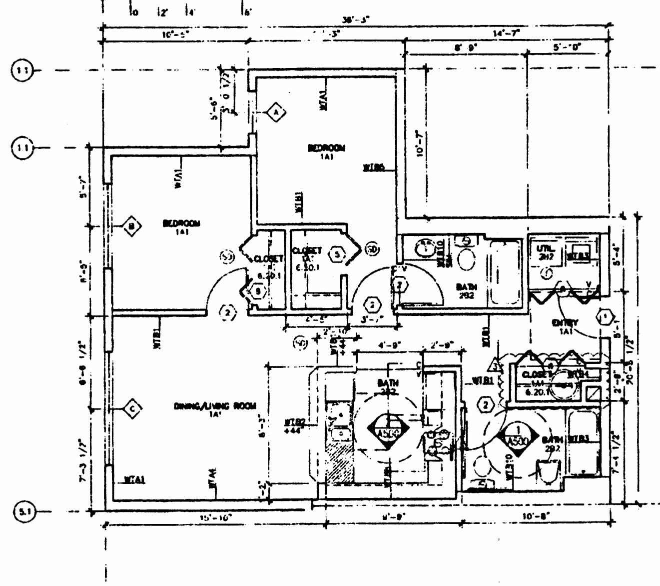
J:\9831\WW\9831FSC1



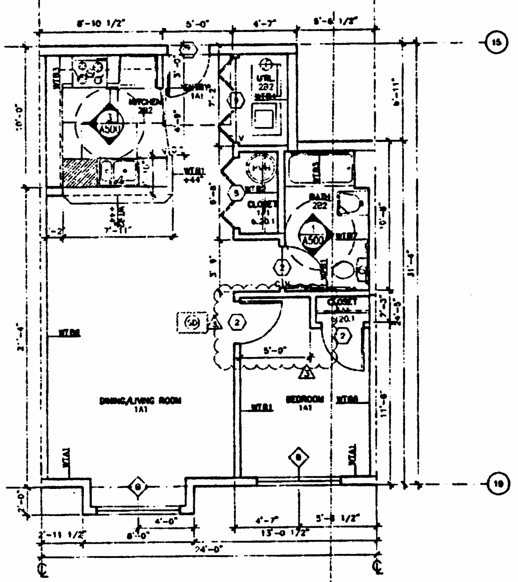
Plan: UNIT N
1/4"=1'-0"



Plan: UNIT L
1/4"=1'-0"



Plan: UNIT J (BARRIER FREE)
1/4"=1'-0"



Plan: UNIT C (BARRIER FREE)
1/4"=1'-0"

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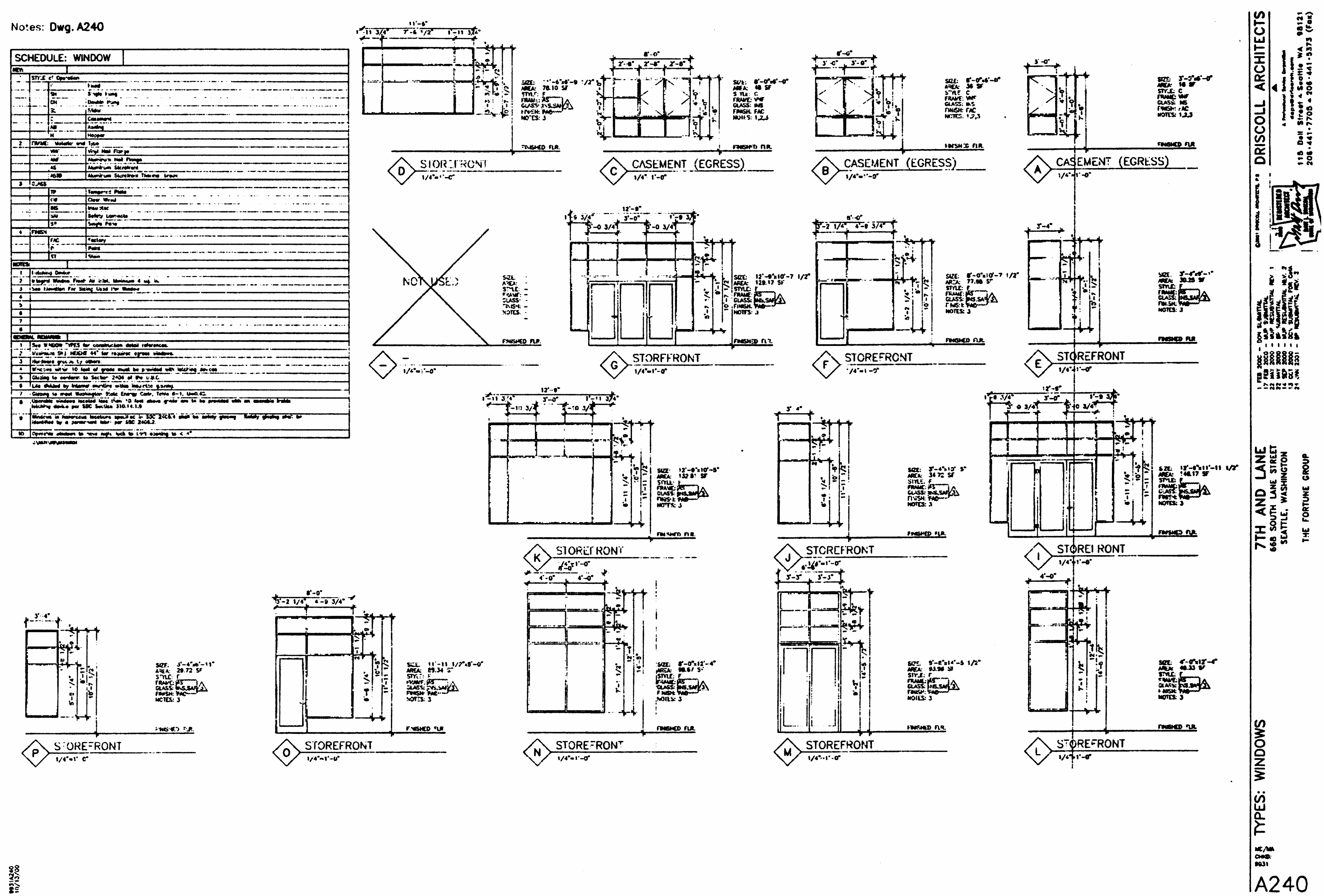
PLANS:
UNIT L; UNIT N
UNIT C–BF; UNIT J–BF

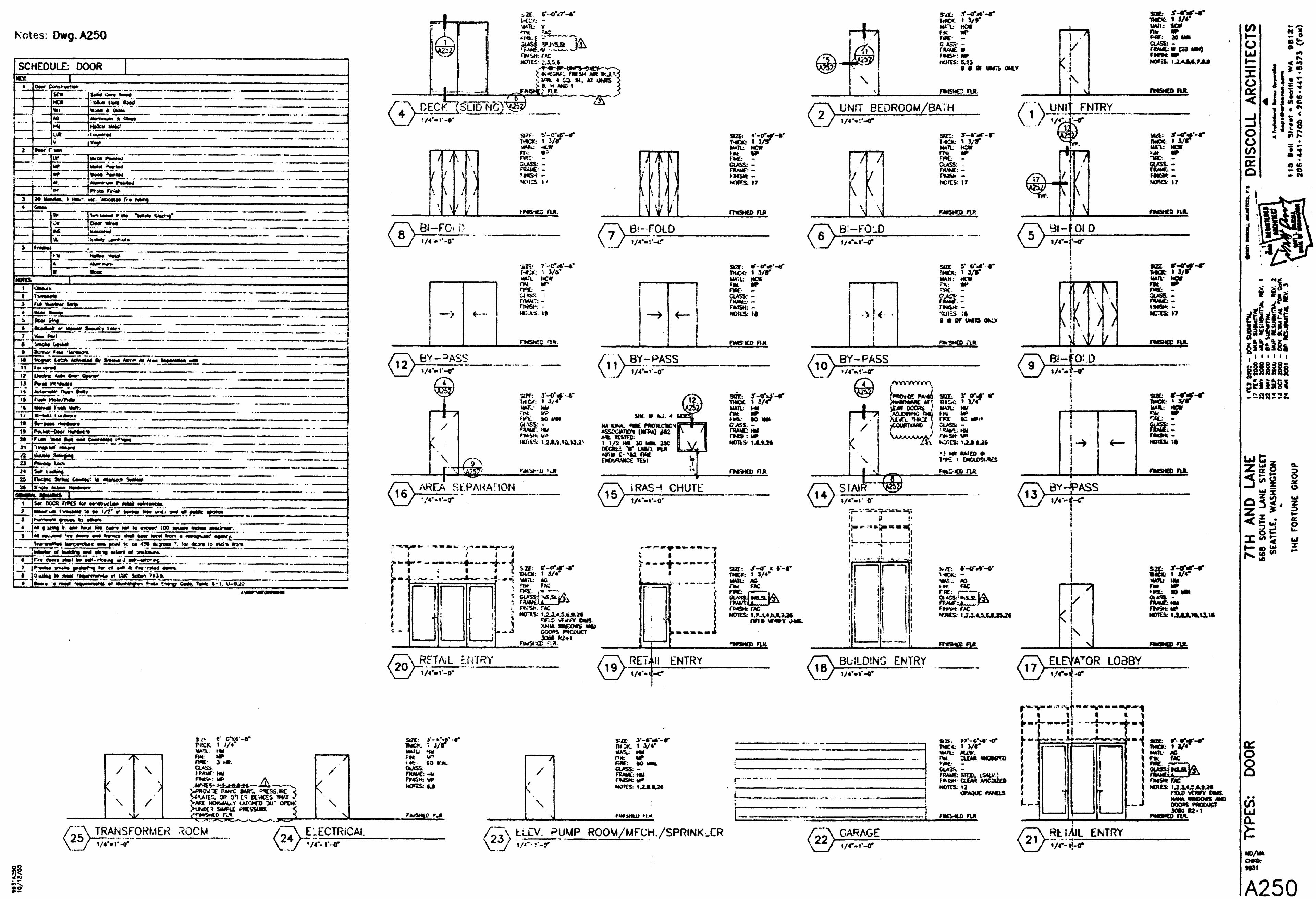
A223

9831A223
12/06/00

eQUEST Hands-On Example — **Mixed Use, Retail /Multi-Family Residential**



Notes: Dwg. A240
SCHEDULE: WINDOW
CASEMENT (EGRESS)
STOREFRONT
NOT USED
DRISCOLL ARCHITECTS
115 Dell Street • Seattle WA 98121
206-441-7705 • 206-441-5373 (Fax)
7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP
TYPES: WINDOWS
A240


Notes: Dwg. A250
SCHEDULE: DOOR
DRISCOLL ARCHITECTS
7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP
TYPES: DOOR
A250
1 UNIT ENTRY
2 UNIT BEDROOM/BATH
4 DECK (SLIDING)
5 BI-FOLD
6 BI-FOLD
7 BI-FOLD
8 BI-FOLD
9 BI-FOLD
10 BY-PASS
11 BY-PASS
12 BY-PASS
13 BY-PASS
14 STAIR
15 TRASH CHUTE
16 AREA SEPARATION
17 ELEVATOR LOBBY
18 BUILDING ENTRY
19 RETAIL ENTRY
20 RETAIL ENTRY
21 RETAIL ENTRY
22 GARAGE
23 ELEV. PUMP ROOM/MECH./SPRINKLER
24 ELECTRICAL
25 TRANSFORMER ROOM

Notes: Dwg. A300

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC.
3.33.4 1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN W/ LRE SHOWN.
3.35.2 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN, FLAT ELSEWHERE, SEE STRUCTURAL
3.51.3 1" "GYPCRETE" TOPPING SLAB

4.20.0 11" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.60.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CORNICE, BUILT-UP

6.11.1 HEADER PER STRUCTURAL
6.11.2 WOOD BLOCKING AS REQUIRED
6.11.3 DRAFT-STOP, ONE HOUR
6.19.1 TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.19.2 TYPICAL "WOOD" ROOF JOISTS: "TJI" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1 CLOSET SHELF & ROD

7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD.
7.12.2 BITUMINOUS MEMBRANE WATERPROOFING
7.24.0 STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5 1/2" ARCHITECTURAL REVEAL
7.26.0 1 1/2" EXPANSION REGLET @ FLOOR LINE
7.46.1 VERTICALLY-ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2 22 GA. SHEET METAL TRIM, FACTORY FINISH
7.57.0 TRAFFIC TOPPING: ELASTOMERIC FLUID APPLIED, SLIP-RESISTENT MEMBRANE
7.62.1 FLASHING, SHEET METAL, PAINTED
7.63.1 SCUPPER AND TIGHTLINED DOWNSPOUT
7.72.1 ROOF VENTILATOR JACK, ALUMINUM AMPCOR, RVA-151 150 SQ. IN. FREE AREA
7.72.2 ROOF HATCH 4'-6" X 7'-6"
7.82.1 SEALANT & CLOSED-CELL BACKER ROD

8.11.1 DOOR & FRAME, STEEL, PAINTED
8.11.2 STOREFRONT DOOR/WINDOW SYSTEM
8.31.0 OVERHEAD COILING DOOR
8.31.1 NAIL-FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL.
8.63.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

9.25.1 5/8" TYPE X GWB
9.25.2 (2) LAYERS 5/8" TYPE X GWB
9.25.3 SHEATHING, GYPSUM, 5/8", TYPE X

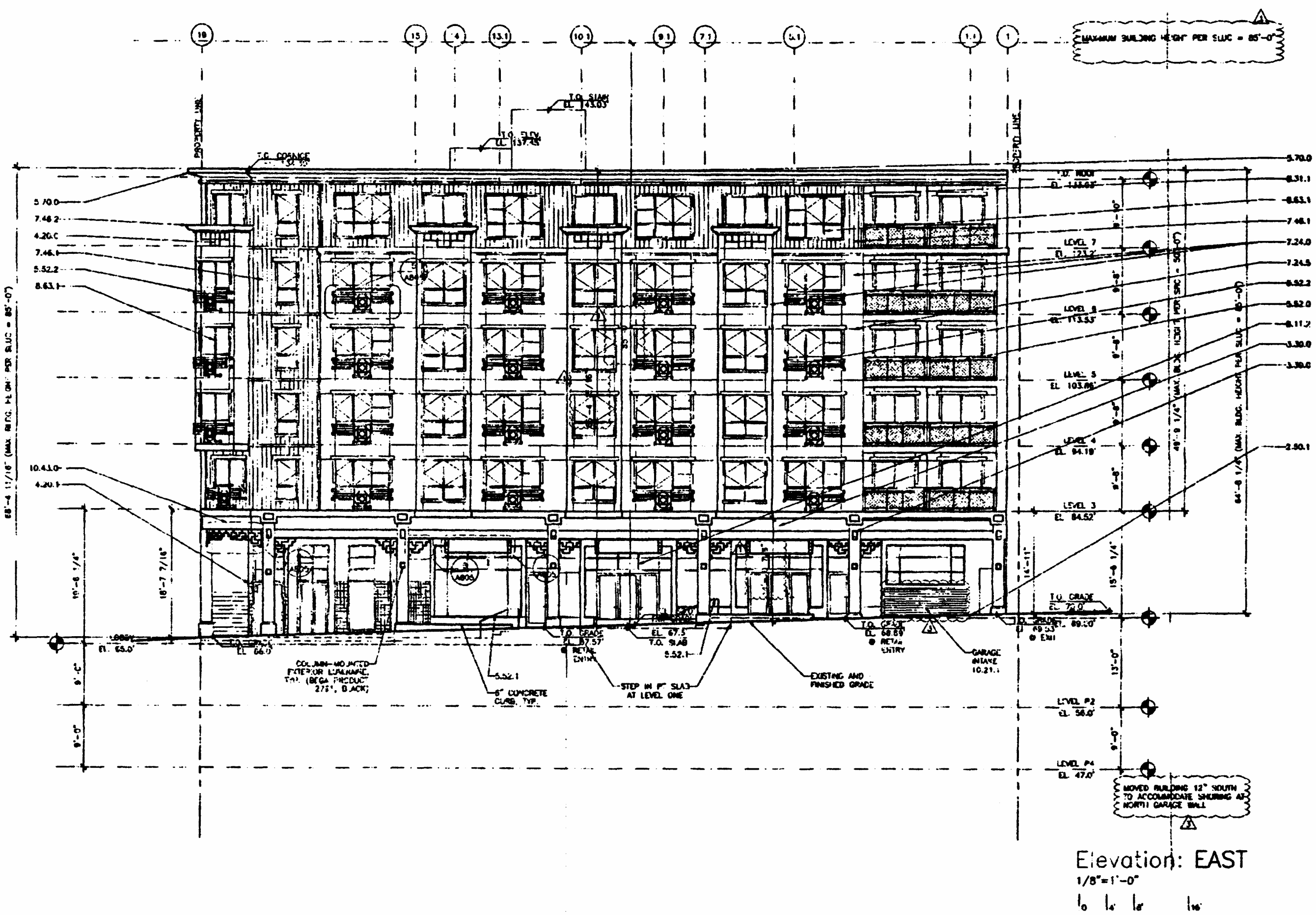
10.21.1 WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1 EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.43.0 SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS

12.30.1 KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3 VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER) W/ PLASTIC LAMINATE COUNTERTOP
12.30.4 PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5 UPPER CABINET

15.30.1 SPRINKLER SYSTEM ALARM
15.30.2 FIRE DEPARTMENT HOOK UP

16.43.0 ELECTRICAL METERS
16.53.1 LIGHTING, EMERGENCY
16.53.2 LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3 LIGHTING, EXTERIOR DECORATIVE

MAXIMUM STRUCTURE HEIGHT:
1. THE MAJOR STREET PROPERTY LINE IS ADJACENT TO 7TH AVENUE SOUTH.
2. THE SLOPE OF THE LOT ALONG THE ENTIRE LENGTH OF THE MAJOR PROPERTY LINE IS 3.71'/119.99' = 3.09%
3. THE SLOPE OF THE MAJOR STREET PROPERTY LINE IS LESS THAN 7 1/2%. THEREFORE, THE ELEVATION OF MAXIMUM HEIGHT IS DETERMINED BY ADDING THE MAXIMUM PERMITTED HEIGHT (65'-0") TO THE EXISTING GRADE ELEVATION AT THE MIDPOINT OF THE MAJOR STREET PROPERTY LINE.



Elevation: EAST
1/8"=1'-0"

ELEVATION: EAST

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1 FEB 2000 - DON SUBMITTAL
17 FEB 2000 - MUP SUBMITTAL
22 MAY 2000 - MUP RESUBMITTAL REV. 1
27 MAY 2000 - BP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - DON SUBMITTAL FOR CofA
24 JAN 2001 - BP RESUBMITTAL REV 3

DRISCOLL ARCHITECTS
A Professional Service Corporation
dops@driscoll.com
115 Bell Street • Seattle WA 98121
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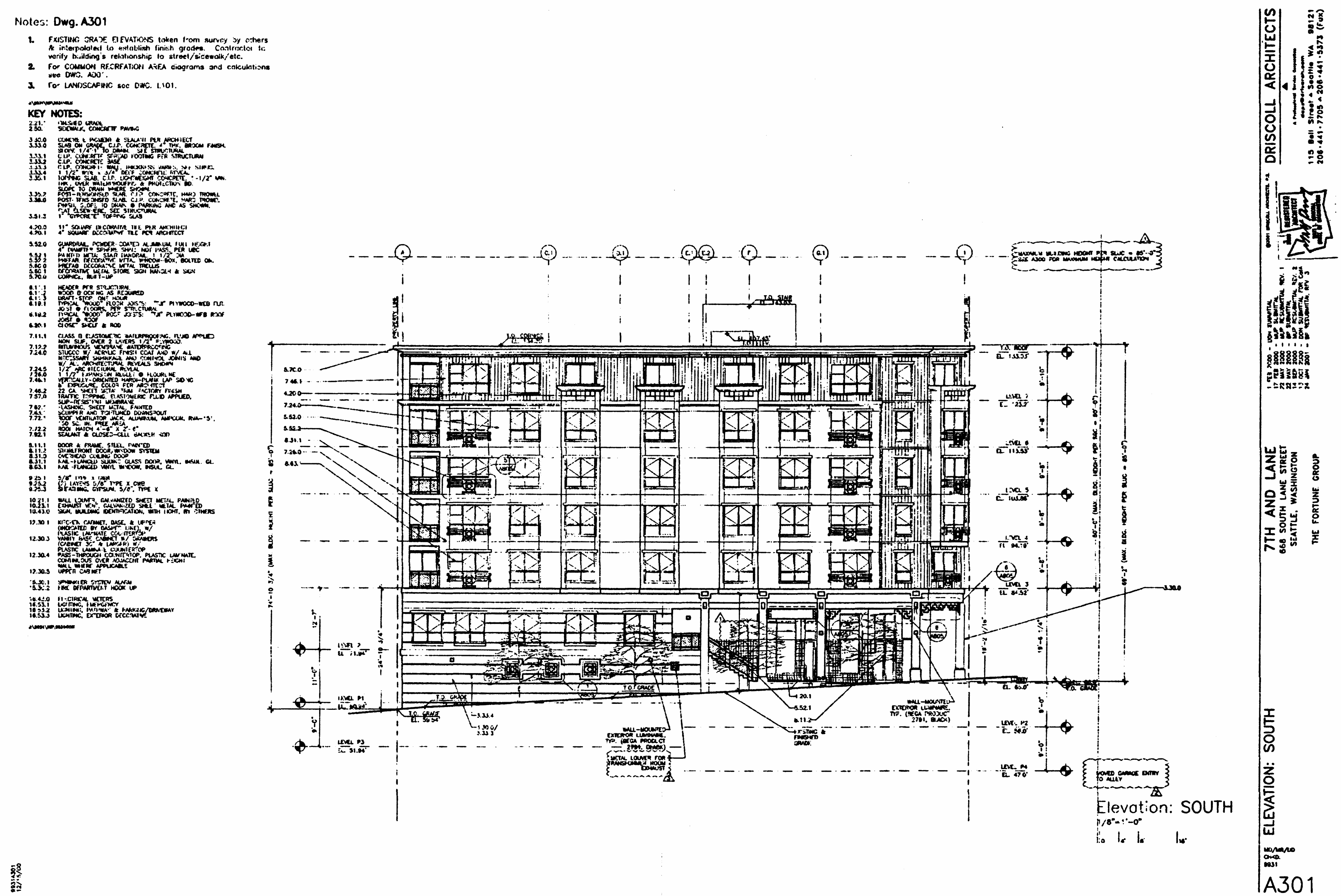
A300

eQUEST Hands-On Example

Mixed Use, Retail /Multi-Family Residential



eQUEST Hands-On Example **Mixed Use, Retail /Multi-Family Residential**

Notes: **Dwg. A302**

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC
3.33.4 1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN WHERE SHOWN.
3.35.2 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN. FLAT ELSEWHERE. SEE STRUCTURAL.
3.61.3 "GYPCRETE" TOPPING SLAB

4.20.0 1" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER-COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.60.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CORNICE, BUILT-UP

6.11.1 HEADER PER STRUCTURAL
6.11.2 WOOD BLOCKING AS REQUIRED
6.11.3 DRAFT STOP, ONE HOUR
6.19.1 TYPICAL "WOOD" FLOOR JOISTS: "TJ" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.19.2 TYPICAL "WOOD" ROOF JOISTS: "TJ" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1 CLOSET SHELF & ROD

7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD
7.12.2 BITUMINOUS MEMBRANE WATERPROOFING
7.24.0 STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5 1/2" ARCHITECTURAL REVEAL
7.26.0 1 1/2" EXPANSION REGLET @ FLOORLINE
7.46.1 VERTICALLY-ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2 22 GA. SHEET METAL TRIM, FACTORY FINISH
7.57.0 TRAFFIC TOPPING, ELASTOMERIC FLUID APPLIED, SLIP-RESISTENT MEMBRANE
7.62.1 FLASHING, SHEET METAL, PAINTED
7.63.1 SCUPPER AND TIGHTLINED DOWNSPOUT
7.72.1 ROOF VENTILATOR JACK, ALUMINUM, AMPCOR, RVA-151, 150 SQ. IN. FREE AREA
7.72.2 ROOF HATCH 4'-6" x 2'-6"
7.92.1 SEALANT & CLOSED-CELL BACKER ROD

8.11.1 DOOR & FRAME, STEEL, PAINTED
8.11.2 STOREFRONT DOOR/WINDOW SYSTEM
8.31.0 OVERHEAD COILING DOOR
8.31.1 NAIL FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL
8.63.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

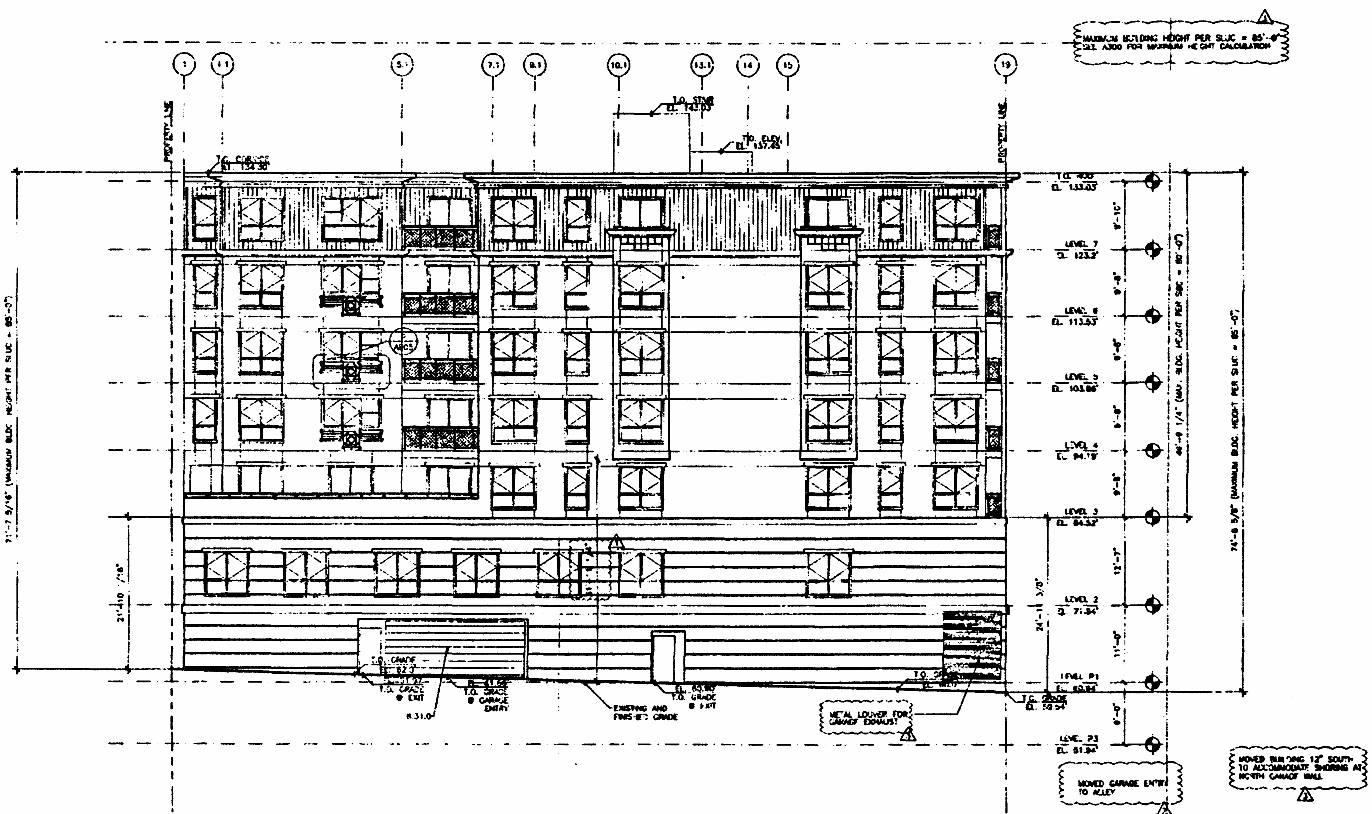
9.25.1 5/8" TYPE X GWB
9.25.2 (2) LAYERS 5/8" TYPE X GWB
9.25.3 SHEATHING, GYPSUM, 5/8", TYPE X

10.21.1 WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1 EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.43.0 SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS

12.30.1 KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3 VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER), W/ PLASTIC LAMINATE COUNTERTOP
12.30.4 PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5 UPPER CABINET

15.30.1 SPRINKLER SYSTEM ALARM
15.30.2 FIRE DEPARTMENT HOOK UP

16.43.0 ELECTRICAL METERS
16.53.1 LIGHTING, EMERGENCY
16.53.2 LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3 LIGHTING, EXTERIOR DECORATIVE



Elevation: WEST
1/8"=1'-0"

DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206-441-7705 • 206-441-5373 (fax)

1 FEB 2000 - DON SUBMITTAL
17 FEB 2000 - MUP SUBMITTAL
22 MAY 2000 - MUP RESUBMITTAL REV. 1
22 MAY 2000 - BP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - DON SUBMITTAL FOR CofA
24 JAN 2001 - BP RESUBMITTAL REV. 3

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP

ELEVATION: WEST

A302

Notes: Dwg. A303

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC
3.33.4 1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN WHERE SHOWN.
3.35.2 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN, FLAT ELSEWHERE, SEE STRUCTURAL
3.51.3 1" "GYPCRETE" TOPPING SLAB

4.20.0 11" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON.
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.60.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CORNICE, BUILT-UP

6.11.1 HEADER PER STRUCTURAL
6.11.2 WOOD BLOCKING AS REQUIRED
6.11.3 DRAFT STOP, ONE HOUR
6.19.1 TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR JOIST @ FLOORS, PER STRUCTURAL
6.19.2 TYPICAL "WOOD" ROOF JOISTS: "TJ" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1 CLOSET SHELF & ROD

7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD.
7.12.2 BITUMINOUS MEMBRANE WATERPROOFING
7.24.0 STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5 1/2" ARCHITECTURAL REVEAL
7.26.0 1 1/2" EXPANSION REGLET @ FLOORLINE
7.46.1 VERTICALLY-ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2 22 GA. SHEET METAL TRIM, FACTORY FINISH
7.57.0 TRAFFIC TOPPING, ELASTOMERIC FLUID APPLIED, SLIP-RESISTENT MEMBRANE
7.62.1 FLASHING, SHEET METAL, PAINTED
7.63.1 SCUPPER AND LIGHTED DOWNSPOUT
7.72.1 ROOF VENTILATOR JACK, ALUMINUM, AMPCOR, NVA-151, 150 SQ. IN. FREE AREA
7.72.2 ROOF HATCH 4'-6" X 2'-6"
7.92.1 SEALANT & CLOSED-CELL BACKER ROD

8.11.1 DOOR & FRAME, STEEL, PAINTED
8.11.2 STOREFRONT DOOR/WINDOW SYSTEM
8.31.0 OVERHEAD COILING DOOR
8.11.1 NAIL-FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL.
8.63.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

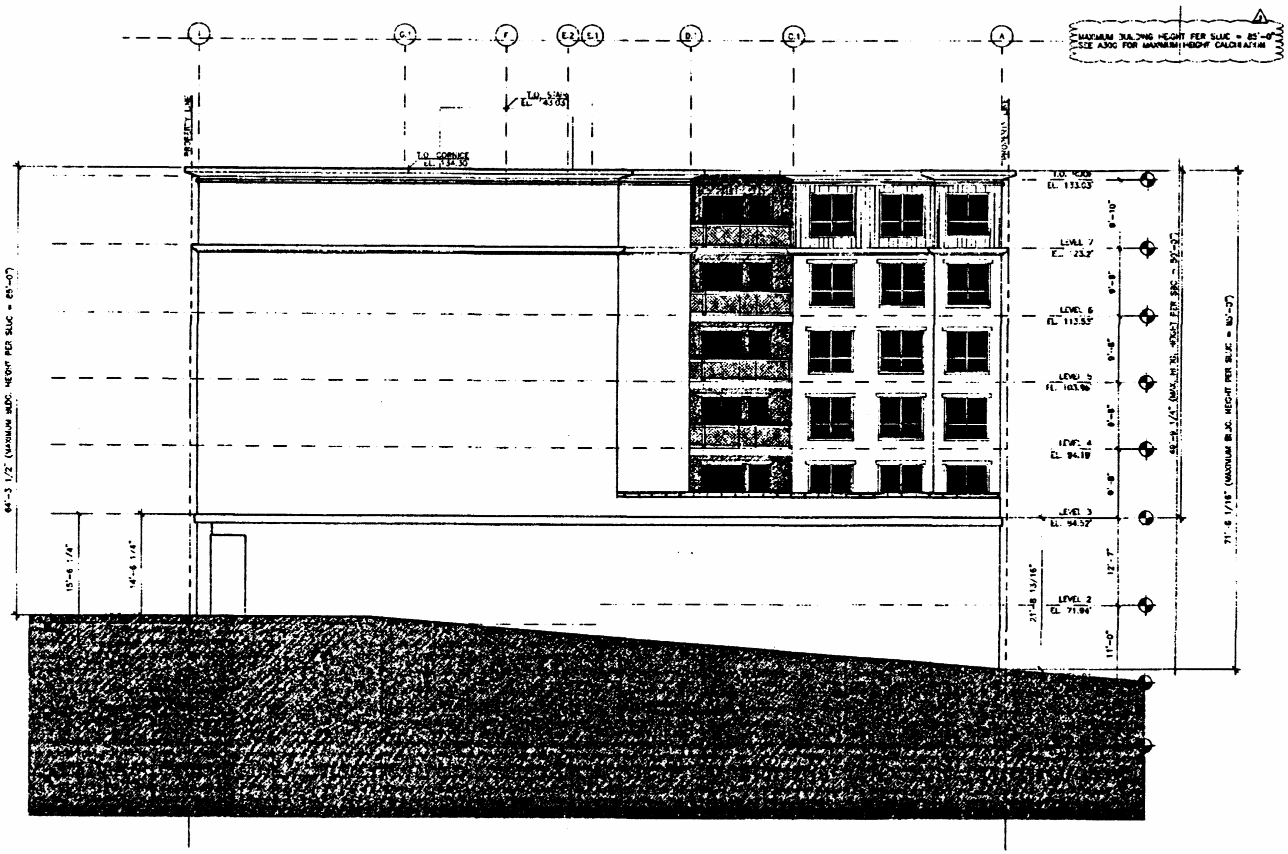
9.25.1 5/8" TYPE X GWB
9.25.2 (2) LAYERS 5/8" TYPE X GWB
9.25.3 SHEATHING, GYPSUM, 5/8", TYPE X

10.21.1 WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1 EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.42.0 SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS

12.30.1 KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3 VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER) W/ PLASTIC LAMINATE COUNTERTOP
12.30.4 PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5 UPPER CABINET

15.30.1 SPRINKLER SYSTEM ALARM
15.30.2 FIRE DEPARTMENT HOOK UP

16.43.0 ELECTRICAL METERS
16.53.1 LIGHTING, EMERGENCY
16.53.2 LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3 LIGHTING, EXTERIOR DECORATIVE



Elevation: NORTH
1/8"=1'-0"

DRISCOLL ARCHITECTS
A Professional Service Corporation
dapo@drisarch.com
115 Bell Street • Seattle WA 98121
206·441·7705 • 206·441·5373 (Fax)

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REGISTERED ARCHITECT
STATE OF WASHINGTON

1 FEB 2000 – DON SUBMITTAL
17 FEB 2000 – MUP SUBMITTAL
22 MAY 2000 – MUP RESUBMITTAL REV. 1
22 MAY 2000 – BP SUBMITTAL
14 SEP 2000 – MUP RESUBMITTAL REV. 2
13 OCT 2000 – DON SUBMITTAL FOR CofA
24 JAN 2001 – BP RESUBMITTAL REV. 3

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON

THE FORTUNE GROUP

ELEVATION: NORTH

MD/MA
CHKD:
9931

A303

Notes: **Dwg. A304**

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolation to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. AC01.
3. For LANDSCAPING see DWG L'01.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK. BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL THICKNESS VARIES. SEE STRUC
3.33.4 1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD SLOPE TO DRAIN WHERE SHOWN.
3.35.2 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN. FLAT ELSEWHERE, SEE STRUCTURAL
3.51.3 1" "GYPCRETE" TOPPING SLAB

4.20.0 11" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER-COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON.
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.80.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CORNICE, BUILT-UP

6.11.1 HEADER PER STRUCTURAL
6.11.2 WOOD BLOCKING AS REQUIRED
6.11.3 DRAFT-STOP, ONE HOUR
6.18.1 TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.18.2 TYPICAL "WOOD" ROOF JOISTS: "TJI" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1 CLOSET SHELF & ROD

7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD
7.12.2 BITUMINOUS MEMBRANE WATERPROOFING
7.24.0 STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5 1/2" ARCHITECTURAL REVEAL
7.26.0 1 1/2" EXPANSION REGLET @ FLOORLINE
7.46.1 VERTICALLY-ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2 22 GA. SHEET METAL 1PW, FACTORY FINISH
7.57.0 TRAFFIC TOPPING, ELASTOMERIC FLUID APPLIED, SLIP-RESISTENT MEMBRANE
7.62.1 FLASHING, SHEET METAL, PAINTED
7.63.1 SCUPPER AND TIGHTLINED DOWNSPOUT
7.72.1 ROOF VENTILATOR JACK, ALUMINUM, AMPCOR, RVA-151, 150 SQ. IN. FREE AREA
7.72.2 ROOF HATCH 4'-6" X 2'-6"
7.92.1 SEALANT & CLOSED-CELL BACKER ROD

8.11.1 DOOR & FRAME, STEEL, PAINTED
8.11.2 STOREFRONT DOOR/WINDOW SYSTEM
8.31.0 OVERHEAD COILING DOOR
8.31.1 NAIL-FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL.
8.63.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

9.25.1 5/8" TYPE X GWB
9.25.2 (2) LAYERS 5/8" TYPE X GWB
9.25.3 SHEATHING, GYPSUM, 5/8", TYPE X

10.21.1 WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1 EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.43.0 SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS

12.30.1 KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3 VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER) W/ PLASTIC LAMINATE COUNTERTOP
12.30.4 PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5 UPPER CABINET

15.30.1 SPRINKLER SYSTEM ALARM
15.30.2 FIRE DEPARTMENT HOOK UP

16.43.0 ELECTRICAL METERS
16.53.1 LIGHTING, EMERGENCY
16.53.2 LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3 LIGHTING, EXTERIOR DECORATIVE

Elevation: EAST
1/8"=1'-0"

DRISCOLL ARCHITECTS
A Professional Service Corporation
dapo@driscarch.com
115 Bell Street • Seattle WA 98121
206-441-7705 • 206-441-5373 (Fax)

1 FEB 2000 - DON SUBMITTAL
17 FEB 2000 - MUP SUBMITTAL
22 MAY 2000 - MUP RESUBMITTAL REV. 1
22 MAY 2000 - BP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - DON SUBMITTAL FOR C&A
24 JAN 2001 - BP RESUBMITTAL REV. 3

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON

THE FORTUNE GROUP

ELEVATION: SOUTHEAST

9831

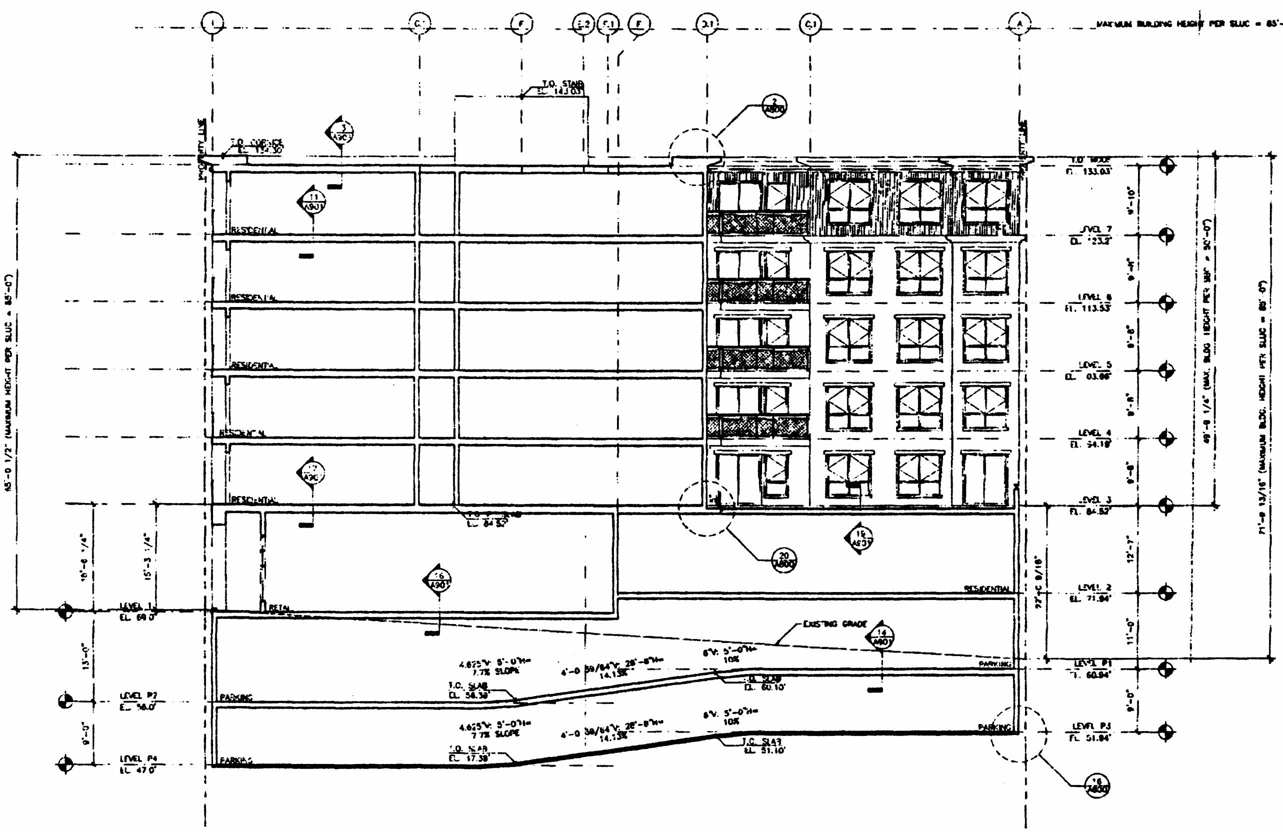
A304

Notes: **Dwg. A310**

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1	FINISHED GRADE
2.50.1	SIDEWALK, CONCRETE PAVING
3.30.0	CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0	SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1	C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2	C.I.P. CONCRETE BASE
3.33.3	C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC
3.33.4	1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1	TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN WHERE SHOWN.
3.35.2	POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0	POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN. FLAT ELSEWHERE, SEE STRUCTURAL
3.51.3	1" "GYPCRETE" TOPPING SLAB
4.20.0	11" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1	4" SQUARE DECORATIVE TILE PER ARCHITECT
5.52.0	GUARDRAIL, POWDER-COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1	PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2	PREFAB DECORATIVE METAL WINDOW-BOX, BOLTED CN.
5.80.0	PREFAB DECORATIVE METAL TRELLIS
5.80.1	DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0	CORNICE, BUILT-UP
6.11.1	HEADER PER STRUCTURAL
6.11.2	WOOD BLOCKING AS REQUIRED
6.11.3	DRAFT-STOP, ONE HOUR
6.19.1	TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.19.2	TYPICAL "WOOD" ROOF JOISTS: "TJI" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1	CLOSET SHELF & ROD
7.11.1	CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD.
7.12.2	BITUMINOUS MEMBRANE WATERPROOFING
7.24.0	STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5	1/2" ARCHITECTURAL REVEAL
7.26.0	1 1/2" EXPANSION REGLET @ FLOORLINE
7.46.1	VERTICALLY ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2	22 GA. SHEET METAL TRIM, FACTORY FINISH
7.57.0	TRAFFIC TOPPING, ELASTOMERIC FLUID APPLIED, SLIP-RESISTANT MEMBRANE
7.62.1	FLASHING, SHEET METAL, PAINTED
7.63.1	SCUPPER AND TIGHTLINED DOWNSPOUT
7.72.1	ROOF VENTILATOR JACK, ALUMINUM, AMPCOR, RVA-151, 150 SQ. IN. FREE AREA
7.72.2	ROOF HATCH 4'-6" X 2'-6"
7.92.1	SEALANT & CLOSED-CELL BACKER ROD
8.11.1	DOOR & FRAME, STEEL, PAINTED
8.11.2	STOREFRONT DOOR/WINDOW SYSTEM
8.31.0	OVERHEAD COILING DOOR
8.31.1	NAIL-FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL.
8.63.1	NAIL-FLANGED VINYL WINDOW, INSUL. GL.
9.25.1	5/8" TYPE X GWB
9.25.2	(2) LAYERS 5/8" TYPE X GWB
9.25.3	SHEATHING, GYPSUM, 5/8", TYPE X
10.21.1	WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1	EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.43.0	SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS
12.30.1	KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3	VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER) W/ PLASTIC LAMINATE COUNTERTOP
12.30.4	PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5	UPPER CABINET
15.30.1	SPRINKLER SYSTEM ALARM
15.30.2	FIRE DEPARTMENT HOOK UP
16.43.0	ELECTRICAL METERS
16.53.1	LIGHTING, EMERGENCY
16.53.2	LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3	LIGHTING, EXTERIOR DECORATIVE



Section:A-A
1/8" = 1'-0"

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dapa@driscollarch.com
115 Bell Street • Seattle WA 98121
206·441·7705 • 206·441·5373 (Fax)

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1 FEB 2000 - DOA SUBMITTAL
17 FEB 2000 - MUP SUBMITTAL
22 MAY 2000 - MUP RESUBMITTAL REV. 1
22 MAY 2000 - MUP SUBMITTAL
14 SEP 2000 - MUP RESUBMITTAL REV. 2
13 OCT 2000 - DOCI SUBMITTAL FOR CPA
24 JAN 2001 - BP RESUBMITTAL REV. 3

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP

SECTION: A-A

MO/MA
CHKD:
9931

A310

9931A310
10/13/00

Notes: **Dwg. A311**

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH. SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC.
3.33.4 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN WHERE SHOWN.
3.35.2 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN, FLAT ELSEWHERE, SEE STRUCTURAL.
3.51.3 1" "GYPCRETE" TOPPING SLAB

4.20.0 12" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER-COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON.
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.60.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CONNECT, BUILT-UP

6.11.1 HEADER PER STRUCTURAL
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6.11.3 DRAFT-STOP, ONE HOUR
6.19.1 TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.19.2 TYPICAL "WOOD" ROOF JOISTS: "TJI" PLYWOOD-WEB ROOF JOIST @ ROOF
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7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD.
7.12.2 BITUMINOUS MEMBRANE WATERPROOFING
7.24.0 STUCCO W/ ACRYLIC FINISH COAT AND W/ ALL NECESSARY SHRINKAGE AND CONTROL JOINTS AND W/ ALL ARCHITECTURAL REVEALS SHOWN
7.24.5 1/2" ARCHITECTURAL REVEAL
7.26.0 1 1/2" EXPANSION RECEPT @ FLOORLINE
7.46.1 VERTICALLY-ORIENTED HARDI-PLANK LAP SIDING 8" EXPOSURE, COLOR PER ARCHITECT
7.46.2 22 GA. SHEET METAL TRIM, FACTORY FINISH
7.57.0 TRAFFIC TOPPING; ELASTOMERIC FLUID APPLIED, SLIP-RESISTENT MEMBRANE
7.62.1 FLASHING, SHEET METAL, PAINTED
7.63.1 SCUPPER AND TIGHTLINED DOWNSPOUT
7.72.1 ROOF VENTILATOR JACK, ALUMINUM, AMPCOR, RVA-151, 150 SQ. IN. FREE AREA
7.72.2 ROOF HATCH 4'-6" X 2'-6"
7.92.1 SEALANT & CLOSED-CELL BACKER ROD

8.11.1 DOOR & FRAME, STEEL, PAINTED
8.11.2 STOREFRONT DOOR/WINDOW SYSTEM
8.31.0 OVERHEAD COILING DOOR
8.51.1 NAIL-FLANGED SLIDING GLASS DOOR, VINYL, INSUL. GL.
8.63.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

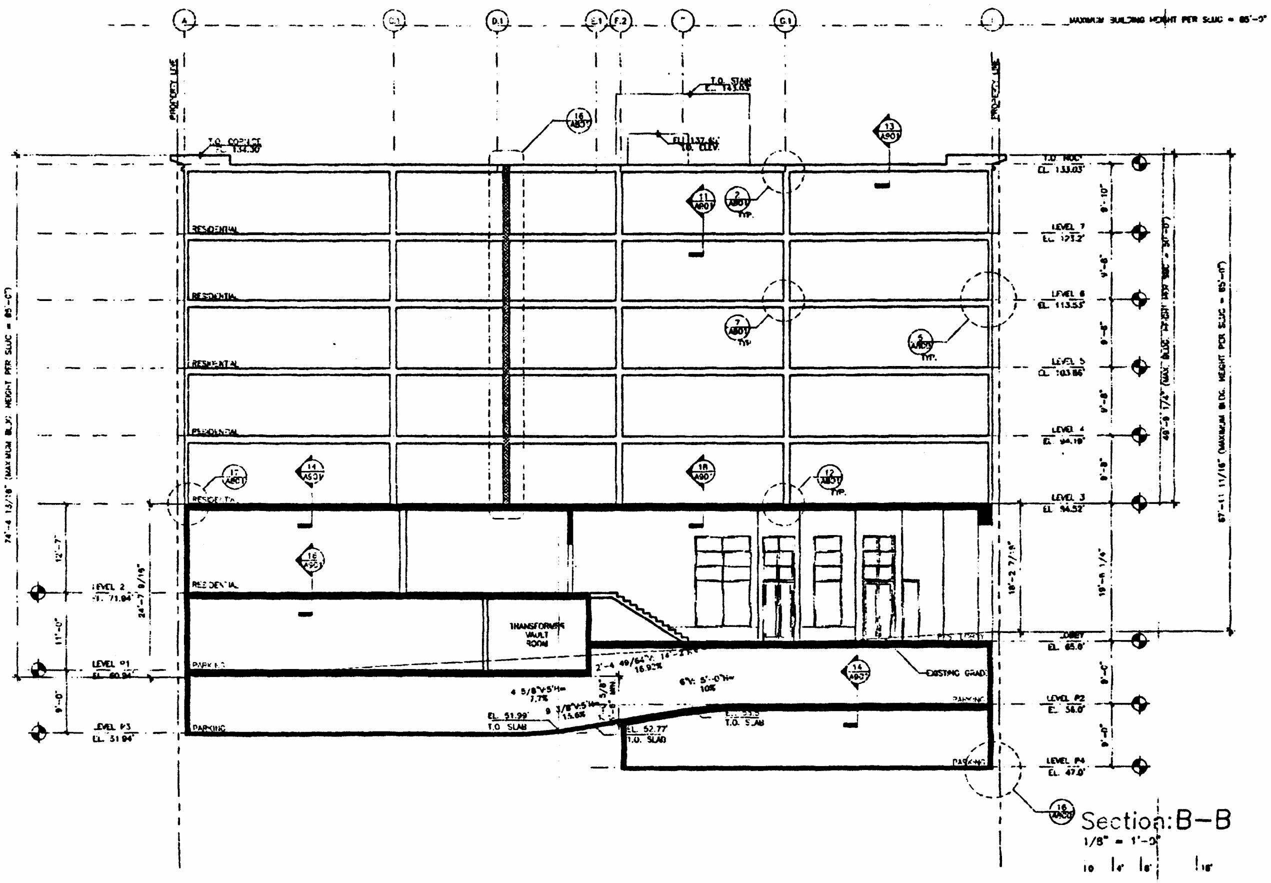
9.25.1 5/8" TYPE X GWB
9.25.2 (2) LAYERS 5/8" TYPE X GWB
9.25.3 SHEATHING, GYPSUM, 5/8", TYPE X

10.21.1 WALL LOUVER, GALVANIZED SHEET METAL, PAINTED
10.23.1 EXHAUST VENT, GALVANIZED SHEET METAL, PAINTED
10.43.0 SIGN, BUILDING IDENTIFICATION, WITH LIGHT, BY OTHERS

12.30.1 KITCHEN CABINET, BASE, & UPPER (INDICATED BY DASHED LINE), W/ PLASTIC LAMINATE COUNTERTOP
12.30.3 VANITY BASE CABINET W/ DRAWERS (CABINET 30" & LARGER) W/ PLASTIC LAMINATE COUNTERTOP
12.30.4 PASS-THROUGH COUNTERTOP, PLASTIC LAMINATE, CONTINUOUS OVER ADJACENT PARTIAL HEIGHT WALL WHERE APPLICABLE
12.30.5 UPPER CABINET

15.30.1 SPRINKLER SYSTEM ALARM
15.30.2 FIRE DEPARTMENT HOOK UP

16.43.0 ELECTRICAL METERS
16.53.1 LIGHTING, EMERGENCY
16.53.2 LIGHTING, PATHWAY & PARKING/DRIVEWAY
16.53.3 LIGHTING, EXTERIOR DECORATIVE



Section: B–B
1/8" = 1'-0"

DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206•441•7705 • 206•441•5373 (Fax)

1 FEB 2000 – DON SUBMITTAL
17 FEB 2000 – MUP SUBMITTAL
22 MAY 2000 – MUP RESUBMITTAL REV. 1
22 SEP 2000 – BP SUBMITTAL
14 SEP 2000 – MUP RESUBMITTAL REV. 2
13 OCT 2000 – DON SUBMITTAL FOR CofA
24 JAN 2001 – BP RESUBMITTAL REV. 3

7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP

SECTION: B–B

A311

Notes: **Dwg. A312**

1. EXISTING GRADE ELEVATIONS taken from survey by others & interpolated to establish finish grades. Contractor to verify building's relationship to street/sidewalk/etc.
2. For COMMON RECREATION AREA diagrams and calculations see DWG. A001.
3. For LANDSCAPING see DWG. L101.

KEY NOTES:

2.21.1 FINISHED GRADE
2.50.1 SIDEWALK, CONCRETE PAVING

3.30.0 CONCRETE PIGMENT & SEALANT PER ARCHITECT
3.33.0 SLAB ON GRADE, C.I.P. CONCRETE, 4" THK, BROOM FINISH, SLOPE 1/4":1' TO DRAIN. SEE STRUCTURAL
3.33.1 C.I.P. CONCRETE SPREAD FOOTING PER STRUCTURAL
3.33.2 C.I.P. CONCRETE BASE
3.33.3 C.I.P. CONCRETE WALL, THICKNESS VARIES, SEE STRUC.
3.33.4 1 1/2" WIDE x 3/4" DEEP CONCRETE REVEAL
3.35.1 TOPPING SLAB, C.I.P. LIGHTWEIGHT CONCRETE, 1-1/2" MIN. THK., OVER WATERPROOFING & PROTECTION BD. SLOPE TO DRAIN WHERE SHOWN.
3.35.2 POST TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL
3.36.0 POST-TENSIONED SLAB, C.I.P. CONCRETE, HARD TROWEL FINISH, SLOPE TO DRAIN @ PARKING AND AS SHOWN. FLAT ELSEWHERE, SEE STRUCTURAL
3.51.1 1" "GYPCRETE" TOPPING SLAB

4.20.0 11" SQUARE DECORATIVE TILE PER ARCHITECT
4.20.1 4" SQUARE DECORATIVE TILE PER ARCHITECT

5.52.0 GUARDRAIL, POWDER-COATED ALUMINUM, FULL HEIGHT 4" DIAMETER SPHERE SHALL NOT PASS, PER UBC
5.52.1 PAINTED METAL STAIR HANDRAIL, 1 1/2" DIA
5.52.2 PREFAB. DECORATIVE METAL WINDOW-BOX, BOLTED ON.
5.60.0 PREFAB. DECORATIVE METAL TRELLIS
5.60.1 DECORATIVE METAL STORE SIGN HANGER & SIGN
5.70.0 CORNICE, BUILT UP

6.11.1 HEADER PER STRUCTURAL
6.11.2 WOOD BLOCKING AS REQUIRED
6.11.3 DRAFT-STOP, ONE HOUR
6.19.1 TYPICAL "WOOD" FLOOR JOISTS: "TJI" PLYWOOD-WEB FLR. JOIST @ FLOORS, PER STRUCTURAL
6.19.2 TYPICAL "WOOD" ROOF JOISTS: "TJI" PLYWOOD-WEB ROOF JOIST @ ROOF
6.20.1 CLOSET SHELF & ROD

7.11.1 CLASS B ELASTOMERIC WATERPROOFING, FLUID APPLIED NON-SLIP, OVER 2 LAYERS 1/2" PLYWOOD
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8.61.1 NAIL-FLANGED VINYL WINDOW, INSUL. GL.

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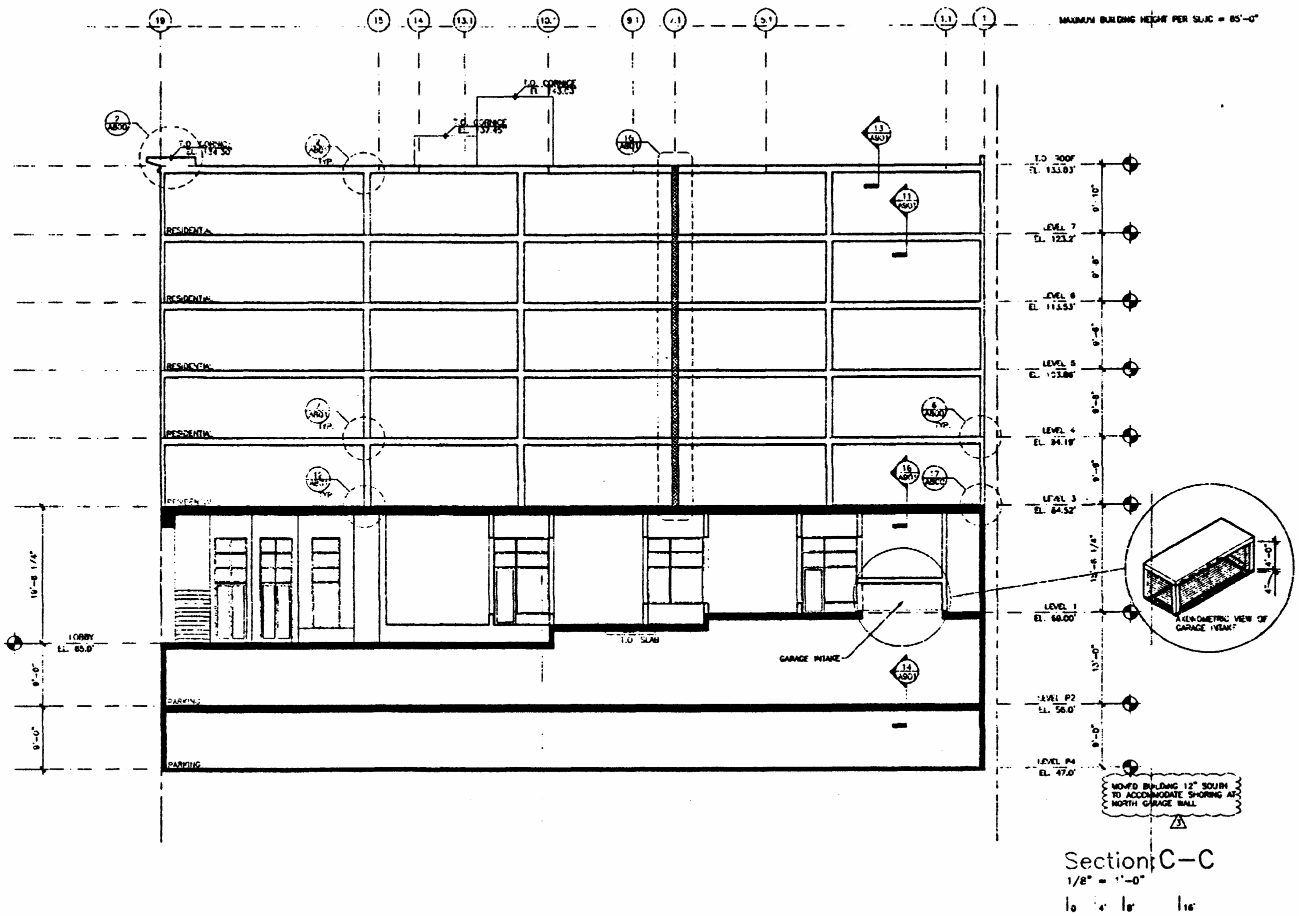
16.53.3 LIGHTING, EXTERIOR DECORATIVE



Section: C–C
1/8" = 1'-0"

DRISCOLL ARCHITECTS
A Professional Service Corporation
115 Bell Street • Seattle WA 98121
206·441·7705 • 206·441·5375 (Fax)

1 FEB 2000 – DON SUBMITTAL
17 FEB 2000 – MUP SUBMITTAL
22 MAY 2000 – MUP RESUBMITTAL REV. 1
22 MAY 2000 – BP SUBMITTAL
14 SEP 2000 – MUP RESUBMITTAL REV. 2
13 OCT 2000 – DON SUBMITTAL FOR CMA
24 JAN 2001 – BP RESUBMITTAL REV. 3

REGISTERED ARCHITECT

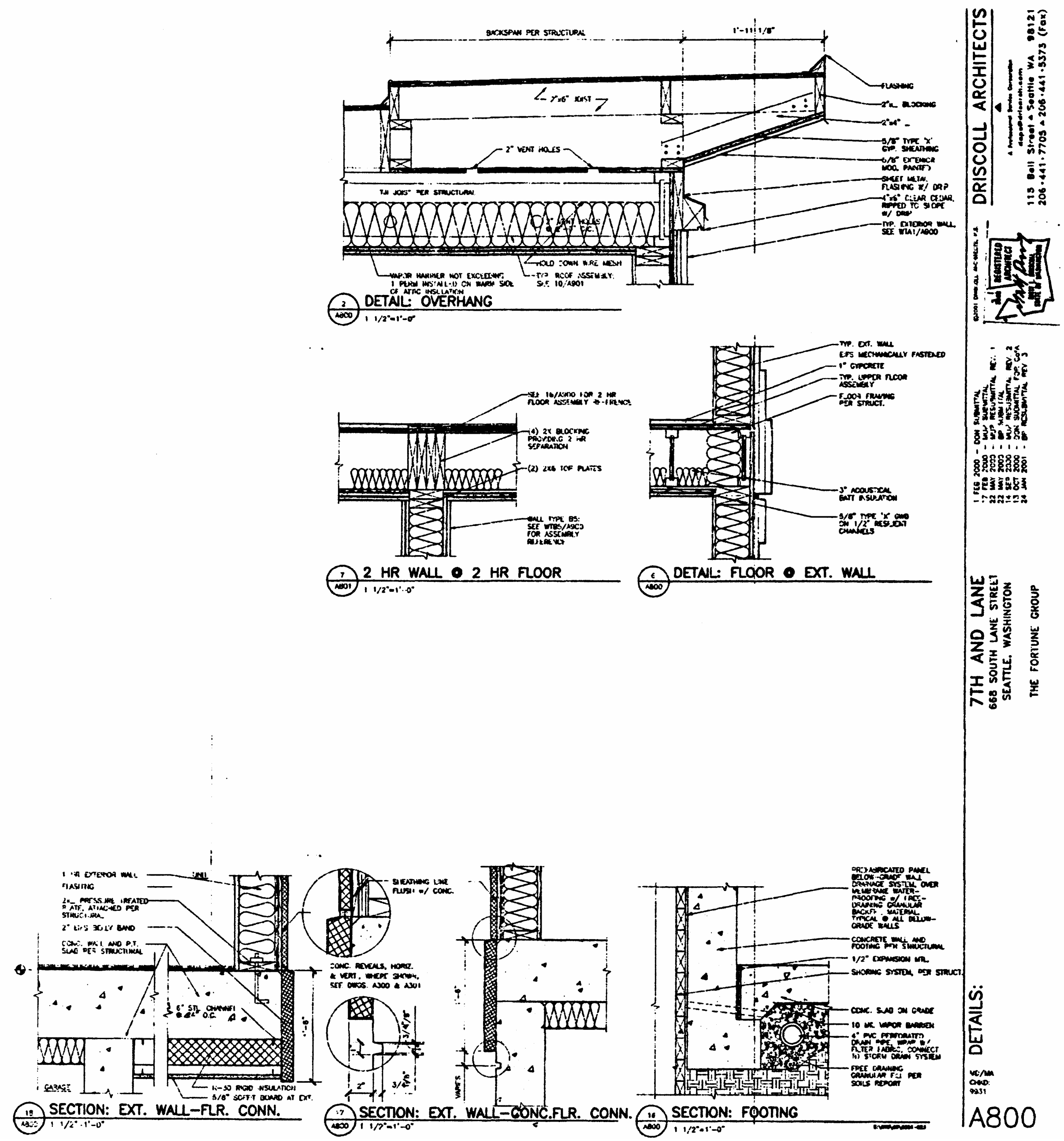
7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP

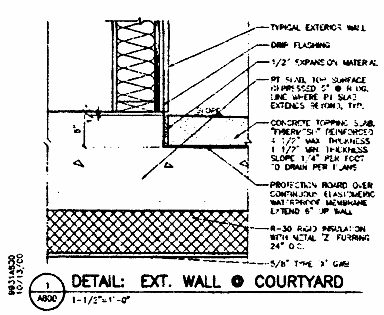
SECTION: C–C

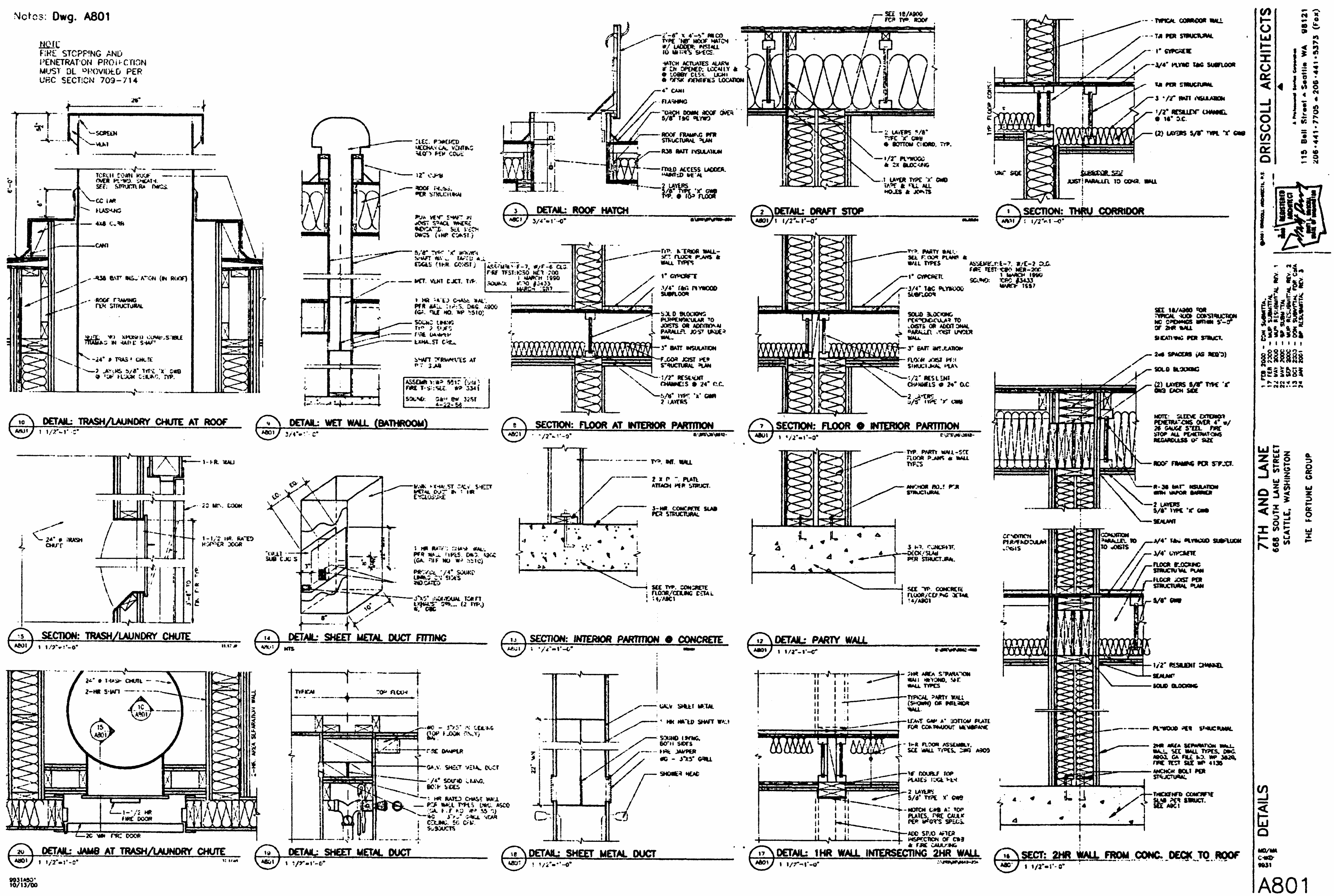
A312

Notes: dwg. A800

NOTE
FIRE STOPPING AND PENETRATION PROTECTION MUST BE PROVIDED PER UBC SECTION 709-7.4 DETAILS WILL BE SUBMITTED BY THE ARCHITECT PRIOR TO INSTALLATION FOR BLDG. DEPARTMENT APPROVAL.

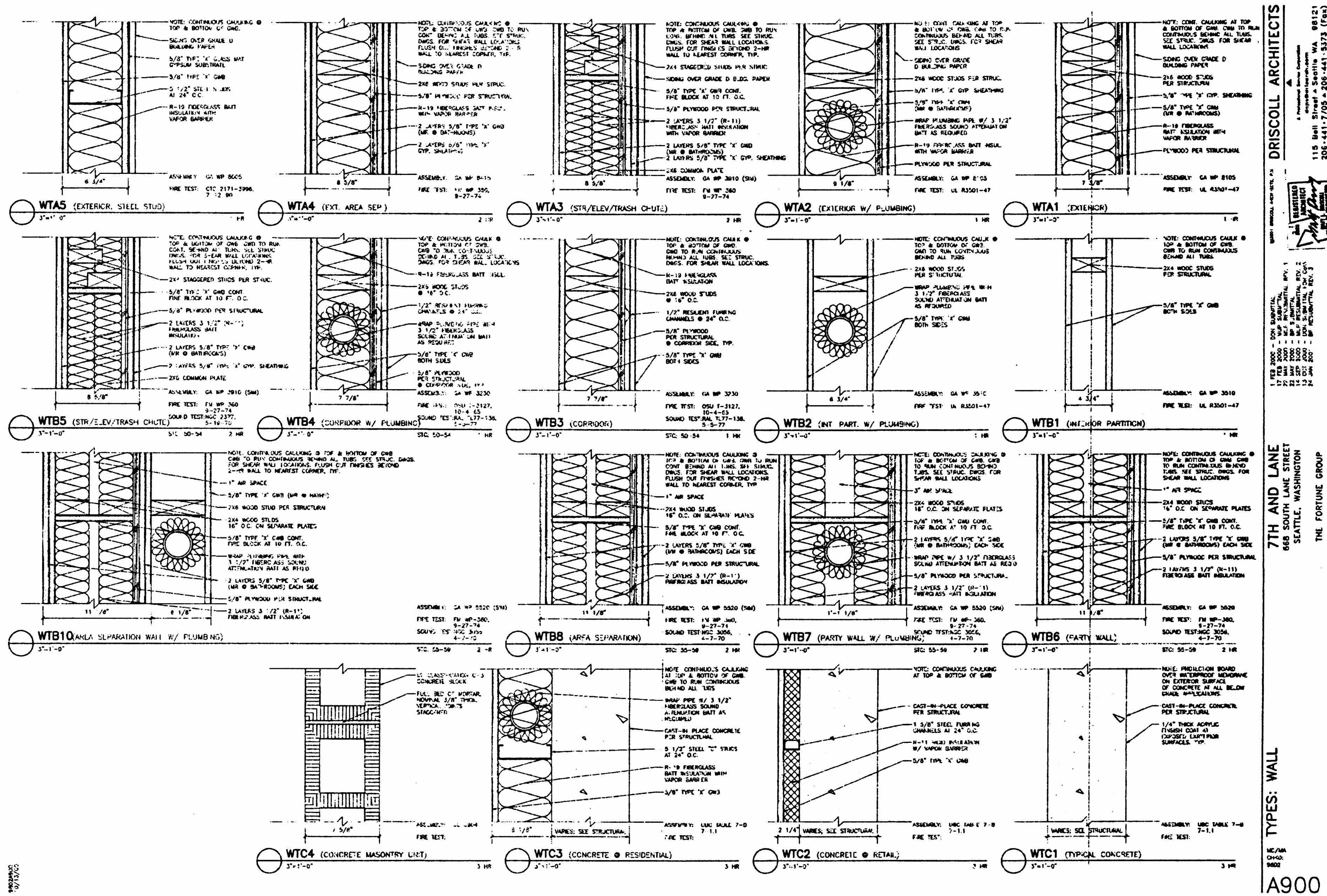


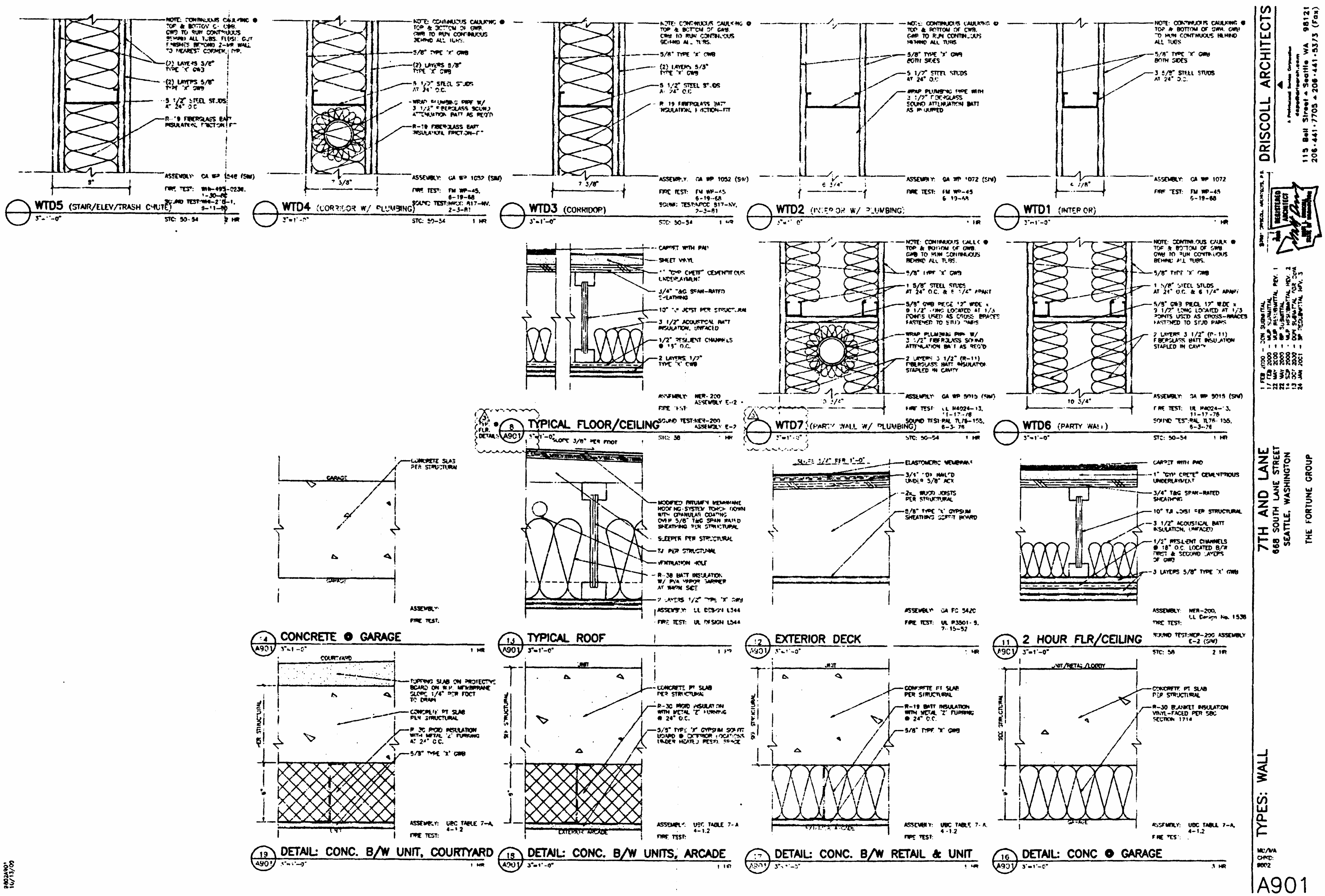




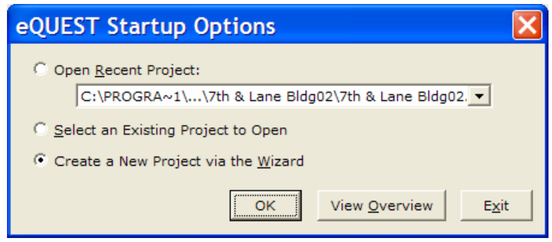
eQUEST Hands-On Example

Mixed Use, Retail /Multi-Family Residential


DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206-441-7705 • 206-441-5373 (Fax)
7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP
TYPES: WALL
A900
WTA1 (EXTERIOR)
WTA2 (EXTERIOR W/ PLUMBING)
WTA3 (STR/ELEV/TRASH CHUTE)
WTA4 (EXT. AREA SEP.)
WTA5 (EXTERIOR, STEEL STUD)
WTB1 (INTERIOR PARTITION)
WTB2 (INT. PART. W/ PLUMBING)
WTB3 (CORRIDOR)
WTB4 (CORRIDOR W/ PLUMBING)
WTB5 (STR/ELEV/TRASH CHUTE)
WTB6 (PARTY WALL)
WTB7 (PARTY WALL W/ PLUMBING)
WTB8 (AREA SEPARATION)
WTB10 (AREA SEPARATION WALL W/ PLUMBING)
WTC1 (TYPICAL CONCRETE)
WTC2 (CONCRETE @ RETAIL)
WTC3 (CONCRETE @ RESIDENTIAL)
WTC4 (CONCRETE MASONRY UNIT)

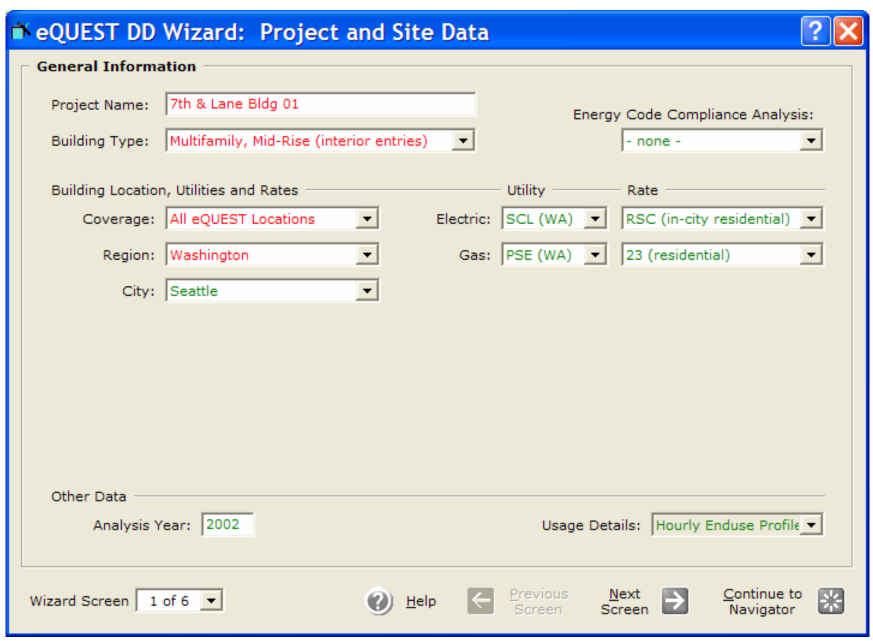

WTD5 (STAIR/ELEV/TRASH CHUTE)
WTD4 (CORRIDOR W/ PLUMBING)
WTD3 (CORRIDOR)
WTD2 (INTERIOR W/ PLUMBING)
WTD1 (INTERIOR)
TYPICAL FLOOR/CEILING
WTD7 (PARTY WALL W/ PLUMBING)
WTD6 (PARTY WALL)
CONCRETE @ GARAGE
TYPICAL ROOF
EXTERIOR DECK
2 HOUR FLR/CEILING
DETAIL: CONC. B/W UNIT, COURTYARD
DETAIL: CONC. B/W UNITS, ARCADE
DETAIL: CONC. B/W RETAIL & UNIT
DETAIL: CONC @ GARAGE
DRISCOLL ARCHITECTS
115 Bell Street • Seattle WA 98121
206·441·7705 • 206·441·5373 (Fax)
7TH AND LANE
668 SOUTH LANE STREET
SEATTLE, WASHINGTON
THE FORTUNE GROUP
TYPES: WALL
A901

Launch eQUEST and select to create a new project via the Wizard



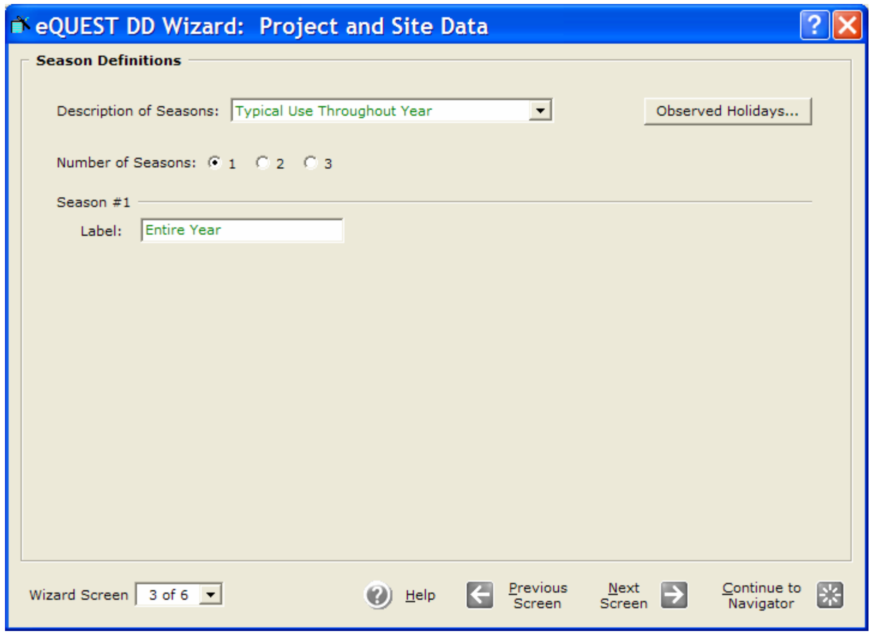
Since this example project involves building footprints that are different in shape (1st floor vs remaining floors), select to use the Design Development Wizard

Name your project (this will become the file name, too). Select the Building Type as indicated. Select the weather location to be Seattle Washington. If this weather file is not on your machine, it will be automatically downloaded from the doe2.com ftp site when you start the simulation.



Accept default seasons: for multifamily, this is one season per year.

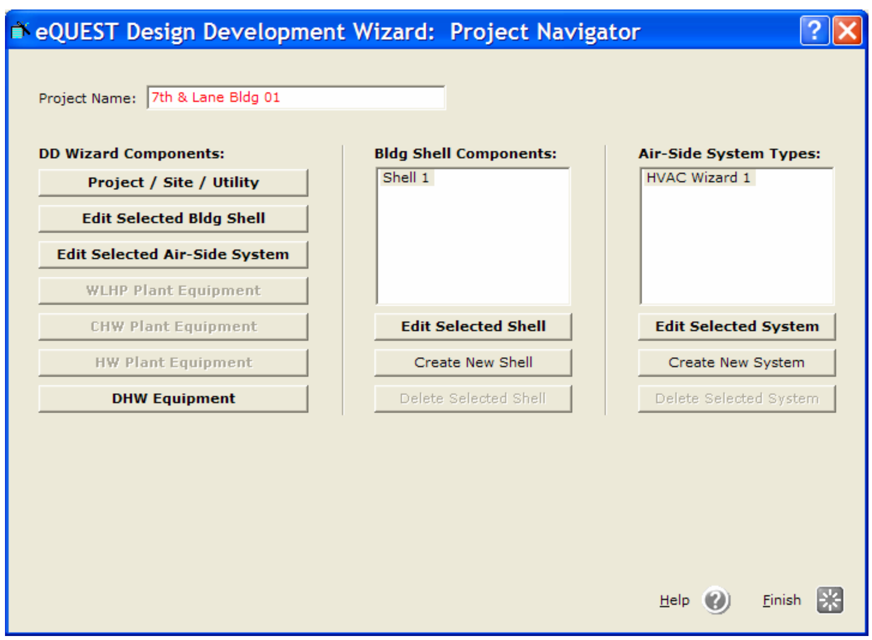
Select "Continue to Navigator" to proceed to the DD Navigator.



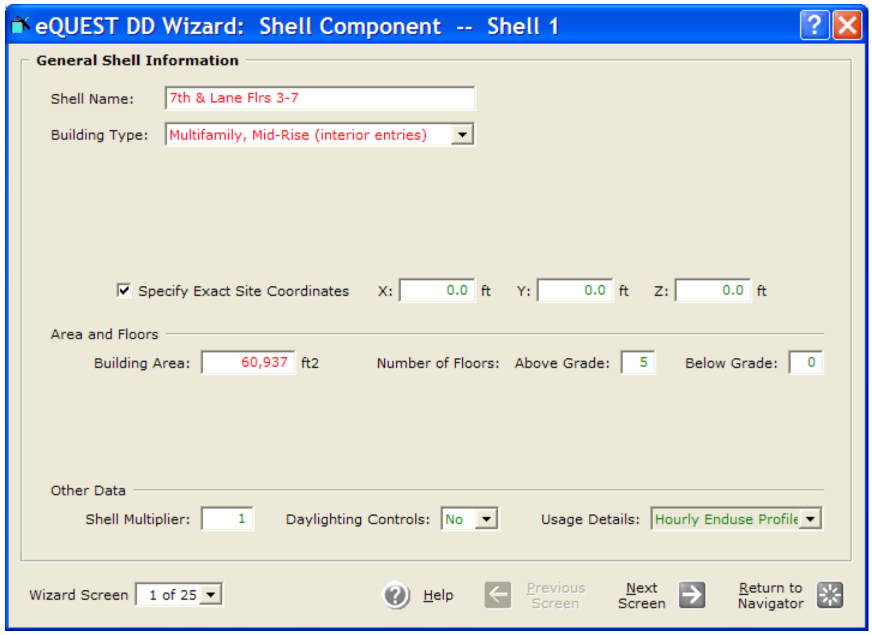
Use the DD Navigator to navigate between shell-related screens and building services screens.

Return to the previous screens by selecting "Project/Site/Utility".

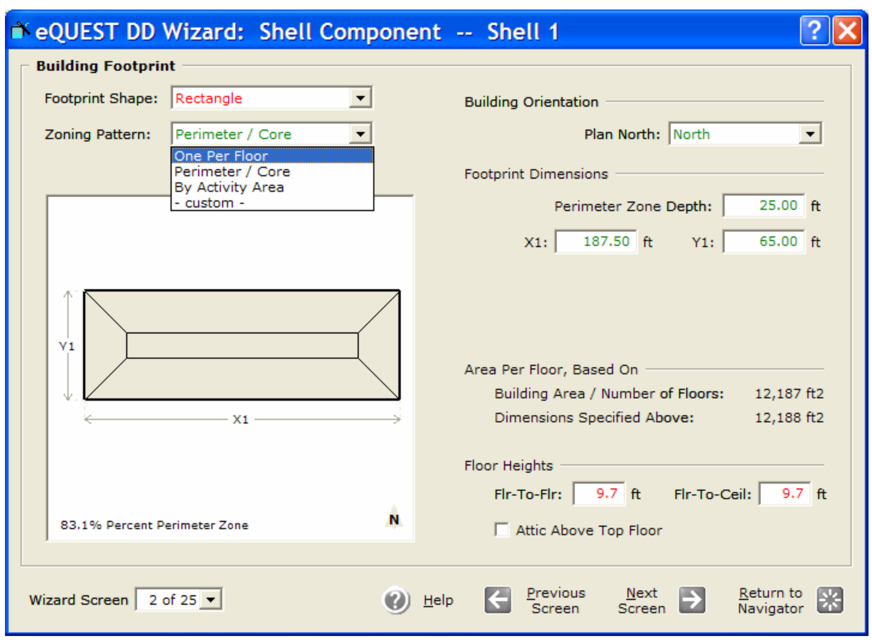
Select "Edit Selected Bldg Shell" to begin the shell description.



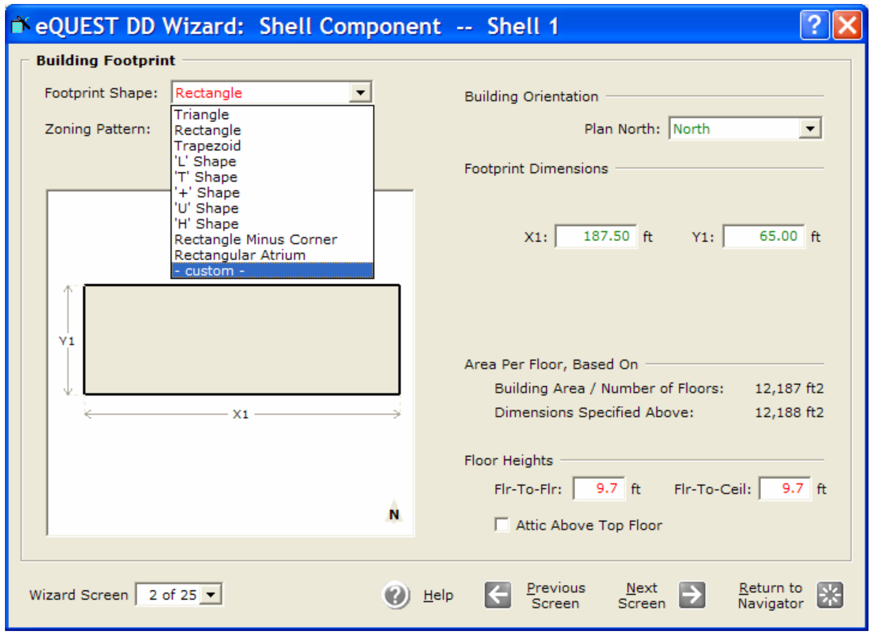
This first envelope component will be floors 3 through 7. Specify the total area for floors 3-7 as indicated. Allow the number of floors to default (5 for midrise).



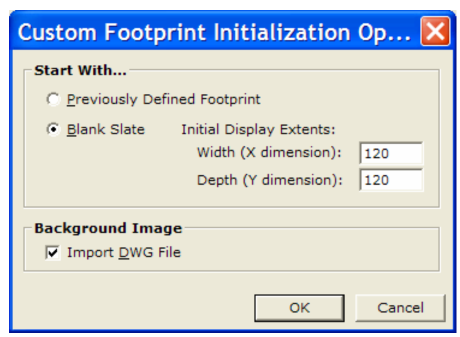
From the Building Footprint screen, temporarily select the Zoning Pattern to be "One per Floor". This will simplify a future step.



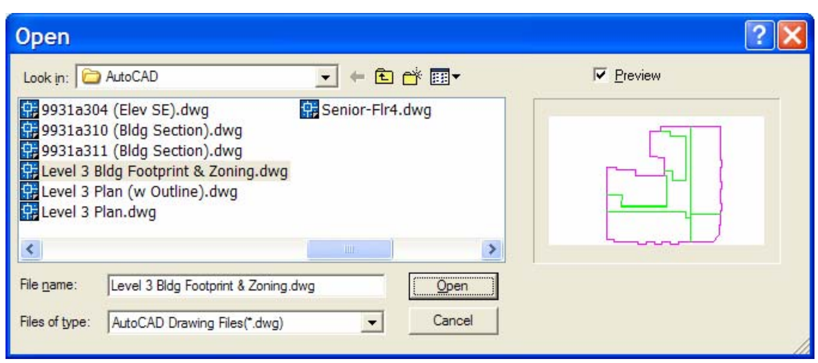
To create a custom floor footprint shape, from the Footprint Shape control, select "custom"



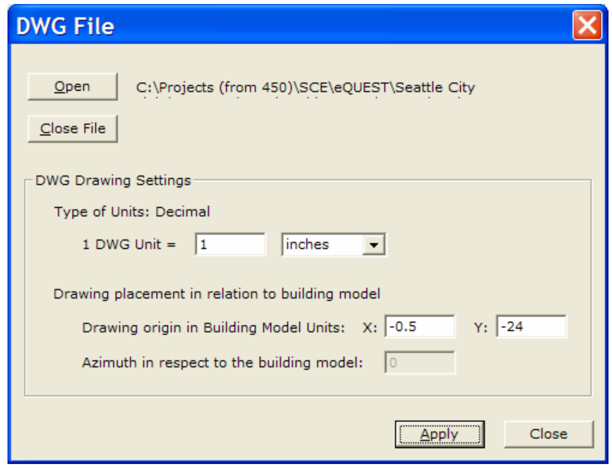
To create a completely custom footprint, indicate "blank slate". Set display extents as preferred. Check the "Import DWG File" control.



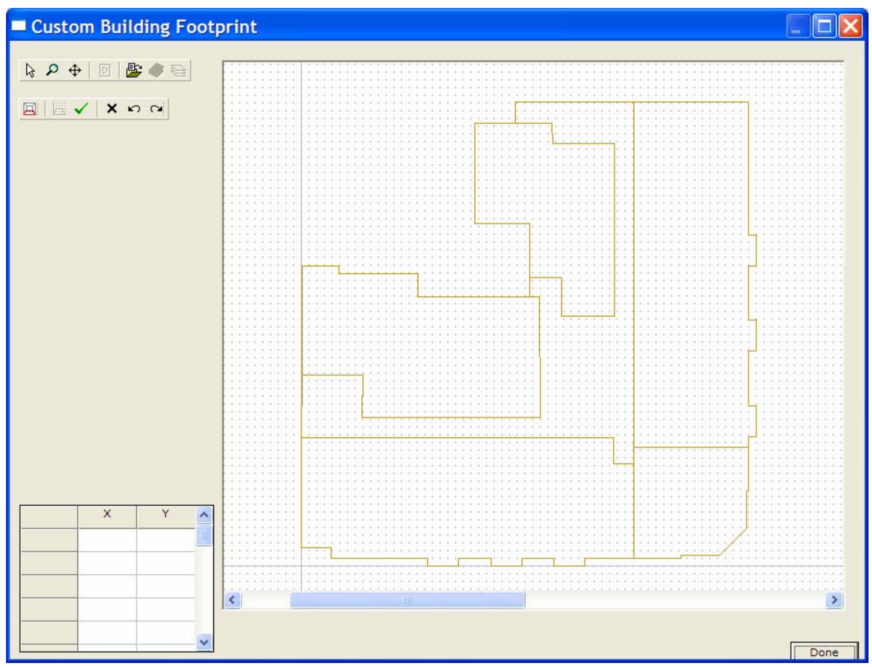
From the DWG file import browse dialog, select to import the "Level 3 Bldg Footprint & Zoning" DW file.



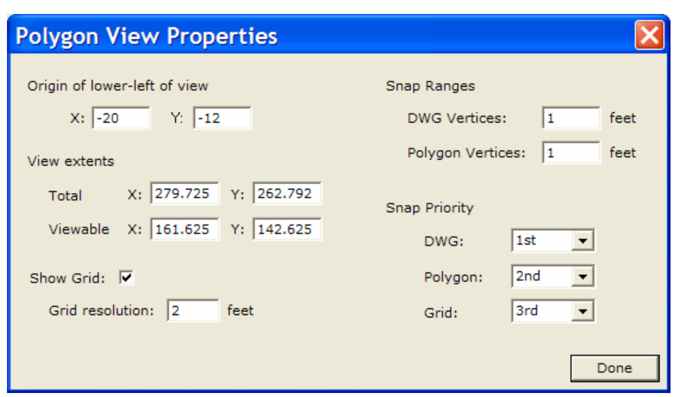
DWG file drawing units can vary, however, 1 drawing unit = 1 inch is most common. Press "Apply", then "Close".



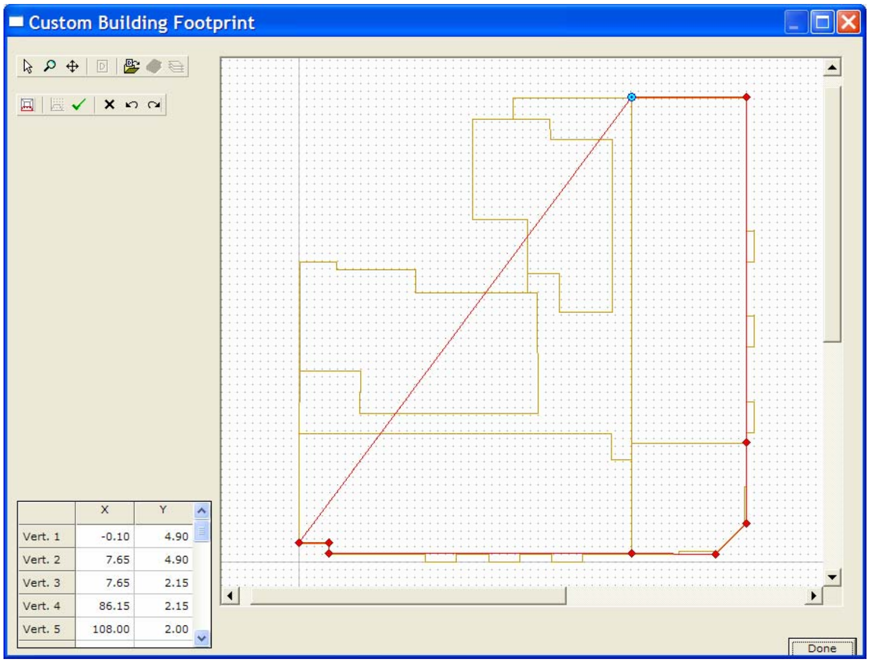
This should result in an image similar to the one at right. Use the pan button (the 4-headed arrow) and zoom button (the magnifying glass) to size the display and position the DWG image to your satisfaction.



Set/confirm snap priorities… to trace around the image, set DWG as the 1st priority.

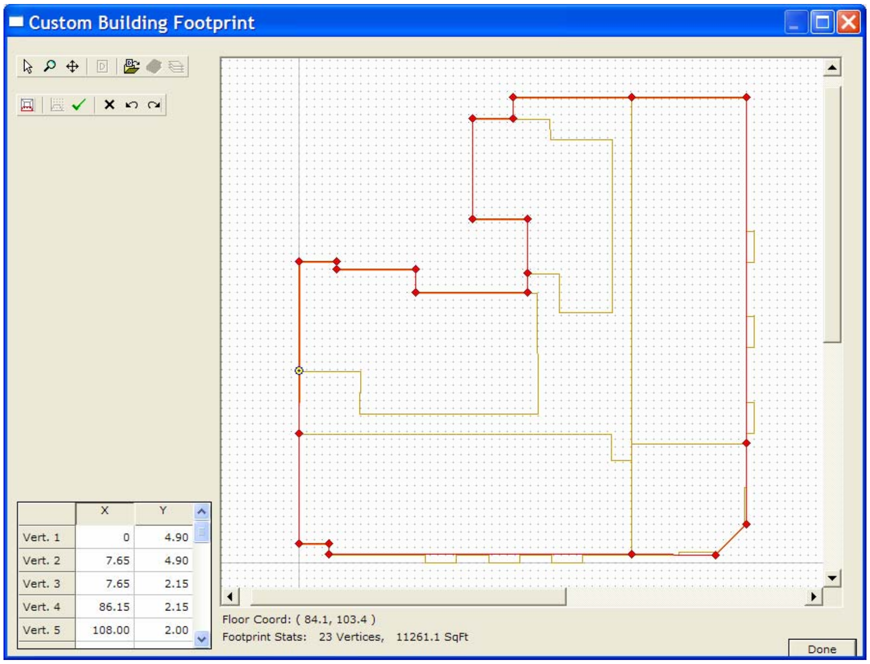


Beginning near the lower left corner of the image, trace around the floor footprint by dragging the active vertex counterclockwise around the image. Let go of the vertex at each point you snap to.

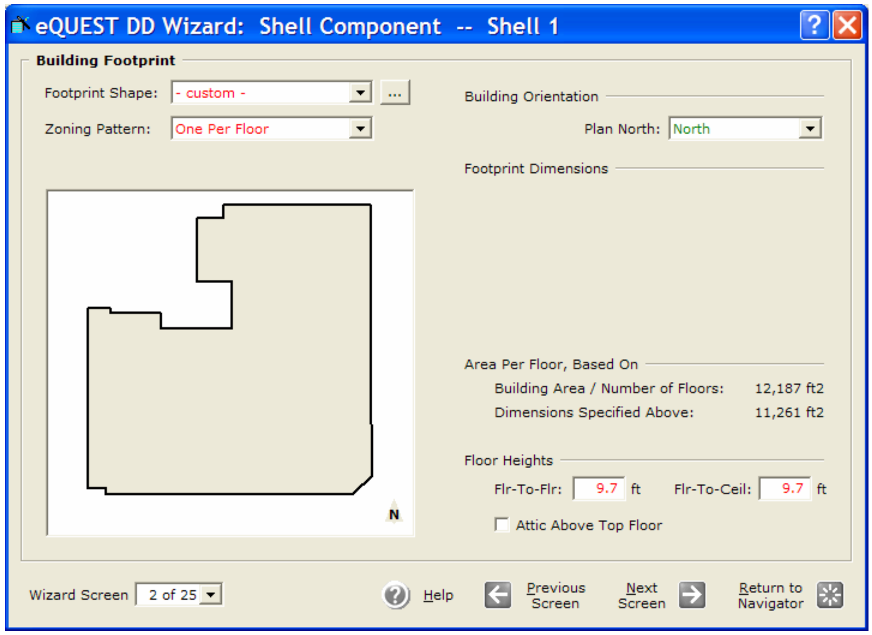


Once you have completed tracing around the floor image, click on the "Done" button.

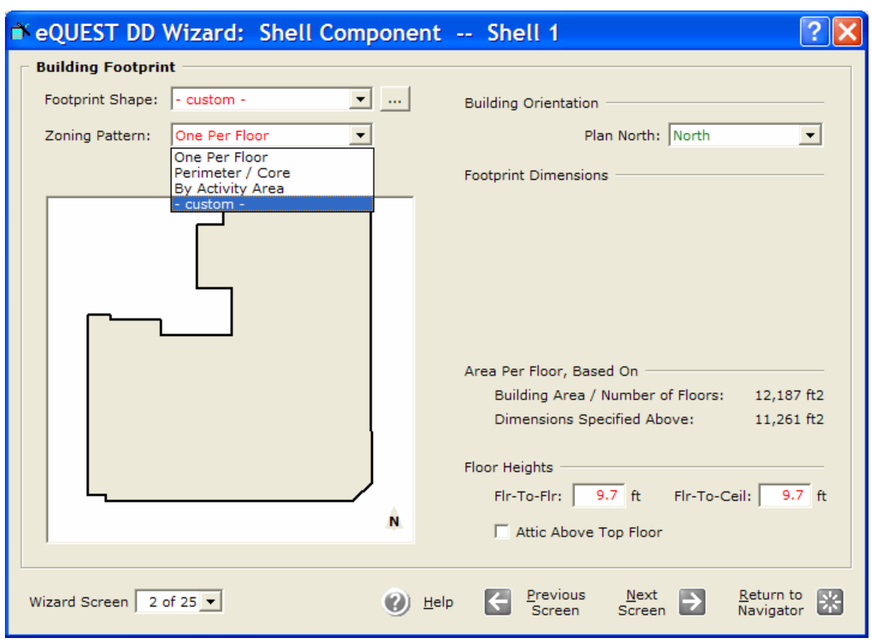
NOTE: You should <u>not</u> click on the origin to complete the trace



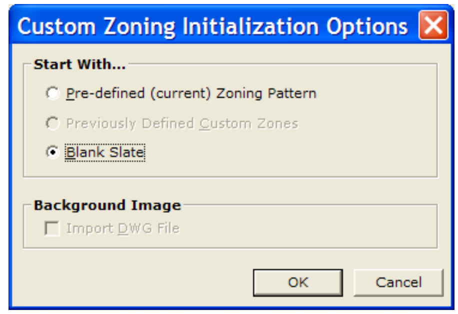
This image illustrates the completed custom floor footprint image with one zone per floor zoning.



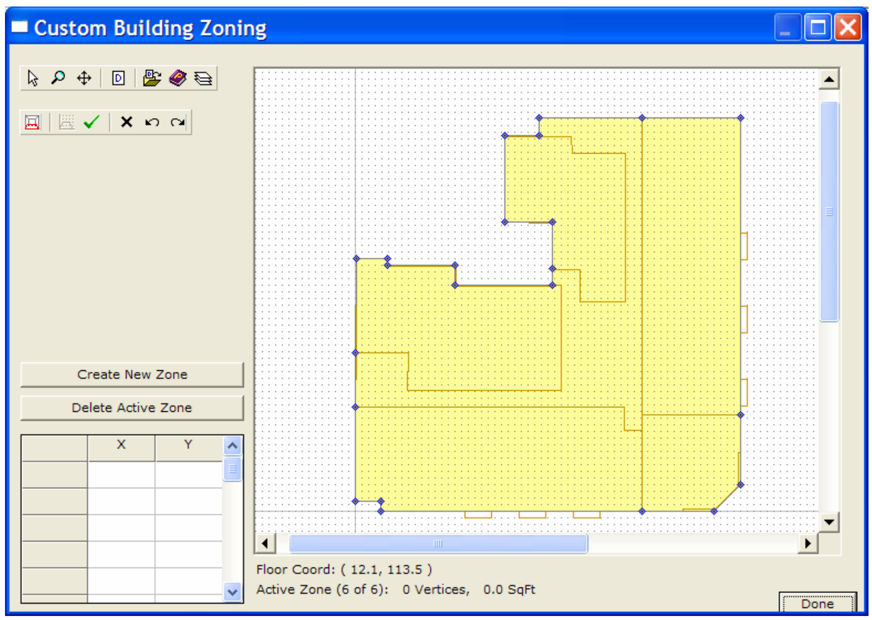
To initiate custom zoning, select "custom" form the Zoning Pattern control.



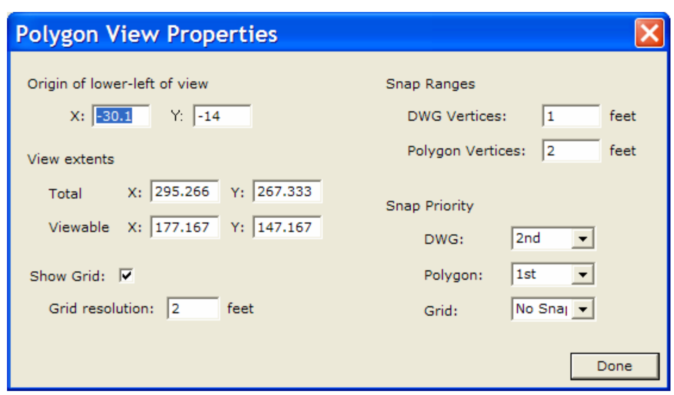
Similar to the building footprint process, select "Blank Slate" to create completely custom zoning.



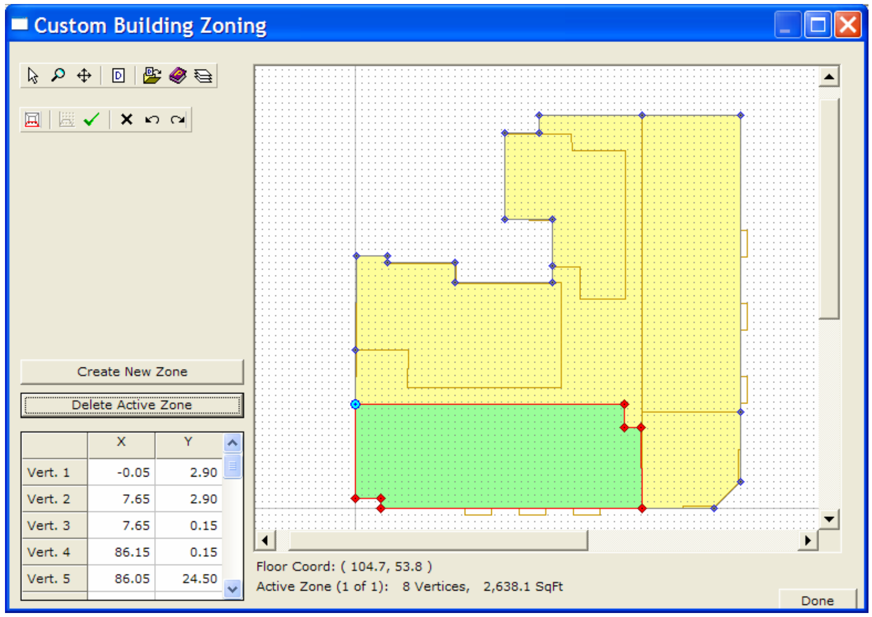
The whole floor image, ready to populate with zones, should appear similar to the image a right.



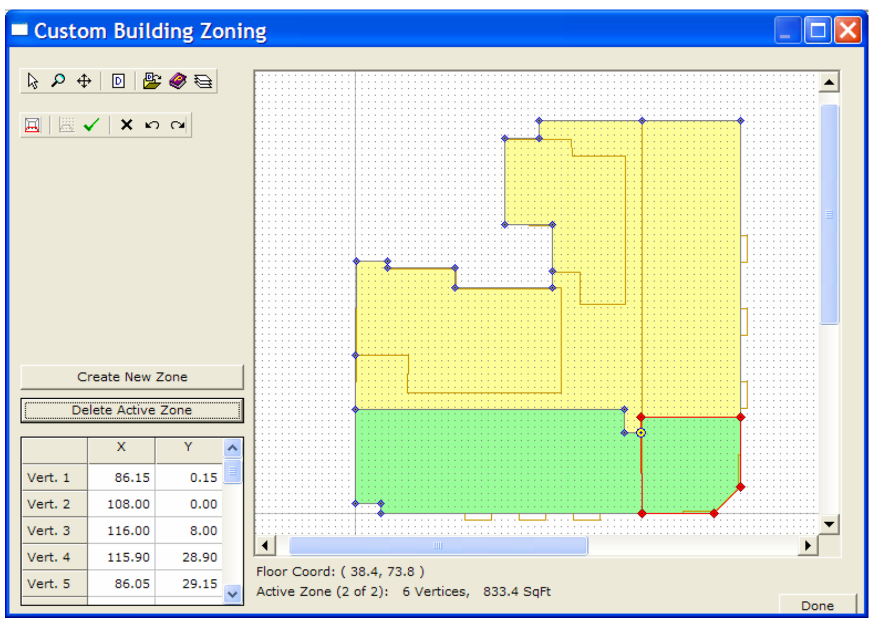
Adjust the Polygon View Properties to give Polygon snap first priority. Increase the Snap Range for the polygon.



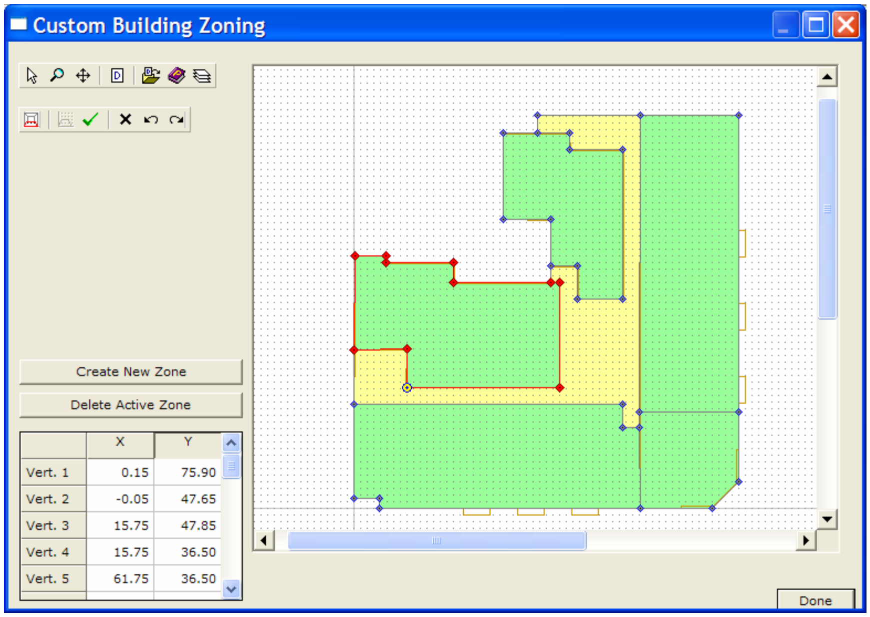
Click on "Create New Zone", the starting at the lower left corner of the image, trace the first zone (counter clockwise) using the same drag-and-drop technique as before (let go of the active vertex at each new snap location).



Continue adding new zones. Click on "Create New Zone" before each new zone.

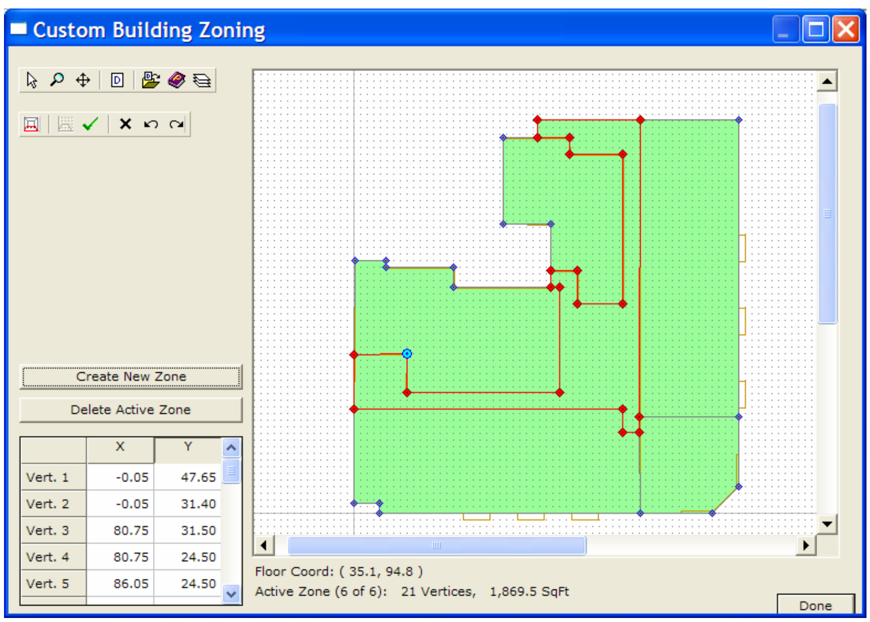


Continue as indicated.



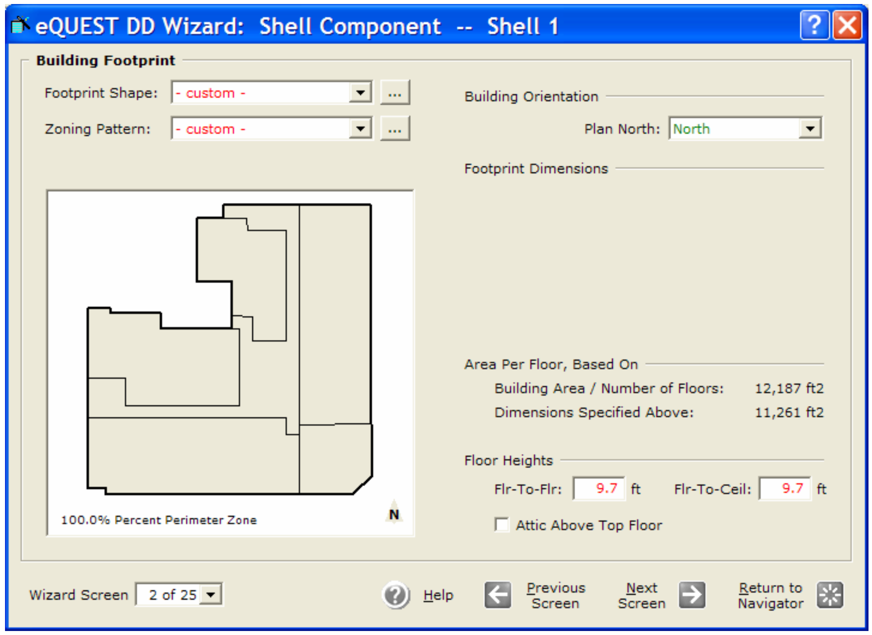
Continue as indicated until the floor footprint is fully populated with zones.

Click on "Done" to return to the main building footprint wizard screen.

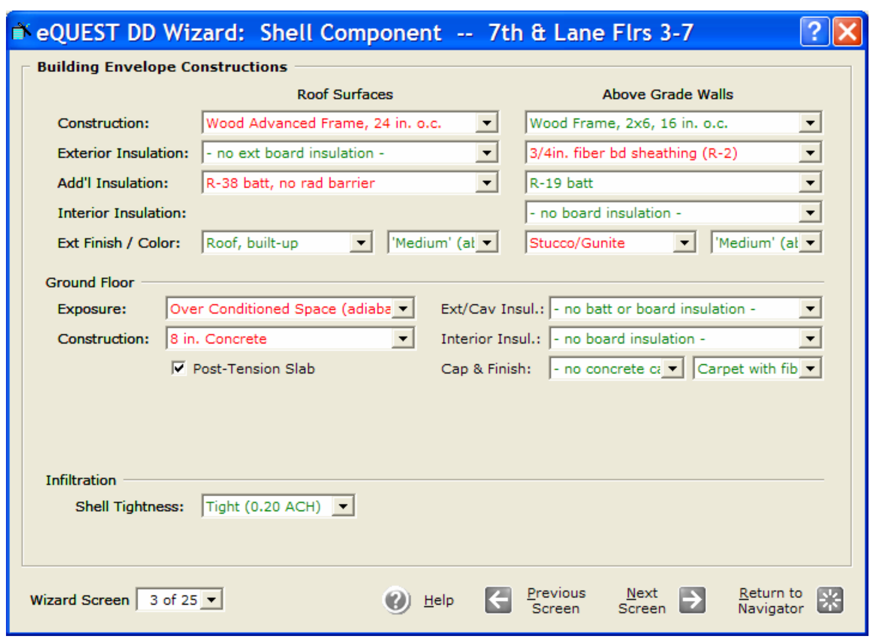


The Building Footprint screen now shows the custom zoning pattern.

Specify the Floor-to-Floor and Floor-to-Ceiling height as indicated.



Provide inputs as indicated for roof, exterior wall, “ground” floor (lowest floor for this shell), and infiltration.

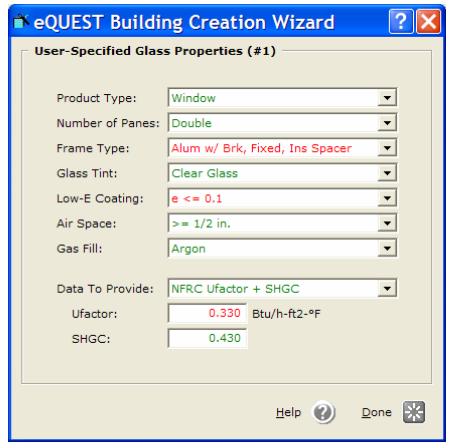


Provide inputs as indicated for interior surfaces.

For the purpose of this example, we will assume that there are no doors in this building shell component.

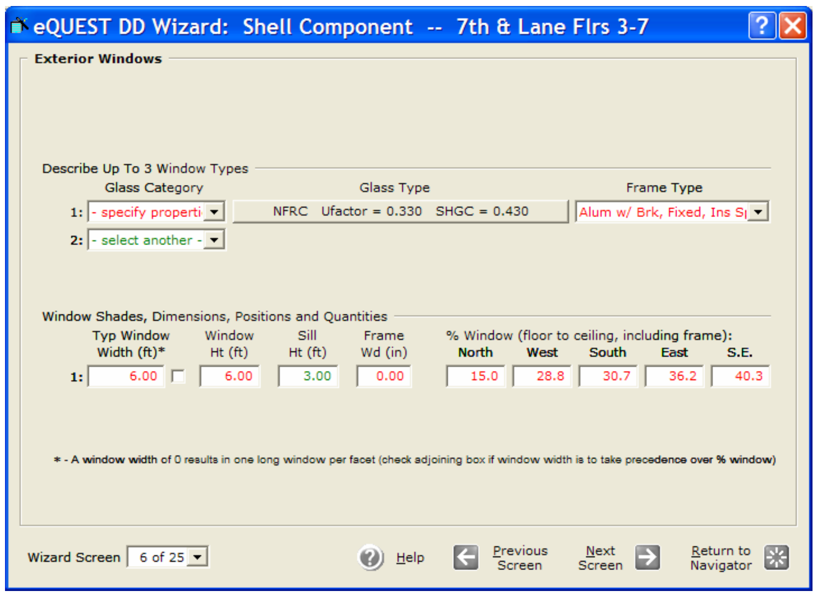
Select “specify properties” (see screen below), then indicate the NFRC U-Factor.

Note that the glass properties inputs above the U-Factor field help determine the default U-Factor and SHGC.



Describe the typical window width, height and sill height as indicated.

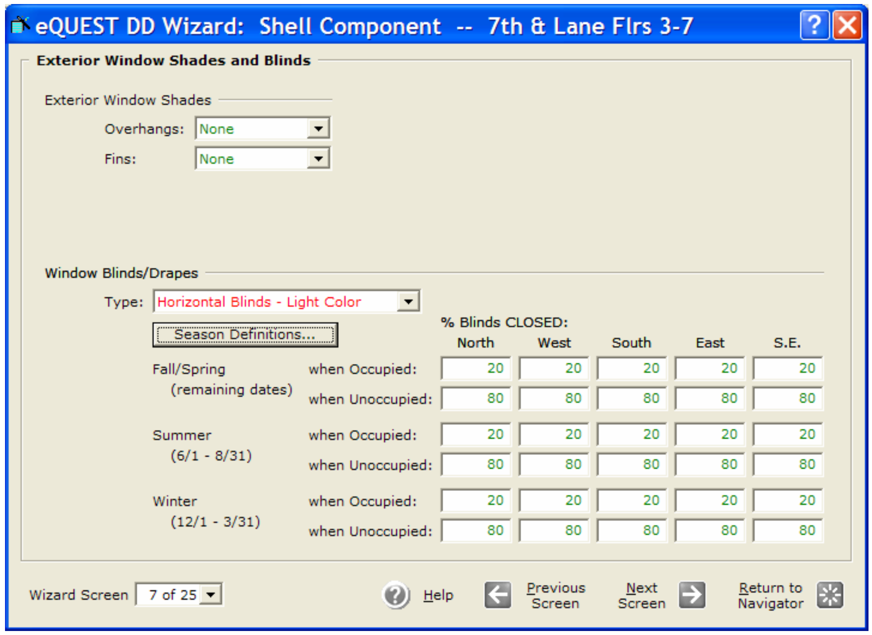
Specify the window-wall ratio for the windows, by orientation, as indicated.



From the Exterior Window Shades and Blinds screen (next page), select “Seasonal Definitions”, then specify up to three seasons, as indicated.

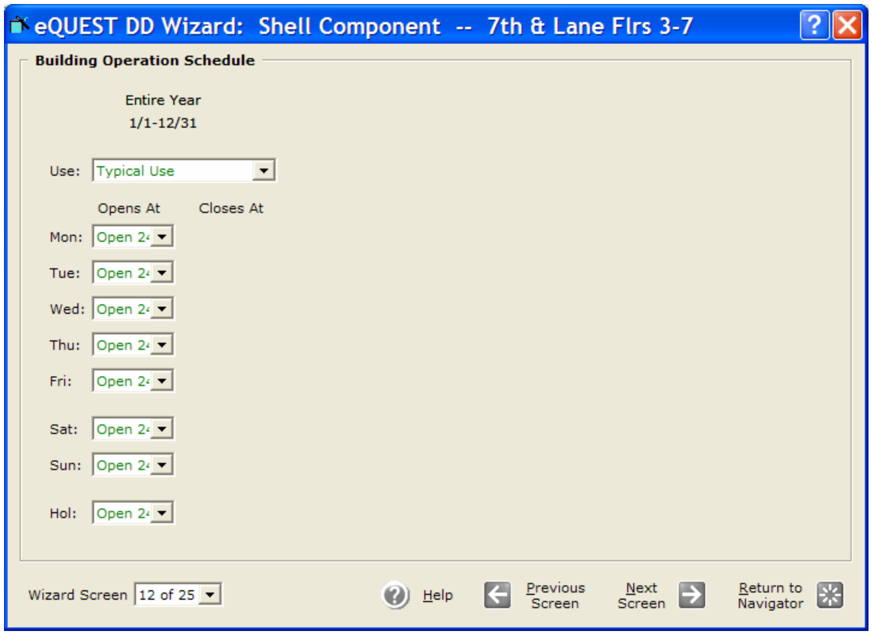
Note that these seasons are different than the seasons specified in the Project & Site dialogs.

Modify the percent Blinds Closed as desired to account for occupant use of internal shading.

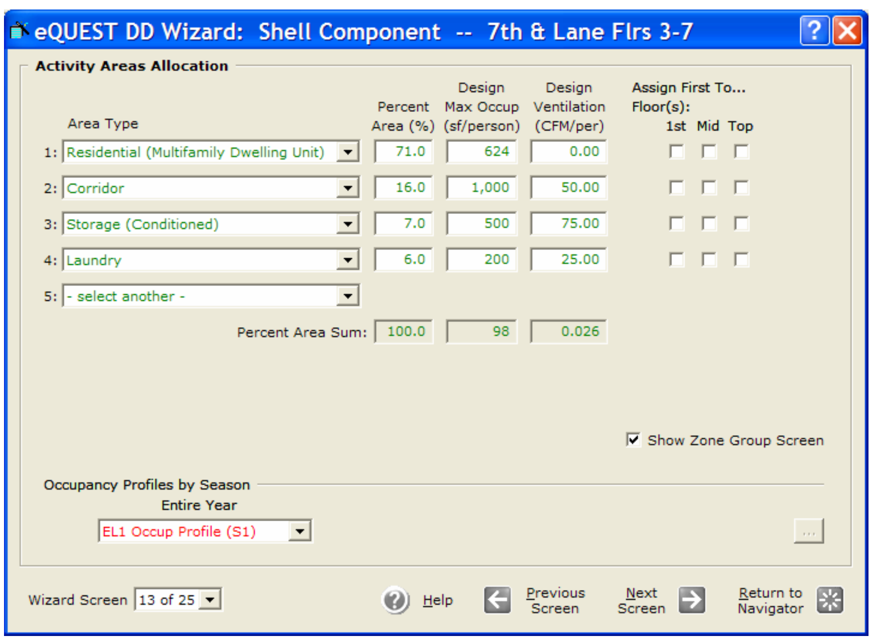


No skylights are included in the example project.

Accept the default occupancy schedule (i.e., for multifamily, occupied 24 hours/day).

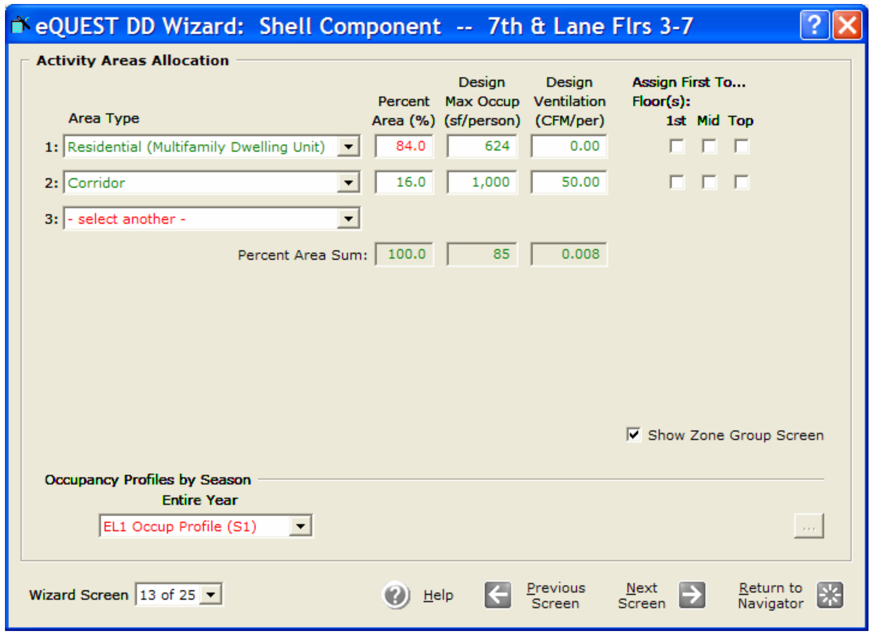


Modify the default activity areas and percent area allocations (as shown at right)… see the following screen.



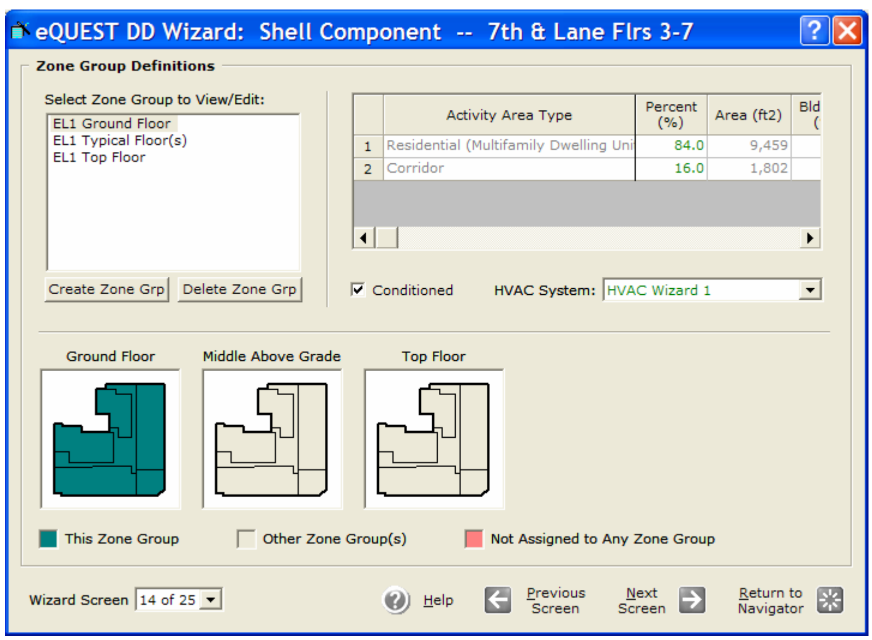
Eliminate unused activity area assignments by selecting “select another” as needed.

Specify Percent Area as indicated.



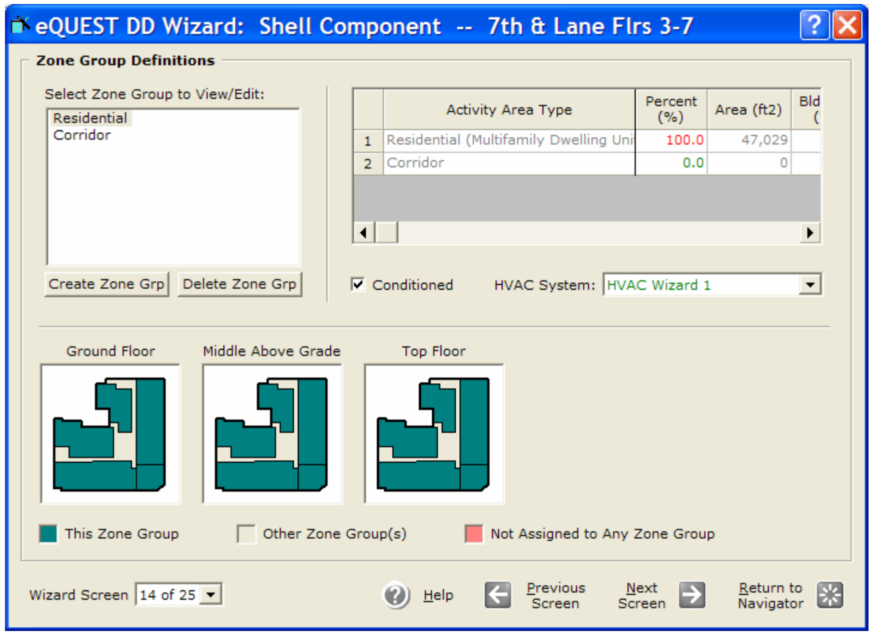
Use the Group Definitions screen to assign activity areas and HVAC systems to specific areas of the project.

Start by deleting the existing (default) zone groups. Define two new zone groups (see the following screen).

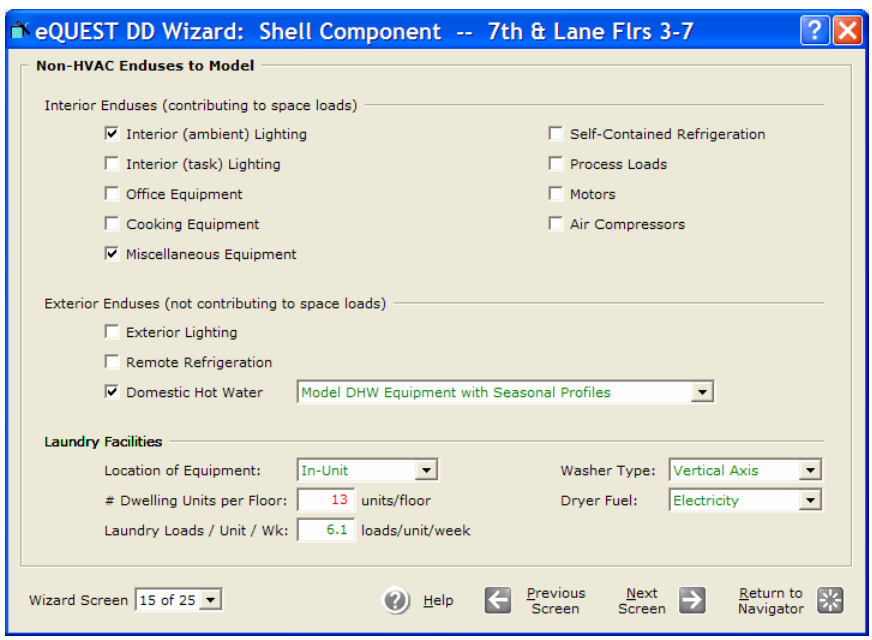


Define two new Zone Groups (by clicking "Create Zone Grp").

Assign zones to these Zone Groups by clicking on the preferred zone in the diagram, then selecting to assign the zone to the current zone group.



Use this screen to indicate which non-HVAC end uses will be included in the project.



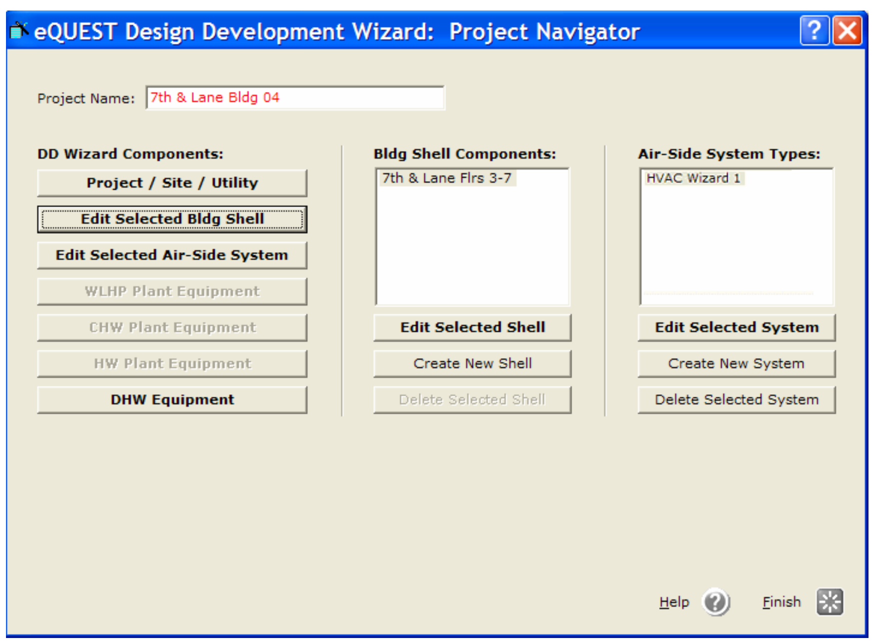
Specify lighting power as desired.

Specify plug loads as desired.

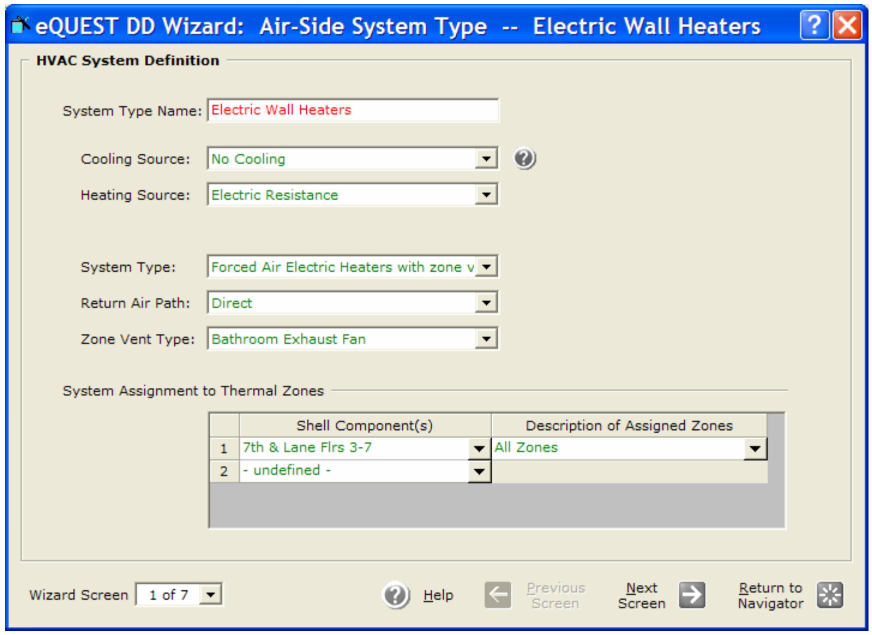
This screen serves to specify the schedule profile to be used to govern hot water demands.

The description of the first shell component is now completed.

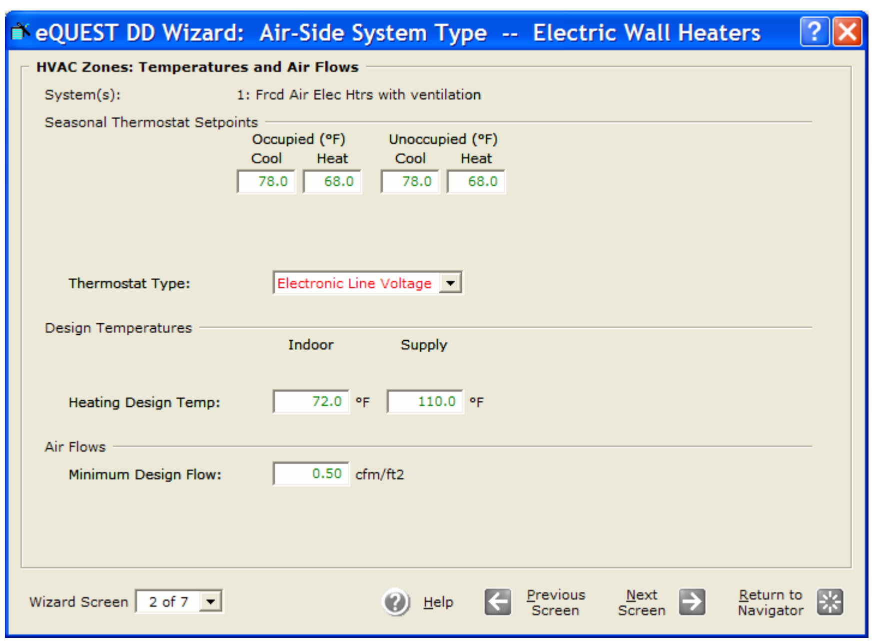
To edit an HVAC system, click on "Edit Selected System".



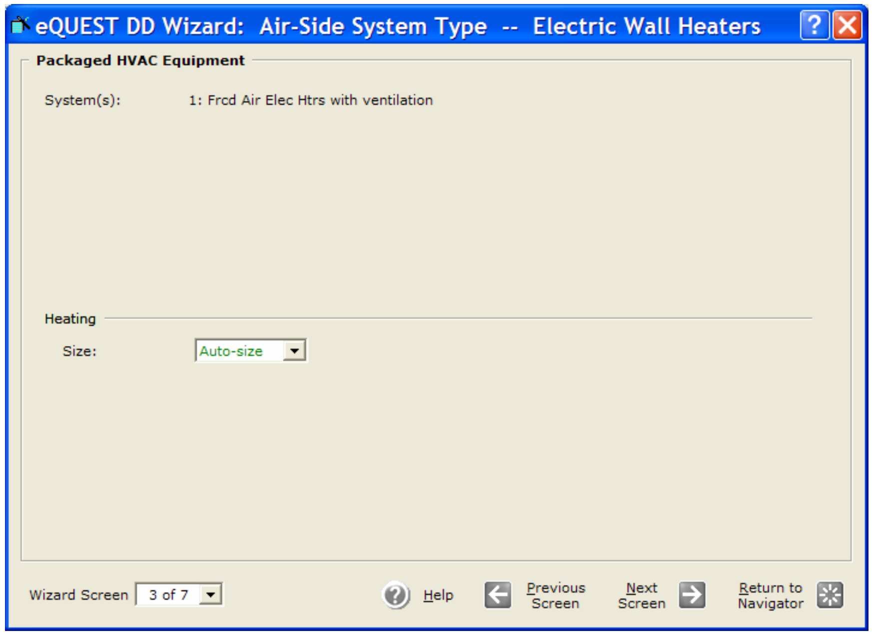
Specify the name and attributes for the heater systems serving the residential units. Note that most of the defaults for the inputs are sufficient.



Indicate thermostat type to be consistent with City Light Built Smart requirements.

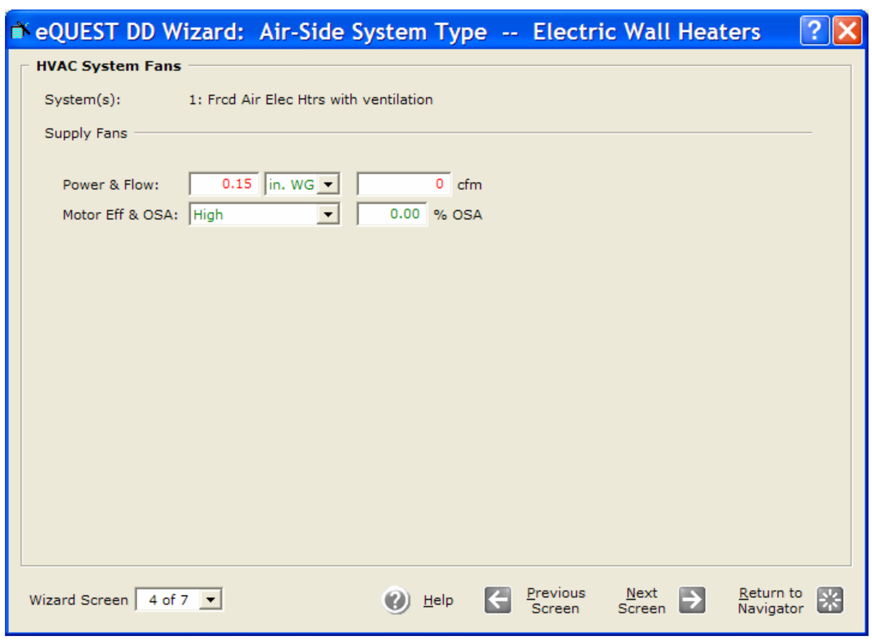


Allow the heating system to be sized by DOE-2/eQUEST.

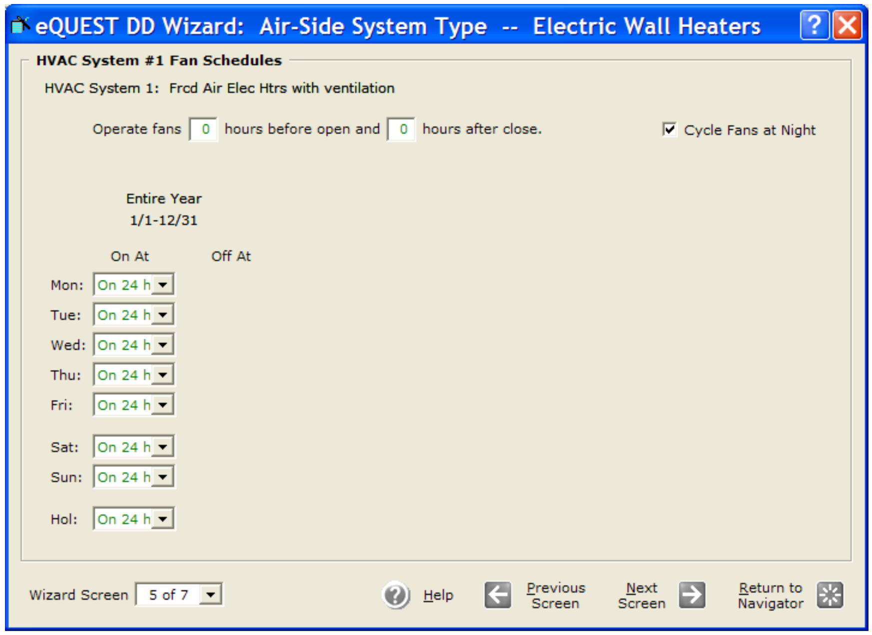


To allow DOE-2 to size the air flow, input a zero ("0") for fan supply flow (cfm).

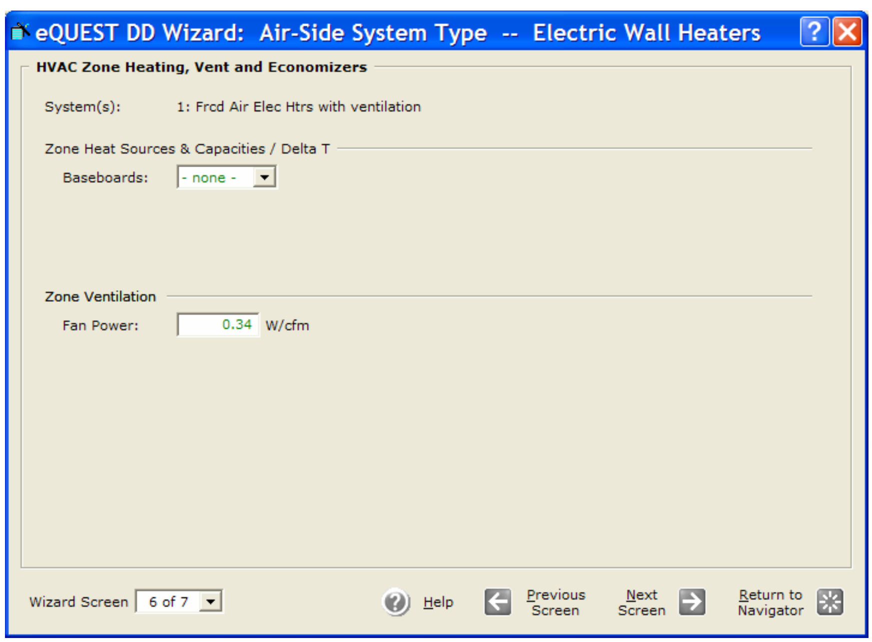
Reduce the default total fan static pressure from 1" to 0.15", to be more representative of these small units.



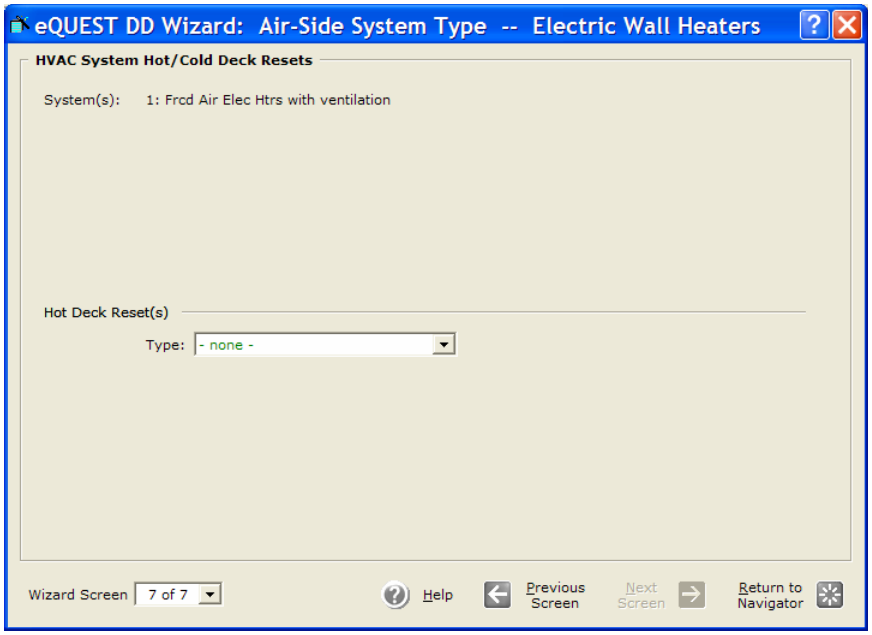
Accept default system operations scheduling.



Accept default values for baseboards ("none"), and zone ventilation fan power.

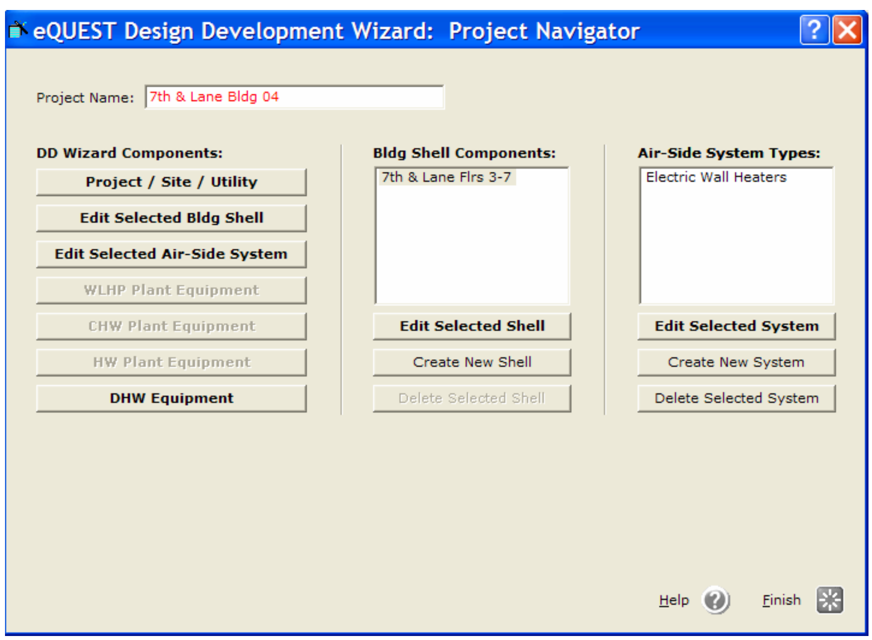


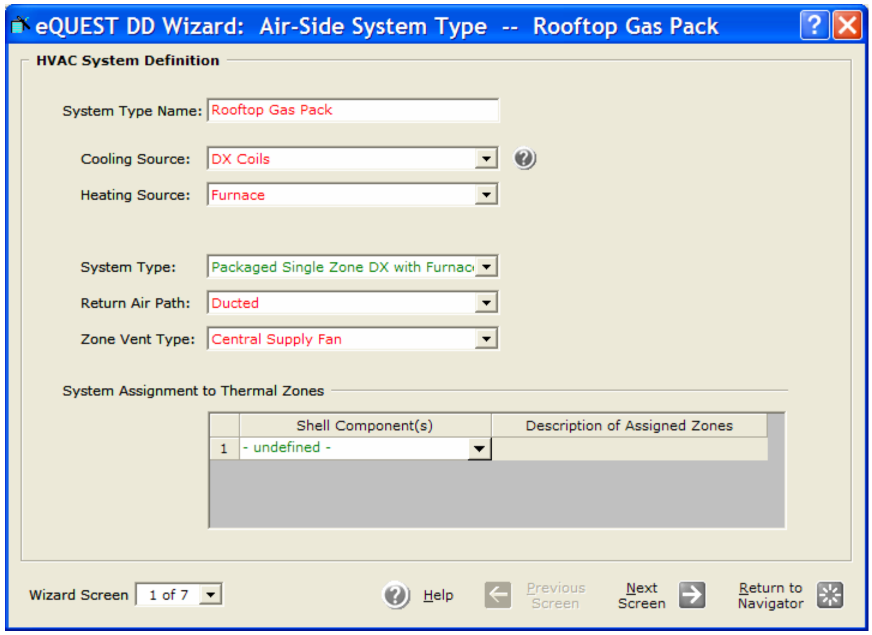
Hot Deck resets will not apply to this simple residential electric furnace.

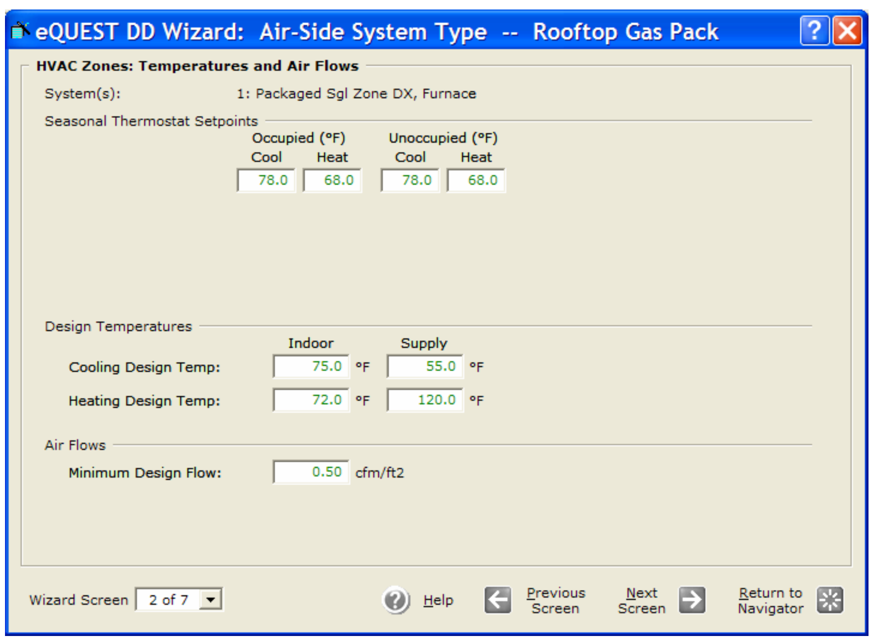


This completes the description of the first HVAC system type.

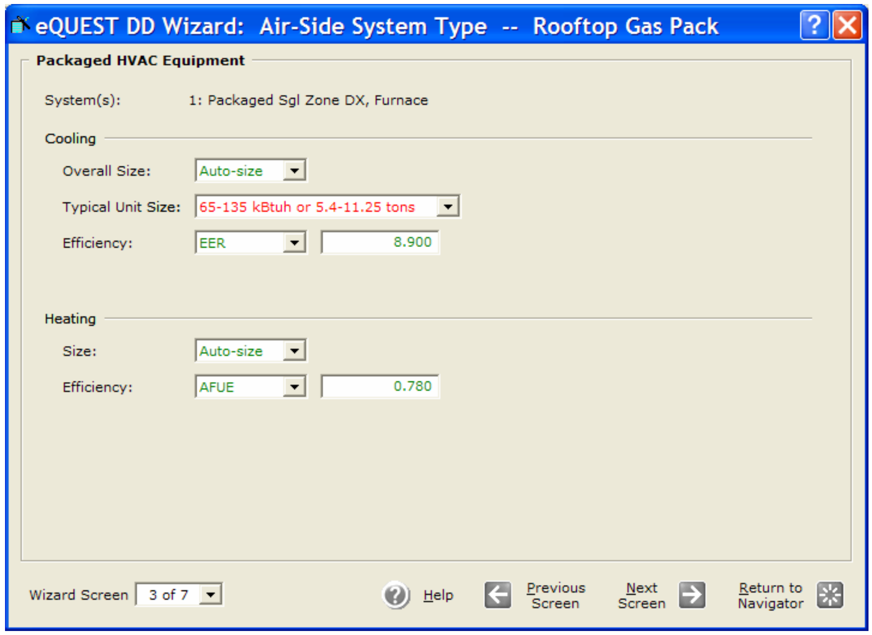
Proceed to describe a second HVAC system type (rooftop "gas packs" to serve the public corridor areas, as indicated on the screens on the following pages.




eQUEST DD Wizard: Air-Side System Type -- Rooftop Gas Pack
HVAC System Definition
System Type Name: Rooftop Gas Pack
Cooling Source: DX Coils
Heating Source: Furnace
System Type: Packaged Single Zone DX with Furnac
Return Air Path: Ducted
Zone Vent Type: Central Supply Fan
System Assignment to Thermal Zones
Shell Component(s)
Description of Assigned Zones
1
- undefined -
Wizard Screen
1 of 7
Help
Previous Screen
Next Screen
Return to Navigator

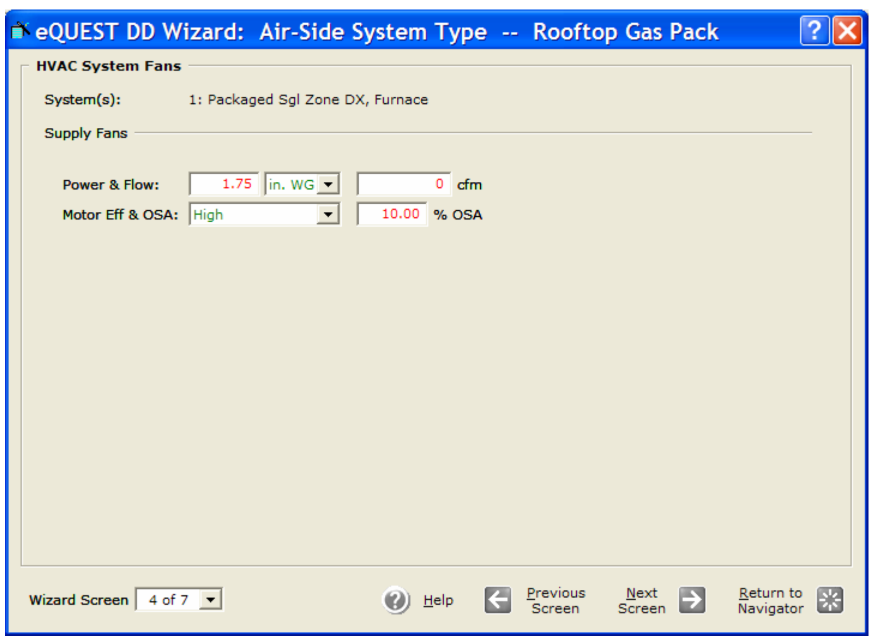

eQUEST DD Wizard: Air-Side System Type -- Rooftop Gas Pack
HVAC Zones: Temperatures and Air Flows
System(s): 1: Packaged Sgl Zone DX, Furnace
Seasonal Thermostat Setpoints
Occupied (°F)
Unoccupied (°F)
Cool Heat Cool Heat
78.0 68.0 78.0 68.0
Design Temperatures
Indoor
Supply
Cooling Design Temp: 75.0 °F 55.0 °F
Heating Design Temp: 72.0 °F 120.0 °F
Air Flows
Minimum Design Flow: 0.50 cfm/ft2
Wizard Screen
2 of 7
Help
Previous Screen
Next Screen
Return to Navigator

Indicating the typical unit size does not affect the automatically-sizing of the units, rather, it affects on the default minimum unit cooling and heating efficiency.

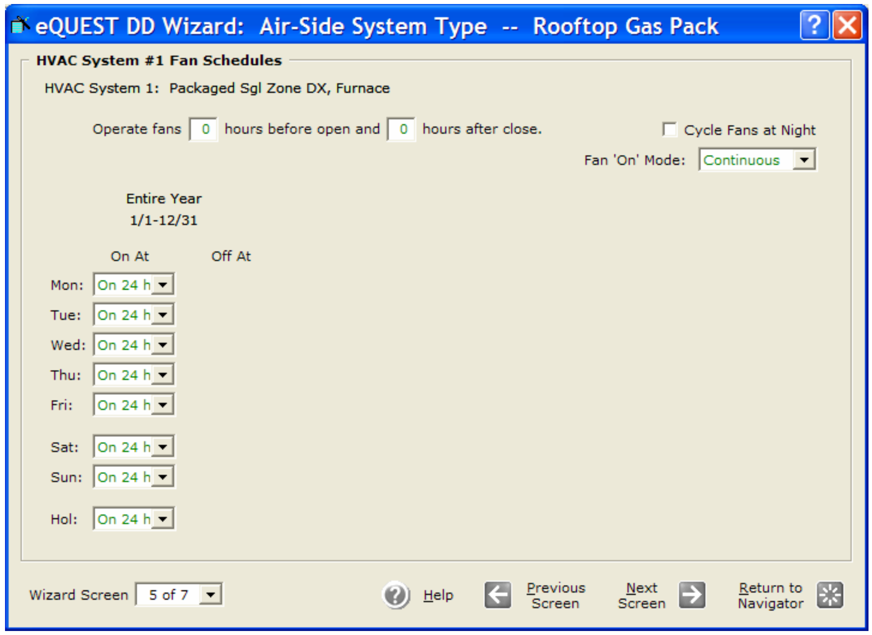


Increase the default total fan static from 1.25 (the default) to 1.75 to better approximate the proposed installation.

Enter a zero (“0”) for Supply Fan Flow to have DOE-2 size the unit(s) based on the hourly annual simulation loads.

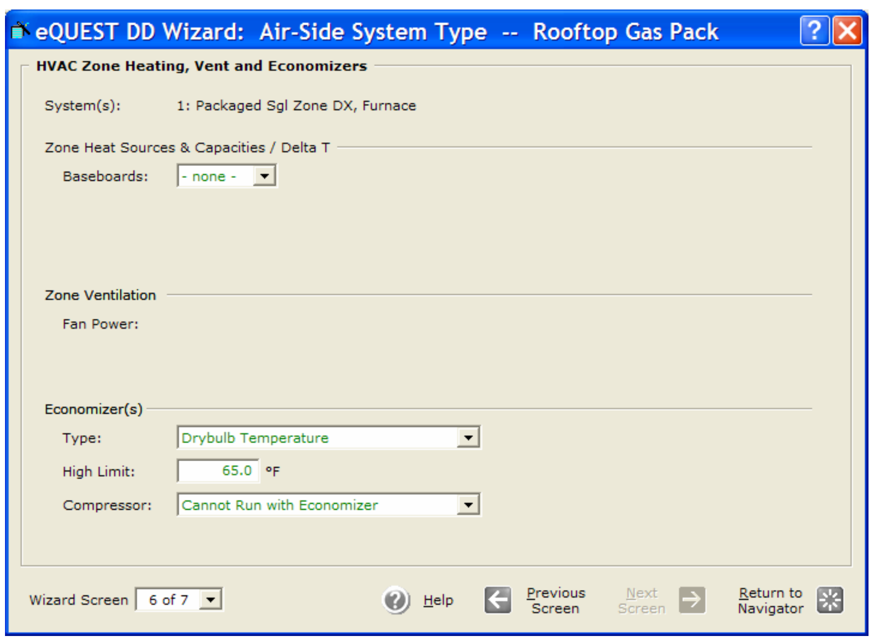


Accept default system operations scheduling.



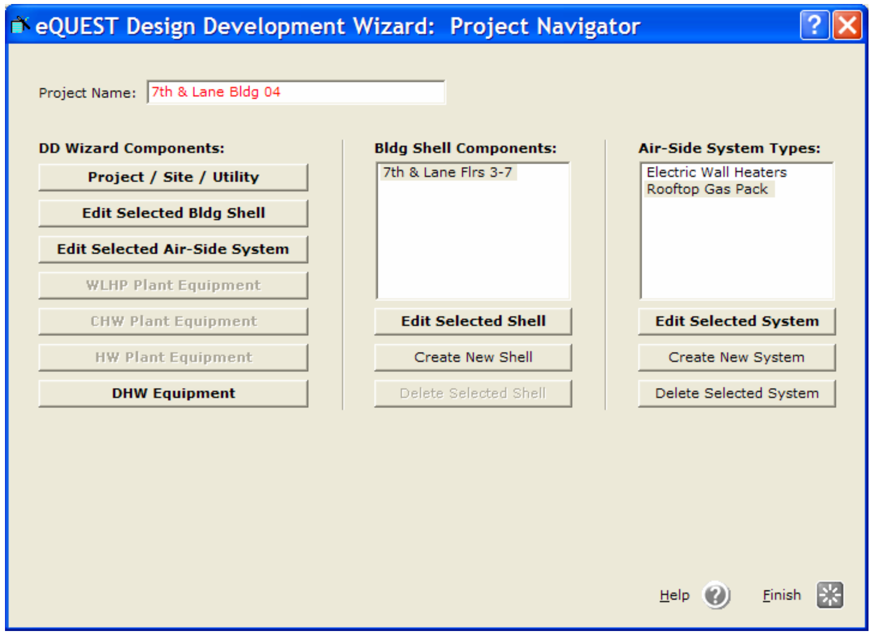
No baseboards are specified.

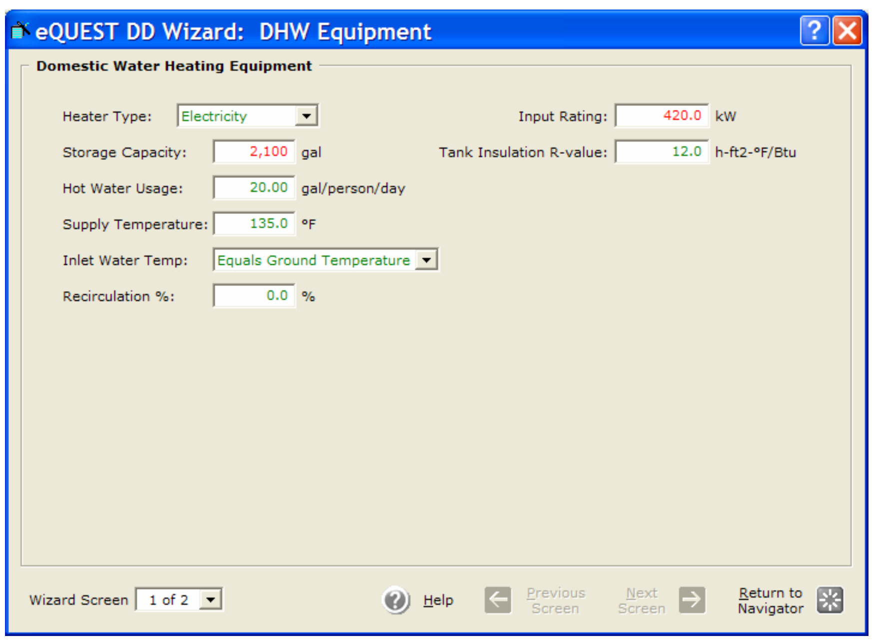
Accept the default provision for an air-side economizer.



This completes the description of the second HVAC system.

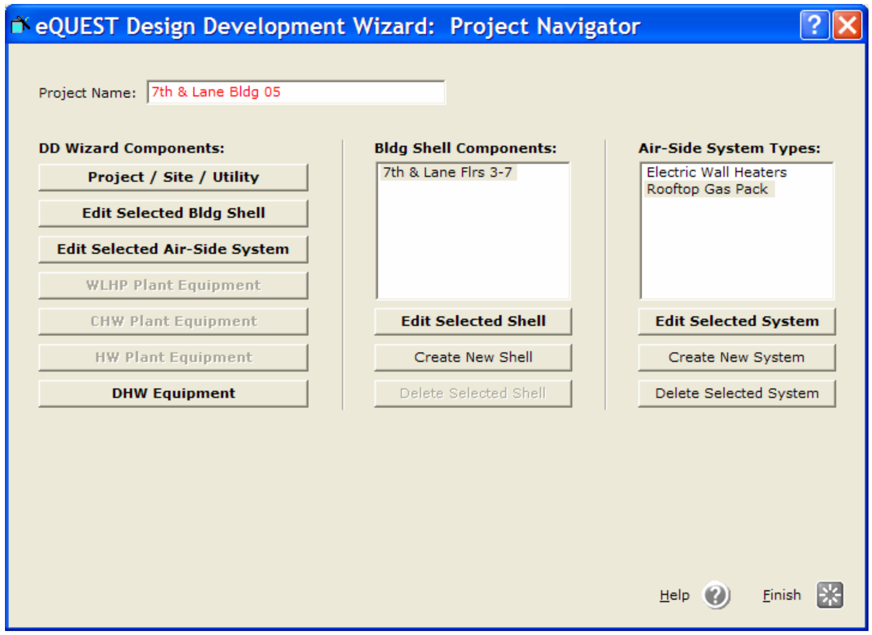
Proceed to describe the DHW equipment

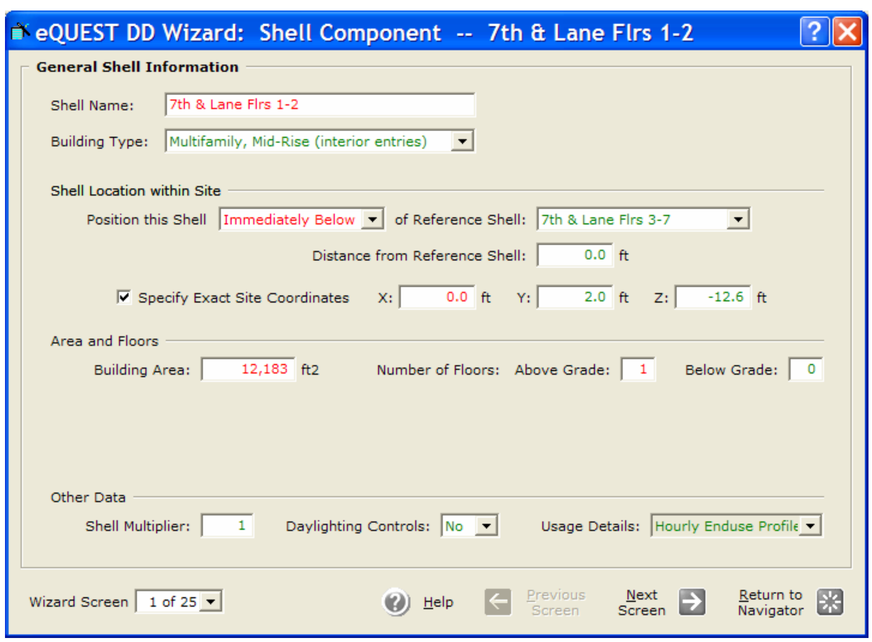


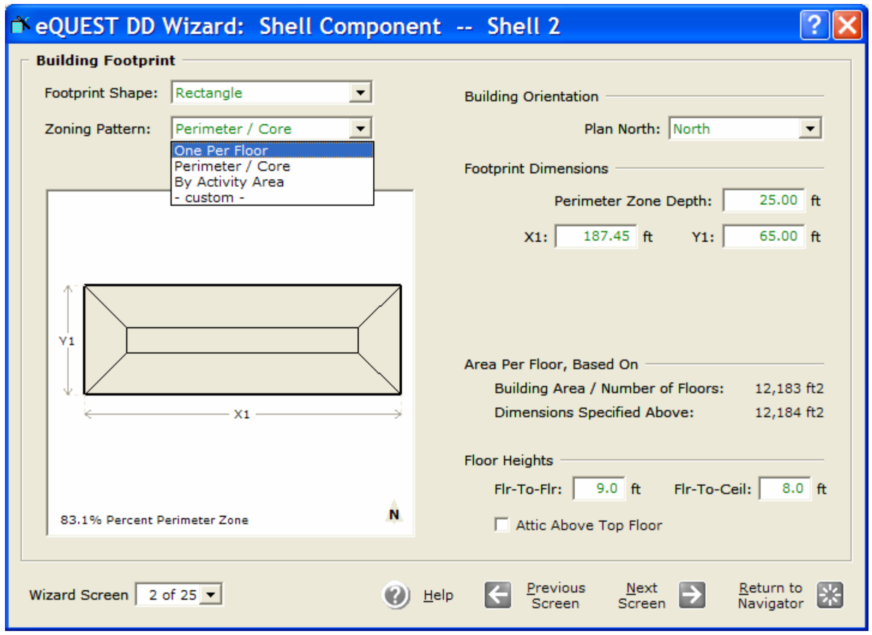


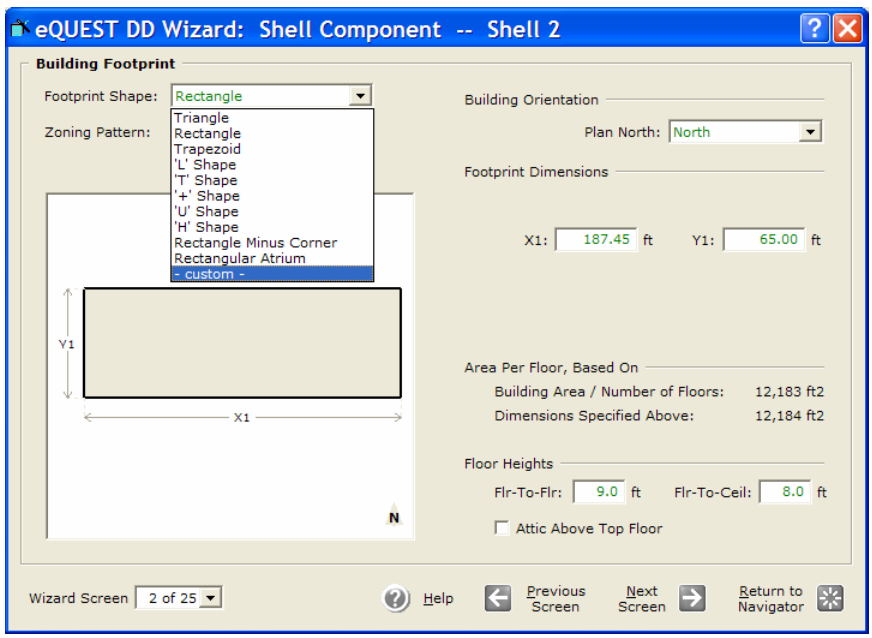
This completes the description of the building services systems in the project.

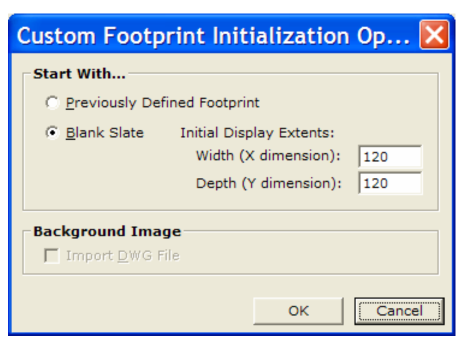
Proceed to describe a second shell component (the first floor), as indicated on the screens on the following pages.

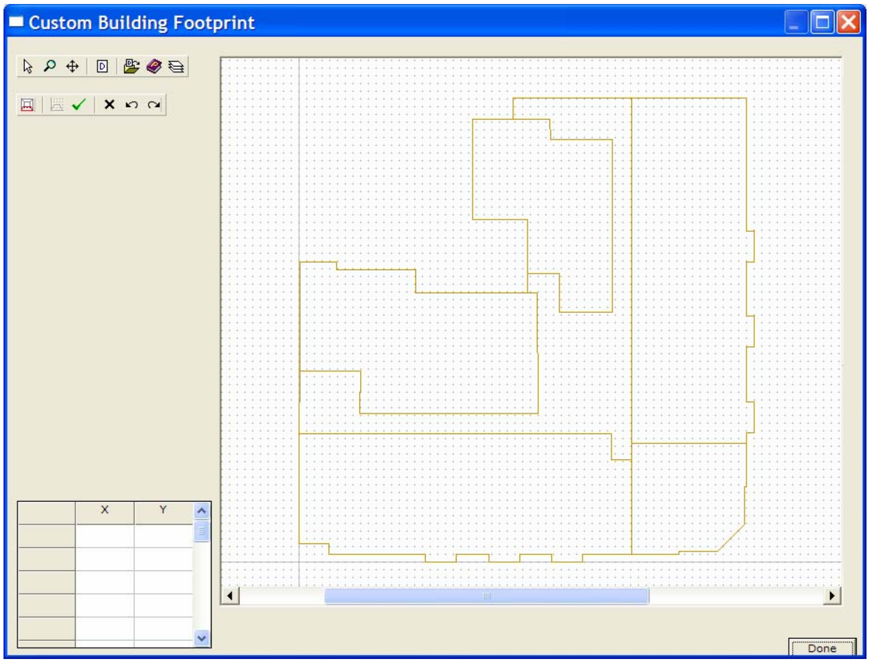


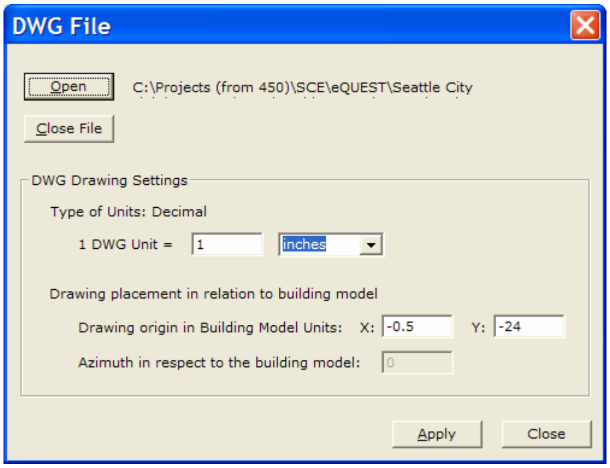


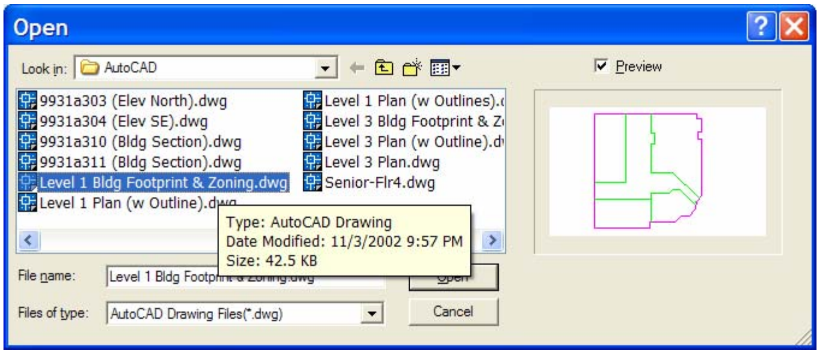

eQUEST DD Wizard: Shell Component -- Shell 2
Building Footprint
Footprint Shape: Rectangle
Zoning Pattern: Perimeter / Core
One Per Floor
Perimeter / Core
By Activity Area
- custom -
Y1
X1
83.1% Percent Perimeter Zone
N
Building Orientation
Plan North: North
Footprint Dimensions
Perimeter Zone Depth: 25.00 ft
X1: 187.45 ft Y1: 65.00 ft
Area Per Floor, Based On
Building Area / Number of Floors: 12,183 ft2
Dimensions Specified Above: 12,184 ft2
Floor Heights
Flr-To-Flr: 9.0 ft Flr-To-Ceil: 8.0 ft
Attic Above Top Floor
Wizard Screen 2 of 25
Help
Previous Screen
Next Screen
Return to Navigator

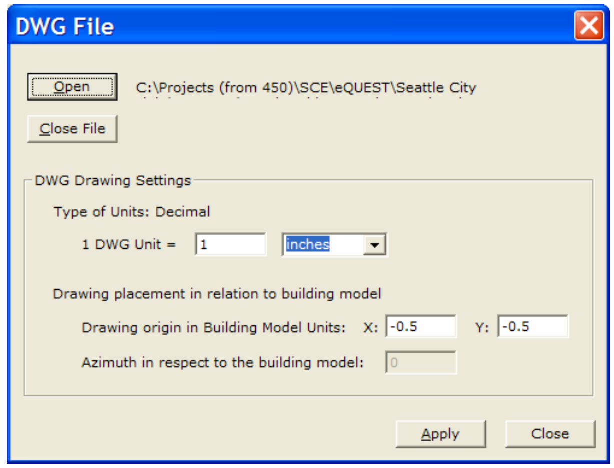

eQUEST DD Wizard: Shell Component -- Shell 2
Building Footprint
Footprint Shape: Rectangle
Zoning Pattern:
Triangle
Rectangle
Trapezoid
'L' Shape
'T' Shape
'+' Shape
'U' Shape
'H' Shape
Rectangle Minus Corner
Rectangular Atrium
- custom -
Y1
X1
N
Building Orientation
Plan North: North
Footprint Dimensions
X1: 187.45 ft Y1: 65.00 ft
Area Per Floor, Based On
Building Area / Number of Floors: 12,183 ft2
Dimensions Specified Above: 12,184 ft2
Floor Heights
Flr-To-Flr: 9.0 ft Flr-To-Ceil: 8.0 ft
Attic Above Top Floor
Wizard Screen 2 of 25
Help
Previous Screen
Next Screen
Return to Navigator

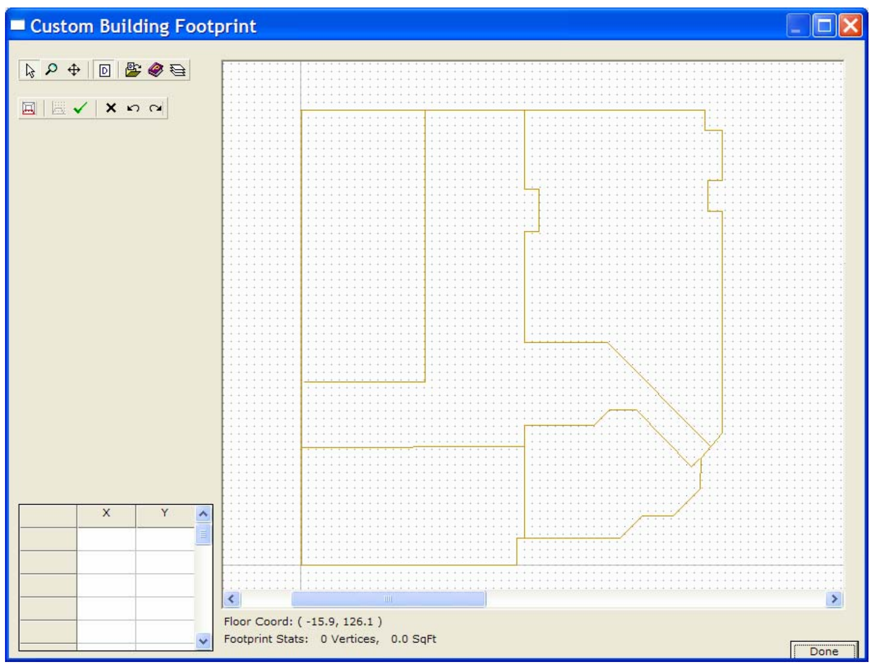

Custom Footprint Initialization Op...
Start With...
Previously Defined Footprint
Blank Slate
Initial Display Extents:
Width (X dimension): 120
Depth (Y dimension): 120
Background Image
Import DWG File
OK
Cancel

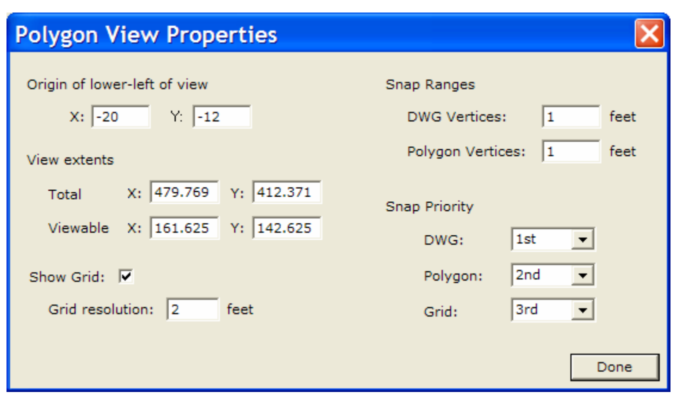

Custom Building Footprint
X
Y
Done

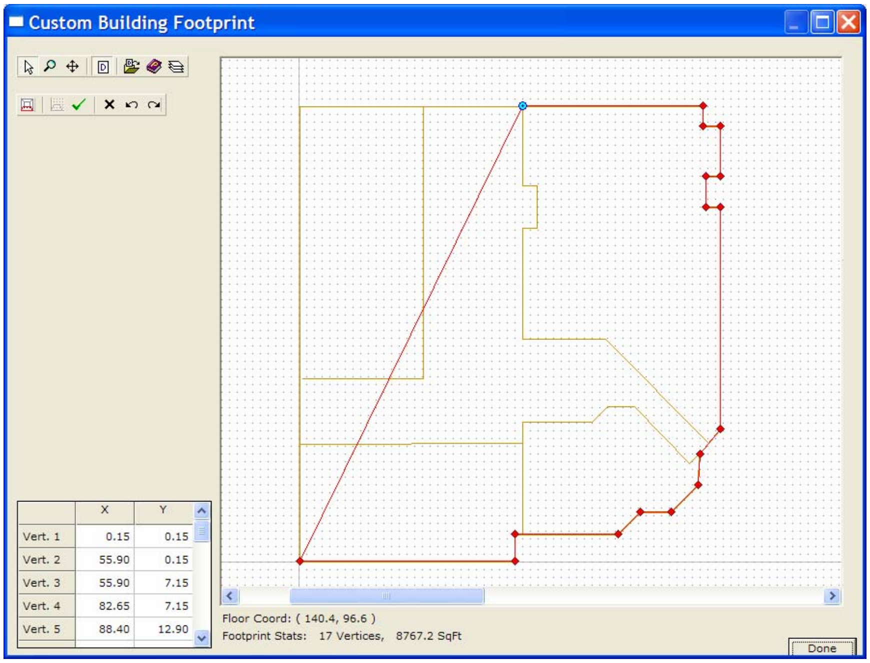

DWG File
Open
C:\Projects (from 450)\SCE\eQUEST\Seattle City
Close File
DWG Drawing Settings
Type of Units: Decimal
1 DWG Unit = 1 inches
Drawing placement in relation to building model
Drawing origin in Building Model Units: X: -0.5 Y: -24
Azimuth in respect to the building model: 0
Apply
Close


Open
Look in: AutoCAD
Preview
9931a303 (Elev North).dwg
9931a304 (Elev SE).dwg
9931a310 (Bldg Section).dwg
9931a311 (Bldg Section).dwg
Level 1 Bldg Footprint & Zoning.dwg
Level 1 Plan (w Outline).dwg
Level 1 Plan (w Outlines).
Level 3 Bldg Footprint & Z
Level 3 Plan (w Outline).d
Level 3 Plan.dwg
Senior-Flr4.dwg
Type: AutoCAD Drawing
Date Modified: 11/3/2002 9:57 PM
Size: 42.5 KB
File name: Level 1 Bldg Footprint & Zoning.dwg
Files of type: AutoCAD Drawing Files(*.dwg)
Open
Cancel

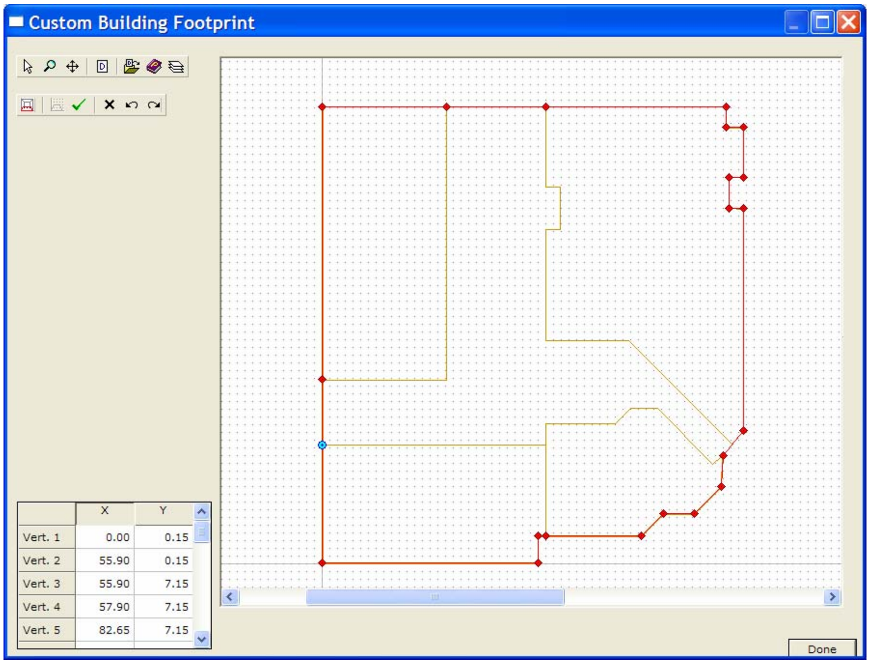

DWG File
Open
C:\Projects (from 450)\SCE\eQUEST\Seattle City
Close File
DWG Drawing Settings
Type of Units: Decimal
1 DWG Unit =
1
inches
Drawing placement in relation to building model
Drawing origin in Building Model Units: X:
-0.5
Y:
-0.5
Azimuth in respect to the building model:
0
Apply
Close


Custom Building Footprint
X
Y
Floor Coord: (-15.9, 126.1)
Footprint Stats: 0 Vertices, 0.0 SqFt
Done

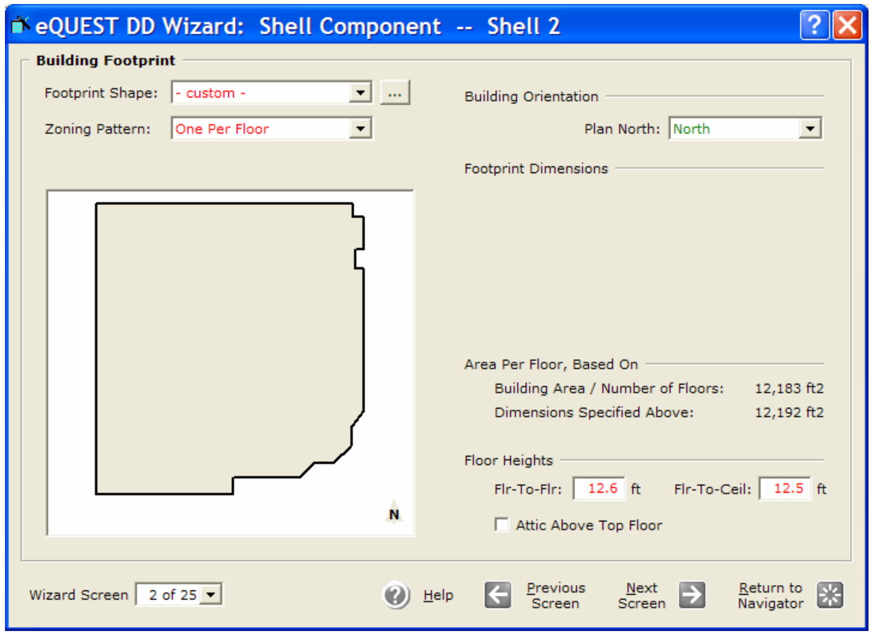

Polygon View Properties
Origin of lower-left of view
X: -20
Y: -12
View extents
Total X: 479.769 Y: 412.371
Viewable X: 161.625 Y: 142.625
Show Grid:
Grid resolution: 2 feet
Snap Ranges
DWG Vertices: 1 feet
Polygon Vertices: 1 feet
Snap Priority
DWG: 1st
Polygon: 2nd
Grid: 3rd
Done

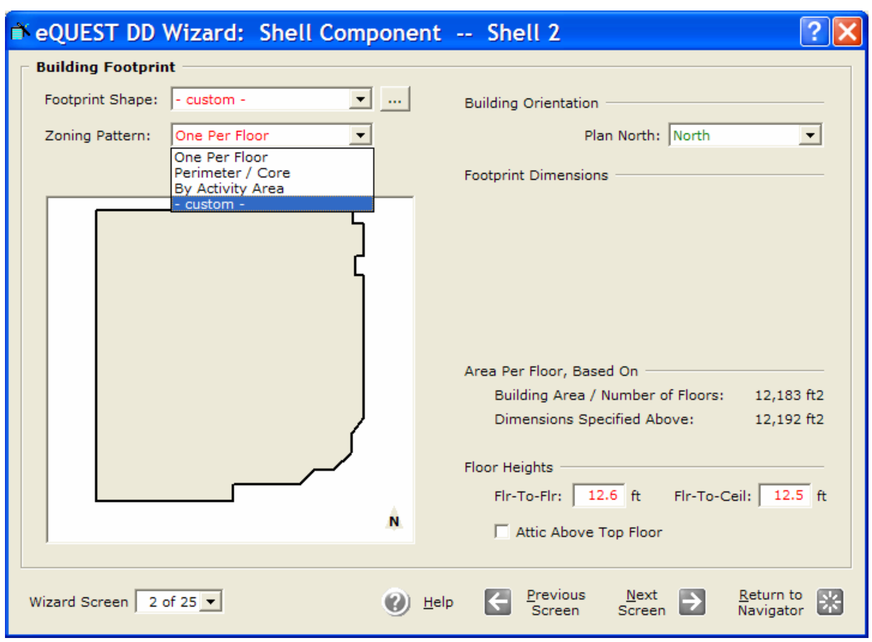


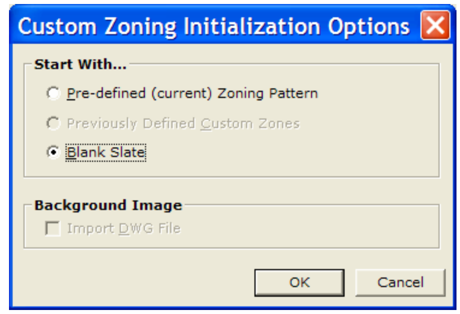
	X	Y
Vert. 1	0.15	0.15
Vert. 2	55.90	0.15
Vert. 3	55.90	7.15
Vert. 4	82.65	7.15
Vert. 5	88.40	12.90

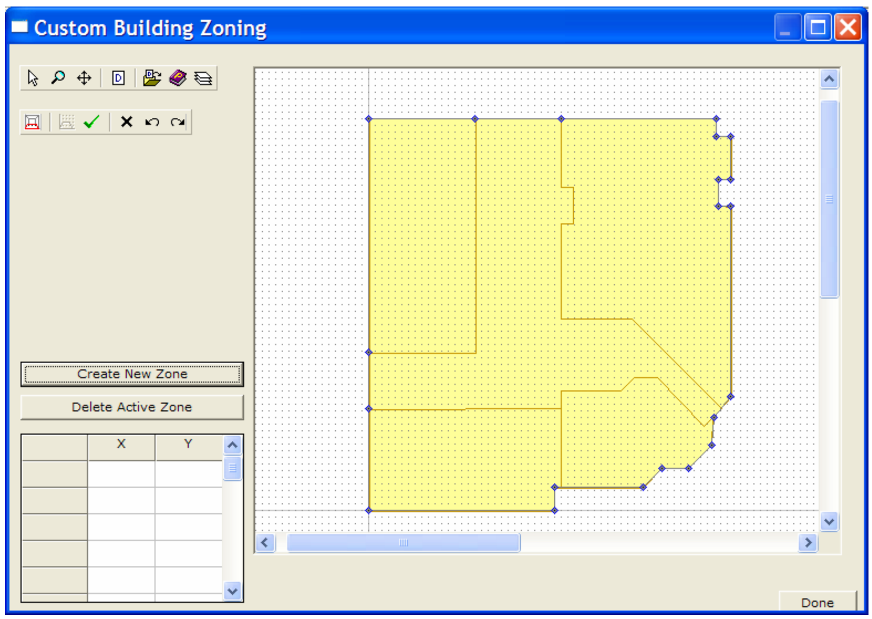


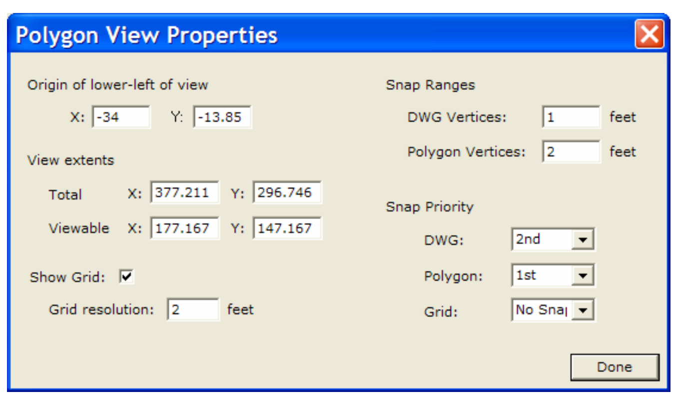
	X	Y
Vert. 1	0.00	0.15
Vert. 2	55.90	0.15
Vert. 3	55.90	7.15
Vert. 4	57.90	7.15
Vert. 5	82.65	7.15

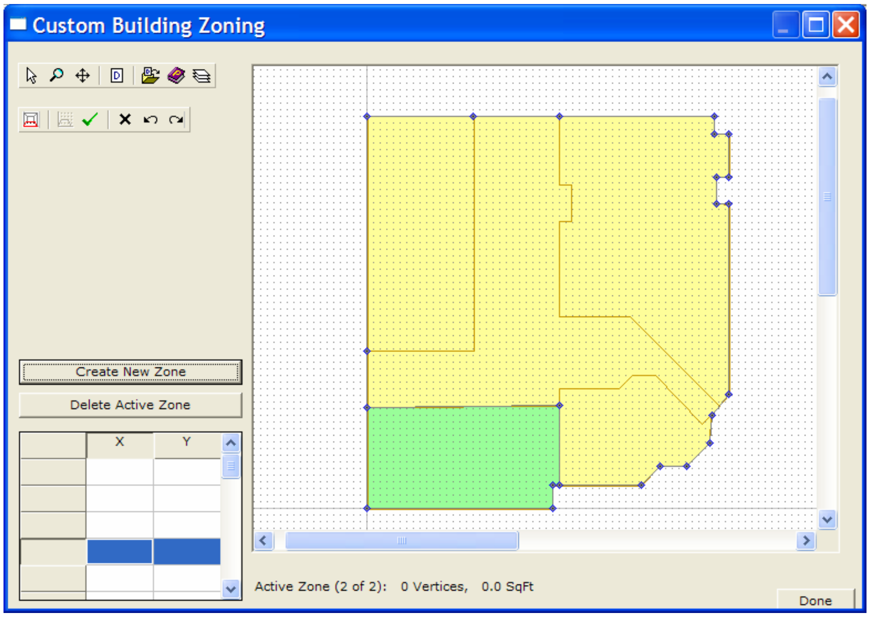

eQUEST DD Wizard: Shell Component -- Shell 2
Building Footprint
Footprint Shape: - custom -
Zoning Pattern: One Per Floor
Building Orientation
Plan North: North
Footprint Dimensions
N
Area Per Floor, Based On
Building Area / Number of Floors: 12,183 ft2
Dimensions Specified Above: 12,192 ft2
Floor Heights
Flr-To-Flr: 12.6 ft
Flr-To-Ceil: 12.5 ft
Attic Above Top Floor
Wizard Screen 2 of 25
Help
Previous Screen
Next Screen
Return to Navigator

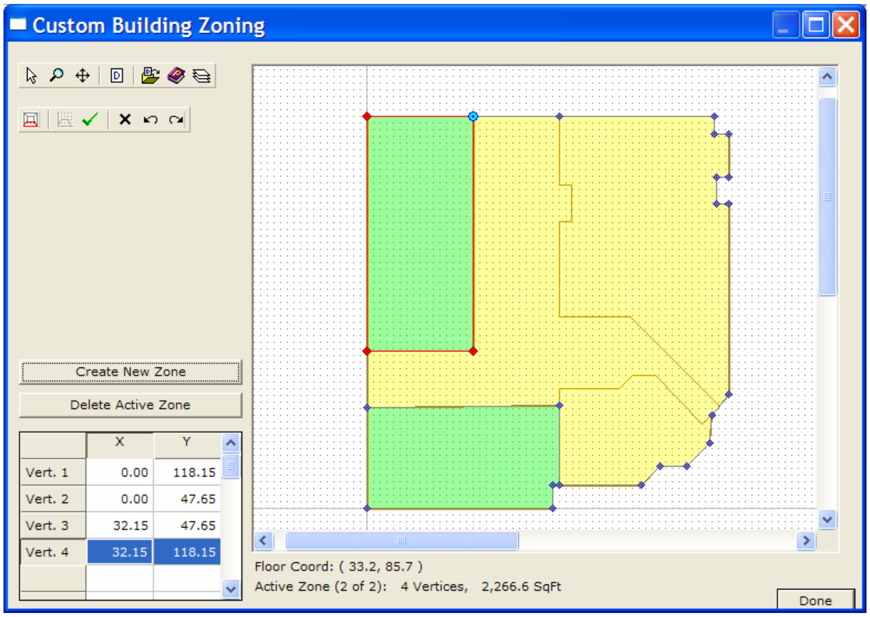

eQUEST DD Wizard: Shell Component -- Shell 2
Building Footprint
Footprint Shape: - custom -
Zoning Pattern: One Per Floor
One Per Floor
Perimeter / Core
By Activity Area
- custom -
Building Orientation
Plan North: North
Footprint Dimensions
N
Area Per Floor, Based On
Building Area / Number of Floors: 12,183 ft2
Dimensions Specified Above: 12,192 ft2
Floor Heights
Flr-To-Flr: 12.6 ft
Flr-To-Ceil: 12.5 ft
Attic Above Top Floor
Wizard Screen 2 of 25
Help
Previous Screen
Next Screen
Return to Navigator


Custom Zoning Initialization Options
Start With...
Pre-defined (current) Zoning Pattern
Previously Defined Custom Zones
Blank Slate
Background Image
Import DWG File
OK
Cancel

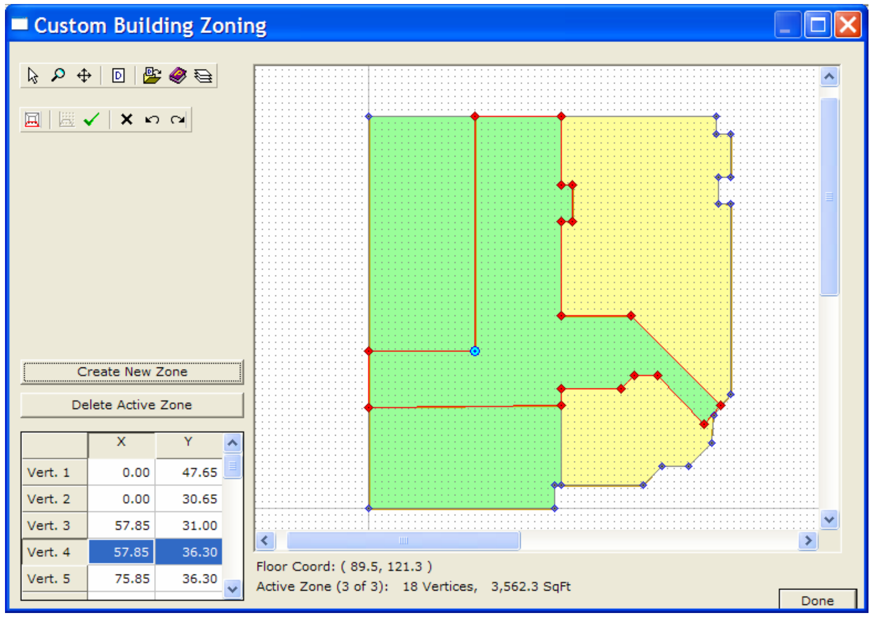

Custom Building Zoning
Create New Zone
Delete Active Zone
X
Y
Done

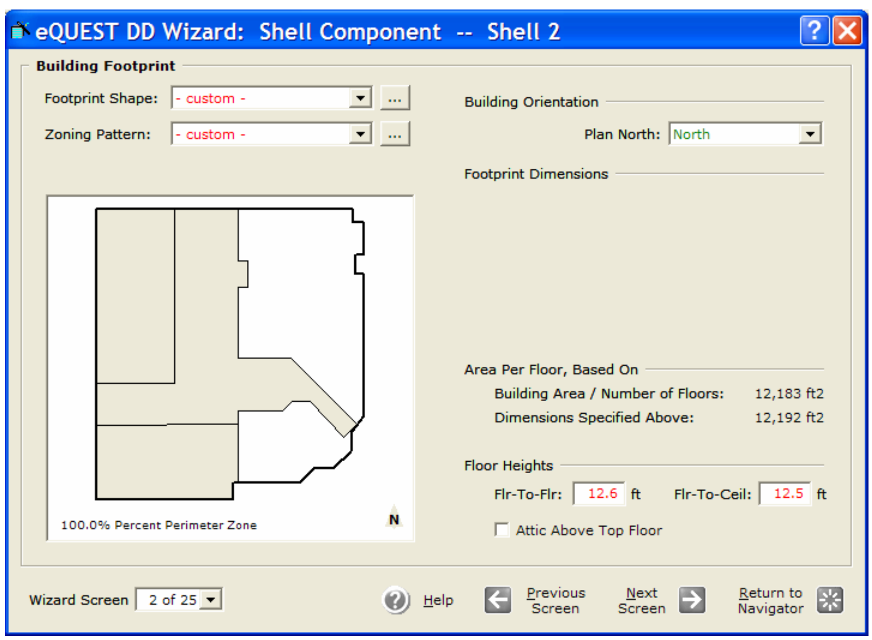

Polygon View Properties
Origin of lower-left of view
X: -34
Y: -13.85
View extents
Total X: 377.211 Y: 296.746
Viewable X: 177.167 Y: 147.167
Show Grid:
Grid resolution: 2 feet
Snap Ranges
DWG Vertices: 1 feet
Polygon Vertices: 2 feet
Snap Priority
DWG: 2nd
Polygon: 1st
Grid: No Snap
Done

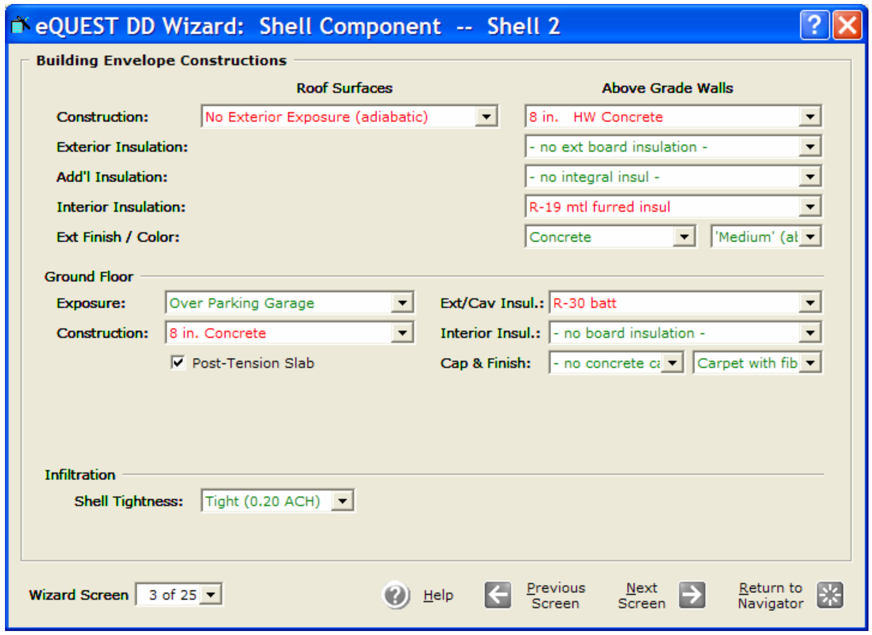

Custom Building Zoning
Create New Zone
Delete Active Zone
X
Y
Active Zone (2 of 2): 0 Vertices, 0.0 SqFt
Done

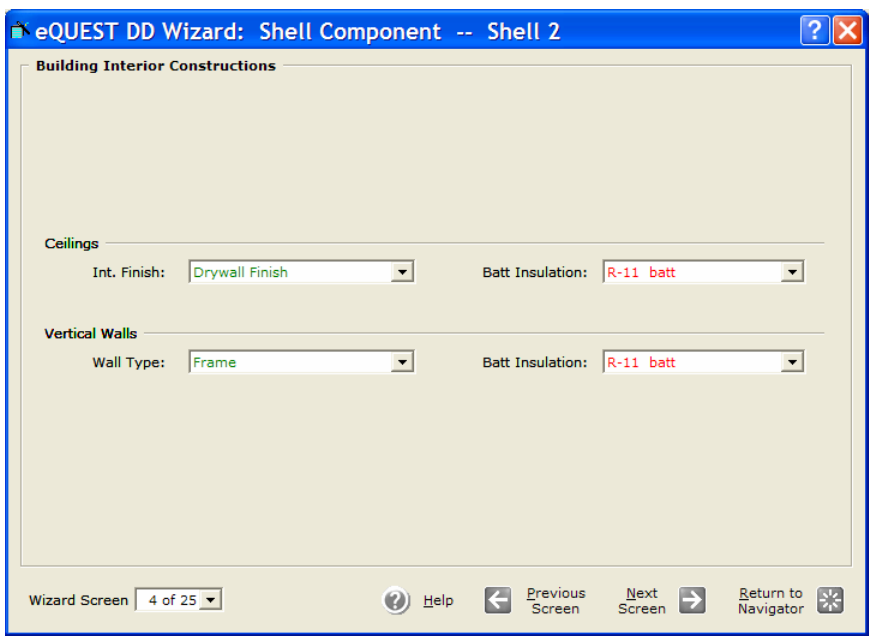

Custom Building Zoning
Create New Zone
Delete Active Zone
X
Y
Vert. 1 0.00 118.15
Vert. 2 0.00 47.65
Vert. 3 32.15 47.65
Vert. 4 32.15 118.15
Floor Coord: (33.2, 85.7)
Active Zone (2 of 2): 4 Vertices, 2,266.6 SqFt
Done

The unassigned areas in the floor plan of the first level are retail (non-residential) areas.

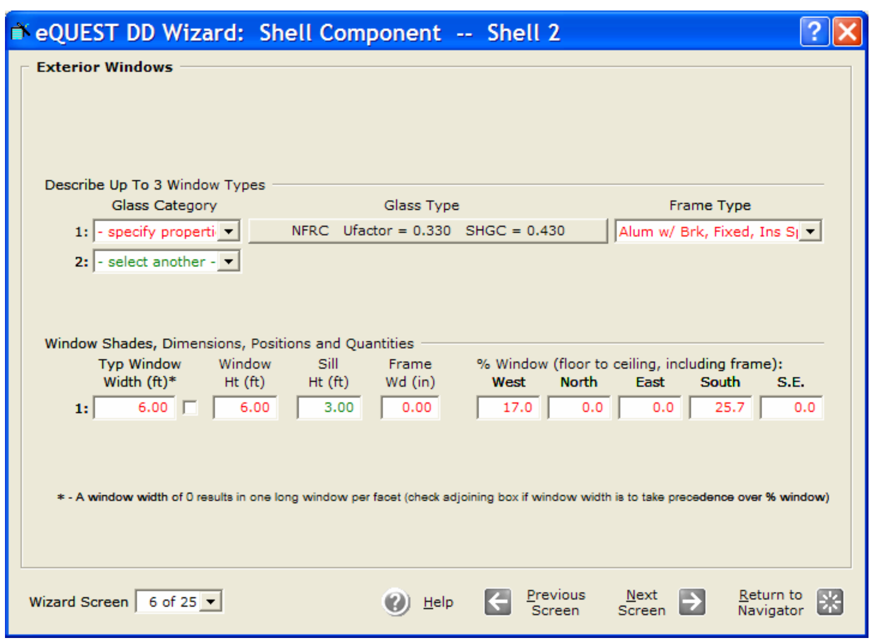


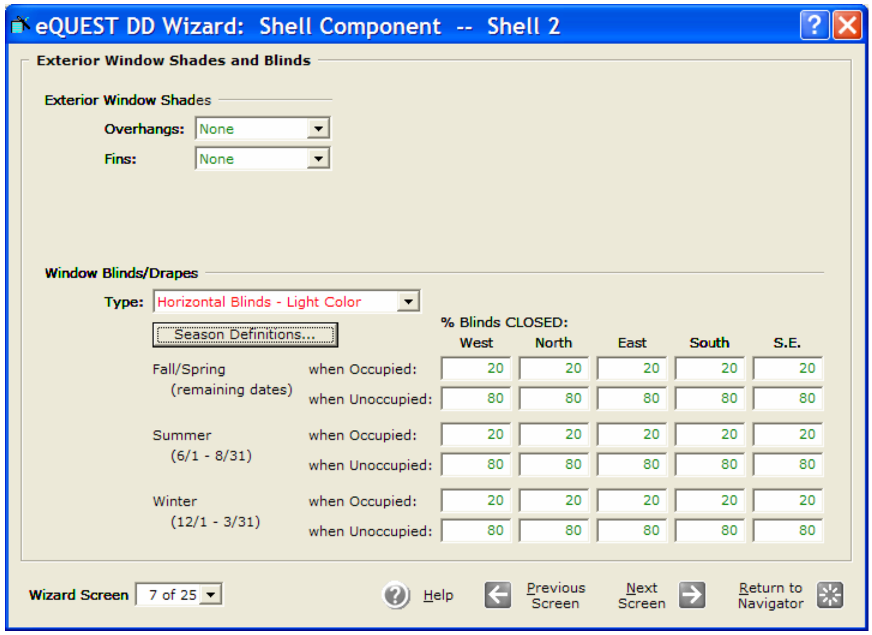


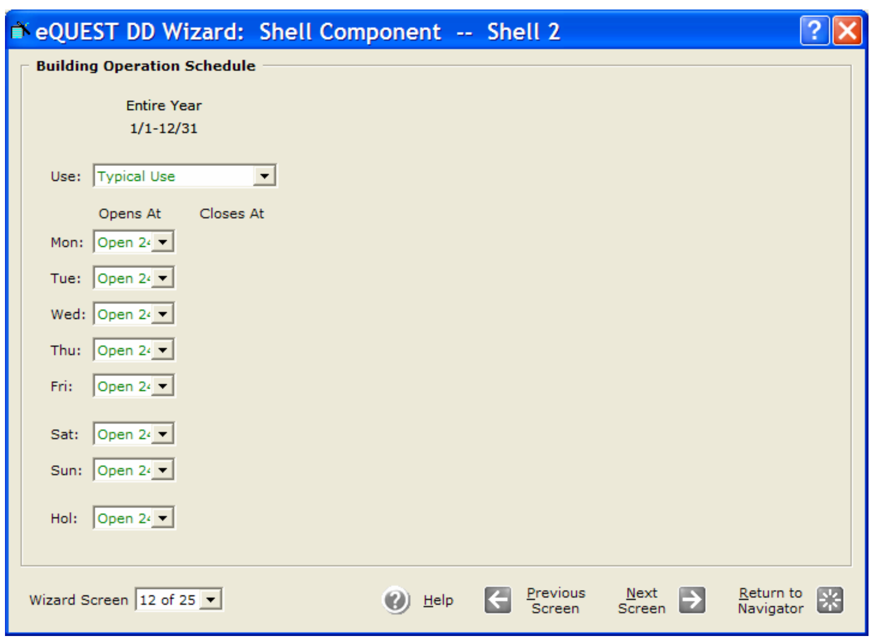

eQUEST DD Wizard: Shell Component -- Shell 2
Building Envelope Constructions
Roof Surfaces
Above Grade Walls
Construction:
No Exterior Exposure (adiabatic)
8 in. HW Concrete
Exterior Insulation:
- no ext board insulation -
Add'l Insulation:
- no integral insul -
Interior Insulation:
R-19 mtl furred insul
Ext Finish / Color:
Concrete
'Medium' (al
Ground Floor
Exposure:
Over Parking Garage
Ext/Cav Insul.:
R-30 batt
Construction:
8 in. Concrete
Interior Insul.:
- no board insulation -
Post-Tension Slab
Cap & Finish:
- no concrete ca
Carpet with fib
Infiltration
Shell Tightness:
Tight (0.20 ACH)
Wizard Screen
3 of 25
Help
Previous Screen
Next Screen
Return to Navigator


eQUEST DD Wizard: Shell Component -- Shell 2
Building Interior Constructions
Ceilings
Int. Finish:
Drywall Finish
Batt Insulation:
R-11 batt
Vertical Walls
Wall Type:
Frame
Batt Insulation:
R-11 batt
Wizard Screen
4 of 25
Help
Previous Screen
Next Screen
Return to Navigator

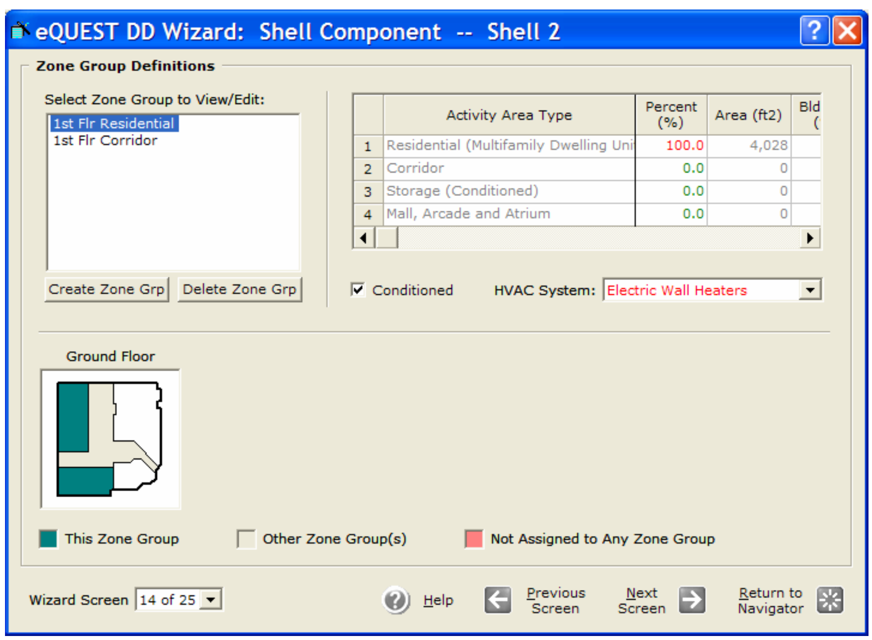

eQUEST DD Wizard: Shell Component -- Shell 2
Exterior Doors
Describe Up To 3 Door Types
Doors by Orientation:
Door Type
West North East South S.E.
1: - select another -
Door Dimensions and Construction / Glass Definitions
Ht (ft) Wd (ft) Construction -or- Glass Category and Glass Type
Wizard Screen 5 of 25
Help
Previous Screen
Next Screen
Return to Navigator


eQUEST DD Wizard: Shell Component -- Shell 2
Exterior Windows
Describe Up To 3 Window Types
Glass Category
Glass Type
Frame Type
1: - specify properti
NFRC Ufactor = 0.330 SHGC = 0.430
Alum w/ Brk, Fixed, Ins S|
2: - select another -
Window Shades, Dimensions, Positions and Quantities
Typ Window Width (ft)*
Window Ht (ft)
Sill Ht (ft)
Frame Wd (in)
% Window (floor to ceiling, including frame):
West North East South S.E.
1: 6.00 6.00 3.00 0.00 17.0 0.0 0.0 25.7 0.0
* - A window width of 0 results in one long window per facet (check adjoining box if window width is to take precedence over % window)
Wizard Screen 6 of 25
Help
Previous Screen
Next Screen
Return to Navigator

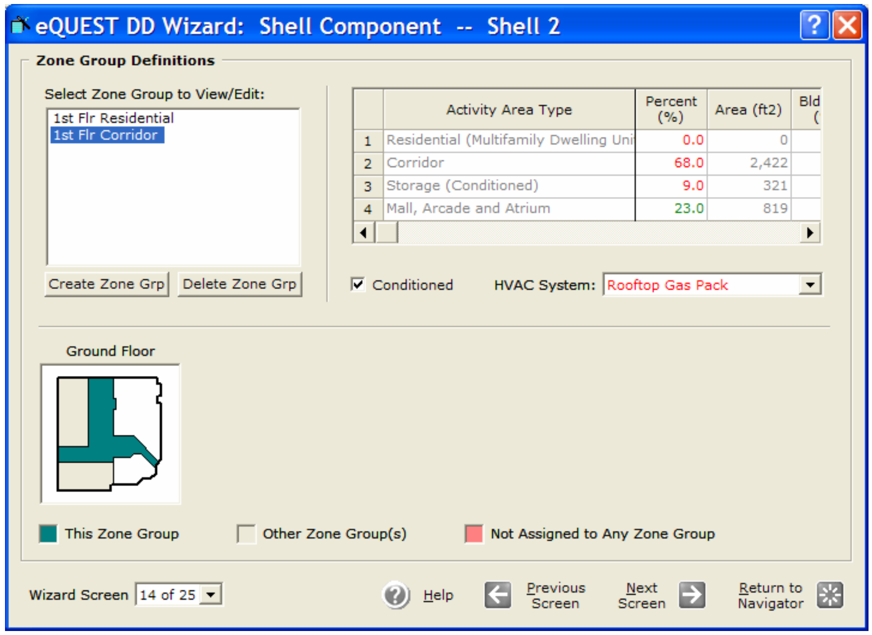

eQUEST DD Wizard: Shell Component -- Shell 2
Exterior Window Shades and Blinds
Exterior Window Shades
Overhangs: None
Fins: None
Window Blinds/Drapes
Type: Horizontal Blinds - Light Color
Season Definitions...
% Blinds CLOSED:
West North East South S.E.
Fall/Spring (remaining dates) when Occupied: 20 20 20 20 20
when Unoccupied: 80 80 80 80 80
Summer (6/1 - 8/31) when Occupied: 20 20 20 20 20
when Unoccupied: 80 80 80 80 80
Winter (12/1 - 3/31) when Occupied: 20 20 20 20 20
when Unoccupied: 80 80 80 80 80
Wizard Screen 7 of 25
Help
Previous Screen
Next Screen
Return to Navigator

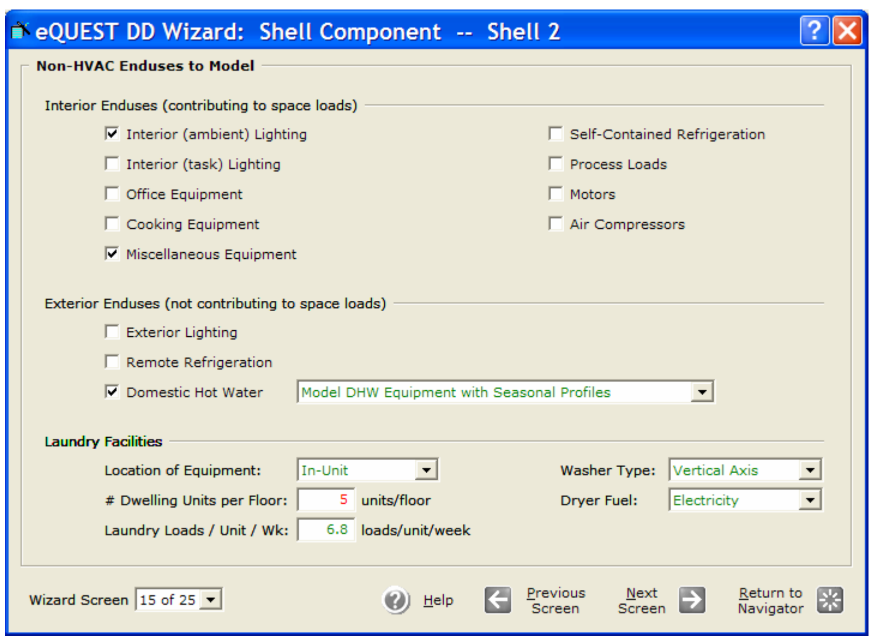

eQUEST DD Wizard: Shell Component -- Shell 2
Building Operation Schedule
Entire Year
1/1-12/31
Use: Typical Use
Opens At Closes At
Mon: Open 24
Tue: Open 24
Wed: Open 24
Thu: Open 24
Fri: Open 24
Sat: Open 24
Sun: Open 24
Hol: Open 24
Wizard Screen 12 of 25
Help
Previous Screen
Next Screen
Return to Navigator

Assign the 1st Floor Residential areas to be served by the electric wall heater system

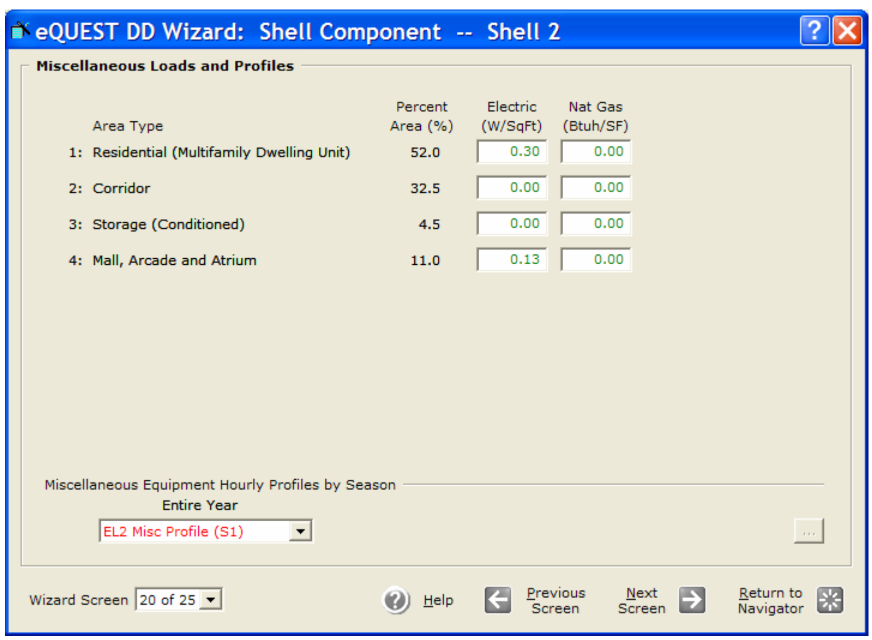


Assign the 1st Floor corridor areas to be served by the rooftop gas pack system

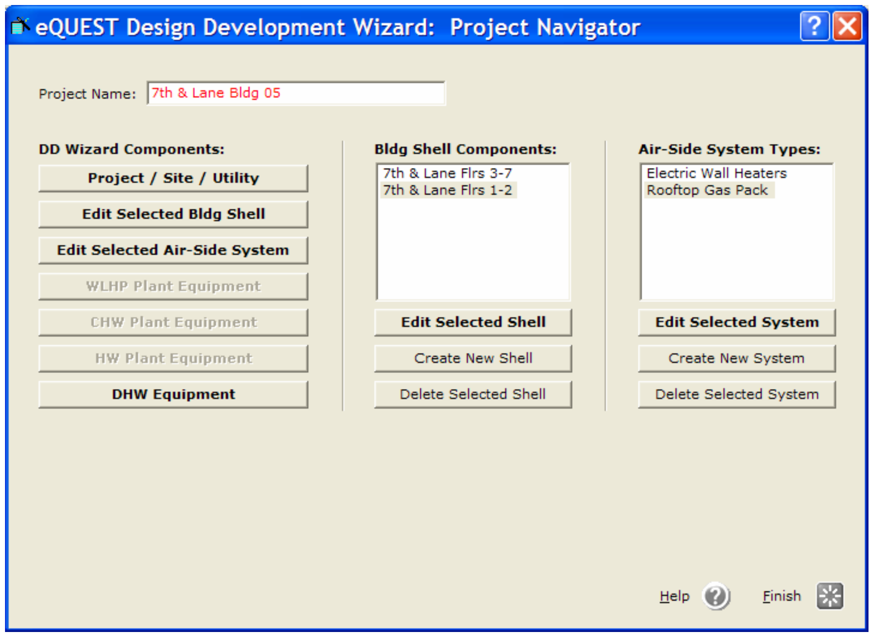




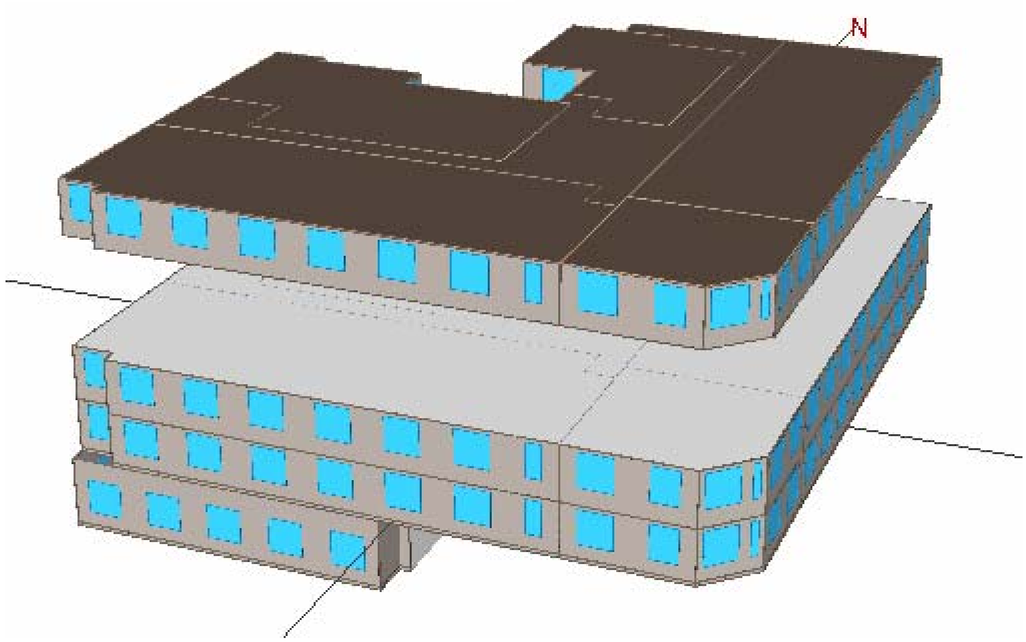

eQUEST DD Wizard: Shell Component -- Shell 2
Interior Lighting Loads and Profiles
Area Type
Percent Area (%)
Lighting (W/SqFt)
1: Residential (Multifamily Dwelling Unit) 52.0 0.50
2: Corridor 32.5 1.20
3: Storage (Conditioned) 4.5 1.20
4: Mall, Arcade and Atrium 11.0 1.70
Interior Lighting Hourly Profiles by Season
Entire Year
Ambient: EL2 InsLtg Profile (S1)
Wizard Screen 16 of 25
Help
Previous Screen
Next Screen
Return to Navigator


eQUEST DD Wizard: Shell Component -- Shell 2
Miscellaneous Loads and Profiles
Area Type
Percent Area (%)
Electric (W/SqFt)
Nat Gas (Btuh/SF)
1: Residential (Multifamily Dwelling Unit) 52.0 0.30 0.00
2: Corridor 32.5 0.00 0.00
3: Storage (Conditioned) 4.5 0.00 0.00
4: Mall, Arcade and Atrium 11.0 0.13 0.00
Miscellaneous Equipment Hourly Profiles by Season
Entire Year
EL2 Misc Profile (S1)
Wizard Screen 20 of 25
Help
Previous Screen
Next Screen
Return to Navigator

This completes the description of the second shell component in the project.



3-D view of the completed model (from the detailed interface)..



DOE2/BDL Basics

modeling basics

key concepts

BDL basics

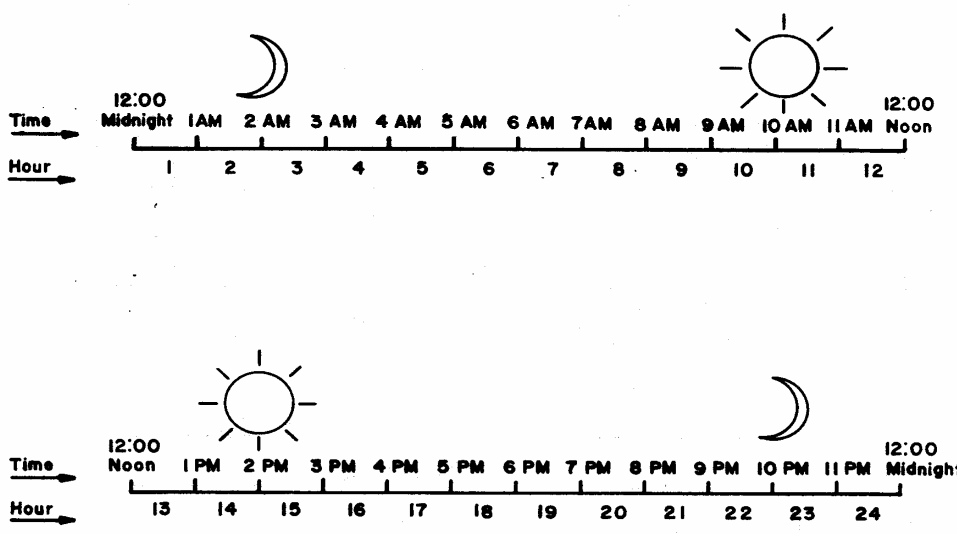
BDL scheduling basics

BDL geometry basics

Time Steps vs Time of Day

DOE2 does not experience time as we do, i.e., as a continuous flow. Rather, an annual DOE2 simulation is composed on 8760 discrete and indivisible "steps" (hours). This leads to at least one convention that will likely be unfamiliar to the new user:

operational schedules refer to "hour number" rather than "time of day" (see below)



For example, a fan system is scheduled for use from 6am to 9pm. Referring to the figure above, 6am to 9pm corresponds to hour number 7 to 21. It is helpful to recognize that each time of day represents the "hour ending" at that time.

Weighting Factor Methodology in DOE2/BDL

When energy is introduced into a DOE2 zone, e.g., by solar heat gain, the thermal mass of the space must first "absorb" the energy, then release it to the room air mass.

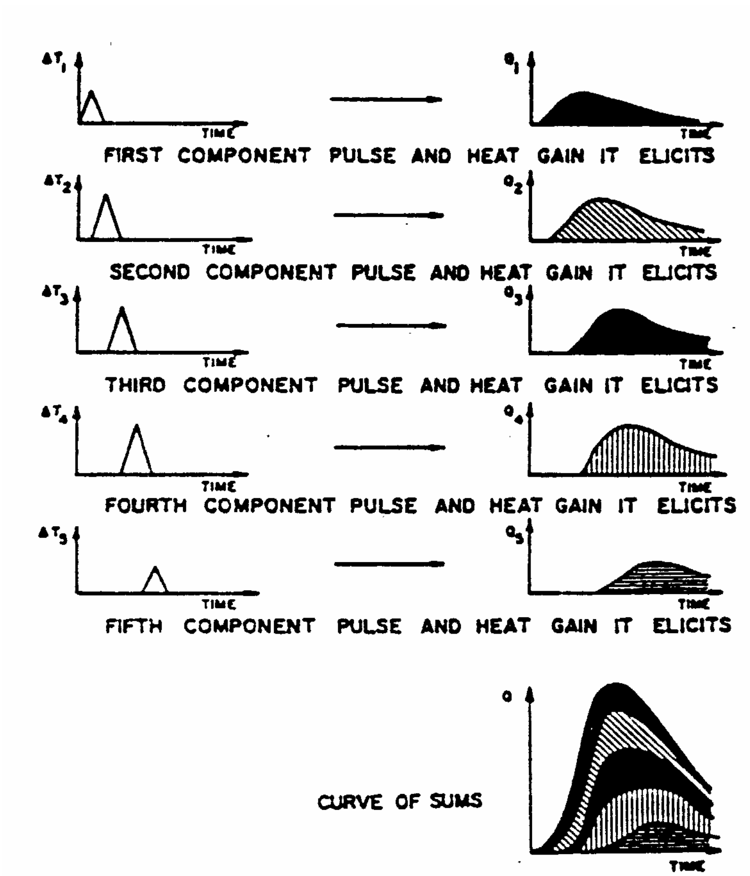
The time delay associated with this means that not all of the solar gain is immediately released as load to the air mass. Some of it is released during the first hour while the remainder is released during subsequent hours.

If you could calculate the percentage release each hour that resulted from the original "pulse" of solar gain, you could predict future load on the air mass by maintaining a history of heat gains and the space's "response" to them. The more massive the space, the longer would be the required history, however, the room's response could be assumed to be a constant.

We can apply the same idea looking into the past, i.e., keeping track of previous hours' instantaneous gains and the "room response factors" or "weighting factors" .

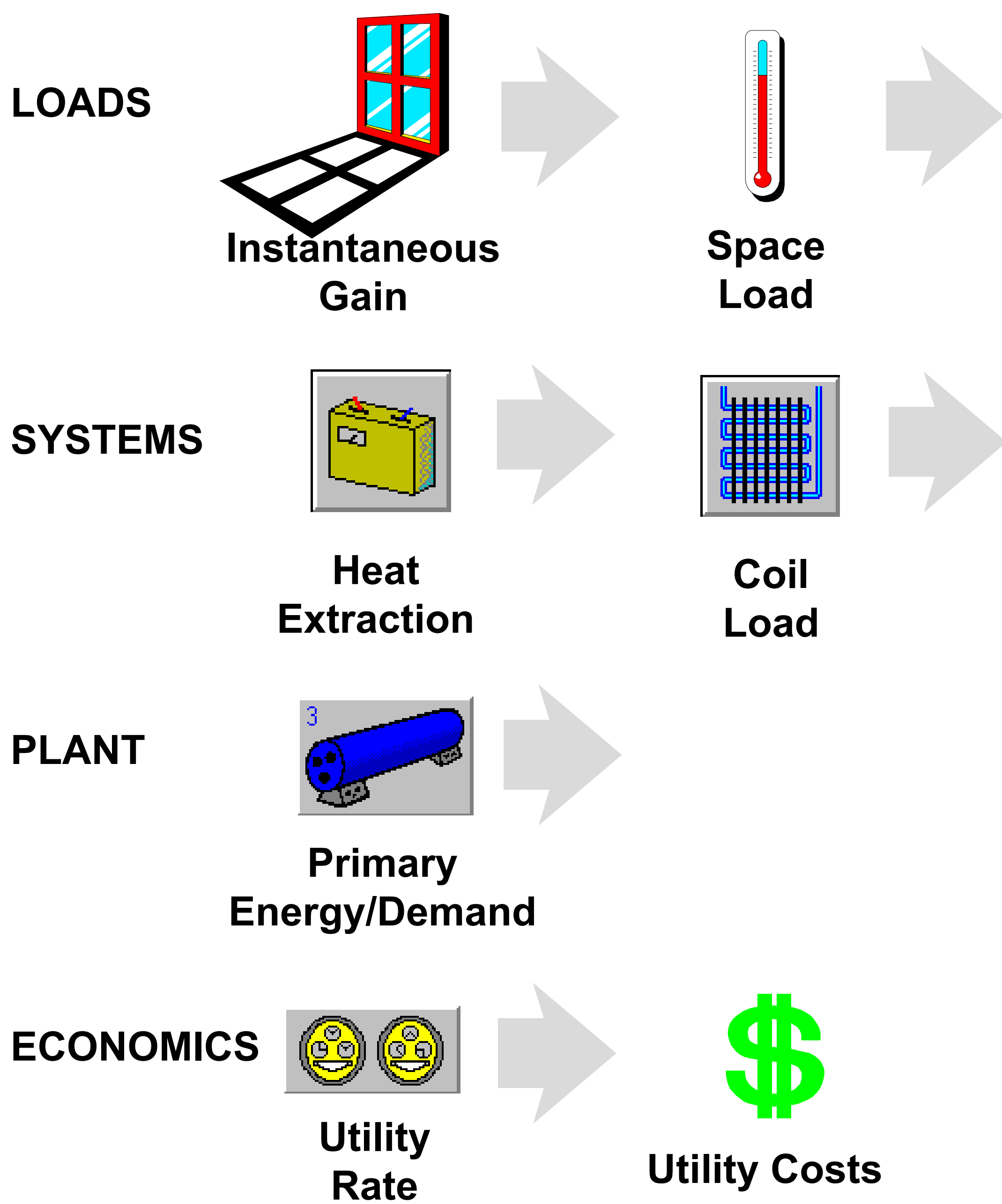
Weighting Factors

As energy is introduced into a DOE2 zone at differing times and from several sources, e.g., solar gain, occupants, conduction, lights, and equipment, the weighting factor methodology uses the convolution principal as illustrated below.



Although the principal benefit of weighting factors is computational speed, they also allow a reliable dissaggregation of total thermal HVAC load.

Computational Steps in DOE2/BDL



DOE2 Building Description Language

- The DOE2 BDL processor consists of four separate programs:

    - LDL
    - SDL
    - PDL
    - EDL

  each corresponds to the four DOE2 simulation modules: Loads, Systems, Plant and Economics

- All BDL input is free-format

- Most BDL instructions are optional in that they have default values preassigned to them

- User can specify/reassign BDL default values

- All BDL instructions are processed before any simulation takes place

- BDL provides sophisticated run-time error checking and diagnostics

- User can disable automatic range checking

BDL Input Instruction Syntax

The general form of BDL input instruction is:

```
u-name        =    COMMAND
                   KEYWORD1          = value
                   KEYWORD2          = code-word
                   KEYWORD3          = u-name
                   KEYWORD4          = list
                                     •
                                     •
                                     •
                   KEYWORDn          = value    ••
```

For example, the BDL input for an interior wall might be:

```
BACK-WALL     =    INTERIOR-WALL
                   AREA              = 250
                   INT-WALL-TYPE     = STANDARD
                   CONSTRUCTION      = GYP-PARTITION
                   INSIDE-VIS-REFL   = (.7,.5)
                                     •
                                     •
                                     •
                                                ••
```


General BDL Syntax Rules

INSTRUCTIONS

- one or more blanks must separate each element of an instruction
- the equal sign is optional (however, its use is recommended)
- commands, keywords, code words and u-names must not be misspelled or contain embedded blanks
- every instruction must end with a terminator (two successive periods preceded and followed by a blank)
- 80 column input format with multiple lines as required

U-NAMES

- only the first 32 characters of a u-name are significant
- u-names must be unique and cannot be a DOE2 defined command keyword or code-word
- u-names may not contain the following characters: ( ) [ ] , =
- when used, the u-name and command must appear on same line

INSTRUCTION DATA

- values in a list must be contained between parentheses and separated by a comma or a blank
- numeric values may be integers, decimal fractions or exponentials (e.g. 90, 90.0, 9E+1)
- plus signs (i.e. +) can only appear in an exponent, minus signs (i.e. -) are used to indicate negative numbers or negative exponents and must not be followed by a blank

Building Operations Scheduling

Schedules are used to define operations conditions on an hour-by-hour basis for the entire period of the simulation (up to one year).

Schedules are used to:

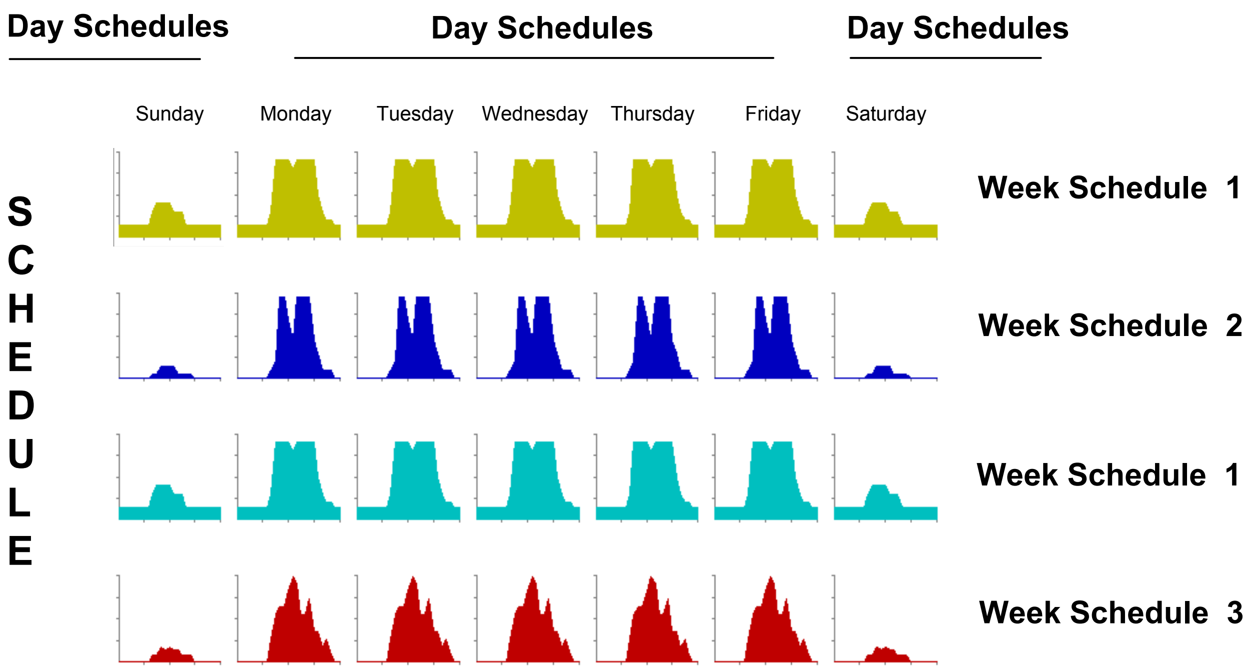
- indicate occupancy level
- control lighting levels
- control equipment use
- define thermostat set points
- operate movable insulation
- enable user operable devices such as windows and shades
- vary the transmissivity of a shade
- vary service load requirements
- define seasonal or time-of-use utility tariffs

DOE2 schedules

Schedules will vary in complexity, however, each schedule will be defined using three BDL schedule instructions:

- DAY SCHEDULE: Used to define typical 24-hour profiles
- WEEK SCHEDULE: Used to define typical 7-day profiles by assigning daily profiles to particular days of the week
- SCHEDULE: Used to define a full year profile by assigning weekly profiles to particular periods of the year

DOE2 schedules

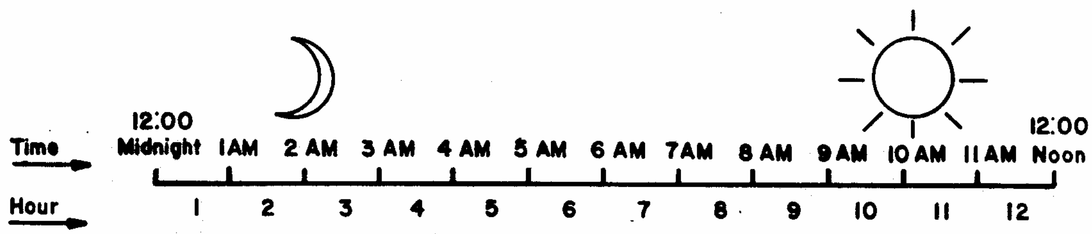


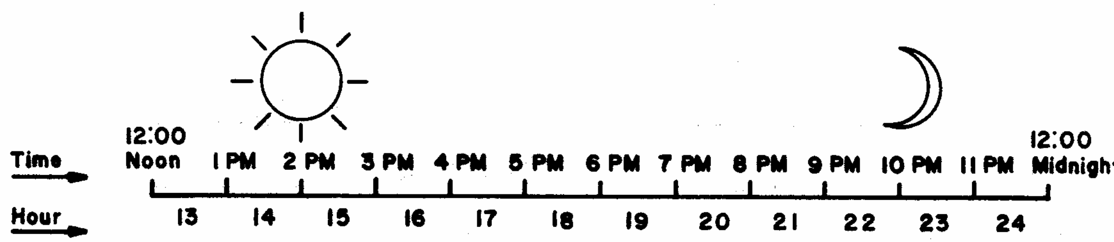
If the example above describes a full year's schedule, then we would use the following BDL commands:

- ♦ 9 DAY-SCHEDULEs
- ♦ 3 WEEK-SCHEDULEs
- ♦ 1 SCHEDULE

BDL hour number convention

Recall that BDL schedules use HOUR NUMBER rather than TIME OF DAY.



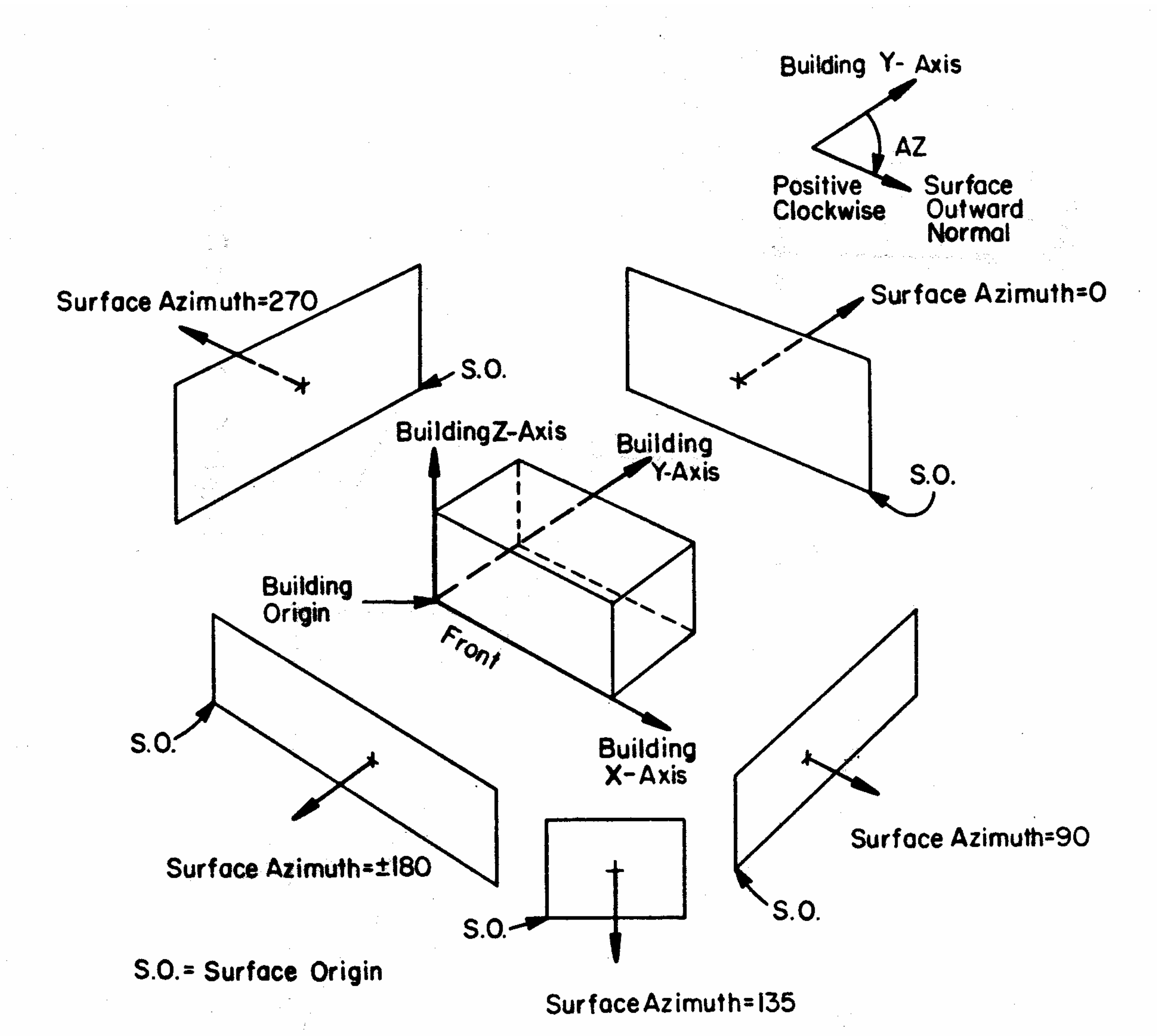


Building geometry: DOE2 coordinate systems

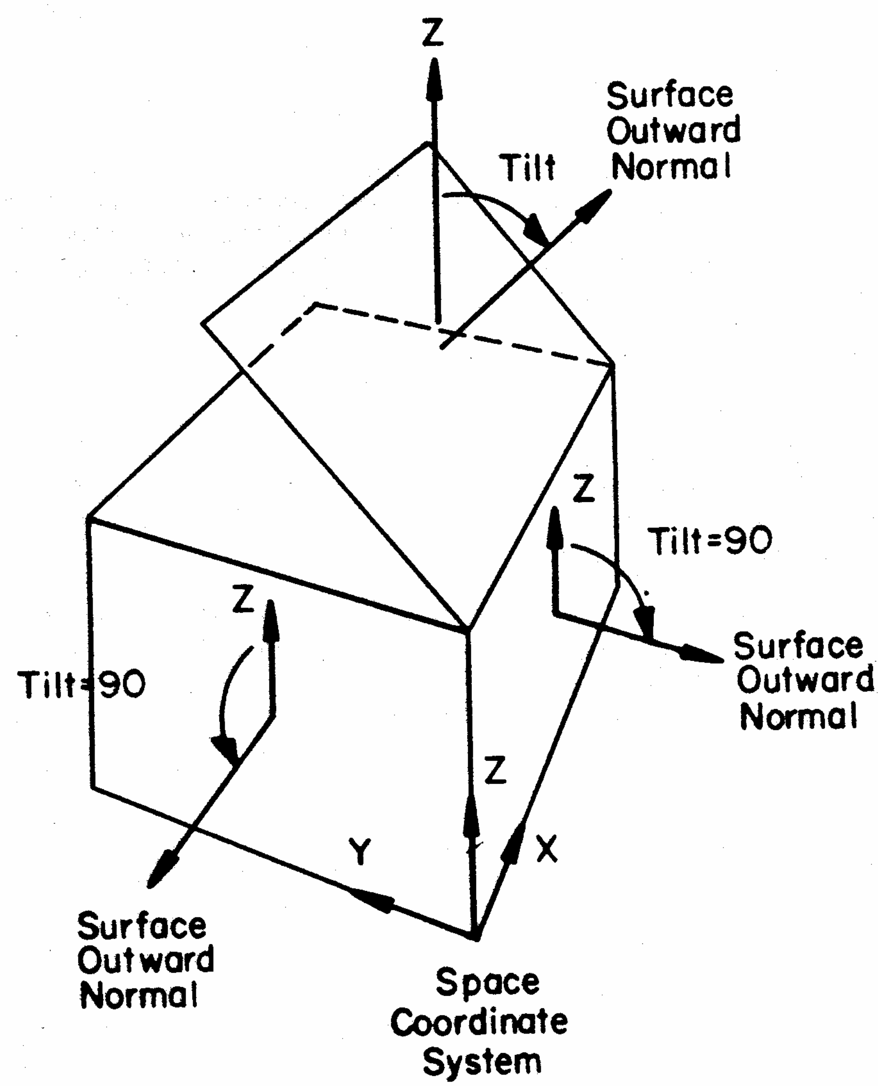
When coordinate information is required, the following four step procedure wil be helpful.

Rotate to vertical:	mentally roate a surface into a vertical tilt (e.g., a vertical wall)
Surface ORIGIN:	View a surface from the outside. Identify its lower left corner. Specify the location of this lower left corner relative to the origin of the space with which this wall is associated.
Surface AZIMUTH:	Construct an outward-pointing nornmal for each surface. Identify the rotation of the surface norml with respect to the space positive Y-axis (clockwise is positive rotation).
Surface TILT:	Site along the space X-axis in te positive X direction, then identify the rotation of the surface normal with respect to the space positive Z-axis (clockwise is positive rotation).

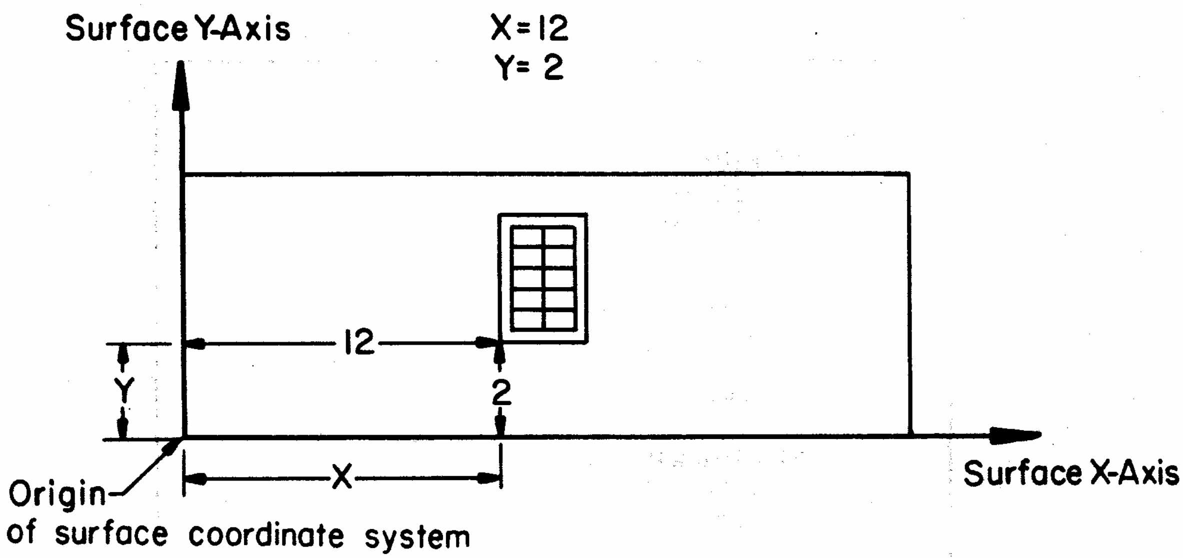
Building geometry: DOE2 coordinate systems



Building geometry: DOE2 coordinate systems



Building geometry: DOE2 coordinate systems



Building geometry: DOE2 coordinate systems

Each coordinate system is related to its "reference" system by translation and rotation as follows:

Site (Reference) Coordinate System

The origin of the Site (Reference) coordinate system is located by the LATITUDE and LONGITUDE keywords in the BUILD-PARAMETERS instruction. The site Y-axis always points due north.

Building Coordinate System

The origin of the Building coordinate system is always located with respect to the Site origin using the X-REF and Y-REF keywords in the BUILDING-LOCATION instruction. The Building Y-axis is rotated with respect to the Site Y-axis using the AZIMUTH keyword in the BUILDING-LOCATION instruction. The building Z-axis always points up.

Floor Coordinate System

The origin of the Floor coordinate system is always located with respect to the Building origin using the X, Y and Z keywords in the FLOOR instruction. The Floor Y-axis is rotated with respect to the Building Y-axis using the AZIMUTH keyword in the FLOOR instruction.

Space Coordinate System

The origin of the Space coordinate system is always located with respect to the Floor origin using the X, Y and Z keywords in the SPACE instruction. The Space Y-axis is rotated with respect to the Floor Y-axis using the AZIMUTH keyword in the SPACE instruction.

Surface Coordinate System

The origin of the surface coordinate system is located with respect to the Space origin using the X, Y and Z keywords in the EXTERIOR-WALL (or similar) instruction. There is no Z-axis in the Surface coordinate system. The surface normal points "out" and is tilted with respect to the Space Z-axis using the TILT keyword. The surface outward-pointing normal is rotated with respect to the Space Y-axis using the AZIMUTH keyword.

Reference Materials

U.S. Holidays Observed in DOE-2.2

Holiday Name	Holiday is Celebrated on this Day
New Years Day	December 31 if a Friday January 1 (unless on Saturday or Sunday) January 2 if a Monday
M.L. King Birthday	Third Monday in January
Washington's Birthday	Third Monday in February
Memorial Day Last	Monday in May
Fourth of July	July 3 if a Friday July 4 (unless on Saturday or Sunday) July 5 if a Monday
Labor Day	First Monday in September
Columbus Day	Second Monday in October
Veterans Day	November 10 if a Friday November 11 (unless on Saturday or Sunday) November 12 if a Monday
Thanksgiving	Fourth Thursday in NOV
Christmas	December 24 if a Friday December 25 (unless on Saturday or Sunday) December 26 if a Monday

Weekday for Jan 1st for Seven-Year Calendar

Year	Jan 1st	Year	Jan 1st	Year	Jan 1st
1980	Tuesday	1990	Monday	2000	Saturday
1981	Thursday	1991	Tuesday	2001	Monday
1982	Friday	1992	Wednesday	2002	Tuesday
1983	Saturday	1993	Friday	2003	Wednesday
1984	Sunday	1994	Saturday	2004	Thursday
1985	Tuesday	1995	Sunday	2005	Saturday
1986	Wednesday	1996	Monday	2006	Sunday
1987	Thursday	1997	Wednesday	2007	Monday
1988	Friday	1998	Thursday	2008	Tuesday
1989	Sunday	1999	Friday	2009	Thursday

Seven Year Calendar
(page 1 of 2)

January 1st:

	Sunday							Monday							Tuesday							Wednesday						
	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	**2**	3	4	5	6	7		**1**	2	3	4	5	6			**1**	2	3	4	5				**1**	2	3	4
J	8	9	10	11	12	13	14	7	8	9	10	11	12	13	6	7	8	9	10	11	12	5	6	7	8	9	10	11
A	15	**16**	17	18	19	20	21	14	**15**	16	17	18	19	20	13	14	15	16	17	18	19	12	13	14	15	16	17	18
N	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	**21**	22	23	24	25	26	19	**20**	21	22	23	24	25
	29	30	31	1	2	3	4	28	29	30	31	1	2	3	27	28	29	30	31	1	2	26	27	28	29	30	31	1
F	5	6	7	8	9	10	11	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8
E	12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16	9	10	11	12	13	14	15
B	19	**20**	21	22	23	24	25	18	**19**	20	21	22	23	24	17	**18**	19	20	21	22	23	16	**17**	18	19	20	21	22
	26	27	28	1	2	3	4	25	26	27	28	1	2	3	24	25	26	27	28	1	2	23	24	25	26	27	28	1
M	5	6	7	8	9	10	11	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8
A	12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16	9	10	11	12	13	14	15
R	19	20	21	22	23	24	25	18	19	20	21	22	23	24	17	18	19	20	21	22	23	16	17	18	19	20	21	22
	26	27	28	29	30	31	1	25	26	27	28	29	30	31	24	25	26	27	28	29	30	23	24	25	26	27	28	29
	2	3	4	5	6	7	8	1	2	3	4	5	6	7	31	1	2	3	4	5	6	30	31	1	2	3	4	5
A	9	10	11	12	13	14	15	8	9	10	11	12	13	14	7	8	9	10	11	12	13	6	7	8	9	10	11	12
P	16	17	18	19	20	21	22	15	16	17	18	19	20	21	14	15	16	17	18	19	20	13	14	15	16	17	18	19
R	23	24	25	26	27	28	29	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	21	22	23	24	25	26
	30	1	2	3	4	5	6	29	30	1	2	3	4	5	28	29	30	1	2	3	4	27	28	29	30	1	2	3
M	7	8	9	10	11	12	13	6	7	8	9	10	11	12	5	6	7	8	9	10	11	4	5	6	7	8	9	10
A	14	15	16	17	18	19	20	13	14	15	16	17	18	19	12	13	14	15	16	17	18	11	12	13	14	15	16	17
Y	21	22	23	24	25	26	27	20	21	22	23	24	25	26	19	20	21	22	23	24	25	18	19	20	21	22	23	24
	28	**29**	30	31	1	2	3	27	**28**	29	30	31	1	2	26	**27**	28	29	30	31	1	25	**26**	27	28	29	30	31
J	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8	1	2	3	4	5	6	7
U	11	12	13	14	15	16	17	10	11	12	13	14	15	16	9	10	11	12	13	14	15	8	9	10	11	12	13	14
N	18	19	20	21	22	23	24	17	18	19	20	21	22	23	16	17	18	19	20	21	22	15	16	17	18	19	20	21
	25	26	27	28	29	30	1	24	25	26	27	28	29	30	23	24	25	26	27	28	29	22	23	24	25	26	27	28
	2	3	**4**	5	6	7	8	1	2	3	**4**	5	6	7	30	1	2	3	**4**	5	6	29	30	1	2	3	**4**	5
J	9	10	11	12	13	14	15	8	9	10	11	12	13	14	7	8	9	10	11	12	13	6	7	8	9	10	11	12
U	16	17	18	19	20	21	22	15	16	17	18	19	20	21	14	15	16	17	18	19	20	13	14	15	16	17	18	19
L	23	24	25	26	27	28	29	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	21	22	23	24	25	26
	30	31	1	2	3	4	5	29	30	31	1	2	3	4	28	29	30	31	1	2	3	27	28	29	30	31	1	2
A	6	7	8	9	10	11	12	5	6	7	8	9	10	11	4	5	6	7	8	9	10	3	4	5	6	7	8	9
U	13	14	15	16	17	18	19	12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16
G	20	21	22	23	24	25	26	19	20	21	22	23	24	25	18	19	20	21	22	23	24	17	18	19	20	21	22	23
	27	28	29	30	31	1	2	26	27	28	29	30	31	1	25	26	27	28	29	30	31	24	25	26	27	28	29	30
S	3	**4**	5	6	7	8	9	2	**3**	4	5	6	7	8	1	**2**	3	4	5	6	7	31	**1**	2	3	4	5	6
E	10	11	12	13	14	15	16	9	10	11	12	13	14	15	8	9	10	11	12	13	14	7	8	9	10	11	12	13
P	17	18	19	20	21	22	23	16	17	18	19	20	21	22	15	16	17	18	19	20	21	14	15	16	17	18	19	20
	24	25	26	27	28	29	30	23	24	25	26	27	28	29	22	23	24	25	26	27	28	21	22	23	24	25	26	27
	1	2	3	4	5	6	7	30	1	2	3	4	5	6	29	30	1	2	3	4	5	28	29	30	1	2	3	4
O	8	**9**	10	11	12	13	14	7	**8**	9	10	11	12	13	6	7	8	9	10	11	12	5	6	7	8	9	10	11
C	15	16	17	18	19	20	21	14	15	16	17	18	19	20	13	**14**	15	16	17	18	19	12	**13**	14	15	16	17	18
T	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	21	22	23	24	25	26	19	20	21	22	23	24	25
	29	30	31	1	2	3	4	28	29	30	31	1	2	3	27	28	29	30	31	1	2	26	27	28	29	30	31	1
N	5	6	7	8	9	**10**	11	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8
O	12	13	14	15	16	17	18	11	**12**	13	14	15	16	17	10	**11**	12	13	14	15	16	9	10	**11**	12	13	14	15
V	19	20	21	22	**23**	24	25	18	19	20	21	**22**	23	24	17	18	19	20	21	22	23	16	17	18	19	20	21	22
	26	27	28	29	30	1	2	25	26	27	28	29	30	1	24	25	26	27	**28**	29	30	23	24	25	26	**27**	28	29
	3	4	5	6	7	8	9	2	3	4	5	6	7	8	1	2	3	4	5	6	7	30	1	2	3	4	5	6
D	10	11	12	13	14	15	16	9	10	11	12	13	14	15	8	9	10	11	12	13	14	7	8	9	10	11	12	13
E	17	18	19	20	21	22	23	16	17	18	19	20	21	22	15	16	17	18	19	20	21	14	15	16	17	18	19	20
C	24	**25**	26	27	28	29	30	23	24	**25**	26	27	28	29	22	23	24	**25**	26	27	28	21	22	23	24	**25**	26	27
	31							30	31						29	30	31					28	29	30	31			

- *U.S. Federal holidays are indicated*

Seven Year Calendar
(page 2 of 2)

January 1st:

	Thursday							Friday							Saturday						
	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	3						**1**	2						Dec 31	1
J	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8
A	11	12	13	14	15	16	17	10	11	12	13	14	15	16	9	10	11	12	13	14	15
N	18	**19**	20	21	22	23	24	17	**18**	19	20	21	22	23	16	**17**	18	19	20	21	22
	25	26	27	28	29	30	31	24	25	26	27	28	29	30	23	24	25	26	27	28	29
F	1	2	3	4	5	6	7	31	1	2	3	4	5	6	30	31	1	2	3	4	5
E	8	9	10	11	12	13	14	7	8	9	10	11	12	13	6	7	8	9	10	11	12
B	15	**16**	17	18	19	20	21	14	**15**	16	17	18	19	20	13	14	15	16	17	18	19
	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	**21**	22	23	24	25	26
	1	2	3	4	5	6	7	28	1	2	3	4	5	6	27	28	1	2	3	4	5
M	8	9	10	11	12	13	14	7	8	9	10	11	12	13	6	7	8	9	10	11	12
A	15	16	17	18	19	20	21	14	15	16	17	18	19	20	13	14	15	16	17	18	19
R	22	23	24	25	26	27	28	21	22	23	24	25	26	27	20	21	22	23	24	25	26
	29	30	31	1	2	3	4	28	29	30	31	1	2	3	27	28	29	30	31	1	2
A	5	6	7	8	9	10	11	4	5	6	7	8	9	10	3	4	5	6	7	8	9
P	12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16
R	19	20	21	22	23	24	25	18	19	20	21	22	23	24	17	18	19	20	21	22	23
	26	27	28	29	30	1	2	25	26	27	28	29	30	1	24	25	26	27	28	29	30
M	3	4	5	6	7	8	9	2	3	4	5	6	7	8	1	2	3	4	5	6	7
A	10	11	12	13	14	15	16	9	10	11	12	13	14	15	8	9	10	11	12	13	14
Y	17	18	19	20	21	22	23	16	17	18	19	20	21	22	15	16	17	18	19	20	21
	24	**25**	26	27	28	29	30	23	24	25	26	27	28	29	22	23	24	25	26	27	28
	31	1	2	3	4	5	6	30	**31**	1	2	3	4	5	29	**30**	31	1	2	3	4
J	7	8	9	10	11	12	13	6	7	8	9	10	11	12	5	6	7	8	9	10	11
U	14	15	16	17	18	19	20	13	14	15	16	17	18	19	12	13	14	15	16	17	18
N	21	22	23	24	25	26	27	20	21	22	23	24	25	26	19	20	21	22	23	24	25
	28	29	30	1	2	**3**	4	27	28	29	30	1	2	3	26	27	28	29	30	1	2
J	5	6	7	8	9	10	11	4	**5**	6	7	8	9	10	3	**4**	5	6	7	8	9
U	12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16
L	19	20	21	22	23	24	25	18	19	20	21	22	23	24	17	18	19	20	21	22	23
	26	27	28	29	30	31	1	25	26	27	28	29	30	31	24	25	26	27	28	29	30
	2	3	4	5	6	7	8	1	2	3	4	5	6	7	31	1	2	3	4	5	6
A	9	10	11	12	13	14	15	8	9	10	11	12	13	14	7	8	9	10	11	12	13
U	16	17	18	19	20	21	22	15	16	17	18	19	20	21	14	15	16	17	18	19	20
G	23	24	25	26	27	28	29	22	23	24	25	26	27	28	21	22	23	24	25	26	27
	30	31	1	2	3	4	5	29	30	31	1	2	3	4	28	29	30	31	1	2	3
S	6	**7**	8	9	10	11	12	5	**6**	7	8	9	10	11	4	**5**	6	7	8	9	10
E	13	14	15	16	17	18	19	12	13	14	15	16	17	18	11	12	13	14	15	16	17
P	20	21	22	23	24	25	26	19	20	21	22	23	24	25	18	19	20	21	22	23	24
	27	28	29	30	1	2	3	26	27	28	29	30	1	2	25	26	27	28	29	30	1
O	4	5	6	7	8	9	10	3	4	5	6	7	8	9	2	3	4	5	6	7	8
C	11	**12**	13	14	15	16	17	10	**11**	12	13	14	15	16	9	**10**	11	12	13	14	15
T	18	19	20	21	22	23	24	17	18	19	20	21	22	23	16	17	18	19	20	21	22
	25	26	27	28	29	30	31	24	25	26	27	28	29	30	23	24	25	26	27	28	29
	1	2	3	4	5	6	7	31	1	2	3	4	5	6	30	31	1	2	3	4	5
N	8	9	10	**11**	12	13	14	7	8	9	10	**11**	12	13	6	7	8	9	10	**11**	12
O	15	16	17	18	19	20	21	14	15	16	17	18	19	20	13	14	15	16	17	18	19
V	22	23	24	25	**26**	27	28	21	22	23	24	**25**	26	27	20	21	22	23	**24**	25	26
	29	30	1	2	3	4	5	28	29	30	1	2	3	4	27	28	29	30	1	2	3
D	6	7	8	9	10	11	12	5	6	7	8	9	10	11	4	5	6	7	8	9	10
E	13	14	15	16	17	18	19	12	13	14	15	16	17	18	11	12	13	14	15	16	17
C	20	21	22	23	24	**25**	26	19	20	21	22	23	**24**	25	18	19	20	21	22	23	24
	27	28	29	30	31			26	27	28	29	30	**31**		25	**26**	27	28	29	30	31

** U.S. Federal holidays are indicated*

Design Sizing Factors

The following design factors may be useful in assessing the expected size of HVAC equipment including, HVAC fans, tower fans, and circulation pumps. Inputs are indicated in bold font.

$$\text{HVAC fan kW} = \frac{\mathbf{cfm} * \dfrac{\textbf{fan static}\ (\text{in } H_2O)}{\mathbf{eff}_{\text{fan}}}}{8520\ \dfrac{ft^3 * \text{inches}}{\text{minutes} * kW}}$$

$$\text{hot water pump kW} = .643\ \frac{\text{Btu} * \text{minute}}{\text{ft} * \text{gal} * \text{hr}} * \frac{\textbf{hw head}(\text{ft}) * \mathbf{gpm}}{\mathbf{eff}_{\text{motor}} * \mathbf{eff}_{\text{impellor}} * 3413\ \dfrac{\text{Btu / hr}}{kW}}$$

$$\text{where: } \mathbf{gpm} = \frac{\textbf{heating capacity}\ (\text{Btuh})}{\mathbf{deltaT} * 8.33\ \text{lbs / gal} * 60\ \text{min / hr} * 1.0\ \text{Btu / (lb} * \text{F)}}$$

$$\text{chilled water pump kW} = .643\ \frac{\text{Btu} * \text{minute}}{\text{ft} * \text{gal} * \text{hr}} * \frac{\textbf{chw head}(\text{ft}) * 1.7 \text{ to } 2.4\ \textbf{gpm/ ton} * \textbf{peak cooling tons}}{\mathbf{eff}_{\text{motor}} * \mathbf{eff}_{\text{impellor}} * 3413\ \dfrac{\text{Btu / hr}}{kW}}$$

$$\text{condenser pump kW} = .643\ \frac{\text{Btu} * \text{minute}}{\text{ft} * \text{gal} * \text{hr}} * \frac{\textbf{cw head}(\text{ft}) * 3.0\ \textbf{gpm/ ton} * \textbf{peak cooling tons}}{\mathbf{eff}_{\text{motor}} * \mathbf{eff}_{\text{impellor}} * 3413\ \dfrac{\text{Btu / hr}}{kW}}$$

$$\text{tower fans kW} = \frac{\textbf{peak cooling tons} * 3.0\ \textbf{gpm/ ton} * 8.33\ \text{lbs / gal} * 13.33\ ft^3 / \text{lb} * \textbf{fan static}\ (\text{inches}) / \mathbf{eff}_{\text{fans}}}{8520\ \dfrac{ft^3 * \text{inches}}{\text{minutes} * kW}}$$

Design Sizing Factors

Condenser Water Pump*

	kW/ton[1]	gpm/ton	ft head
Reciprocating	0.057	3.0	64[2]
Screw	0.048	2.8	57[2]
Centrifugal	0.048	2.8	57[2]
Absorption			
1-Stage: Steam	0.110	3.9	95[2]
2-Stage:			
Steam	0.094	4.4	70
Exhaust Gas Fired	0.096	4.6	70
Direct Fired	0.096	4.6	70
Natural Gas Engine	0.054	3.3	55

1 Based on efficiencies of 0.70 pump and 0.90 motor.
2 Based on same size pipe as electric centrifugal

* from EPRI, *CFC's and Electric Chillers*, TR-100537s

Design Sizing Factors

Water-Cooled Electric Chiller Packages*

Type Compressor	Size (tons)[1]	New Chiller Efficiency (kW/ton)	Existing Chiller Efficiency (kW/ton)	Refrigerants Used Today
Centrifugal: High Efficiency	120-2,000	0.58 to 0.62	(Not applicable)	CFC-11 & 12[2]
Moderate Efficiency	120-2,000	0.63 to 0.70	0.70 to 0.80 or higher	CFC-11 & 12[2]
Screw	50-1,200	0.62 to 0.75	0.75 to 0.85 or higher	HCFC-22
Reciprocating	10-250	0.78 to 0.85	0.90 to 1.20 or higher	HCFC-22

1 Nominal tons at 44°F leaving chilled water with 85°F cooling water watering the condenser.
2 Some centrifugal chillers also use CFC-14 and R-500.

Cooling Tower Fans*

	kW/ton	
Reciprocating	0.083	
Screw	0.079	
Centrifugal	0.079	
Absorption 1-Stage	0.138	
Absorption 2-Stage	0.113[1]	(All models)
Natural Gas Engine	0.087	

1 Direct-gas fired absorption: add 0.030 kW/ton for the required induced draft fan in the exhaust stack

* from EPRI, *CFC's and Electric Chillers*, TR-100537s

Design Sizing Factors

Cooling Tower Motor Sizes
Based on Baltimore Aircoil Literature

tonnage	motor hp
43	2
51	3
60	3
68	3
74	5
88	5
97	5
116	5
133	7.5
160	7.5
173	10
211	10
250	2-7.5
266	2-7.5
320	2-7.5
346	2-10
422	2-10
500	2-15

Fuel Conversion Factors

Fuel Type Description	Btu Value per Units of Usage	Units of Usage
Natural Gas	1,000 Btu	CuFt
#2 Oil	139,000 Btu	Gal
#5 Oil	149,000 Btu	Gal
#6 Oil	153,000 Btu	Gal
Electricity	3,413 Btu	KWh
Coal	14,000 Btu	Lbs
Steam	1,160 Btu	Lbs
Propane	91,000 Btu	Gal
Natural Gas	100,000 Btu	Therm

Hot Water Demands

Table 1 Hot Water Demands and Use for Various Types of Buildings

Type of Building	Maximum Hour	Maximum Day	Average Day
Men's dormitories	3.8 gal (14.4 L)/student	22.0 gal (83.4 L)/student	13.1 gal (49.7 L)/student
Women's dormitories	5.0 gal (19 L)/student	26.5 gal (100.4 L)/student	12.3 gal (46.6 L)/student
Motels: No. of units[a]			
20 or less	6.0 gal (22.7 L)/unit	35.0 gal (132.6 L)/unit	20.0 gal (75.8 L)/unit
60	5.0 gal (19.7 L)/unit	25.0 gal (94.8 L)/unit	14.0 gal (53.1 L)/unit
100 or more	4.0 gal (15.2 L)/unit	15.0 gal (56.8 L)/unit	10.0 gal (37.9 L)/unit
Nursing homes	4.5 gal (17.1 L)/bed	30.0 (113.7 L)/bed	18.4 gal (69.7 L)/bed
Office buildings	0.4 gal (1.5 L)/person	2.0 gal (7.6 L)/person	1.0 gal (3.8 L)/person
Food service establishments:			
Type A—full meal restaurants and cafeterias	1.5 gal (5.7 L)/max meals/h	11.0 gal (41.7 L)/max meals/h	2.4 gal (9.1 L)/avg meals/day[b]
Type B—drive-ins, grilles, luncheonettes, sandwich and snack shops	0.7 gal (2.6 L)/max meals/h	6.0 gal (22.7 L)/max meals/h	0.7 gal (2.6 L)/avg meals/day[b]
Apartment houses: No. of apartments			
20 or less	12.0 gal (45.5 L)/apt.	80.0 gal (303.2 L)/apt.	42.0 gal (159.2 L)/apt.
50	10.0 gal (37.9 L)/apt.	73.0 gal (276.7 L)/apt.	40.0 gal (151.6 L)/apt.
75	8.5 gal (32.2 L)/apt.	66.0 gal (250 L)/apt.	38.0 gal (144 L)/apt.
100	7.0 gal (26.5 L)/apt.	60.0 gal (227.4 L)/apt.	37.0 gal (140.2 L)/apt.
200 or more	5.0 gal (19 L)	50.0 gal (195 L)/apt.	35.0 gal (132.7 L)/apt.
Elementary schools	0.6 gal (2.3 L)/student	1.5 gal (5.7 L)/student	0.6 gal (2.3 L)/student[b]
Junior and senior high schools	1.0 gal (3.8 L)/student	3.6 gal (13.6 L)/student	1.8 gal (6.8 L)/student[b]

[a]Interpolate for intermediate values. [b]Per day of operation.

Table 7 Hot Water Demand per Fixture for Various Types of Buildings
[Gallons (litres) of water per hour per fixture, calculated at a final temperature of 140 °F (60 °C)]

	Apartment House	Club	Gym-nasium	Hospital	Hotel	Industrial Plant	Office Building	Private Residence	School	YMCA
1. Basins, private lavatory	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)
2. Basins, public lavatory	4 (15)	6 (23)	8 (30)	6 (23)	8 (30)	12 (45.5)	6 (23)	—	15 (57)	8 (30)
3. Bathtubs	20 (76)	20 (76)	30 (114)	20 (76)	20 (76)	—	—	20 (76)	—	30 (114)
4. Dishwashers[a]	15 (57)	50-150 (190-570)	—	50-150 (190-570)	50-200 (190-760)	20-100 (76-380)	—	15 (57)	20-100 (76-380)	20-100 (76-380)
5. Foot basins	3 (11)	3 (11)	12 (46)	3 (11)	3 (11)	12 (46)	—	3 (11)	3 (11)	12 (46)
6. Kitchen sink	10 (38)	20 (76)	—	20 (76)	30 (114)	20 (76)	20 (76)	10 (38)	20 (76)	20 (76)
7. Laundry, stationary tubs	20 (76)	28 (106)	—	28 (106)	28 (106)	—	—	20 (76)	—	28 (106)
8. Pantry sink	5 (19)	10 (38)	—	10 (38)	10 (38)	—	10 (38)	5 (19)	10 (38)	10 (38)
9. Showers	30 (114)	150 (568)	225 (850)	75 (284)	75 (284)	225 (850)	30 (114)	30 (114)	225 (850)	225 (850)
10. Service sink	20 (76)	20 (76)	—	20 (76)	30 (114)	20 (76)	20 (76)	15 (57)	20 (76)	20 (76)
11. Hydrotherapeutic showers				400 (1520)						
12. Hubbard baths				600 (2270)						
13. Leg baths				100 (380)						
14. Arm baths				35 (130)						
15. Sitz baths				30 (114)						
16. Continuous-flow baths				165 (625)						
17. Circular wash sinks				20 (76)	20 (76)	30 (114)	20 (76)		30 (114)	
18. Semicircular wash sinks				10 (38)	10 (38)	15 (57)	10 (38)		15 (57)	
19. DEMAND FACTOR	0.30	0.30	0.40	0.25	0.25	0.40	0.30	0.30	0.40	0.40
20. STORAGE CAPACITY FACTOR[b]	1.25	0.90	1.00	0.60	0.80	1.00	2.00	0.70	1.00	1.00

[a]Dishwasher requirements should be taken from this table or from manufacturers' data for the model to be used, if this is known.
[b]Ratio of storage tank capacity to probable maximum demand/h. Storage capacity may be reduced where an unlimited supply of steam is available from a central street steam system or large boiler plant.

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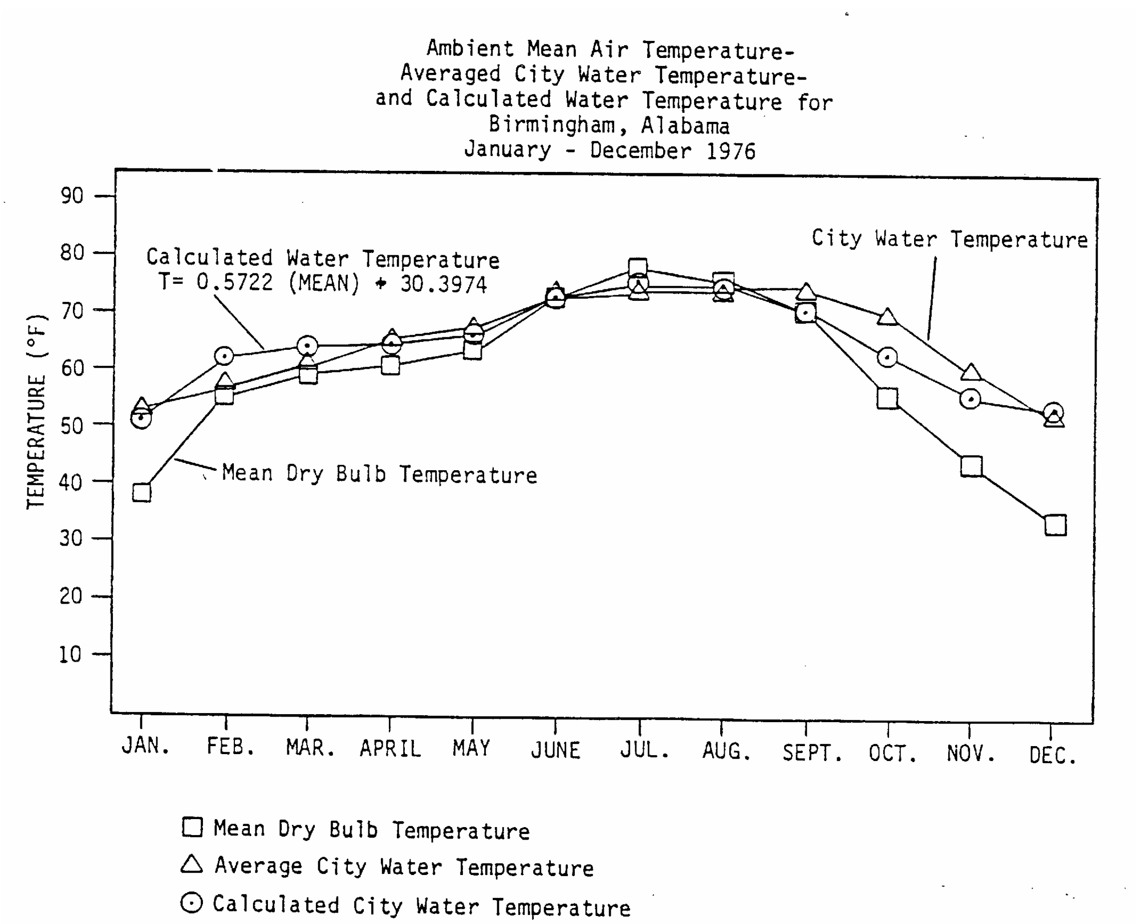
Inlet Water Temperatures

Good practice in simulation studies requires that domestic hot water loads be varied with inlet water temperature. A common procedure for estimating inlet water temperatures is to simply use whatever ground temperatures may be available in the weather file for a given location.

An improved procedure predicts inlet water temperature based on month-long average outdoor dry bulb temperature. For any given mean monthly outdoor dry bulb temperature, the estimated inlet water temperature for that month is:

inlet water temperature = 0.5722 * (mean monthly db temperature) + 30.4

The graph reproduced below illustrates the approximate fit of this simple relationship between outdoor dry bulb temperature and inlet water temperature.



Internal Loads
Appliance Heat Gain

TABLE 52—HEAT GAIN FROM MISCELLANEOUS APPLIANCES

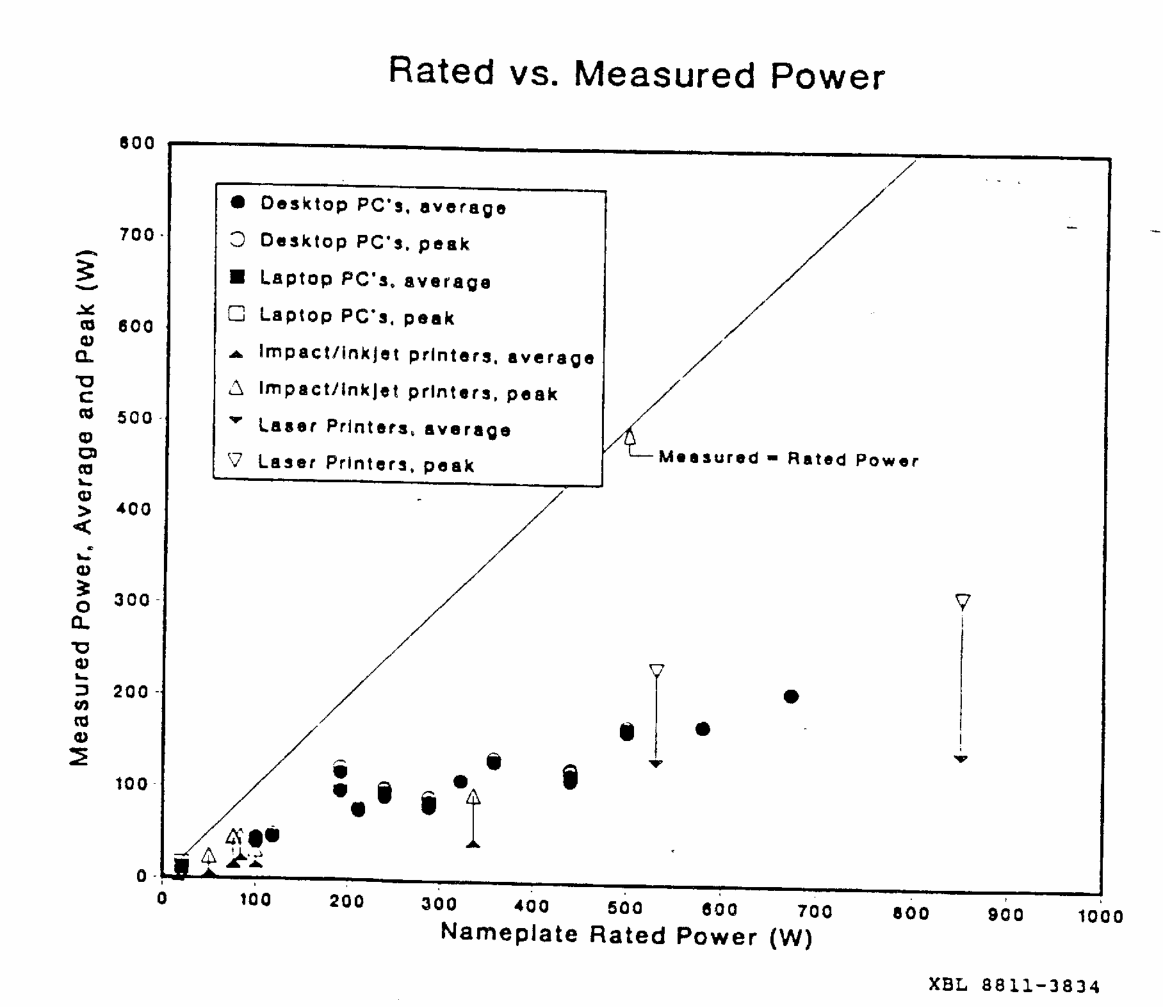
NOT HOODED*

APPLIANCE	TYPE OF CONTROL	MISCELLANEOUS DATA	MFR MAX RATING Btu/hr	RECOM HEAT GAIN FOR AVG USE		
				Sensible Heat Btu/hr	Latent Heat Btu/hr	Total Heat Btu/hr
ELECTRIC						
Hair Dryer, Blower Type 15 amps, 115 volts AC	Man.	Fan 165 watts, (low 915 watts, high 1580 watts)	5,370	2,300	400	2,700
Hair Dryer, helmet type, 6.5 amps, 115 volts AC	Man.	Fan 80 watts, (low 300 watts, high 710 watts)	2,400	1,870	330	2,200
Permanent Wave Machine	Man.	60 heaters at 25 watts each, 36 in normal use	5,100	850	150	1,000
Pressurized Instrument Washer and Sterilizer		11″ x 11″ x 22″		12,000	23,460	35,460
Neon Sign, per linear ft tube		½″ outside dia ⅜″ outside dia		30 60		30 60
Solution and/or Blanket Warmer		18″ x 30″ x 72″ 18″ x 24″ x 72″		1,200 1,050	3,000 2,400	4,200 3,450
Sterilizer Dressing	Auto. Auto.	16″ x 24″ 20″ x 36″		9,600 23,300	8,700 24,000	18,300 47,300
Sterilizer, Rectangular Bulk	Auto. Auto. Auto. Auto. Auto. Auto. Auto.	24″ x 24″ x 36″ 24″ x 24″ x 48″ 24″ x 36″ x 48″ 24″ x 36″ x 60″ 36″ x 42″ x 84″ 42″ x 48″ x 96″ 48″ x 54″ x 96″		34,800 41,700 56,200 68,500 161,700 184,000 210,000	21,000 27,000 36,000 45,000 97,500 140,000 180,000	55,800 68,700 92,200 113,500 259,200 324,000 390,000
Sterilizer, Water	Auto. Auto.	10 gallon 15 gallon		4,100 6,100	16,500 24,600	20,600 30,700
Sterilizer, Instrument	Auto. Auto. Auto. Auto. Auto.	6″ x 8″ x 17″ 9″ x 10″ x 20″ 10″ x 12″ x 22″ 10″ x 12″ x 36″ 12″ x 16″ x 24″		2,700 5,100 8,100 10,200 9,200	2,400 3,900 5,900 9,400 8,600	5,100 9,000 14,000 19,600 17,800
Sterilizer, Utensil	Auto. Auto.	16″ x 16″ x 24″ 20″ x 20″ x 24″		10,600 12,300	20,400 25,600	31,000 37,900
Sterilizer, Hot Air	Auto. Auto.	Model 120 Amer Sterilizer Co Model 100 Amer Sterilizer Co		2,000 1,200	4,200 2,100	6,200 3,300
Water Still		5 gal/hour		1,700	2,700	4,400
X-ray Machines, for making pictures		Physicians and Dentists office		None	None	None
X-ray Machines, for therapy		Heat load may be appreciable—write mfg for data				
GAS BURNING						
Burners, Laboratory small bunsen	Man.	7/16 dia barrel with manufactured gas	1,800	960	240	1,200
small bunsen fishtail burner	Man. Man.	7/16 dia with nat gas 7/16 dia with nat gas	3,000 3,500	1,680 1,960	420 490	2,100 2,450
fishtail burner large bunsen	Man. Man.	7/16 dia bar with nat gas 1½ dia mouth, adj orifice	5,500 6,000	3,080 3,350	770 850	3,850 4,200
Cigar Lighter	Man.	Continuous flame type	2,500	900	100	1,000
Hair Dryer System 5 helmets 10 helmets	Auto. Auto.	Consists of heater & fan which blows hot air thru duct system to helmets	33,000	15,000 21,000	4,000 6,000	19,000 27,000

*If properly designed positive exhaust hood is used, multiply recommended value by .50

Internal Loads
Electronic Office Equipment

An LBL study of electronic office equipment reported that current office equipment load is approximately 1-2 W/ft2, roughly equivalent to the lighting loads in many new offices. Office equipment such as personal computers, copy machines, communications equipment, and peripherals may account for 5 to 20% of daytime electrical loads in new offices. A major finding of this study was that nameplate ratings overstate measured power on average, by a factor of 3 for PC's and a factor of 4.5 for printers (see figure below).



Source: *Technology Assessment: Electronic Office Equipment*, LBL-25558, 1988

Internal Loads
Electronic Office Equipment

Table 9 Recommended Rate of Heat Gain from Selected Office Equipment

Appliance	Size	Maximum Input Watts	Maximum Input Btu/h	Standby Input Watts	Standby Input Btu/h	Recommended Rate of Heat Gain Watts	Recommended Rate of Heat Gain Btu/h
Computer Devices							
Communication/ transmission		1800-4600	6140-15700	1640-2810	5600-9600	1640-2810	5600-9600
Disk drives/mass storage		1000-10000	3400-34100	1000-6600	3400-22400	1000-6600	3400-22400
Microcomputer/ wordprocessor	16-640 kbytes[a]	100-600	340-2050	90-530	300-1800	90-530	300-1800
Minicomputer		2200-6600	7500-15000	2200-6600	7500-15000	2200-6600	7500-15000
Printer (laser)	8 pages/min	870	3000	180	600	300	1000
Printer (Line, high speed	5000-more pages/min	1000-5300	3400-18000	500-2550	2160-9040	730-3800	2500-13000
Tape drives		1200-6500	4100-22200	1000-4700	3500-15000	1000-4700	3500-15000
Terminal		90-200	300-700	80-180	270-600	80-180	270-600
Copiers/Typesetters							
Blue print		1150-12500	3900-42700	500-5000	1700-17000	1150-12500	3900-42700
Copiers (large)	30-67[a] copies/min.	5800-22500	1700-6600	5800-22500	900	3100	1700-6600
Copiers	6-30[a] copies/min.	1570-5800	460-1700	1570-5800	300-900	1000-3100	460-1700
Phototypesetter		1725	5900			1520	5200
Mailprocessing							
Inserting machine 3600-6800 pieces/h		600-3300	2000-11300			390-2150	1300-7300
Labeling machine 1500-30000 pieces/h		600-6600	2000-22500			390-4300	1300-14700
Miscellaneous							
Cash register		60	200			48	160
Cold food/beverage		1150-1920	3900-6600			575-960	1960-3280
Coffee maker	10 cup	1500	5120		sensible	1050	3580
					latent	450	1540
Microwave oven	1 ft^3	600	2050			400	1360
Paper shredder		250-3000	850-10200			200-2420	680-8250
Water cooler	8 gal/h	700	2400			1750	6000

[a]Input is not proportional to capacity.

Source: *Technology Assessment: Electronic Office Equipment*, LBL-25558, 1988

Internal Loads
Occupancy Heat Gain

Table 3 Rates of Heat Gain from Occupants of Conditioned Spaces

Degree of Activity		Total Heat, Btu/h Adult Male	Total Heat, Btu/h Adjusted, M/F[a]	Sensible Heat, Btu/h	Latent Heat, Btu/h	% Sensible Heat that is Radiant[b] Low V	% Sensible Heat that is Radiant[b] High V
Seated at theater	Theater, matinee	390	330	225	105		
Seated at theater, night	Theater, night	390	350	245	105	60	27
Seated, very light work	Offices, hotels, apartments	450	400	245	155		
Moderately active office work	Offices, hotels, apartments	475	450	250	200		
Standing, light work; walking	Department store; retail store	550	450	250	200	58	38
Walking, standing	Drug store, bank	550	500	250	250		
Sedentary work	Restaurant[c]	490	550	275	275		
Light bench work	Factory	800	750	275	475		
Moderate dancing	Dance hall	900	850	305	545	49	35
Walking 3 mph; light machine work	Factory	1000	1000	375	625		
Bowling[d]	Bowling alley	1500	1450	580	870		
Heavy work	Factory	1500	1450	580	870	54	19
Heavy machine work; lifting	Factory	1600	1600	635	965		
Athletics	Gymnasium	2000	1800	710	1090		

Notes:
1. Tabulated values are based on 75°F room dry-bulb temperature. For 80°F room dry bulb, the total heat remains the same, but the sensible heat values should be decreased by approximately 20%, and the latent heat values increased accordingly.
2. Also refer to Table 4, Chapter 8, for additional rates of metabolic heat generation.
3. All values are rounded to nearest 5 Btu/h.

[a] Adjusted heat gain is based on normal percentage of men, women, and children for the application listed, with the postulate that the gain from an adult female is 85% of that for an adult male, and that the gain from a child is 75% of that for an adult male.

[b] Values approximated from data in Table 6, Chapter 8, where is air velocity with limits shown in that table.

[c] Adjusted heat gain includes 60 Btu/h for food per individual (30 Btu/h sensible and 30 Btu/h latent).

[d] Figure one person per alley actually bowling, and all others as sitting (400 Btu/h) or standing or walking slowly (550 Btu/h).

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TABLE 48—HEAT GAIN FROM PEOPLE

DEGREE OF ACTIVITY	TYPICAL APPLICATION	Metabolic Rate (Adult Male) Btu/hr	Average Adjusted Metabolic Rate* Btu/hr	82 F Btu/hr Sensible	82 F Btu/hr Latent	80 F Btu/hr Sensible	80 F Btu/hr Latent	78 F Btu/hr Sensible	78 F Btu/hr Latent	75 F Btu/hr Sensible	75 F Btu/hr Latent	70 F Btu/hr Sensible	70 F Btu/hr Latent
Seated at rest	Theater, Grade School	390	350	175	175	195	155	210	140	230	120	260	90
Seated, very light work	High School	450	400	180	220	195	205	215	185	240	160	275	125
Office worker	Offices, Hotels, Apts., College	475	450	180	270	200	250	215	235	245	205	285	165
Standing, walking slowly	Dept., Retail, or Variety Store	550											
Walking, seated	Drug Store	550	500	180	320	200	300	220	280	255	245	290	210
Standing, walking slowly	Bank	550											
Sedentary work	Restaurant†	500	550	190	360	220	330	240	310	280	270	320	230
Light bench work	Factory, light work	800	750	190	560	220	530	245	505	295	455	365	385
Moderate dancing	Dance Hall	900	850	220	630	245	605	275	575	325	525	400	450
Walking, 3 mph	Factory, fairly heavy work	1000	1000	270	730	300	700	330	670	380	620	460	540
Heavy work	Bowling Alley‡, Factory	1500	1450	450	1000	465	985	485	965	525	925	605	845

*Adjusted Metabolic Rate is the metabolic rate to be applied to a mixed group of people with a typical percent composition based on the following factors:
Metabolic rate, adult female = Metabolic rate, adult male × 0.85
Metabolic rate, children = Metabolic rate, adult male × 0.75

†Restaurant—Values for this application include 60 Btu per hr for food per individual (30 Btu sensible and 30 Btu latent heat per hr).

‡Bowling—Assume one person per alley actually bowling and all others sitting, metabolic rate 400 Btu per hr; or standing, 550 Btu per hr.

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Internal Loads
Restaurant Appliances Heat Gain - Electric

TABLE 50—HEAT GAIN FROM RESTAURANT APPLIANCES

NOT HOODED*—ELECTRIC

APPLIANCE	OVERALL DIMENSIONS Less Legs and Handles (In.)	TYPE OF CON-TROL	MISCELLANEOUS DATA	MFR MAX RATING Btu/hr	MAIN-TAIN-ING RATE Btu/hr	RECOM HEAT GAIN FOR AVG USE		
						Sensible Heat Btu/hr	Latent Heat Btu/hr	Total Heat Btu/hr
Coffee Brewer—½ gal Warmer—½ gal		Man. Man.		2240 306	306 306	900 230	220 90	1120 320
4 Coffee Brewing Units with 4½ gal Tank	20 x 30 x 26H	Auto.	Water heater—2000 watts Brewers—2960 watts	16900		4800	1200	6000
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Man. Auto. Auto.	Black finish Nickel plated Nickel plated	11900 15300 17000	3000 2600 3600	2600 2200 3400	1700 1500 2300	4300 3700 5700
Doughnut Machine	22 x 22 x 57H	Auto.	Exhaust system to outdoors—½ hp motor	16000		5000		5000
Egg Boiler	10 x 13 x 25H	Man.	Med. ht.—550 watts Low ht—275 watts	3740		1200	800	2000
Food Warmer with Plate Warmer, per sq ft top surface		Auto.	Insulated, separate heating unit for each pot. Plate warmer in base	1350	500	350	350	700
Food Warmer without Plate Warmer, per sq ft top surface		Auto.	Ditto, without plate warmer	1020	400	200	350	550
Fry Kettle—11½ lb fat	12 Dia x 14H	Auto.		8840	1100	1600	2400	4000
Fry Kettle—25 lb fat	16 x 18 x 12H	Auto.	Frying area 12″ x 14″	23800	2000	3800	5700	9500
Griddle, Frying	18 x 18 x 8H	Auto.	Frying top 18″ x 14″	8000	2800	3100	1700	4800
Grille, Meat	14 x 14 x 10H	Auto.	Cooking area 10″ x 12″	10200	1900	3900	2100	6000
Grille, Sandwich	13 x 14 x 10H	Auto.	Grill area 12″ x 12″	5600	1900	2700	700	3400
Roll Warmer	26 x 17 x 13H	Auto.	One drawer	1500	400	1100	100	1200
Toaster, Continuous	15 x 15 x 28H	Auto.	2 Slices wide—360 slices/hr	7500	5000	5100	1300	6400
Toaster, Continuous	20 x 15 x 28H	Auto.	4 Slices wide—720 slices/hr	10200	6000	6100	2600	8700
Toaster, Pop-Up	6 x 11 x 9H	Auto.	2 Slices	4150	1000	2450	450	2900
Waffle Iron	12 x 13 x 10H	Auto.	One waffle 7″ dia	2480	600	1100	750	1850
Waffle Iron for Ice Cream Sandwich	14 x 13 x 10H	Auto.	12 Cakes, each 2½″ x 3¾″	7500	1500	3100	2100	5200

*If properly designed positive exhaust hood is used, multiply recommended value by .50.

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Internal Loads
Restaurant Appliances Heat Gain – Gas & Steam

TABLE 51—HEAT GAIN FROM RESTAURANT APPLIANCES

NOT HOODED*—GAS BURNING AND STEAM HEATED

APPLIANCE	OVERALL DIMENSIONS Less Legs and Handles (In.)	TYPE OF CON-TROL	MISCELLANEOUS DATA	MFR MAX RATING Btu/hr	MAIN-TAIN-ING RATE Btu/hr	RECOM HEAT GAIN FOR AVG USE		
						Sensible Heat Btu/hr	Latent Heat Btu/hr	Total Heat Btu/hr
GAS BURNING								
Coffee Brewer—½ gal Warmer—½ gal		Man. Man.	Combination brewer and warmer	3400 500	 500	1350 400	350 100	1700 500
Coffee Brewer Unit with Tank	19 x 30 x 26H		4 Brewers and 4½ gal tank			7200	1800	9000
Coffee Urn—3 gal	15″ Dia x 34H	Auto.	Black finish	3200	3900	2900	2900	5800
Coffee Urn—3 gal	12 x 23 oval x 21H	Auto.	Nickel plated		3400	2500	2500	5000
Coffee Urn—5 gal	18 Dia x 37H	Auto.	Nickel plated		4700	3900	3900	7800
Food Warmer, Values per sq ft top surface		Man.	Water bath type	2000	900	850	450	1300
Fry Kettle—15 lb fat	12 x 20 x 18H	Auto.	Frying area 10 x 10	14250	3000	4200	2800	7000
Fry Kettle—28 lb fat	15 x 35 x 11H	Auto.	Frying area 11 x 16	24000	4500	7200	4800	12000
Grill—Broil-O-Grill Top Burner Bottom Burner	22 x 14 x 17H (1.4 sq ft grill surface)	Man.	Insulated 22,000 Btu/hr 15,000 Btu/hr	37000		14400	3600	18000
Stoves, Short Order—Open Top. Values per sq ft top surface		Man.	Ring type burners 12000 to 22000 Btu/ea	14000		4200	4200	8400
Stoves, Short Order—Closed Top. Values per sq ft top surface		Man.	Ring type burners 10000 to 12000 Btu/ea	11000		3300	3300	6600
Toaster, Continuous	15 x 15 x 28H	Auto.	2 Slices wide—360 slices/hr	12000	10000	7700	3300	11000
STEAM HEATED								
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Auto. Auto. Auto.	Black finish Nickel plated Nickel plated			2900 2400 3400	1900 1600 2300	4800 4000 5700
Coffee Urn—3 gal —3 gal —5 gal	15 Dia x 34H 12 x 23 oval x 21H 18 Dia x 37H	Man. Man. Man.	Black finish Nickel plated Nickel plated			3100 2600 3700	3100 2600 3700	6200 5200 7400
Food Warmer, per sq ft top surface		Auto.				400	500	900
Food Warmer, per sq ft top surface		Man.				450	1150	1500

*If properly designed positive exhaust hood is used, multiply recommended value by .50.

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Psychrometric Chart

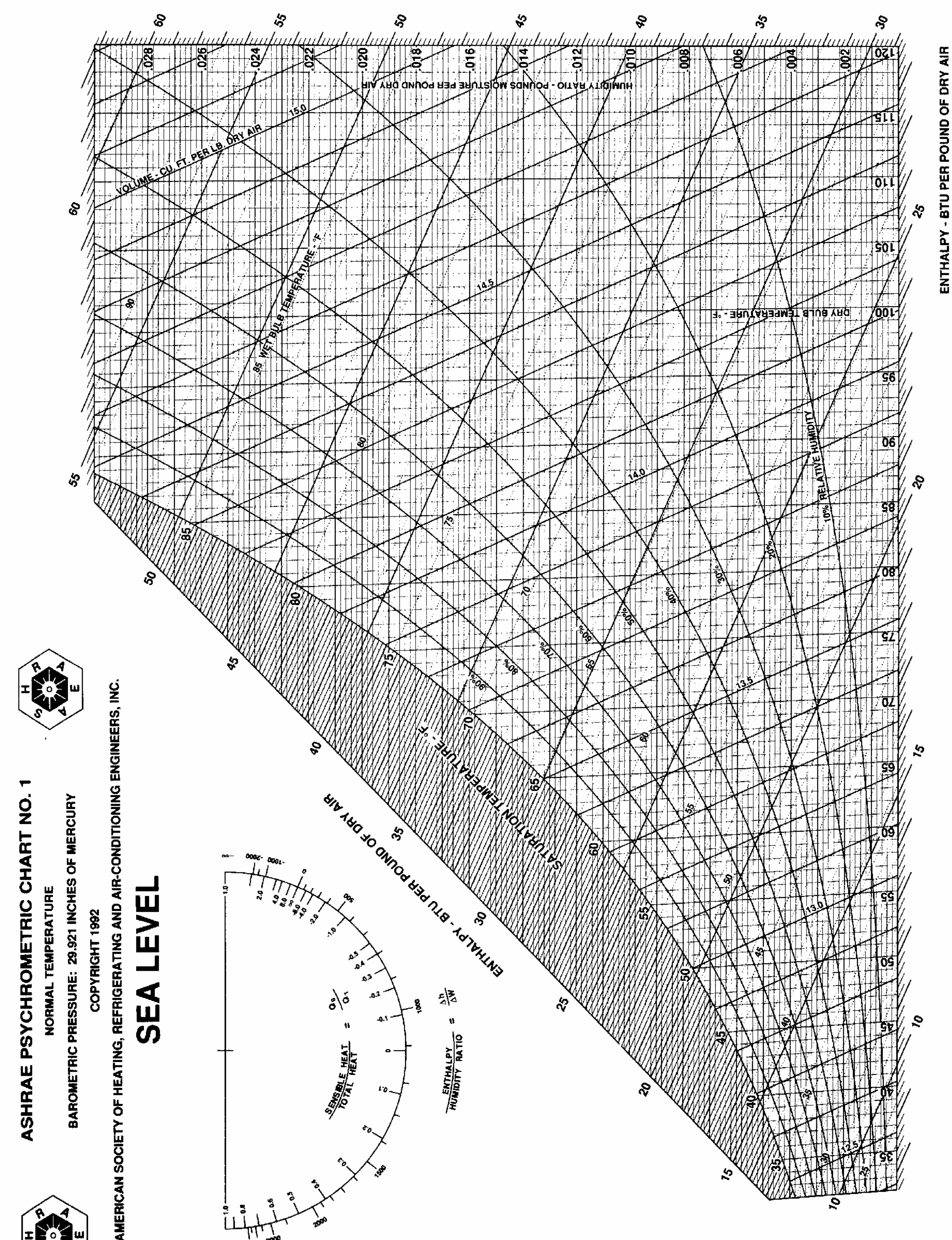

Fig. 1 ASHRAE Psychrometric Chart No. 1

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Reading List

For a general introduction to using detailed simulation in DSM applications, including specific information on selected models:

- *Engineering Methods for Estimating the Impacts of Demand-Side Management Programs* (EPRI TR-100984, V. 1)

For a good general comparison of simulation methodologies and a detailed list of typical energy efficiency measures applicable to new and existing construction:

- *Architect's and Engineer's Guide to Energy Conservation in Existing Buildings*, Volumes 1 and 2, U.S. Department of Energy, 1990

For an HVAC systems overview:

- *Principals of Heating, Ventilating and Air Conditioning*, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1990
- *1992 ASHRAE Handbook - HVAC Systems and Equipment*, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1992
- *Handbook of Air Conditioning System Design*, Carrier Air Conditioning Company and McGraw-Hill, 1965
- *HVAC Systems Applications*, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), 1987

For an overview of thermal load estimation:

- *Principals of Heating, Ventilating and Air Conditioning*, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1990
- *1989 ASHRAE Handbook - Fundamentals*, see especially chapters 23-27, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1989

For an overview of energy estimation (simulation) methods:

- *Principals of Heating, Ventilating and Air Conditioning*, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1990
- *1989 ASHRAE Handbook - Fundamentals*, see especially chapter 28, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, 1989

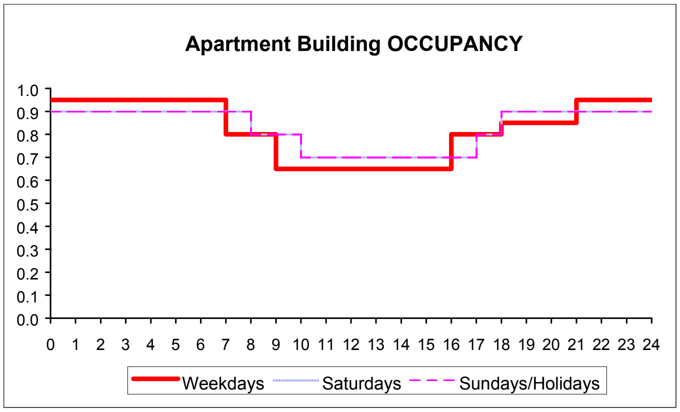
Simulation Program Reviews and Comparisons:

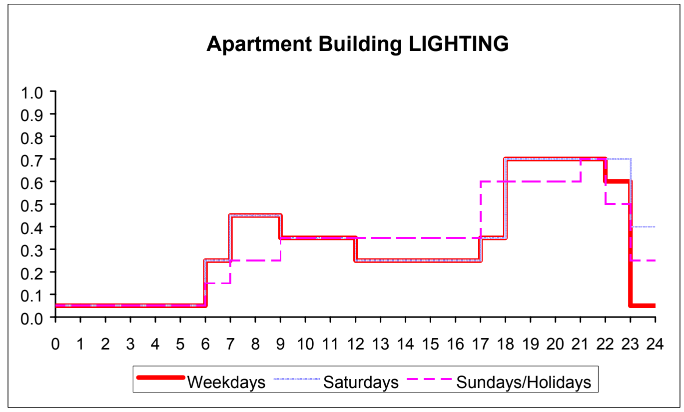
- “Energy Analysis Software Review”, *Engineered Systems*, Oct., 1993

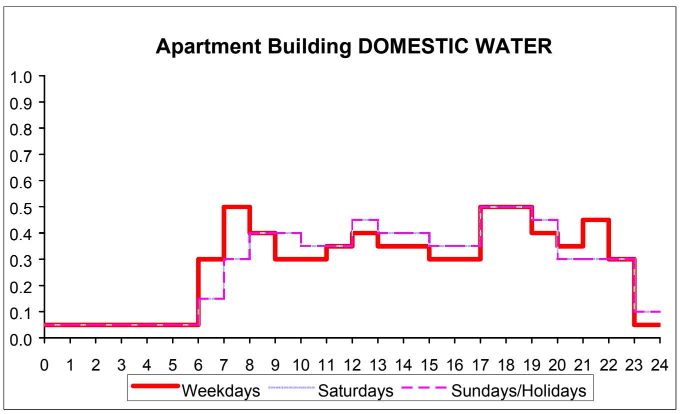
Simulation Practice and Guidelines:

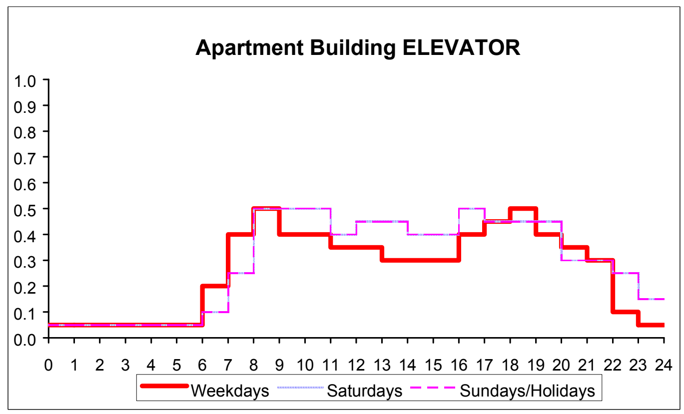
- *Guidelines for Energy Simulation of Commercial Buildings*, Bonneville Power Administration, 1992

Apartment Building Schedule Profiles









Apartment Building

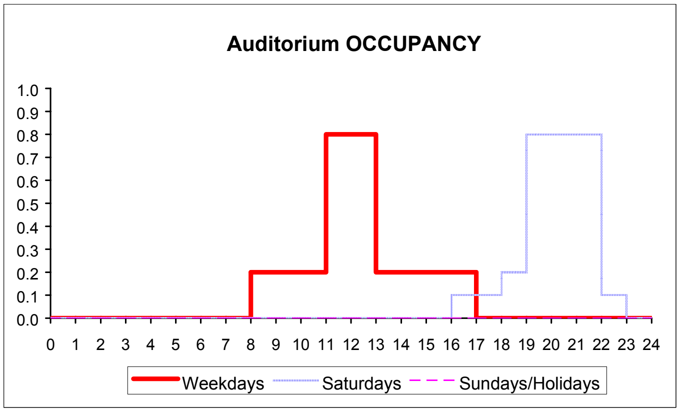
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.80	0.80	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.80	0.80	0.85	0.85	0.85	0.95	0.95	0.95
Saturdays	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.90	0.90	0.90	0.90	0.90	0.90
Sundays/Holidays	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.90	0.90	0.90	0.90	0.90	0.90

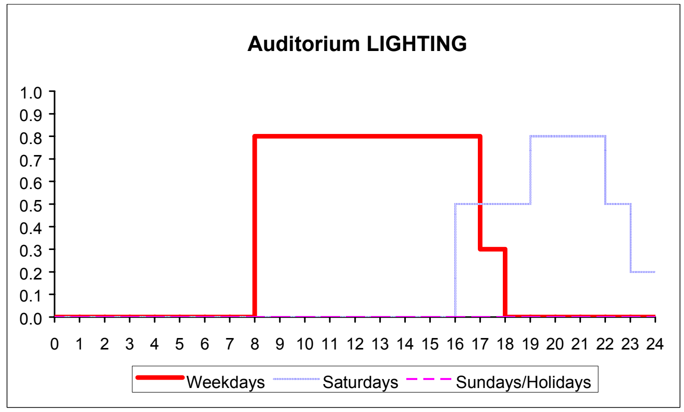
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.45	0.45	0.35	0.35	0.35	0.25	0.25	0.25	0.25	0.25	0.35	0.70	0.70	0.70	0.70	0.60	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.45	0.45	0.35	0.35	0.35	0.25	0.25	0.25	0.25	0.25	0.35	0.70	0.70	0.70	0.70	0.70	0.40
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.25	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.60	0.60	0.60	0.60	0.70	0.50	0.25

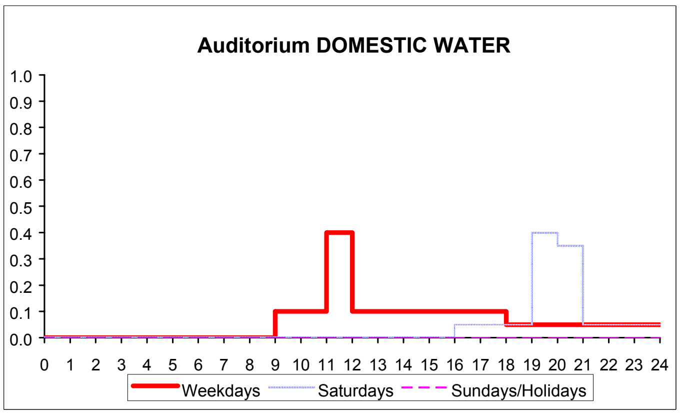
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.50	0.40	0.30	0.30	0.35	0.40	0.35	0.35	0.30	0.30	0.50	0.50	0.40	0.35	0.45	0.30	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.30	0.40	0.40	0.35	0.35	0.45	0.40	0.40	0.35	0.35	0.50	0.50	0.45	0.30	0.30	0.30	0.10
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.30	0.40	0.40	0.35	0.35	0.45	0.40	0.40	0.35	0.35	0.50	0.50	0.45	0.30	0.30	0.30	0.10

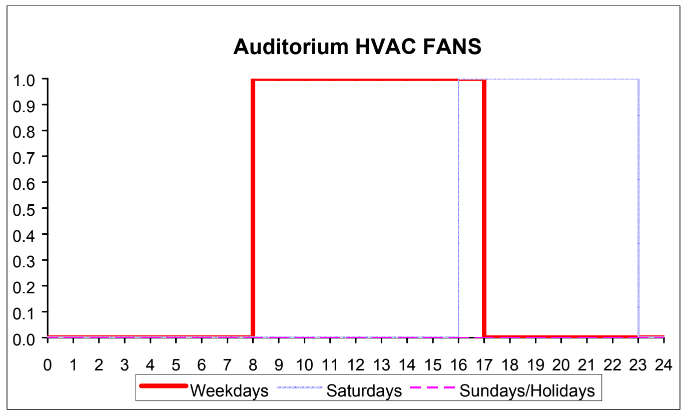
ELEVATOR	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.40	0.50	0.40	0.40	0.35	0.35	0.30	0.30	0.30	0.40	0.45	0.50	0.40	0.35	0.30	0.10	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.25	0.50	0.50	0.50	0.40	0.45	0.45	0.40	0.40	0.50	0.45	0.45	0.45	0.30	0.30	0.25	0.15
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.25	0.50	0.50	0.50	0.40	0.45	0.45	0.40	0.40	0.50	0.45	0.45	0.45	0.30	0.30	0.25	0.15

Auditorium Schedule Profiles









Auditorium

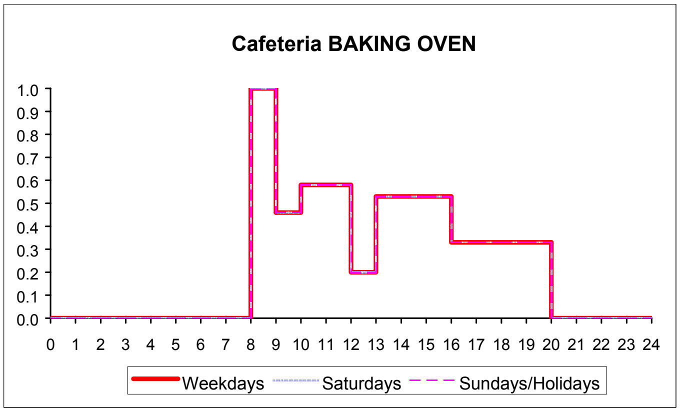
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.80	0.80	0.20	0.20	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.80	0.80	0.80	0.10	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

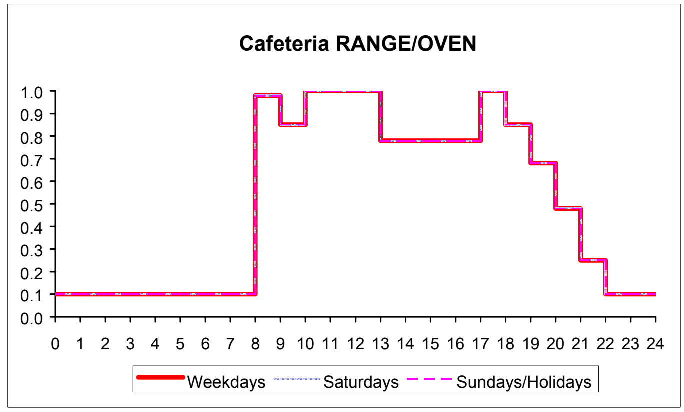
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.80	0.80	0.80	0.50	0.20
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

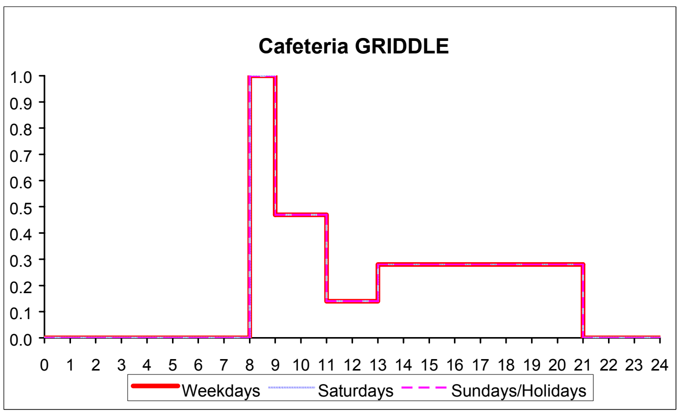
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.40	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.40	0.35	0.05	0.05	0.05
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

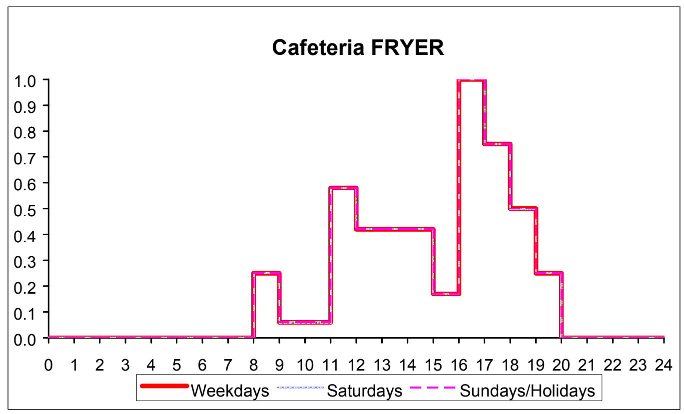
HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Cafeteria Schedule Profiles









Cafeteria

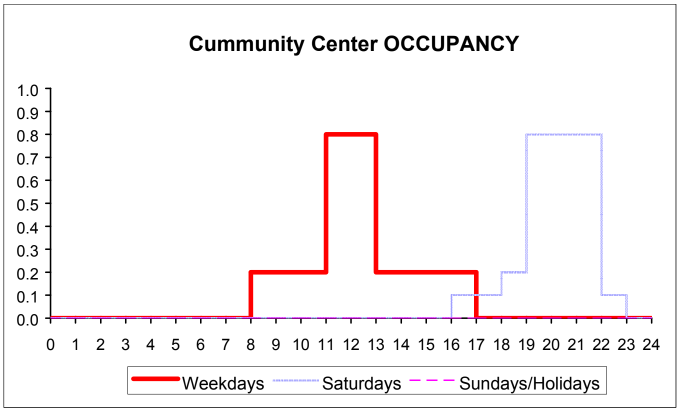
BAKING OVEN	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.46	0.58	0.58	0.20	0.53	0.53	0.53	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.46	0.58	0.58	0.20	0.53	0.53	0.53	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.46	0.58	0.58	0.20	0.53	0.53	0.53	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00

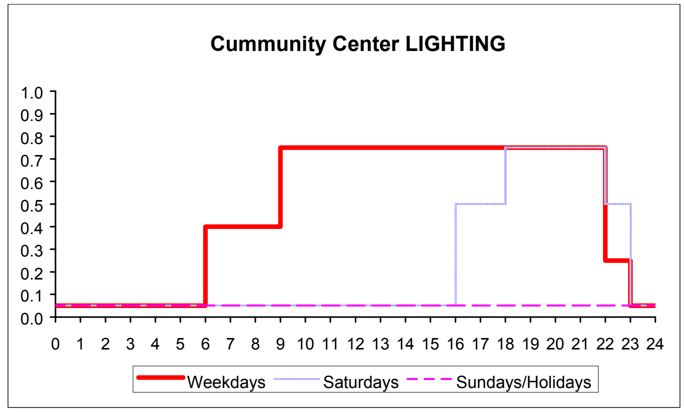
RANGE/OVEN	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.98	0.85	1.00	1.00	1.00	0.78	0.78	0.78	0.78	1.00	0.85	0.68	0.48	0.25	0.10	0.10
Saturdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.98	0.85	1.00	1.00	1.00	0.78	0.78	0.78	0.78	1.00	0.85	0.68	0.48	0.25	0.10	0.10
Sundays/Holidays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.98	0.85	1.00	1.00	1.00	0.78	0.78	0.78	0.78	1.00	0.85	0.68	0.48	0.25	0.10	0.10

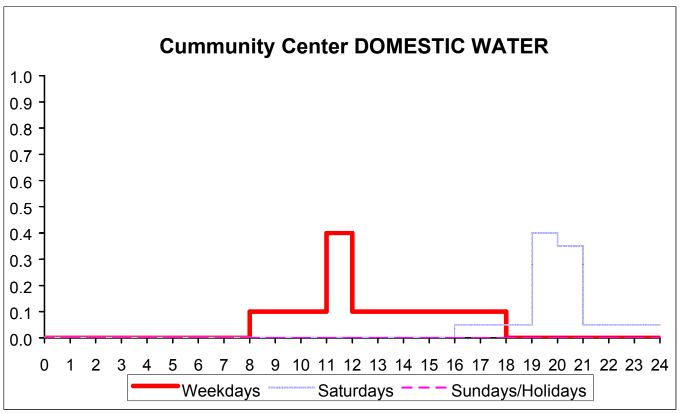
GRIDDLE	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.47	0.47	0.14	0.14	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.47	0.47	0.14	0.14	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.47	0.47	0.14	0.14	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.00	0.00

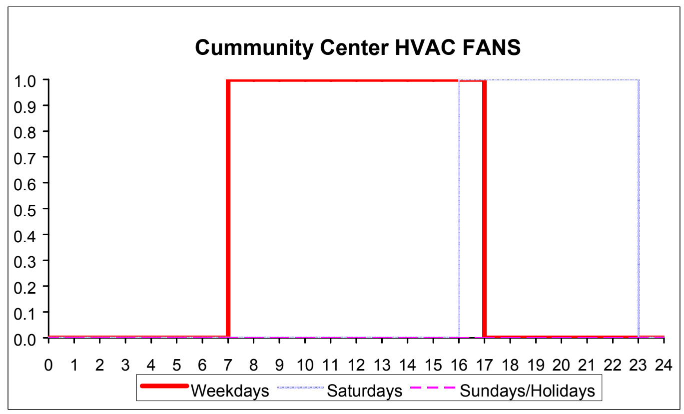
FRYER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.06	0.06	0.58	0.42	0.42	0.42	0.17	1.00	0.75	0.50	0.25	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.06	0.06	0.58	0.42	0.42	0.42	0.17	1.00	0.75	0.50	0.25	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.06	0.06	0.58	0.42	0.42	0.42	0.17	1.00	0.75	0.50	0.25	0.00	0.00	0.00	0.00

Cummunity Center Schedule Profiles









Cummunity Center

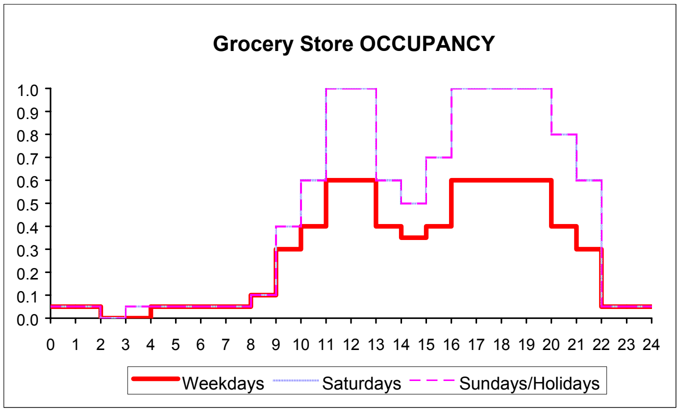
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.80	0.80	0.20	0.20	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.80	0.80	0.80	0.10	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

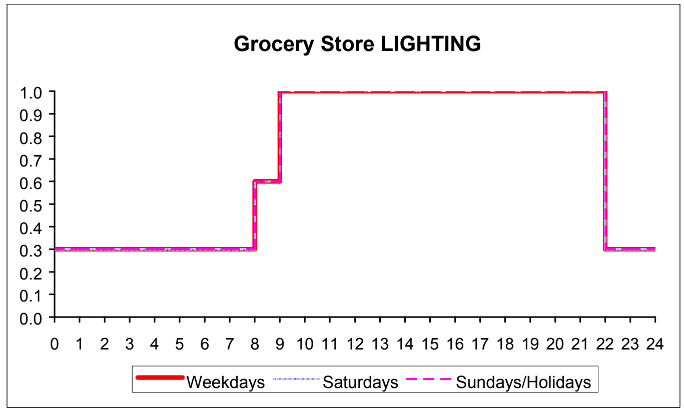
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.40	0.40	0.40	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.25	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.50	0.50	0.75	0.75	0.75	0.75	0.50	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

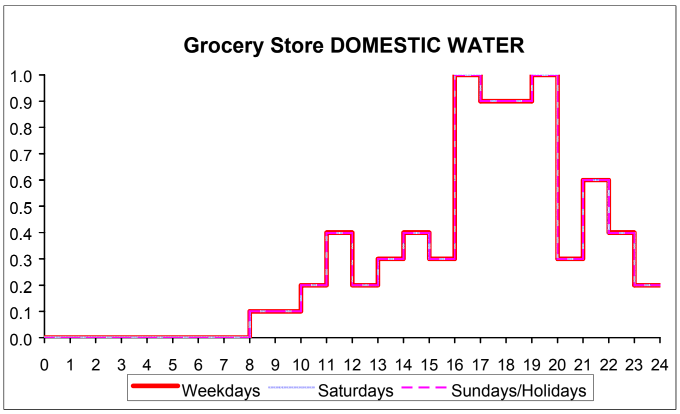
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.40	0.10	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.40	0.35	0.05	0.05	0.05
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

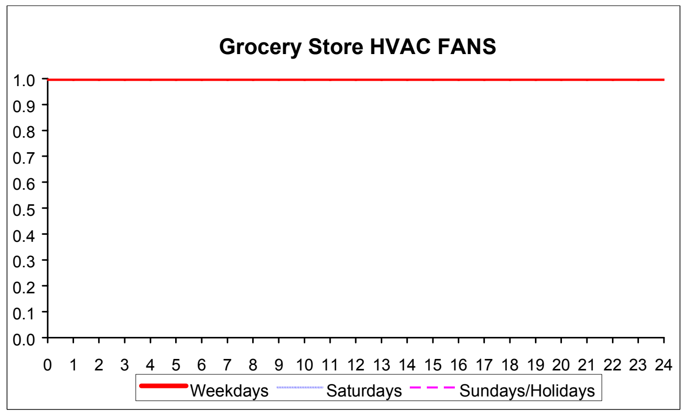
HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Grocery Store Schedule Profiles









Grocery Store

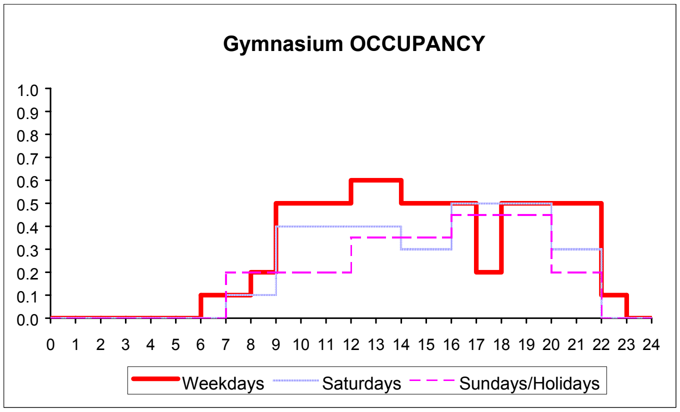
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.00	0.00	0.05	0.05	0.05	0.05	0.10	0.30	0.40	0.60	0.60	0.40	0.35	0.40	0.60	0.60	0.60	0.60	0.40	0.30	0.05	0.05
Saturdays	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.10	0.40	0.60	1.00	1.00	0.60	0.50	0.70	1.00	1.00	1.00	1.00	0.80	0.60	0.05	0.05
Sundays/Holidays	0.05	0.05	0.00	0.05	0.05	0.05	0.05	0.05	0.10	0.40	0.60	1.00	1.00	0.60	0.50	0.70	1.00	1.00	1.00	1.00	0.80	0.60	0.05	0.05

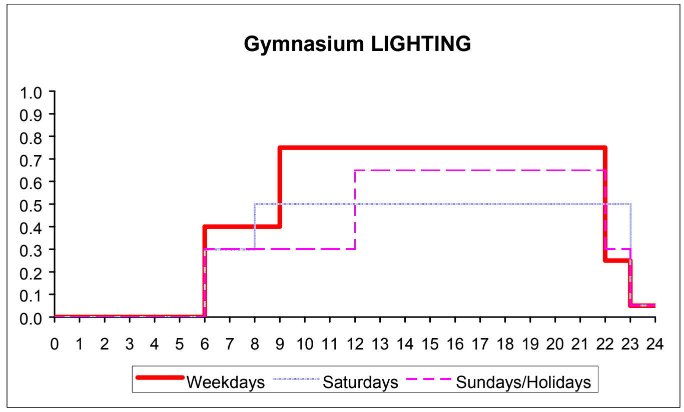
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30	0.30
Saturdays	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30	0.30
Sundays/Holidays	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30	0.30

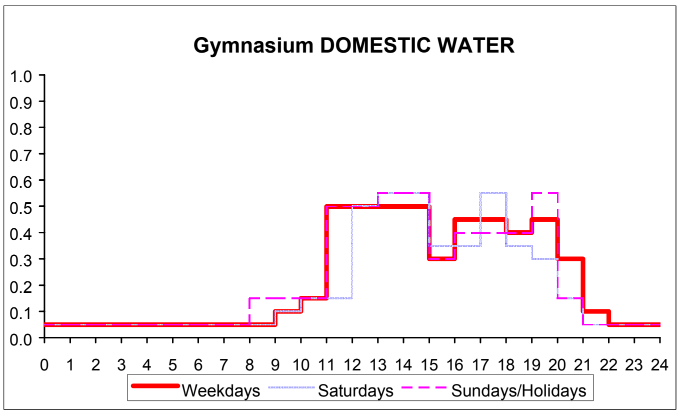
DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.40	0.20	0.30	0.40	0.30	1.00	0.90	0.90	1.00	0.30	0.60	0.40	0.20
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.40	0.20	0.30	0.40	0.30	1.00	0.90	0.90	1.00	0.30	0.60	0.40	0.20
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.40	0.20	0.30	0.40	0.30	1.00	0.90	0.90	1.00	0.30	0.60	0.40	0.20

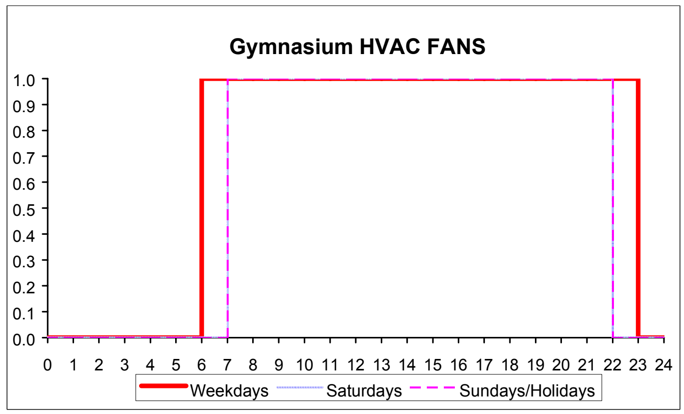
HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Saturdays	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sundays/Holidays	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Gymnasium Schedule Profiles









Gymnasium

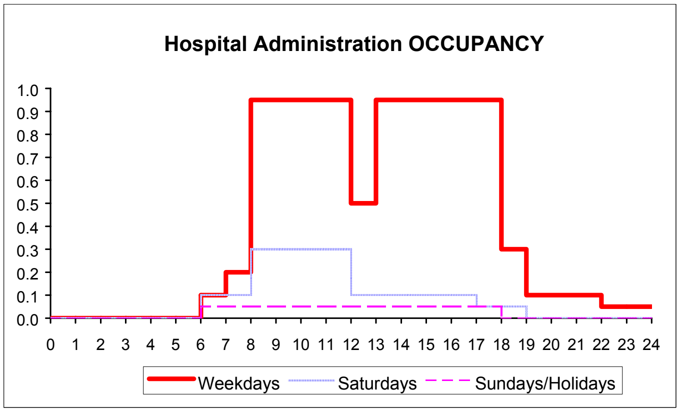
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.50	0.50	0.50	0.60	0.60	0.50	0.50	0.50	0.20	0.50	0.50	0.50	0.50	0.10	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.40	0.40	0.40	0.40	0.40	0.30	0.30	0.50	0.50	0.50	0.50	0.30	0.30	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.20	0.20	0.35	0.35	0.35	0.35	0.45	0.45	0.45	0.45	0.20	0.20	0.00	0.00

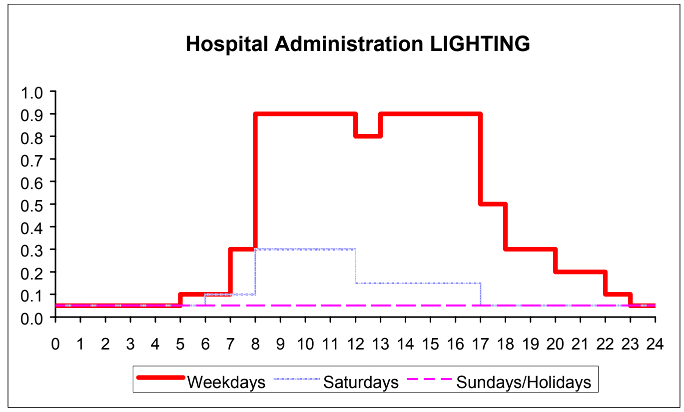
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.25	0.05
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.05
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30	0.30	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.30	0.05

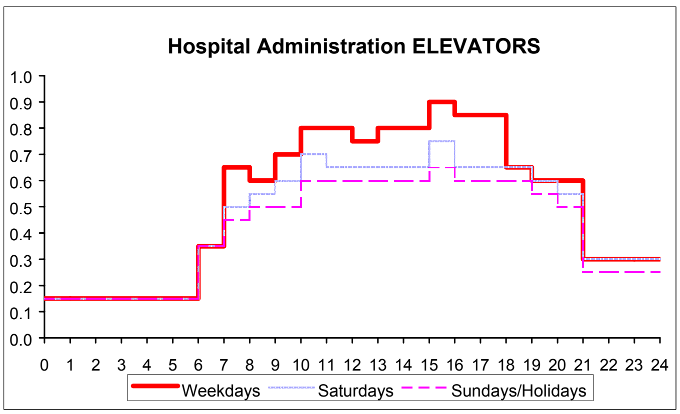
DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.15	0.50	0.50	0.50	0.50	0.30	0.45	0.45	0.40	0.45	0.30	0.10	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.15	0.15	0.50	0.55	0.55	0.35	0.35	0.55	0.35	0.30	0.15	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.15	0.15	0.50	0.50	0.55	0.55	0.30	0.40	0.40	0.40	0.55	0.15	0.05	0.05	0.05

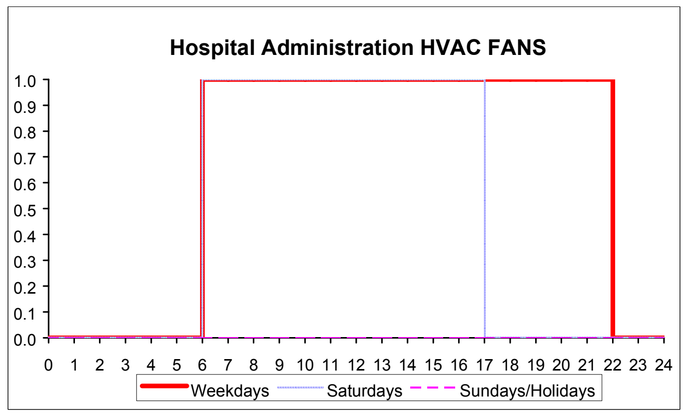
HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Hospital Administration Schedule Profiles









Hospital Administration

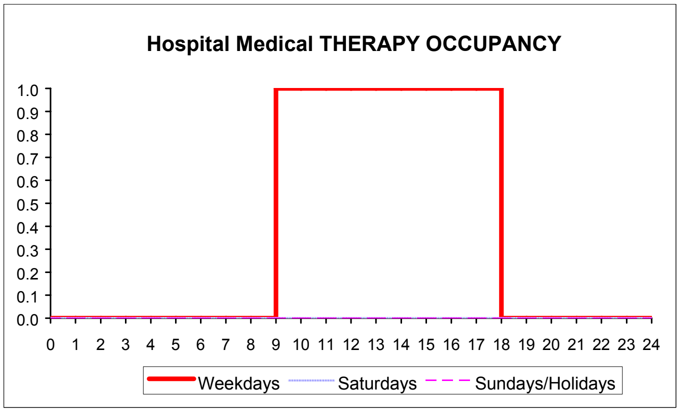
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.95	0.95	0.95	0.95	0.50	0.95	0.95	0.95	0.95	0.95	0.30	0.10	0.10	0.10	0.05	0.05
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.30	0.30	0.30	0.30	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00

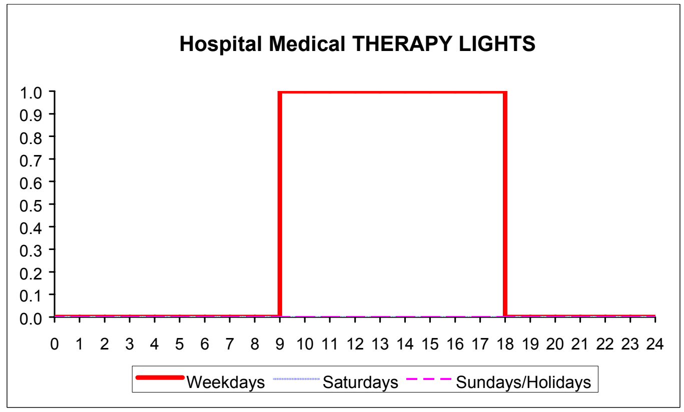
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.20	0.20	0.10	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

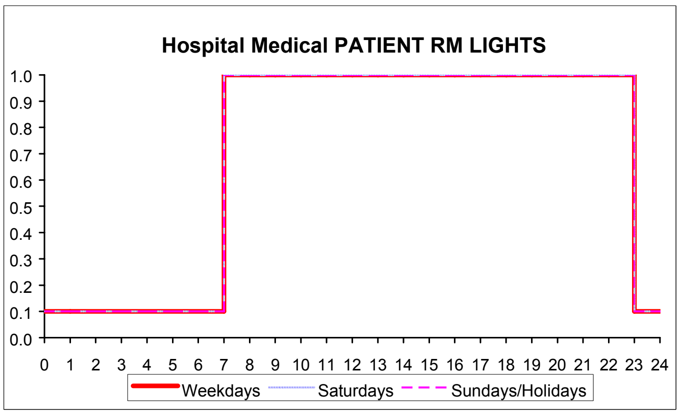
ELEVATORS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.15	0.15	0.15	0.15	0.15	0.15	0.35	0.65	0.60	0.70	0.80	0.80	0.75	0.80	0.80	0.90	0.85	0.85	0.65	0.60	0.60	0.30	0.30	0.30
Saturdays	0.15	0.15	0.15	0.15	0.15	0.15	0.35	0.50	0.55	0.60	0.70	0.65	0.65	0.65	0.65	0.75	0.65	0.65	0.65	0.60	0.55	0.30	0.30	0.30
Sundays/Holidays	0.15	0.15	0.15	0.15	0.15	0.15	0.35	0.45	0.50	0.50	0.60	0.60	0.60	0.60	0.60	0.65	0.60	0.60	0.60	0.55	0.50	0.25	0.25	0.25

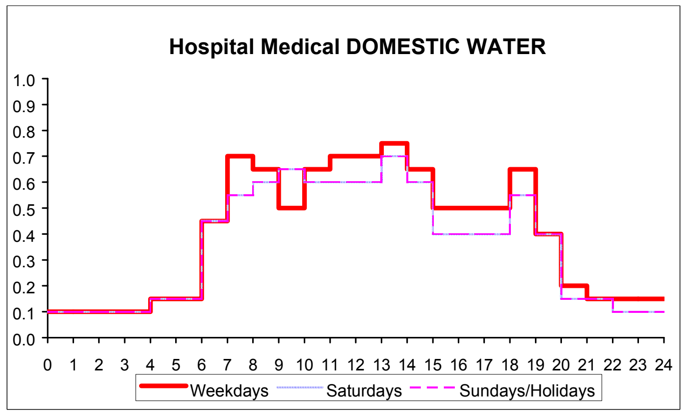
HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hospital Medical Schedule Profiles









Hospital Medical

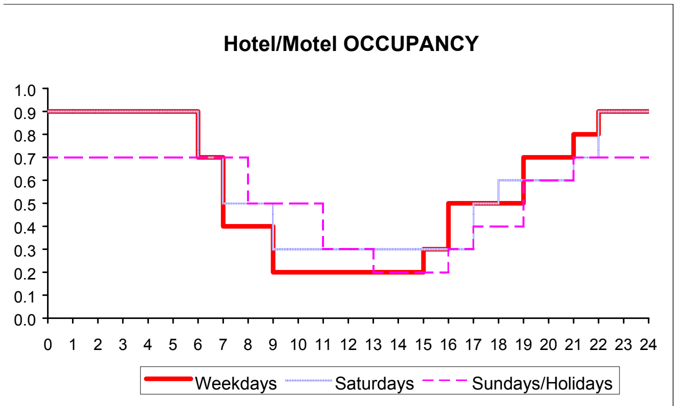
THERAPY OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

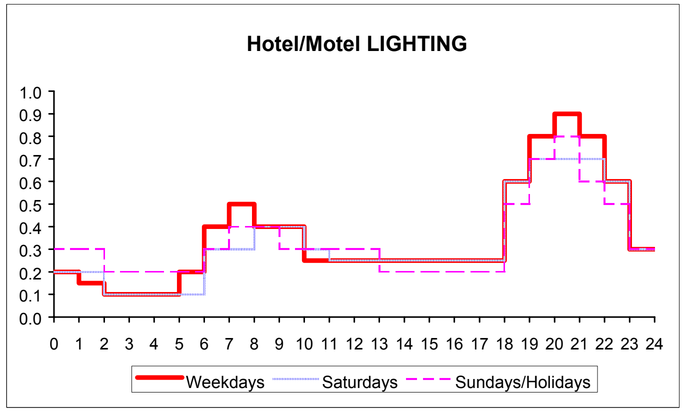
THERAPY LIGHTS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

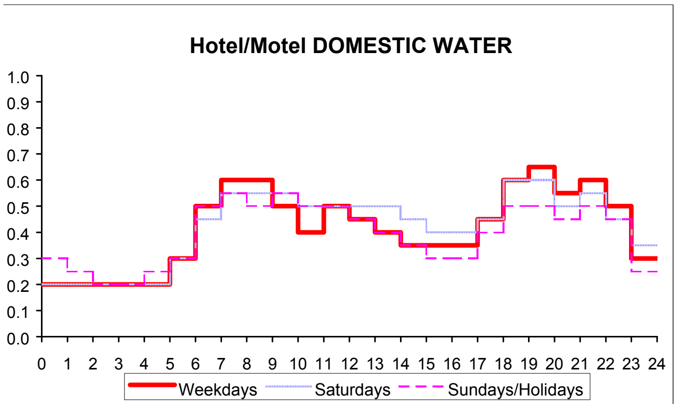
PATIENT RM LIGHTS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10
Saturdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10
Sundays/Holidays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10

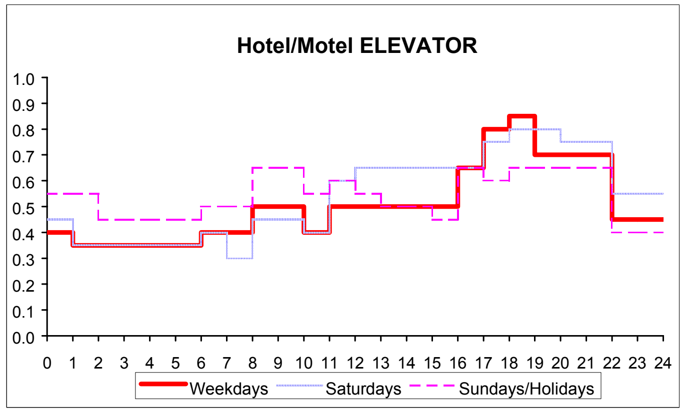
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.15	0.15	0.45	0.70	0.65	0.50	0.65	0.70	0.70	0.75	0.65	0.50	0.50	0.50	0.65	0.40	0.20	0.15	0.15	0.15
Saturdays	0.10	0.10	0.10	0.10	0.15	0.15	0.45	0.55	0.60	0.65	0.60	0.60	0.60	0.70	0.60	0.40	0.40	0.40	0.55	0.40	0.15	0.15	0.10	0.10
Sundays/Holidays	0.10	0.10	0.10	0.10	0.15	0.15	0.45	0.55	0.60	0.65	0.60	0.60	0.60	0.70	0.60	0.40	0.40	0.40	0.55	0.40	0.15	0.15	0.10	0.10

Hotel/Motel Schedule Profiles









Hotel/Motel

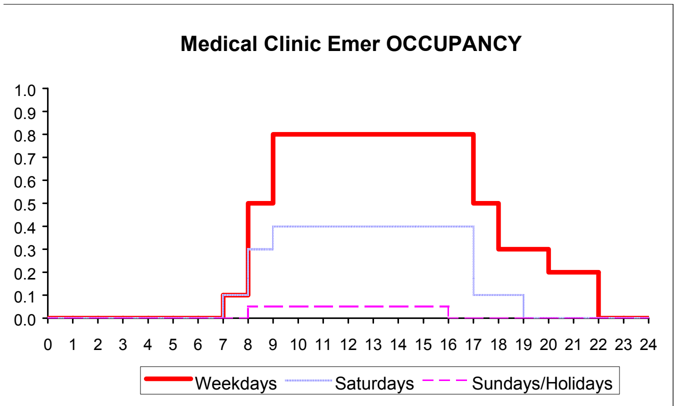
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.50	0.50	0.70	0.70	0.80	0.90	0.90
Saturdays	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.50	0.50	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.60	0.60	0.60	0.70	0.90	0.90
Sundays/Holidays	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.50	0.50	0.50	0.30	0.30	0.20	0.20	0.20	0.30	0.40	0.40	0.60	0.60	0.70	0.70	0.70

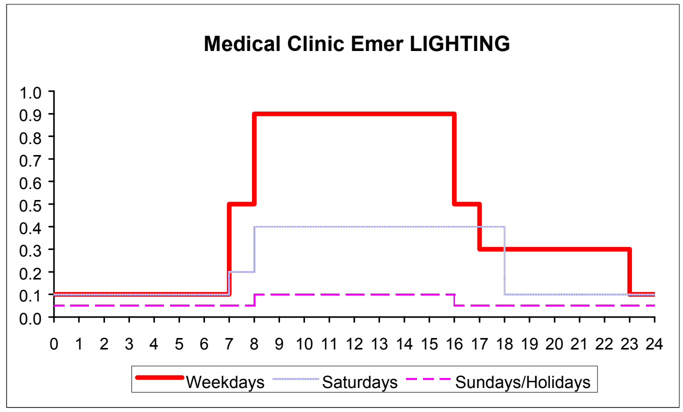
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.20	0.15	0.10	0.10	0.10	0.20	0.40	0.50	0.40	0.40	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.60	0.80	0.90	0.80	0.60	0.30
Saturdays	0.20	0.20	0.10	0.10	0.10	0.10	0.30	0.30	0.40	0.40	0.30	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.60	0.70	0.70	0.70	0.60	0.30
Sundays/Holidays	0.30	0.30	0.20	0.20	0.20	0.20	0.30	0.40	0.40	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.20	0.20	0.50	0.70	0.80	0.60	0.50	0.30

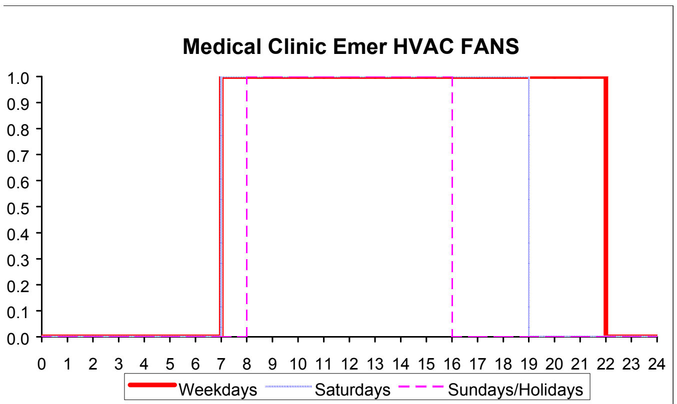
DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.60	0.60	0.50	0.40	0.50	0.45	0.40	0.35	0.35	0.35	0.45	0.60	0.65	0.55	0.60	0.50	0.30
Saturdays	0.20	0.20	0.20	0.20	0.20	0.30	0.45	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.40	0.40	0.45	0.60	0.60	0.50	0.55	0.45	0.35
Sundays/Holidays	0.30	0.25	0.20	0.20	0.25	0.30	0.50	0.55	0.50	0.55	0.50	0.50	0.45	0.40	0.35	0.30	0.30	0.40	0.50	0.50	0.45	0.50	0.45	0.25

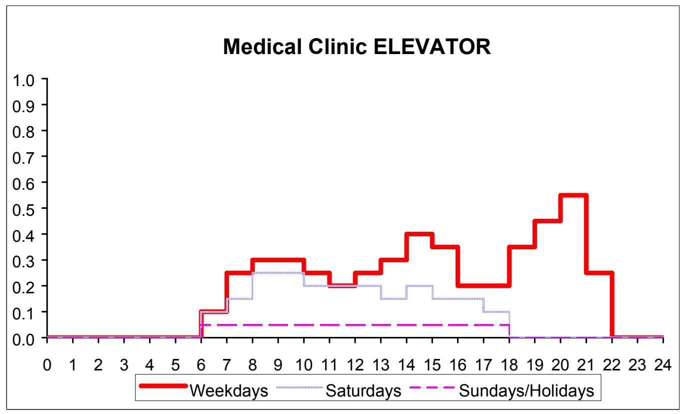
ELEVATOR	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.40	0.35	0.35	0.35	0.35	0.35	0.40	0.40	0.50	0.50	0.40	0.50	0.50	0.50	0.50	0.50	0.65	0.80	0.85	0.70	0.70	0.70	0.45	0.45
Saturdays	0.45	0.35	0.35	0.35	0.35	0.35	0.40	0.30	0.45	0.45	0.40	0.60	0.65	0.65	0.65	0.65	0.65	0.75	0.80	0.80	0.75	0.75	0.55	0.55
Sundays/Holidays	0.55	0.55	0.45	0.45	0.45	0.45	0.50	0.50	0.65	0.65	0.55	0.60	0.55	0.50	0.50	0.45	0.65	0.60	0.65	0.65	0.65	0.65	0.40	0.40

Medical Clinic Schedule Profiles









Medical Clinic

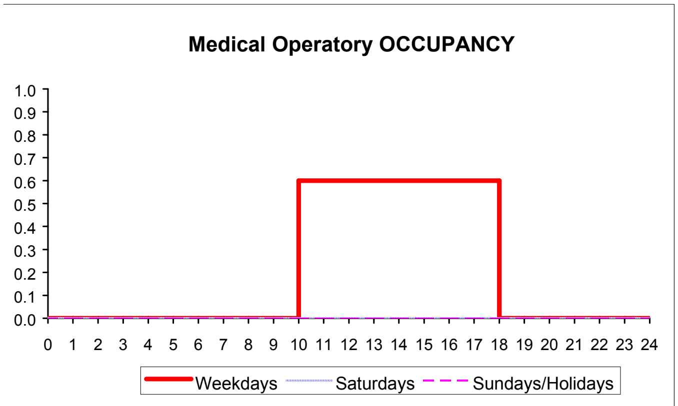
Emer OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.50	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.50	0.30	0.30	0.20	0.20	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

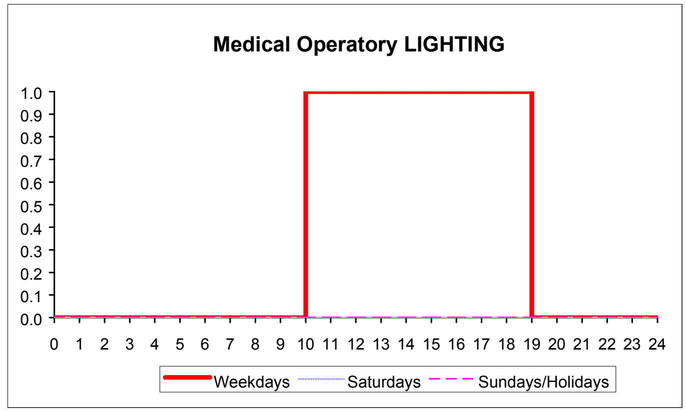
Emer LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.30	0.30	0.30	0.30	0.10
Saturdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	0.10	0.10	0.10	0.10
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

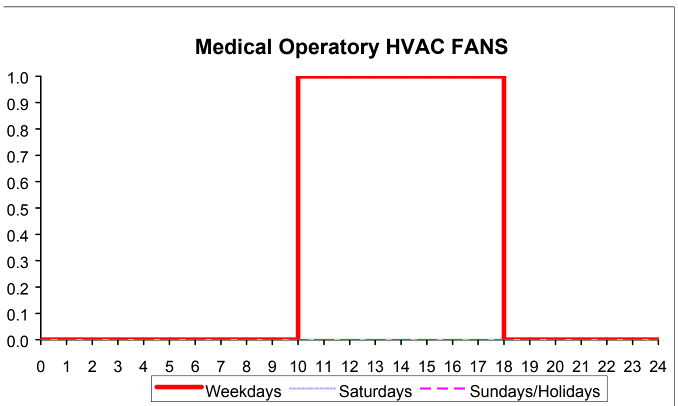
Emer HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ELEVATOR	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.25	0.30	0.30	0.25	0.20	0.25	0.30	0.40	0.35	0.20	0.20	0.35	0.45	0.55	0.25	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.15	0.25	0.25	0.20	0.20	0.20	0.15	0.20	0.15	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00

Medical Operatory Schedule Profiles







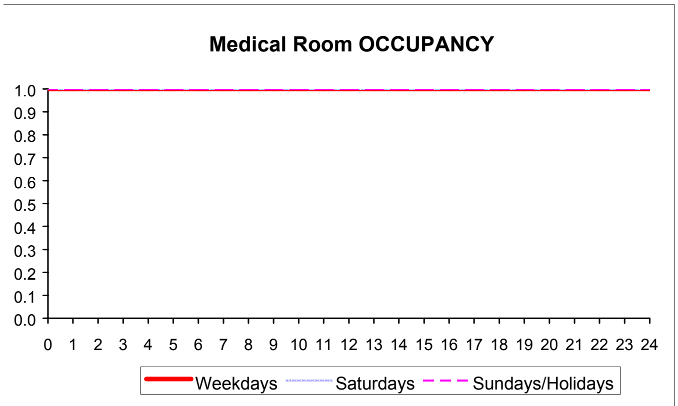
Medical Operatory

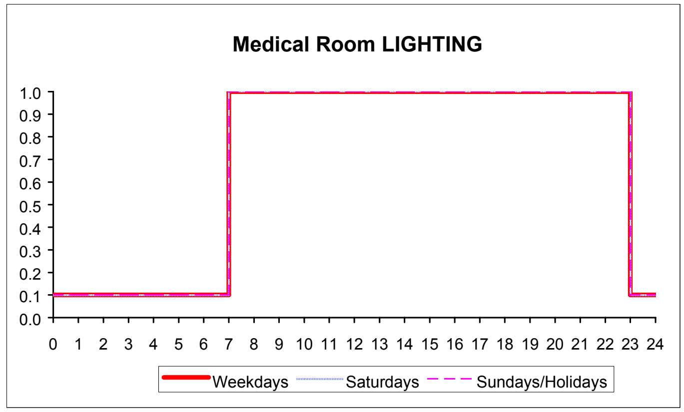
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

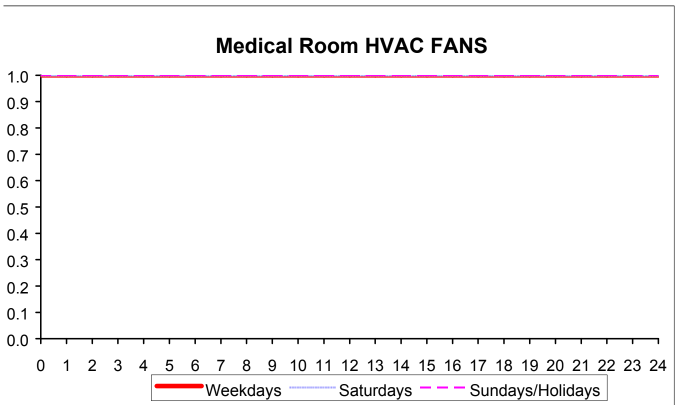
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Medical Room Schedule Profiles







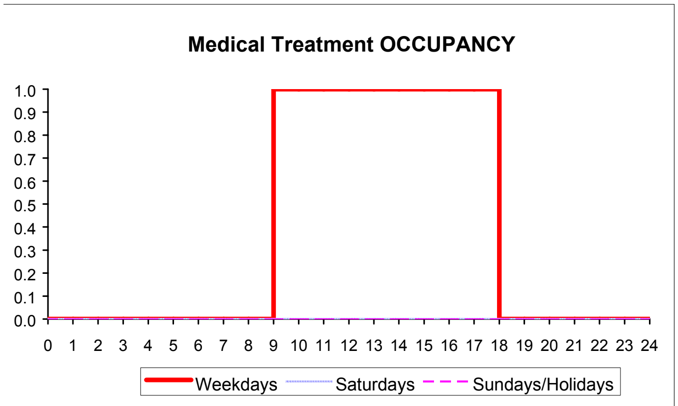
Medical Room

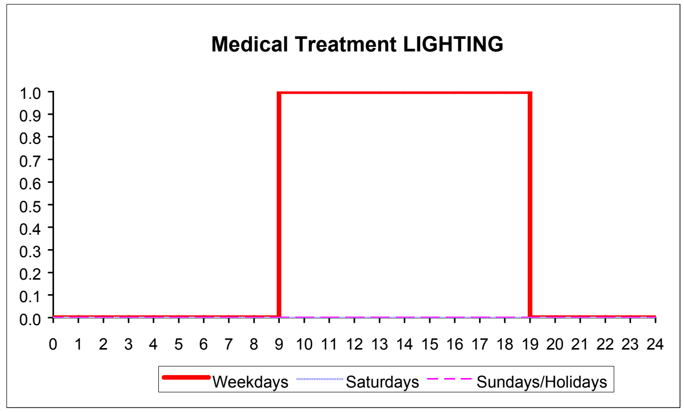
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Saturdays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sundays/Holidays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

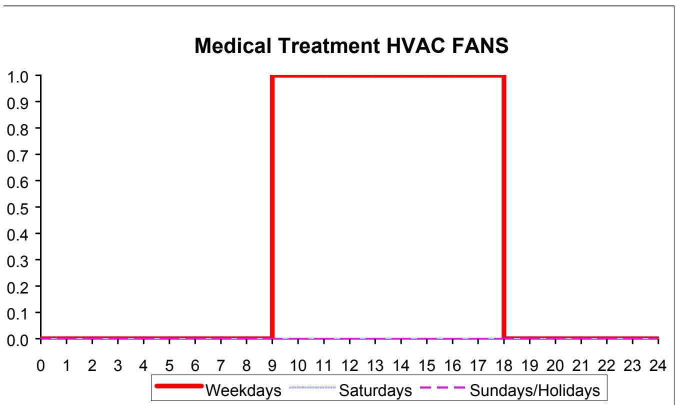
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10
Saturdays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10
Sundays/Holidays	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.10

HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Saturdays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sundays/Holidays	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Medical Treatment Schedule Profiles







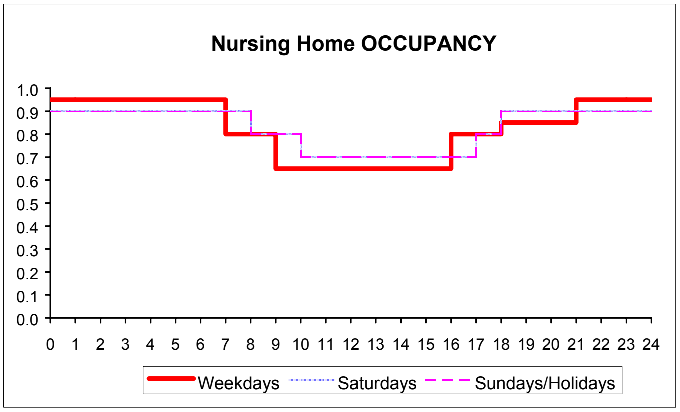
Medical Treatment

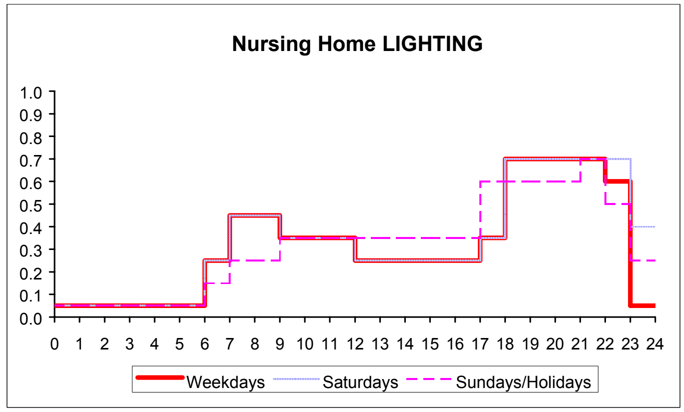
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

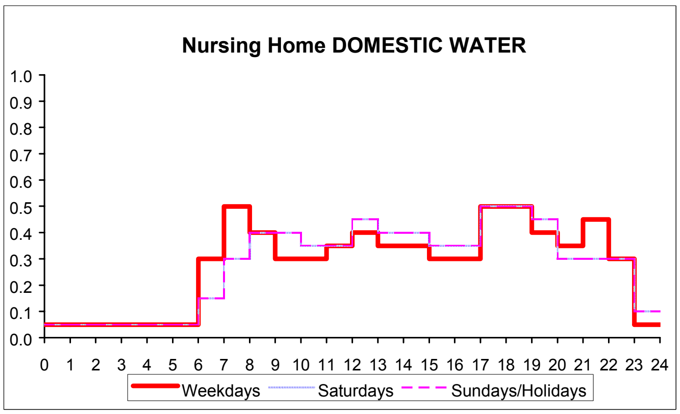
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

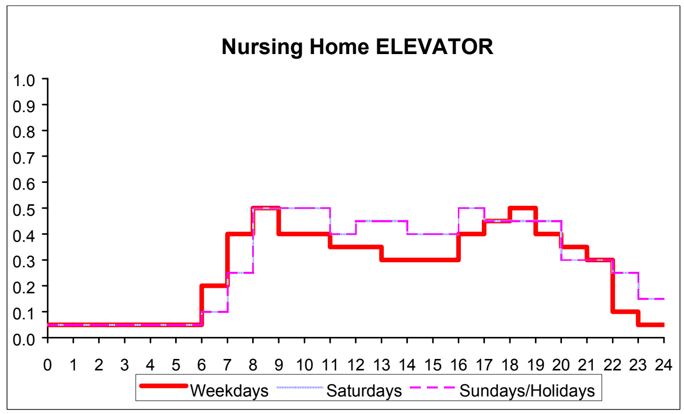
HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Nursing Home Schedule Profiles









Nursing Home

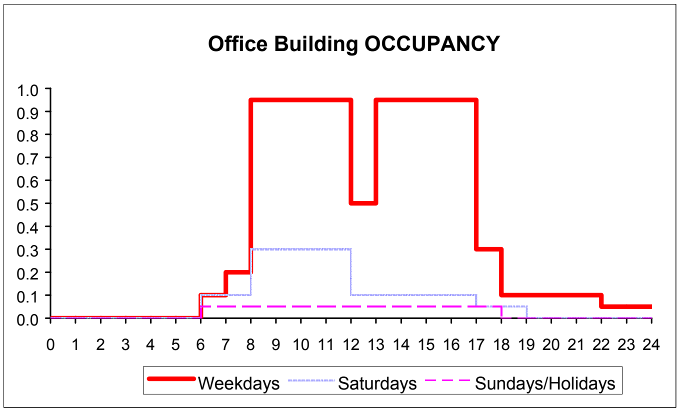
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.80	0.80	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.80	0.80	0.85	0.85	0.85	0.95	0.95	0.95
Saturdays	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.90	0.90	0.90	0.90	0.90	0.90
Sundays/Holidays	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.80	0.90	0.90	0.90	0.90	0.90	0.90

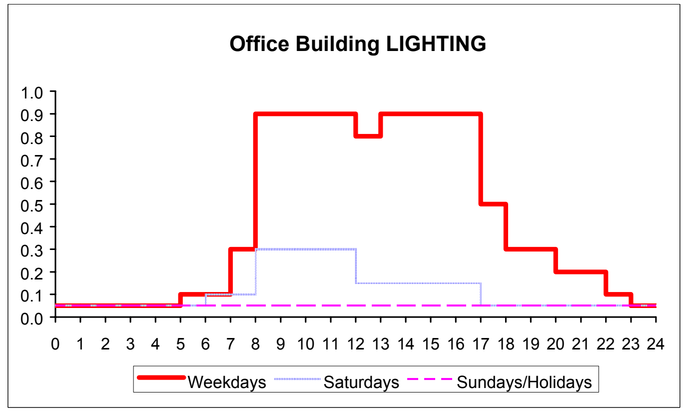
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.45	0.45	0.35	0.35	0.35	0.25	0.25	0.25	0.25	0.25	0.35	0.70	0.70	0.70	0.70	0.60	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.45	0.45	0.35	0.35	0.35	0.25	0.25	0.25	0.25	0.25	0.35	0.70	0.70	0.70	0.70	0.70	0.40
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.25	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.60	0.60	0.60	0.60	0.70	0.50	0.25

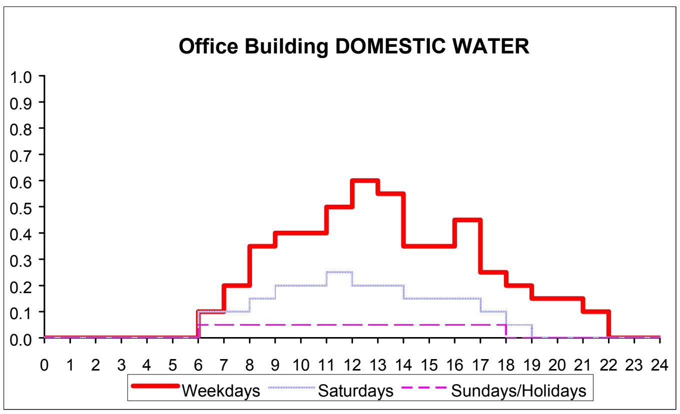
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.50	0.40	0.30	0.30	0.35	0.40	0.35	0.35	0.30	0.30	0.50	0.50	0.40	0.35	0.45	0.30	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.30	0.40	0.40	0.35	0.35	0.45	0.40	0.40	0.35	0.35	0.50	0.50	0.45	0.30	0.30	0.30	0.10
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.30	0.40	0.40	0.35	0.35	0.45	0.40	0.40	0.35	0.35	0.50	0.50	0.45	0.30	0.30	0.30	0.10

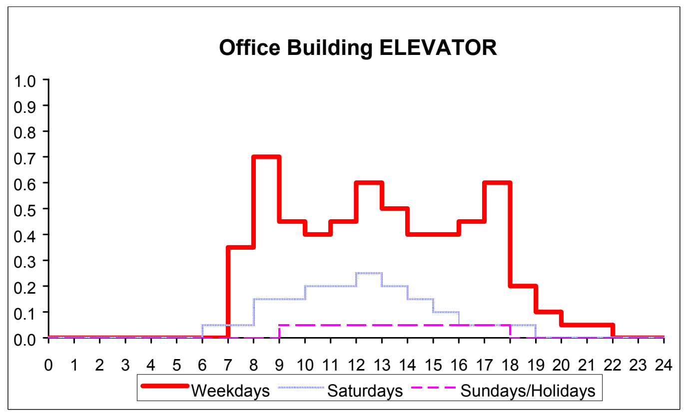
ELEVATOR	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.40	0.50	0.40	0.40	0.35	0.35	0.30	0.30	0.30	0.40	0.45	0.50	0.40	0.35	0.30	0.10	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.25	0.50	0.50	0.50	0.40	0.45	0.45	0.40	0.40	0.50	0.45	0.45	0.45	0.30	0.30	0.25	0.15
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.25	0.50	0.50	0.50	0.40	0.45	0.45	0.40	0.40	0.50	0.45	0.45	0.45	0.30	0.30	0.25	0.15

Office Building Schedule Profiles









Office Building

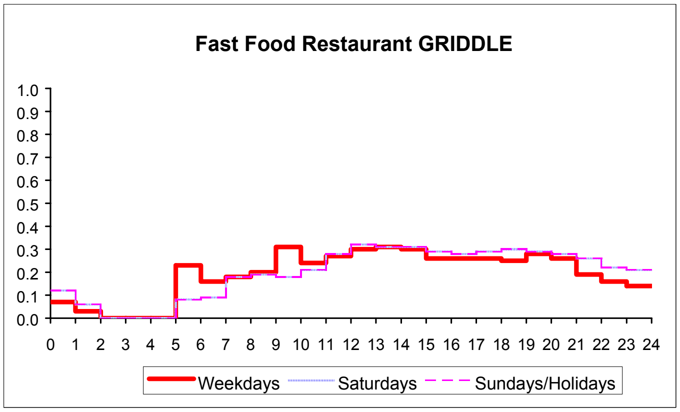
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.95	0.95	0.95	0.95	0.50	0.95	0.95	0.95	0.95	0.30	0.10	0.10	0.10	0.10	0.05	0.05
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.30	0.30	0.30	0.30	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00

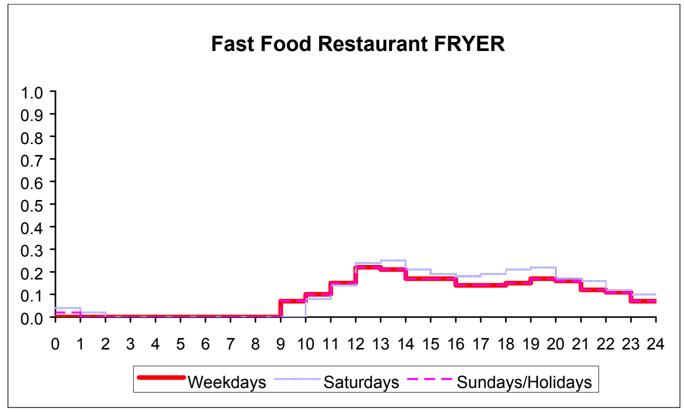
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.20	0.20	0.10	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

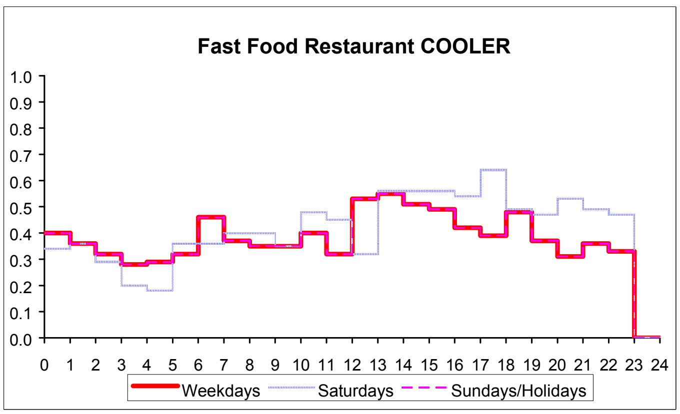
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.35	0.40	0.40	0.50	0.60	0.55	0.35	0.35	0.45	0.25	0.20	0.15	0.15	0.10	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.15	0.20	0.20	0.25	0.20	0.20	0.15	0.15	0.15	0.10	0.05	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00

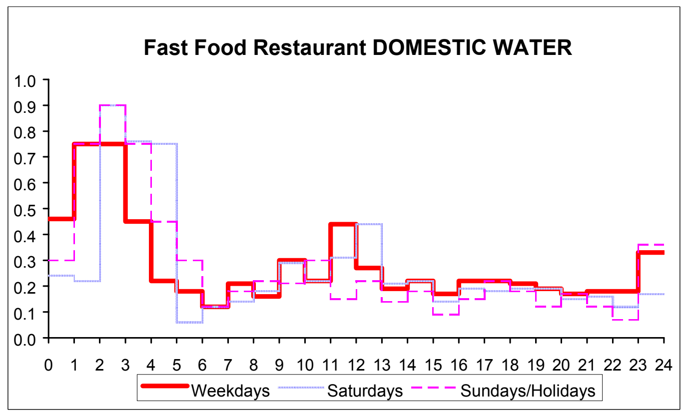
ELEVATOR	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight	
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.70	0.45	0.40	0.45	0.60	0.50	0.40	0.40	0.45	0.60	0.20	0.10	0.05	0.05	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.15	0.15	0.20	0.20	0.25	0.20	0.15	0.10	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00

Fast Food Restaurant Schedule Profiles









Fast Food Restaurant

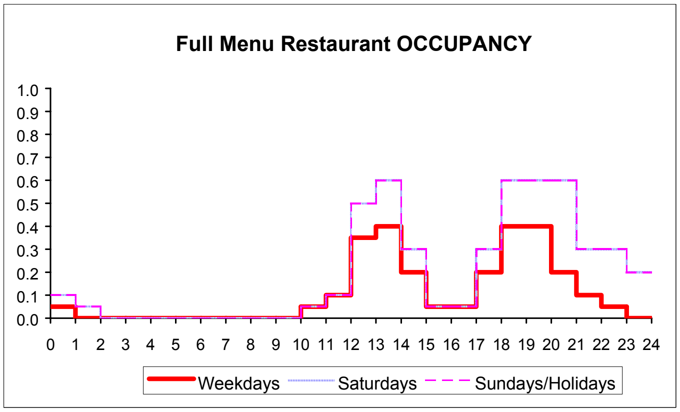
GRIDDLE	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.07	0.03	0.00	0.00	0.00	0.23	0.16	0.18	0.20	0.31	0.24	0.27	0.30	0.31	0.30	0.26	0.26	0.26	0.25	0.28	0.26	0.19	0.16	0.14
Saturdays	0.12	0.06	0.00	0.00	0.00	0.08	0.09	0.18	0.19	0.18	0.21	0.28	0.32	0.31	0.31	0.29	0.28	0.29	0.30	0.29	0.28	0.26	0.22	0.21
Sundays/Holidays	0.12	0.06	0.00	0.00	0.00	0.08	0.09	0.18	0.19	0.18	0.21	0.28	0.32	0.31	0.31	0.29	0.28	0.29	0.30	0.29	0.28	0.26	0.22	0.21

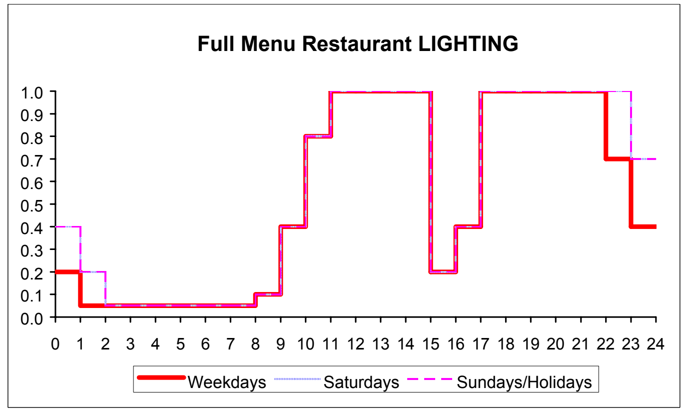
FRYER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.15	0.22	0.21	0.17	0.17	0.14	0.14	0.15	0.17	0.16	0.12	0.11	0.07
Saturdays	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.14	0.24	0.25	0.21	0.19	0.18	0.19	0.21	0.22	0.17	0.16	0.12	0.10
Sundays/Holidays	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.15	0.22	0.21	0.17	0.17	0.14	0.14	0.15	0.17	0.16	0.12	0.11	0.07

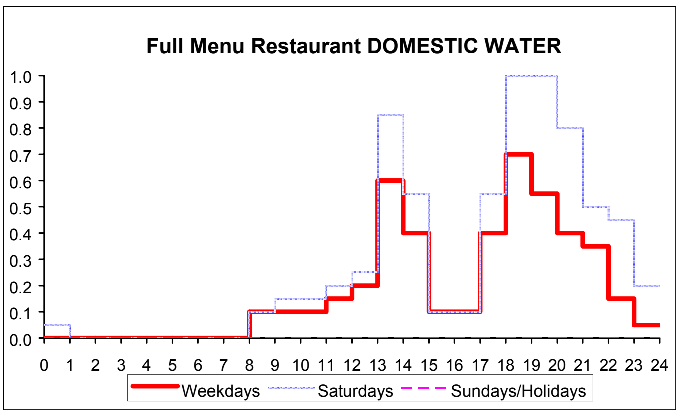
COOLER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.40	0.36	0.32	0.28	0.29	0.32	0.46	0.37	0.35	0.35	0.40	0.32	0.53	0.55	0.51	0.49	0.42	0.39	0.48	0.37	0.31	0.36	0.33	0.00
Saturdays	0.34	0.36	0.29	0.20	0.18	0.36	0.36	0.40	0.40	0.35	0.48	0.45	0.32	0.56	0.56	0.56	0.54	0.64	0.49	0.47	0.53	0.49	0.47	0.00
Sundays/Holidays	0.40	0.36	0.32	0.28	0.29	0.32	0.46	0.37	0.35	0.35	0.40	0.32	0.53	0.55	0.51	0.49	0.42	0.39	0.48	0.37	0.31	0.36	0.33	0.00

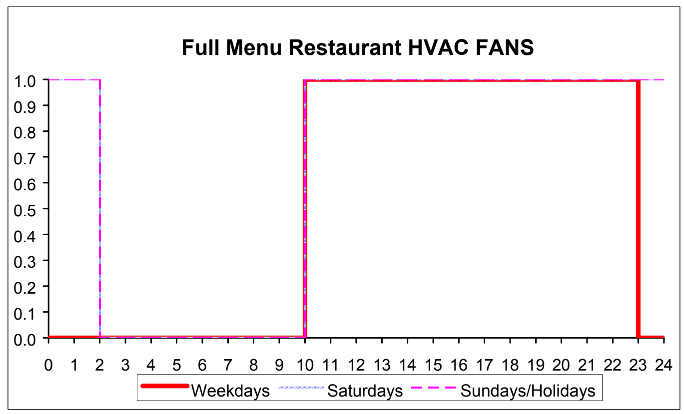
DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.46	0.75	0.75	0.45	0.22	0.18	0.12	0.21	0.16	0.30	0.22	0.44	0.27	0.19	0.22	0.17	0.22	0.22	0.21	0.19	0.17	0.18	0.18	0.33
Saturdays	0.24	0.22	0.90	0.76	0.75	0.06	0.12	0.14	0.18	0.29	0.22	0.31	0.44	0.21	0.22	0.14	0.19	0.18	0.19	0.19	0.15	0.16	0.12	0.17
Sundays/Holidays	0.30	0.75	0.90	0.75	0.45	0.30	0.12	0.18	0.22	0.21	0.30	0.15	0.22	0.14	0.18	0.09	0.15	0.22	0.18	0.12	0.17	0.12	0.07	0.36

Full Menu Restaurant Schedule Profiles









Full Menu Restaurant

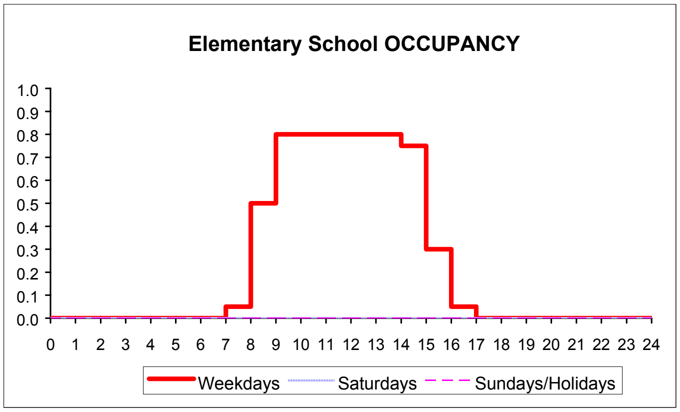
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.35	0.40	0.20	0.05	0.05	0.20	0.40	0.40	0.20	0.10	0.05	0.00
Saturdays	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.50	0.60	0.30	0.05	0.05	0.30	0.60	0.60	0.60	0.30	0.30	0.20
Sundays/Holidays	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.50	0.60	0.30	0.05	0.05	0.30	0.60	0.60	0.60	0.30	0.30	0.20

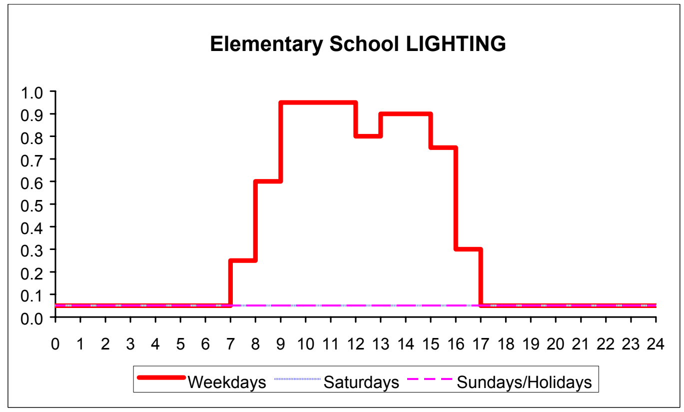
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.40	0.80	1.00	1.00	1.00	1.00	0.20	0.40	1.00	1.00	1.00	1.00	1.00	0.70	0.40
Saturdays	0.40	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.40	0.80	1.00	1.00	1.00	1.00	0.20	0.40	1.00	1.00	1.00	1.00	1.00	1.00	0.70
Sundays/Holidays	0.40	0.20	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.40	0.80	1.00	1.00	1.00	1.00	0.20	0.40	1.00	1.00	1.00	1.00	1.00	1.00	0.70

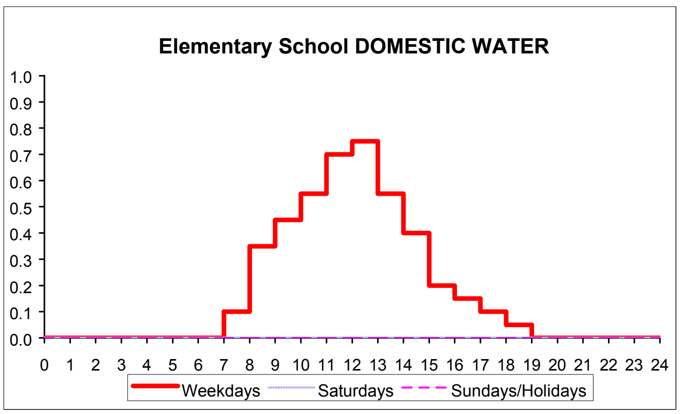
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.15	0.20	0.60	0.40	0.10	0.10	0.40	0.70	0.55	0.40	0.35	0.15	0.05
Saturdays	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.15	0.15	0.20	0.25	0.85	0.55	0.10	0.10	0.55	1.00	1.00	0.80	0.50	0.45	0.20
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

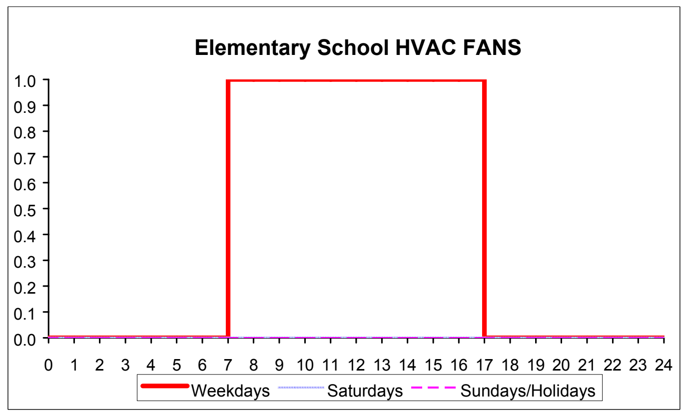
HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Saturdays	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sundays/Holidays	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Elementary School Schedule Profiles









Elementary School

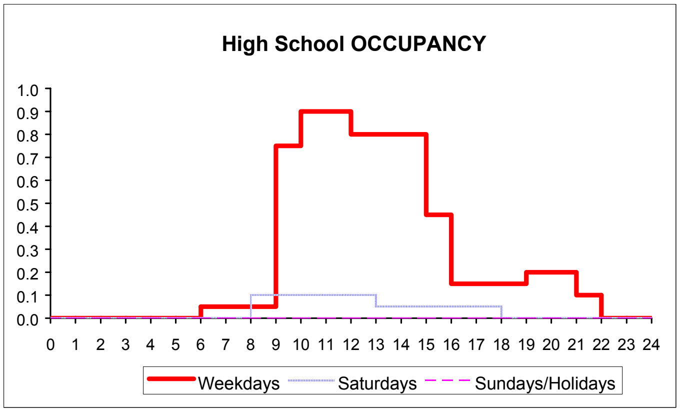
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.50	0.80	0.80	0.80	0.80	0.80	0.75	0.30	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

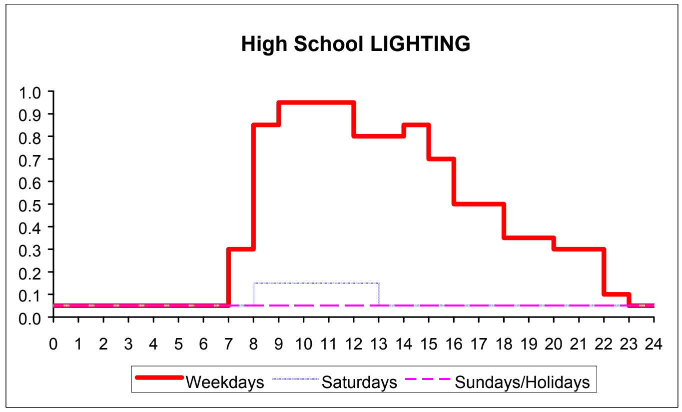
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.60	0.95	0.95	0.95	0.80	0.90	0.90	0.75	0.30	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

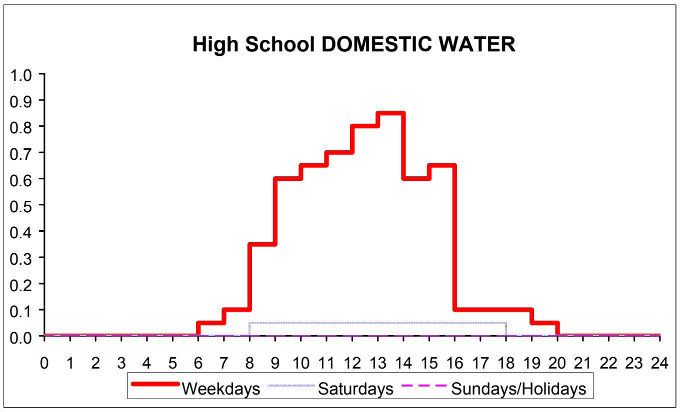
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.35	0.45	0.55	0.70	0.75	0.55	0.40	0.20	0.15	0.10	0.05	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

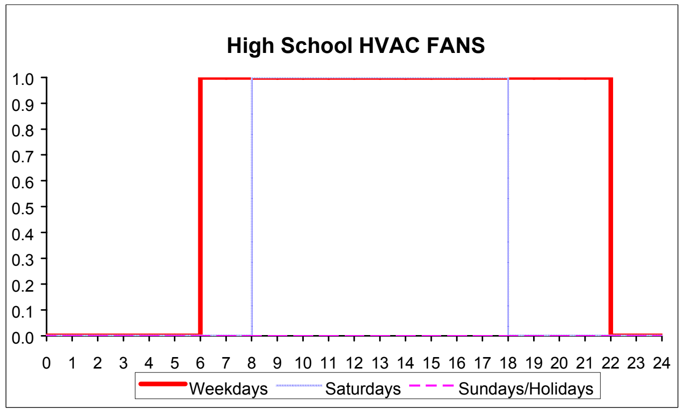
HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

High School Schedule Profiles









High School

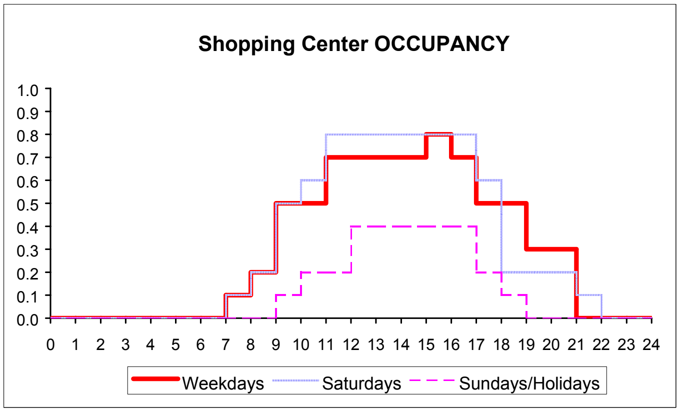
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.75	0.90	0.90	0.80	0.80	0.80	0.45	0.15	0.15	0.15	0.20	0.20	0.10	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

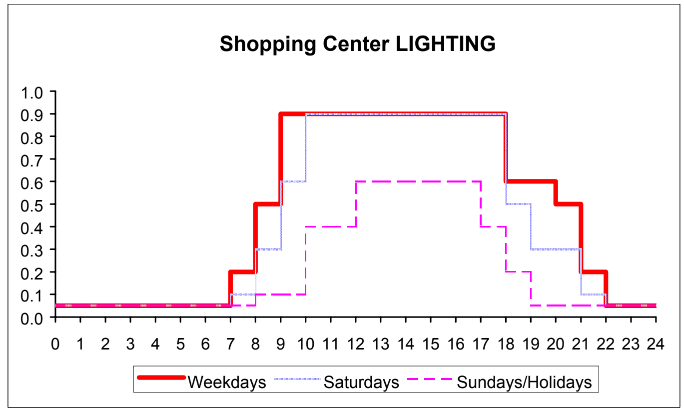
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.85	0.95	0.95	0.95	0.80	0.80	0.85	0.70	0.50	0.50	0.35	0.35	0.30	0.30	0.10	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

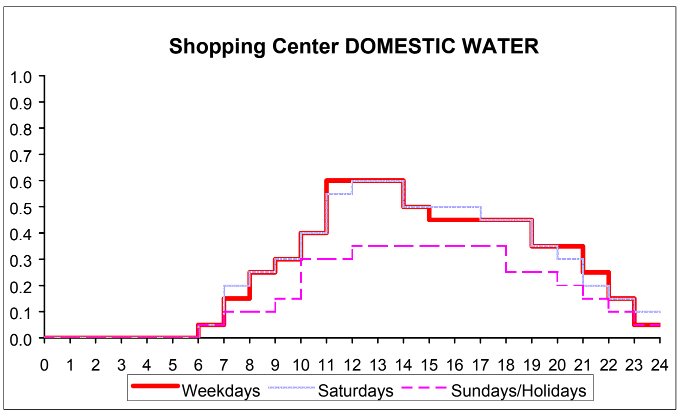
DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.35	0.60	0.65	0.70	0.80	0.85	0.60	0.65	0.10	0.10	0.10	0.05	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

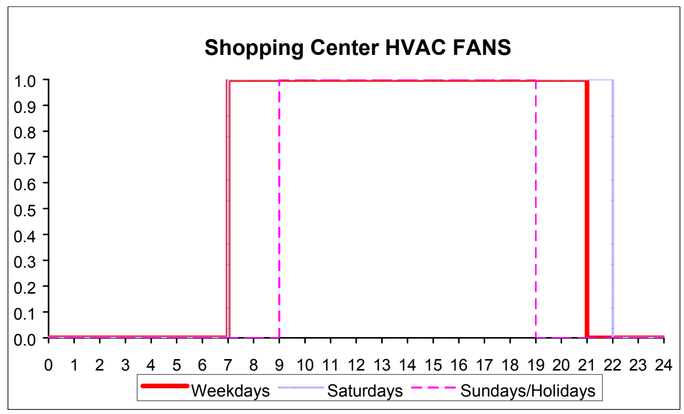
HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Shopping Center Schedule Profiles









Shopping Center

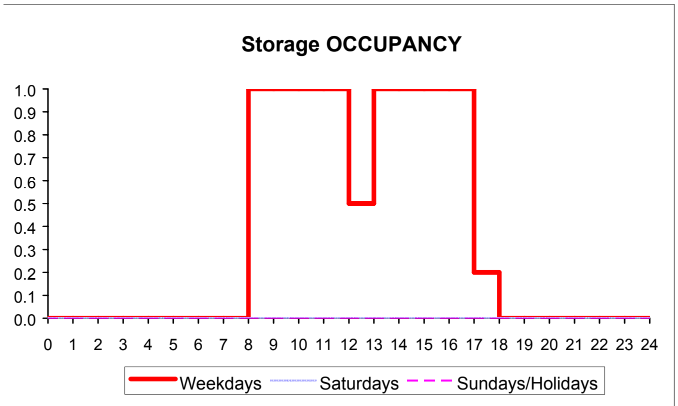
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.50	0.50	0.70	0.70	0.70	0.70	0.80	0.70	0.50	0.50	0.30	0.30	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.50	0.60	0.80	0.80	0.80	0.80	0.80	0.80	0.60	0.20	0.20	0.20	0.10	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.20	0.40	0.40	0.40	0.40	0.40	0.20	0.10	0.00	0.00	0.00	0.00	0.00

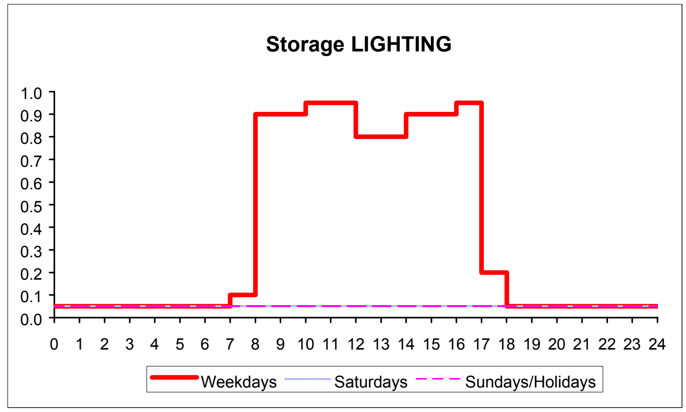
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.60	0.60	0.50	0.20	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.30	0.60	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.10	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.40	0.40	0.60	0.60	0.60	0.60	0.60	0.40	0.20	0.05	0.05	0.05	0.05	0.05

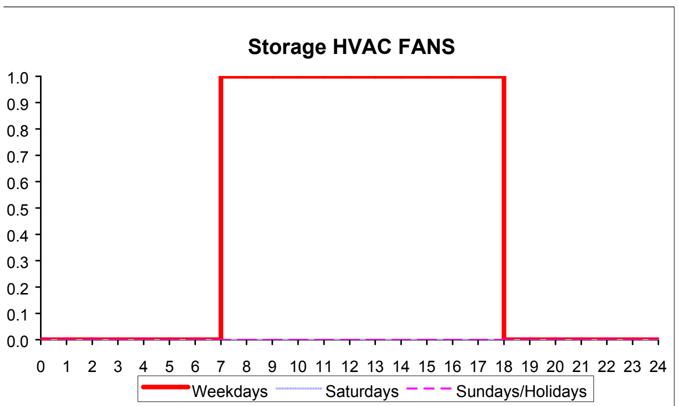
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.25	0.30	0.40	0.60	0.60	0.60	0.50	0.45	0.45	0.45	0.45	0.35	0.35	0.25	0.15	0.05
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.20	0.25	0.30	0.40	0.55	0.60	0.60	0.50	0.50	0.50	0.45	0.45	0.35	0.30	0.20	0.15	0.10
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.10	0.15	0.30	0.30	0.35	0.35	0.35	0.35	0.35	0.35	0.25	0.25	0.20	0.15	0.10	0.05

HVAC FANS	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00

Storage Schedule Profiles







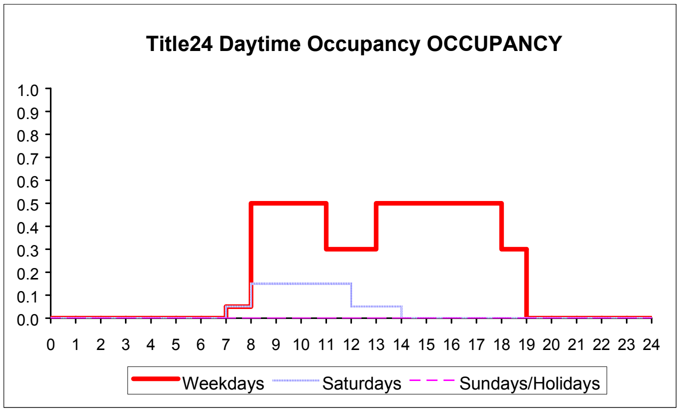
Storage

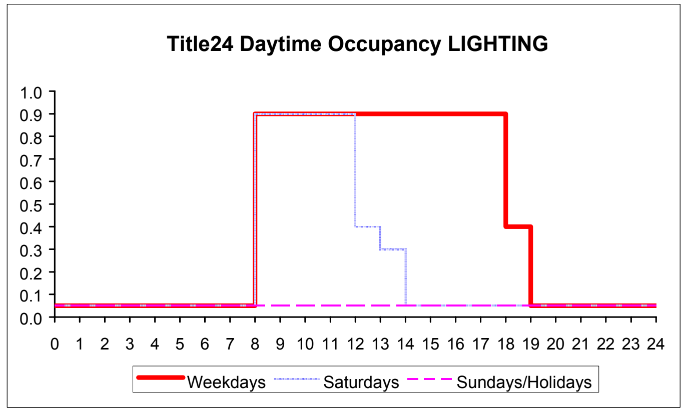
OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.50	1.00	1.00	1.00	1.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

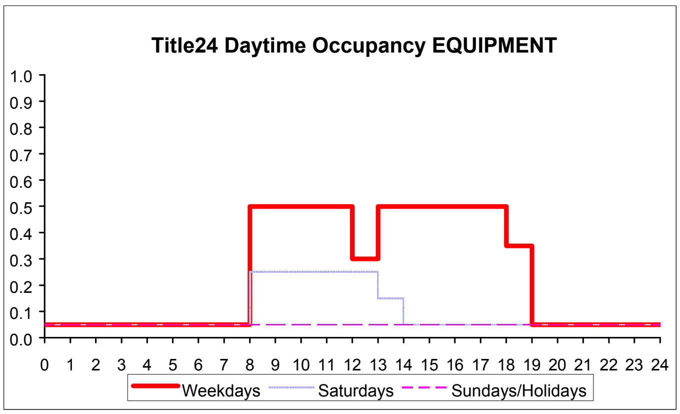
LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.90	0.90	0.95	0.95	0.80	0.80	0.90	0.90	0.95	0.20	0.05	0.05	0.05	0.05	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

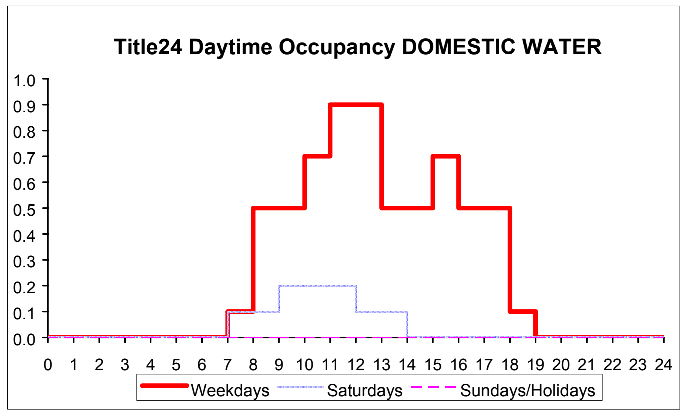
HVAC FANS	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Title24 Daytime Occupancy Schedule Profiles









Title24 Daytime Occupancy

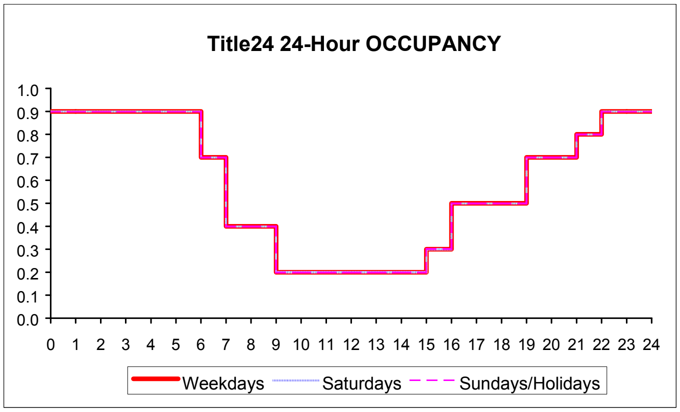
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.50	0.50	0.50	0.30	0.30	0.50	0.50	0.50	0.50	0.50	0.30	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.15	0.15	0.15	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

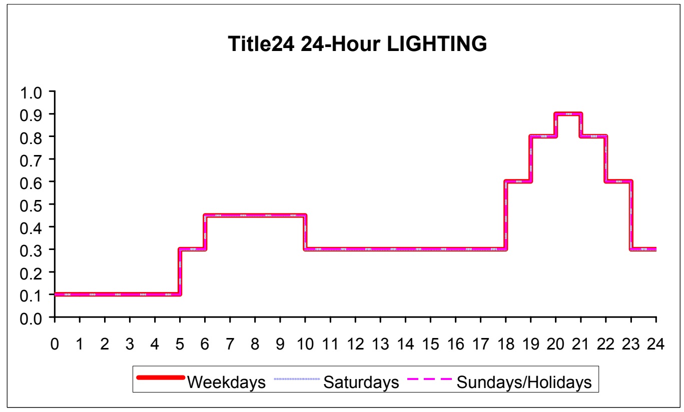
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.40	0.05	0.05	0.05	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.90	0.90	0.90	0.90	0.40	0.30	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

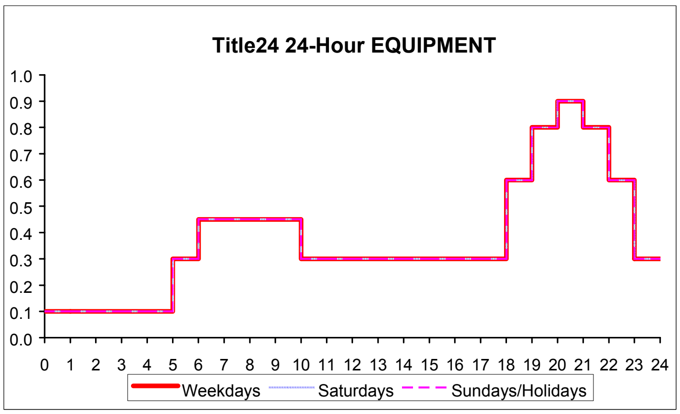
EQUIPMENT	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.50	0.50	0.50	0.50	0.30	0.50	0.50	0.50	0.50	0.50	0.35	0.05	0.05	0.05	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.25	0.25	0.25	0.25	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

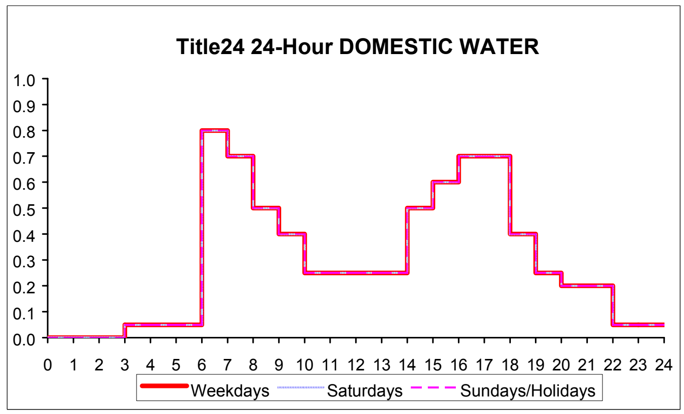
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.50	0.50	0.70	0.90	0.90	0.50	0.50	0.70	0.50	0.50	0.10	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.20	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Title24 24-Hour Schedule Profiles









Title24 24-Hour

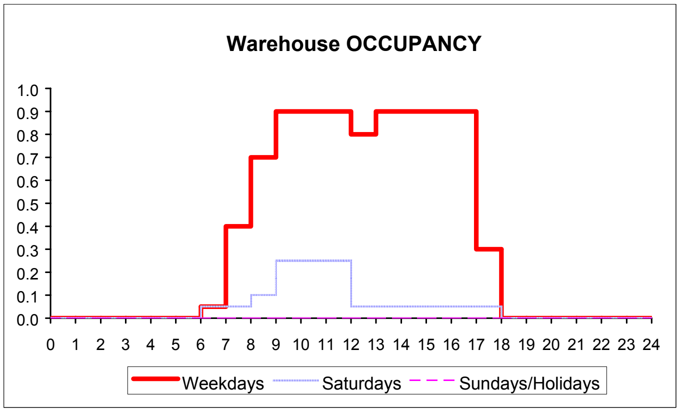
OCCUPANCY	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.50	0.50	0.70	0.70	0.80	0.90	0.90
Saturdays	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.50	0.50	0.70	0.70	0.80	0.90	0.90
Sundays/Holidays	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.50	0.50	0.70	0.70	0.80	0.90	0.90

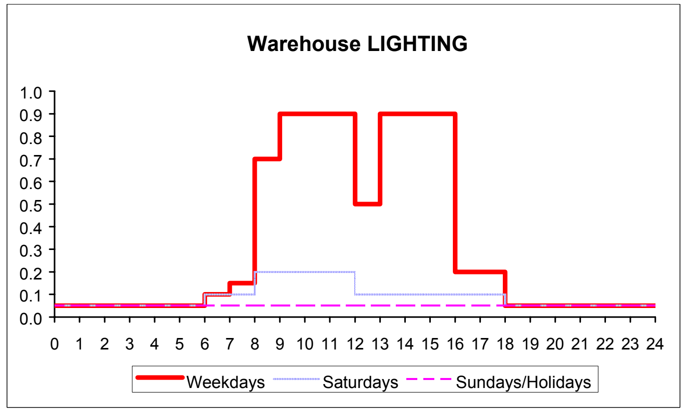
LIGHTING	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30
Saturdays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30
Sundays/Holidays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30

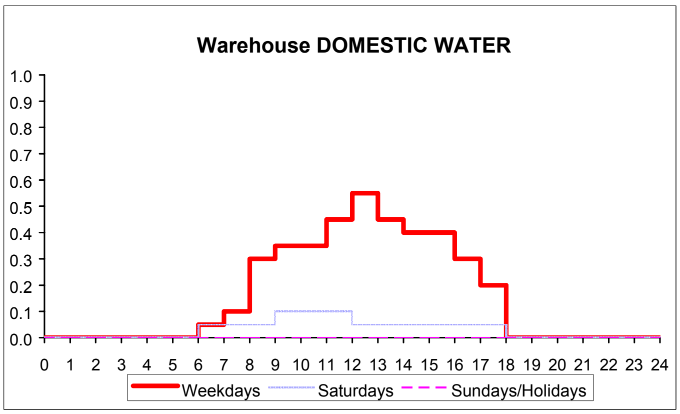
EQUIPMENT	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30
Saturdays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30
Sundays/Holidays	0.10	0.10	0.10	0.10	0.10	0.30	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.60	0.80	0.90	0.80	0.60	0.30

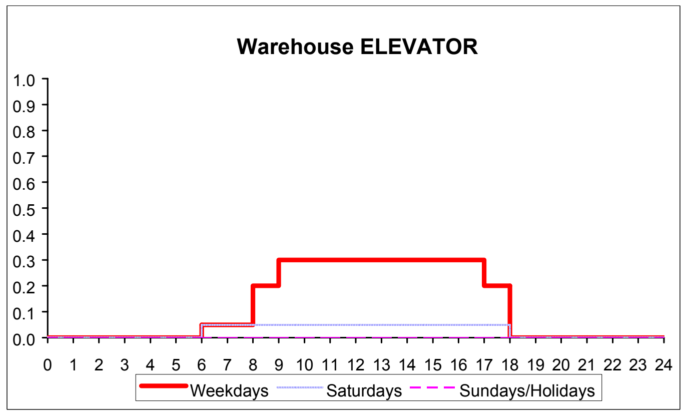
DOMESTIC WATER	Midnight	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p		Midnight
Weekdays	0.00	0.00	0.00	0.05	0.05	0.05	0.80	0.70	0.50	0.40	0.25	0.25	0.25	0.25	0.50	0.60	0.70	0.70	0.40	0.25	0.20	0.20	0.05	0.05
Saturdays	0.00	0.00	0.00	0.05	0.05	0.05	0.80	0.70	0.50	0.40	0.25	0.25	0.25	0.25	0.50	0.60	0.70	0.70	0.40	0.25	0.20	0.20	0.05	0.05
Sundays/Holidays	0.00	0.00	0.00	0.05	0.05	0.05	0.80	0.70	0.50	0.40	0.25	0.25	0.25	0.25	0.50	0.60	0.70	0.70	0.40	0.25	0.20	0.20	0.05	0.05

Warehouse Schedule Profiles









Warehouse

OCCUPANCY	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.40	0.70	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.10	0.25	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LIGHTING	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.15	0.70	0.90	0.90	0.90	0.50	0.90	0.90	0.90	0.20	0.20	0.05	0.05	0.05	0.05	0.05	0.05
Saturdays	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.20	0.20	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
Sundays/Holidays	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

DOMESTIC WATER	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.30	0.35	0.35	0.45	0.55	0.45	0.40	0.40	0.30	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ELEVATOR	Midnight		2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12p	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p	Midnight
Weekdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.20	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Saturdays	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Sundays/Holidays	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXTERIOR WALL Constructions Library

EXTERIOR-WALL Constructions		
LAYERS Code-word	**Description**	**Materials** (outside to inside)
ASH Wall-1	4 In. Face Brick, 2 In. Insulation, and 4 In. Light Wt. Concrete Block	HF-A2,HF-B3,HF-C2,HF-E1
ASH Wall-2	4 In. Light Weight Concrete	HF-C14,HF-E1
ASH Wall-3	4 In. Face Brick, Air Space and 8 In. Common Brick	HF-A2,HF-B1,HF-C9,HF-E1
ASH Wall-4	4 In. Face Brick, Air Space and 8 In. Heavy Wt. Concrete Block	HF-A2,HF-B1,HF-C8,HF-E1
ASH Wall-5	4 In. Face Brick, Air Space and 8 In. Light Weight Concrete Block	HF-A2,HF-B1,HF-C7,HF-E1
ASH Wall-6	4 In. Face Brick, Air Space and 8 In. Clay Tile	HF-A2,HF-B1,HF-C6,HF-E1
ASH Wall-7	4 In. Face Brick, Air Space and 2 In. Heavy Weight Concrete	HF-A2,HF-B1,HF-C12,HF-E1
ASH Wall-8	4 In. Face Brick, Air Space and 4 In. Common Brick	HF-A2,HF-B1,HF-C4,HF-E1
ASH Wall-9	4 In. Face Brick, Air Space and 4 In. Heavy Weight Concrete Block	HF-A2,HF-B1,HF-C3,HF-E1
ASH Wall-10	4In. Face Brick, Air Space and 4 In. Light Weight Concrete Block	HF-A2,HF-B1,HF-C2,HF-E1
ASH Wall-11	12 In. Heavy Weight Concrete	HF-A1,HF-C11,HF-E1
ASH Wall-12	8 In. Heavy Weight Concrete with 2 In. Insulation	HF-A1,HF-C10,HF-B6,HF-E1
ASH Wall-13	8 In. Heavy Weight Concrete with 1 In. Insulation	HF-A1,HF-C10,HF-B5,HF-E1
ASH Wall-14	8 In. Heavy Weight Concrete with Air Space	HF-A1,HF-C10,HF-B1,HF-E1
ASH Wall-15	8 In. Heavy Weight Concrete	HF-A1,HF-C10,HF-E1
ASH Wall-16	4 In. Face Brick, 8 In. Common Brick with 1 In. Insulation	HF-A2,HF-C9,HF-B2,HF-E1
ASH Wall-17	4 In. Face Brick, 8 In. Common Brick with Air Space	HF-A2,HF-C9,HF-B1,HF-E1
ASH Wall-18	4 In. Face Brick, Air Space and 4 In. Light Weight Block	HF-A7,HF-B1,HF-C14
ASH Wall-19	Wall with 3 In. Fiberglass Insulation and Stucco Outside Finish	HF-A6,HF-B4,HF-A6
ASH Wall-20	Two-sided Brick Wall with Air Space	HF-A7,HF-B1,HF-A2
ASH Wall-21	Brick Wall, 8 In. Concrete Block and No Air Space	HF-A7,HF-C7,HF-A6
ASH Wall-22	Brick Wall with 4 In. Concrete Block	HF-A7,HF-B1,HF-C3,HF-A6
ASH Wall-23	Brick Wall with 8 In. Concrete Block	HF-A7,HF-B1,HF-C8,HF-A6
ASH Wall-24	Brick Wall with 6 In. Concrete	HF-A7,HF-B1,HF-C15,HF-A6
ASH Wall-25	Frame Wall with 2 In. Insulation and 4 In. Brick Veneer	HF-A7,HF-B6,HF-A6
ASH Wall-26	Frame Wall with 2 In. Insulation	HF-A6,HF-B6,HF-A6
ASH Wall-27	Metal Curtain Wall with 3 In. Insulation	HF-A3,HF-B12,HF-A3
ASH Wall-28	Metal Curtain Wall with 2 In. Insulation	HF-A3,HF-B6,HF-A3
ASH Wall-29	Metal Curtain Wall with 1 In. Insulation	HF-A3,HF-B5,HF-A3
ASH Wall-30	Wall 12 In. Concrete with 2 In. Insulation on the Outside	HF-A3,HF-B6,HF-C11,HF-A6
ASH Wall-31	Wall 8 In. Concrete with 2 In. Insulation on the Outside	HF-A3,HF-B6,HF-C10,HF-A6
ASH Wall-32	Wall 4 In. Concrete with 2 In. Insulation on the Outside	HF-A3,HF-B6,HF-C5,HF-A6
ASH Wall-33	Wall 12 In. Concrete with 2 In. Insulation on the Inside	HF-C11,HF-B6,HF-A6
ASH Wall-34	Wall 8 In. Concrete with 2 In. Insulation on the Inside	HF-C10,HF-B6,HF-A6
ASH Wall-35	Wall 4 In. Concrete with 2 In. Insulation on the Inside	HF-C5,HF-B6,HF-A6
ASH Wall-36	Frame Wall with 3 In. Insulation	HF-A1,HF-B1,HF-B4,HF-E1
ASH Wall-37	Frame Wall with 2 In. Insulation	HF-A1,HF-B1,HF-B3,HF-E1
ASH Wall-38	Frame Wall with 1 In. Insulation	HF-A1,HF-B1,HF-B2,HF-E1
ASH Wall-39	Frame Wall without Insulation	HF-A1,HF-B1,HF-E1
ASH Wall-40	2 In. Insulation with 12 In. Heavy Weight Concrete	HF-A1,HF-B3,HF-C11,HF-E1
ASH Wall-41	2 in. Insulation with 8 In. Heavy Weight Concrete	HF-A1,HF-B3,HF-C10,HF-E1
ASH Wall-42	2 In. Insulation with 8 In. Common Brick	HF-A1,HF-B3,HF-C9,HF-E1
ASH Wall-43	2 In. Insulation with 8 In. Heavy Weight Concrete Block	HF-A1,HF-B3,HF-C8,HF-E1
ASH Wall-44	2 In. Insulation with 8 In. Light Weight Concrete Block	HF-A1,HF-B3,HF-C7,HF-E1
ASH Wall-45	2 In. Insulation with 8 In. Clay Tile	HF-A1,HF-B3,HF-C6,HF-E1
ASH Wall-46	2 In. Insulation with 4 In. Heavy Weight Concrete	HF-A1,HF-B3,HF-C5,HF-E1
ASH Wall-47	2 In. Insulation with 4 In. Common Brick	HF-A1,HF-B3,HF-C4,HF-E1
ASH Wall-48	2 In. Insulation with 4 In. Heavy Weight Concrete Block	HF-A1,HF-B3,HF-C3,HF-E1
ASH Wall-49	2 In. Insulation with 4 In. Light Weight Concrete Block	HF-A1,HF-B3,HF-C2,HF-E1
ASH Wall-50	2 In. Insulation with 4 In. Clay Tile	HF-A1,HF-B3,HF-C1,HF-E1

EXTERIOR WALL Constructions Library (continued)

EXTERIOR-WALL Constructions (concluded)		
LAYERS Code-word	**Description**	**Materials (outside to inside)**
ASH Wall-51	4 In. Face Brick, 2 In. Insulation and 12 In. Heavy Weight Concrete	HF-A2,HF-B3,HF-C11,HF-E1
ASH Wall-52	4 In. Face Brick, 2 In. Insulation and 8 In. Heavy Weight Concrete	HF-A2,HF-B3,HF-C10,HF-E1
ASH Wall-53	4 In. Face Brick, 2 In. Insulation and 8 In. Common Brick	HF-A2,HF-B3,HF-C9,HF-E1
ASH Wall-54	4 In. Face Brick, Air Space and 12 In. Heavy Weight Concrete	HF-A2,HF-B1,HF-C11,HF-E1
ASH Wall-55	4 In. Face Brick, Air Space and 8 In. Heavy Weight Concrete	HF-A2,HF-B1,HF-C10,HF-E1
ASH Wall-56	4 In. Face Brick, 2 In. Insulation and 8 In. Heavy Weight Concrete Block	HF-A2,HF-B3,HF-C8,HF-E1
ASH Wall-57	4 In. Face Brick, 2 In. Insulation and 8 In. Light Weight Concrete Block	HF-A2,HF-B3,HF-C7,HF-E1
ASH Wall-58	2 In. Face Brick, 2 In. Insulation and 8 In. Clay Tile	HF-A2,HF-B3,HF-C6,HF-E1
ASH Wall-59	4 In. Face Brick, 2 In. Insulation and 4 In. Heavy Weight Concrete	HF-A2,HF-B3,HF-C5,HF-E1
ASH Wall-60	4 In. Face Brick, 2 In. Insulation and 4 In. Common Brick	HF-A2,HF-B3,HF-C4,HF-E1
ASH Wall-61	4 In. Face Brick, 2 In. Insulation and 4 In. Heavy Weight Concrete Block	HF-A2,HF-B3,HF-C3,HF-E1
ASH Wall-62	4 In. Face Brick with 8 In. Common Brick	HF-A2,HF-C9,HF-E1
ASH Wall-63	8 In. Heavy Weight Concrete Block with 1 In. Insulation	HF-A1,HF-C8,HF-B2,HF-E1
ASH Wall-64	8 In. Heavy Weight Concrete Block	HF-A1,HF-C8,HF-E1
ASH Wall-65	8 In. Light Weight Concrete Block with Insulation	HF-A1,HF-C7,HF-B2,HF-E1
ASH Wall-66	8 In. Light Weight Concrete Block	HF-A1,HF-C7,HF-E1
ASH Wall-67	4 In. Face Brick, 8 In. Clay Tile and 1 In. Insulation	HF-A2,HF-C6,HF-B2,HF-E1
ASH Wall-68	4 In. Face Brick, 8 In. ClayTile and Air Space	HF-A2,HF-C6,HF-B1,HF-E1
ASH Wall-69	4 In. Face Brick with 8 In. Clay Tile	HF-A2,HF-C6,HF-E1
ASH Wall-70	8 In. Clay Tile with 1 In.Insulation	HF-A1,HF-C6,HF-B2,HF-E1
ASH Wall-71	8 In. Clay Tile with Air Space	HF-A1,HF-C6,HF-B1,HF-E1
ASH Wall-72	8 In. Clay Tile	HF-A1,HF-C6,HF-E1
ASH Wall-73	4 In. Heavy Weight Concrete with 2 In. Insulation	HF-A1,HF-C5,HF-B3,HF-E1
ASH Wall-74	4 In. Heavy Weight Concrete with 1 In. Insulation	HF-A1,HF-C5,HF-B2,HF-E1
ASH Wall-75	4 In. Heavy Weight Concrete with Air Space	HF-A1,HF-C5,HF-B1,HF-E1
ASH Wall-76	4 In. Heavy Weight Concrete	HF-A1,HF-C5,HF-E1
ASH Wall-77	4 In. Face Brick, 4 In. Common Brick and 1 In. Insulation	HF-A2,HF-C4,HF-B2,HF-E1
ASH Wall-78	4 In. Face Brick, 4 In. Common Brick and Air Space	HF-A2,HF-C4,HF-B1,HF-E1
ASH Wall-79	4 In. Face Brick with 4 In. Common Brick	HF-A2,HF-C4,HF-E1
ASH Wall-80	4 In. Common Brick	HF-A1,HF-C4,HF-E1
ASH Wall-81	4 In. Heavy Weight Concrete Block	HF-A1,HF-C3,HF-E1
ASH Wall-82	4 In. Face Brick, 4 In. Light Wt. Concrete Block and 1 In. Insulation	HF-A2,HF-C2,HF-B2,HF-E1
ASH Wall-83	4 In. Face Brick, 4 In. Light Wt. Concrete Block and Air Space	HF-A2,HF-C2,HF-B1,HF-E1
ASH Wall-84	4 In. Face Brick with 4 In. Light Weight Concrete Block	HF-A2,HF-C2,HF-E1
ASH Wall-85	4 In. Light Weight Concrete Block and 1 In. Insulation	HF-A1,HF-C2,HF-B2,HF-E1
ASH Wall-86	4 In. Light Weight Concrete Block and Air Space	HF-A1,HF-C2,HF-B1,HF-E1
ASH Wall-87	4 In. Light Weight ConcreteBlock	HF-A1,HF-C2,HF-E1
ASH Wall-88	4 In. Face Brick, 4 In. Clay Tile and 1 In. Insulation	HF-A2,HF-C1,HF-B2,HF-E1
ASH Wall-89	4 In. Face Brick, 4 In. Clay Tile and Air Space	HF-A2,HF-C1,HF-B1,HF-E1
ASH Wall-90	4 In. Face Brick and 4 In. Clay Tile	HF-A2,HF-C1,HF-E1
ASH Wall-91	4 In. Clay Tile and 1 In. Insulation	HF-A1,HF-C1,HF-B2,HF-E1
ASH Wall-92	4 In. Clay Tile and Air Space	HF-A1,HF-C1,HF-B1,HF-E1
ASH Wall-93	4 In. Clay Tile	HF-A1,HF-C1,HF-E1
ASH Wall-94	Sheet Metal with 1 In. Insulation	HF-A3,HF-B2,HF-B1,HF-A3
ASH Wall-95	Sheet Metal with 2 In. Insulation	HF-A3,HF-B3,HF-B1,HF-A3
ASH Wall-96	Sheet Metal with 3 In. Insulation	HF-A3,HF-B4,HF-B1,HF-A3

ROOF Constructions Library (continued)

ROOF Constructions		
LAYERS Code-word	**Description**	**Materials** (outside to inside)
ASH Roof-1	Roof Terrace System	HF-C12,HF-B1,HF-B6,HF-E2,HF-E3,HF-C5,HF-E4,HF-E5
ASH Roof-2	4 In. Wood with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-B9,HF-E4,HF-E5
ASH Roof-3	2.5 In. Wood with 2 In.Insulation	HF-E2,HF-E3,HF-B6,HF-B8,HF-E4,HF-E5
ASH Roof-4	4 In. Wood with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-B7,HF-E4,HF-E5
ASH Roof-5	4 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B9,HF-E4,HF-E5
ASH Roof-6	2.5 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B8,HF-E4,HF-E5
ASH Roof-7	1 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B7,HF-E4,HF-E5
ASH Roof-8	8 In. Light Weight Concrete	HF-E2,HF-E3,HF-C16,HF-E4,HF-E5
ASH Roof-9	6 In. Light Weight Concrete	HF-E2,HF-E3,HF-C15,HF-E4,HF-E5
ASH Roof-10	4 In. Light Weight Concrete	HF-E2,HF-E3,HF-C14,HF-E4,HF-E5
ASH Roof-11	6 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C13,HF-E4,HF-E5
ASH Roof-12	4 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C5,HF-E4,HF-E5
ASH Roof-13	2 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C12,HF-E4,HF-E5
ASH Roof-14	6 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C13,HF-E4,HF-E5
ASH Roof-15	4 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C5,HF-E4,HF-E5
ASH Roof-16	2 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C12,HF-E4,HF-E5
ASH Roof-17	Steel Sheet with 2 In. Insulationn	HF-E2,HF-E3,HF-B6,HF-A3,HF-E4,HF-E5
ASH Roof-18	Steel Sheet with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-A3,HF-E4,HF-E5
ASH Roof-19	Roof Terrace System	HF-C12,HF-B1,HF-B6,HF-E2,HF-E3,HF-C5
ASH Roof-20	4 In. Wood with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-B9
ASH Roof-21	2.5 In. Wood with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-B8
ASH Roof-22	1 In. Wood with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-B7
ASH Roof-23	4 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B9
ASH Roof-24	2.5 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B8
ASH Roof-25	1 In. Wood with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-B7
ASH Roof-26	8 In. Light Weight Concrete	HF-E2,HF-E3,HF-C16
ASH Roof-27	6 In. Light Weight Concrete	HF-E2,HF-E3,HF-C15
ASH Roof-28	4 In. Light Weight Concrete	HF-E2,HF-E3,HF-C14
ASH Roof-29	6 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C13
ASH Roof-30	4 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C5
ASH Roof-31	2 In. Heavy Weight Concrete with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-C12
ASH Roof-32	6 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C13
ASH Roof-33	4 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C5
ASH Roof-34	2 In. Heavy Weight Concrete with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-C12
ASH Roof-35	Steel Sheet with 2 In. Insulation	HF-E2,HF-E3,HF-B6,HF-A3
ASH Roof-36	Steel Sheet with 1 In. Insulation	HF-E2,HF-E3,HF-B5,HF-A3

INTERIOR WALL Constructions Library (continued)

INTERIOR-WALL Constructions		
LAYERS Code-word	**Description**	**Materials** (outside to inside)
ASH Int Wall-1	4 In. Clay Tile with 0.75 In.Plaster	HF-E1,HF-C1,HF-E1
ASH Int Wall-2	4 In. Light Weight ConcreteBlock with 0.75 In. Plaster	HF-E1,HF-C2,HF-E1
ASH Int Wall-3	4 In. Heavy Weight ConcreteBlock with 0.75 In. Plaster	HF-E1,HF-C3,HF-E1
ASH Int Wall-4	4 In. Common Brick with 0.75 In. Plaster	HF-E1,HF-C4,HF-E1
ASH Int Wall-5	4 In. Heavy Weight Concretewith 0.75 In. Plaster	HF-E1,HF-C5,HF-E1
ASH Int Wall-6	5 In. Clay Tile with 0.75 In. Plaster	HF-E1,HF-C6,HF-E1
ASH Int Wall-7	8 In. Light Weight Concrete Block, Plastered Both Sides	HF-E1,HF-C7,HF-E1
ASH Int Wall-8	8 In. Heavy Weight Concrete Block, Plastered Both Sides	HF-E1,HF-C8,HF-E1
ASH Int Wall-9	8 In. Common Brick, Plastered Both Sides	HF-E1,HF-C9,HF-E1
ASH Int Wall-10	8 In. Heavy Concrete, Plastered Both Sides	HF-E1,HF-C10,HF-E1
ASH Int Wall-11	12 In. Heavy Concrete, Plastered Both Sides	HF-E1,HF-C11,HF-E1
ASH Int Wall-12	4 In. Clay Tile	HF-C1
ASH Int Wall-13	4 In. Light Weight Concrete Block	HF-C2
ASH Int Wall-14	4 In. Heavy Weight Concrete Block	HF-C3
ASH Int Wall-15	4 In. Common Brick	HF-C4
ASH Int Wall-16	4 In. Heavy Weight Concrete	HF-C5
ASH Int Wall-17	8 In. Clay Tile	HF-C6
ASH Int Wall-18	8 In. Light Weight Concrete Block	HF-C7
ASH Int Wall-19	8 In. Heavy Weight Concrete Block	HF-C8
ASH Int Wall-20	8 In. Common Brick	HF-C9
ASH Int Wall-21	8 In. Heavy Weight Concrete	HF-C10
ASH Int Wall-22	12 In. Heavy Weight Concrete	HF-C11
ASH Int Wall-23	Frame Partition with 0.75 In. Gypsum Board	HF-E1,HF-B1,HF-E1
ASH Int Wall-24	1 In. Wood	HF-B7
ASH Int Wall-25	2 In. Wood	HF-B10
ASH Int Wall-26	3 In. Wood	HF-B11
ASH Int Wall-27	4 In. Wood	HF-B9
ASH Int Wall-28	Frame Partition with 1 In. Wood	HF-B7,HF-B1,HF-B7
ASH Int Wall-29	2 In. Furniture	HF-B10,HF-B1,HF-B10
ASH Int Wall-30	3 In. Furniture	HF-B11,HF-B1,HF-B11
ASH Int Wall-31	2 In. Heavy Weight Concrete Floor Deck	HF-C12
ASH Int Wall-32	4 In. Heavy Weight Concrete Floor Deck	HF-C5
ASH Int Wall-33	2 In. Light Weight Concrete Floor Deck	HF-C5
ASH Int Wall-34	8 In. Heavy Weight Concrete Floor Deck	HF-C10
ASH Int Wall-35	8 In. Light Weight Concrete Floor Deck	HF-C7
ASH Int Wall-36	2 In. Wood Deck	HF-B10
ASH Int Wall-37	3 In. Wood Deck	HF-B11
ASH Int Wall-38	2 In. Heavy Weight Concrete Deck with False Ceiling	HF-C10,HF-E4,HF-E5
ASH Int Wall-39	4 In. Heavy Weight Concrete Deck with False Ceiling	HF-C5,HF-E4,HF-E5
ASH Int Wall-40	4 In. Light Weight Concrete Deck with False Ceiling	HF-C2,HF-E4,HF-E5
ASH Int Wall-41	8 In. Heavy Weight Concrete Deck with False Ceiling	HF-C10,HF-E4,HF-E5
ASH Int Wall-42	8 In. Light Weight Concrete Deck with False Ceiling	HF-C7,HF-E4,HF-E5
ASH Int Wall-43	2 In. Wood Deck with False Ceiling	HF-B10,HF-E4,HF-E5
ASH Int Wall-44	3 In. Wood Deck with False Ceiling	HF-B11,HF-E4,HF-E5
ASH Int Wall-45	12 In. Heavy Weight Concrete Deck with False Ceiling	HF-C11,HF-E4,HF-E5
ASH Int Wall-46	4 In. Wood Deck with False Ceiling	HF-B9,HF-E4,HF-E5
ASH Int Wall-47	Steel Deck with False Ceiling	HF-A3,HF-E4,HF-E5

MATERIALS Library

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Acoustic Tile						
AcousTile 3/8in (AC01)	3/8 in (1 cm)	0.0313 (0.0095)	0.0330 (0.057)	18.0 (288)	0.32 (1339)	0.95 (0.167)
AcousTile 1/2in (AC02)	1/2 in (1.3cm)	0.0417 (0.0127)	0.0330 (0.057)	18.0 (288)	0.32 (1339)	1.26 (0.222)
AcousTile 3/4in (AC03)	3/4 in (1.9cm)	0.0625 (0.0191)	0.0330 (0.057)	18.0 (288)	0.32 (1339)	1.89 (0.333)
AcousTile (HF-E5)	3/4 in (1.9cm)	0.0625 (0.0191)	0.0350 (0.061)	30.0 (480)	0.20 (2142)	1.79 (0.313)
Aluminum or Steel Siding						
Steel Siding (AS01)		0.0050 (0.0015)	26.000 (44.97)	480.0 (7690)	0.10 (418)	1.9×10^{-4}(3.3×10^{-5})
Asbestos-Cement						
AbsCem Bd 1/8in (AB01)	Board, 1/8 in (0.32 cm)	0.0104 (0.0032)	0.3450 (0.597)	120.0 (1922)	0.2 (837)	0.03 (0.005)
AbsCem Bd 1/4in (AB02)	Board, 1/4 in (0.63 cm)	0.0208 (0.0063)	0.3450 (0.597)	120.0 (1922)	0.2 (837)	0.06 (0.011)
AbsCem Shingle (AB03)	Shingle					0.21 (0.037)
AbsCem Siding (AB04)	Lapped Siding, 1/4 in (0.63 cm)					0.21 (0.037)
Asbestos Vinyl Tile						
AbsVinyl Tile (AV01)						0.05 (0.009)
Asphalt						
Asph Roll Roof (AR01)	Roofing Roll					0.15 (0.026)
Asph Siding (AR02)	Shingle and Siding					0.44 (0.078)
Ashp Tile (AR03)	Tile					0.05 (0.009)
Brick						
Com Brick 4in (BK01)	4 in (10.1cm) Common	0.3333 (0.1016)	0.4167 (0.721)	120.0 (1922)	0.20 (837)	0.80 (0.141)
Com Brick 8in (BK02)	8 in (20.3 cm) Common	0.6667 (0.2032)	0.4167 (0.721)	120.0 (1922)	0.20 (837)	1.60 (0.282)
Com Brick 12in (BK03)	12 in (30.5 cm) Common	1.0000 (0.3048)	0.4167 (0.721)	120.0 (1922)	0.20 (837)	2.40 (0.423)
Face Brick 3in (BK04)	3 in (7.6cm) Face	0.2500 (0.0762)	0.7576 (1.310)	130.0 (2083)	0.22 (921)	0.33 (0.058)
Face Brick 4in (BK05)	4 in (10.1cm) Face	0.3333 (0.1016)	0.7576 (1.310)	130.0 (2083)	0.22 (921)	0.44 (0.078)
Face Brick 4in (HF-A2)	4 in (10.1cm) Face	0.3333 (0.1016)	0.7700 (1.331)	130.0 (2083)	0.22 (921)	0.43 (0.076)
Face Brick 4in (HF-A7)	4 in (10.1cm) Face	0.3333 (0.1016)	0.7700 (1.331)	125.0 (2003)	0.22 (921)	0.43 (0.076)
Com Brick 4in (HF-C4)	4 in (10.1cm) Common	0.3333 (0.1016)	0.4200 (0.727)	120.0 (1922)	0.2 (837)	0.79 (0.140)
Com Brick 8in (HF-C9)	8 in (20.3cm) Common	0.6667 (0.2032)	0.4200 (0.727)	120.0 (1922)	0.2 (837)	1.59 (0.280)
Building Paper						
Bldg Paper Felt (BP01)	Permeable Felt					0.06 (0.011)
Bldg Paper Seal (BP02)	2-Layer Seal					0.12 (0.022)
Plastic Film Seal (BP03)	Plastic Film Seal					0.01 (0.002)

MATERIALS Library (continued)

Code-Word	Description	Thickness ft (m)	Conductivity Btu/hr-ft^2-F (W/m-K)	Density lb/ft^3 (kg/m^3)	Specific Heat Btu/lb-F (kJ/kg-K)	Resistance hr-ft^2-F/Btu (K-m^2/W)
Built-Up Roof						
Blt-Up Roof 3/8in (BR01)	3/8 in (1 cm)	0.0313 (0.0095)	0.0939 (0.162)	70.0 (1121)	0.35 (1464)	0.33 (0.026)
Carpet						
Carpet & Fiber Pad (CP01)	With Fibrous Pad					2.08 (0.367)
Carpet & Rubber Pad (CP02)	With Rubber Pad					1.23 (0.217)
Cement						
Cmt Mortar 1in (CM01)	Mortar, 1in (2.5 cm)	0.0833 (0.0254)	0.4167 (0.721)	116.0 (1858)	0.2 (837)	0.20 (0.035)
Cmt Mortar 1.75in (CM02)	Mortar, 1.75 in (4.4 cm)	0.1458 (0.0444)	0.4167 (0.721)	116.0 (1858)	0.2 (837)	0.35 (0.062)
Cmt Plaster 1in (CM03)	Plaster with Sand Aggregate, 1 in (2.5 cm)	0.0833 (0.0254)	0.4167 (0.721)	116.0 (1858)	0.2 (837)	0.20 (0.035
Clay Tile, Hollow						
Hol ClayTile 3in (CT01)	1 Cell, 3in (7.6cm)	0.2500 (0.0762)	0.3125 (0.498)	70.0 (1121)	0.2 (837)	0.80 (0.272)
Hol ClayTile 4in (CT02)	1 Cell, 4 in (10.1cm)	0.3333 (0.1016)	0.2999 (0.519)	70.0 (1121)	0.2 (837)	1.11 (0.196)
Hol ClayTile 6in (CT03)	2 Cells, 6 in (15.2 cm)	0.5000 (0.1524)	0.3300 (0.571)	70.0 (1121)	0.2 (837)	1.52 (0.268)
Hol ClayTile 8in (CT04)	2 Cells, 8 in (20.3cm)	0.6667 (0.2032)	0.3600 (0.623)	70.0 (1121)	0.2 (837)	1.85 (0.326)
Hol ClayTile 10in (CT05)	2 Cells, 10 in (25.4 cm)	0.8333 (0.2540)	0.3749 (0.648)	70.0 (1121)	0.2 (837)	2.22 (0.391)
Hol ClayTile 12in (CT06)	3 Cells, 12 in (30.5 cm)	1.0000 (0.3048)	0.4000 (0.692)	70.0 (1121)	0.2 (837)	2.50 (0.441)
ClayTile 4in (HF-C1)	4 in (10.1cm)	0.3333 (0.1016)	0.3300 (0.571)	70.0 (1121)	0.2 (837)	1.01 (0.178)
ClayTile 8in (HF-C6)	8 in (20.3cm)	0.6667 (0.2032)	0.3300 (0.571)	70.0 (1121)	0.2 (837)	2.02 (0.357)
Clay Tile, Paver						
ClayTile Paver 3/8in (CT11)	3/8 in (1 cm)	0.0313 (0.0095)	1.0416 (1.802)	120.0 (1922)	0.2 (837)	0.03 (0.005)
Concrete, Heavy Weight Dried Aggregate, 140 lbs.						
Conc HW 140lb 1.25in (CC01)	1.25 in (3.2 cm)	0.1042 (0.0318)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	0.14 (0.025)
Conc HW 140lb 2in (CC02)	2 in (5.1 cm)	0.1667 (0.0508)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	0.22 (0.039)
Conc HW 140lb 4in (CC03)	4 in (10.1cm)	0.3333 (0.1016)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	0.44 (0.078)
Conc HW 140lb 6in (CC04)	6 in (15.2 cm)	0.5000 (0.1524	0.7576 (1.310)	140.0 (2243)	0.2 (837)	0.66 (0.116)
Conc HW 140lb 8in (CC05)	8 in (20.3cm)	0.6667 (0.2032)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	0.88 (0.155)
Conc HW 140lb 10in (CC06)	10 in (25.4 cm)	0.8333 (0.2540)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	1.10 (0.194)
Conc HW 140lb 12in (CC07)	12 in (30.5 cm)	1.0000 (0.3048)	0.7576 (1.310)	140.0 (2243)	0.2 (837)	1.32 (0.233)

MATERIALS Library (continued)

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Concrete, Heavy Weight Undried Aggregate, 140 lbs.						
Conc HW 140lb 3/4in (CC11)	3/4 in (1.9 cm)	0.0625 (0.0191)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.06 (0.011)
Conc HW 140lb 1-3/8in (CC12)	1 3/8 in (3.5 cm)	0.1146 (0.0349)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.11 (0.019)
Conc HW 140lb 3.25in (CC13)	3 1/4 in (8.3 cm)	0.2708 (0.0825)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.26 (0.046)
Conc HW 140lb 4in (CC14)	4 in (10.2 cm)	0.3333 (0.1016)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.32 (0.056)
Conc HW 140lb 6in (CC15)	6 in (15.2 cm)	0.5000 (0.1524)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.48 (0.085)
Conc HW 140lb 18in (CC16)	8 in (20.2 cm)	0.6667 (0.2032)	1.0417 (1.802)	140.0 (2243)	0.2 (837)	0.64 (0.113)
Conc HW 140lb 2in (HF-C12)	2 in (5.1 cm)	0.1667 (0.0508)	1.0000 (1.730)	140.0 (2243)	0.2 (837)	0.17 (0.029)
Conc HW 140lb 4in (HF-C5)	4 in (10.2 cm)	0.3333 (0.1016)	1.0000 (1.730)	140.0 (2243)	0.2 (837)	0.33 (0.059)
Conc HW 140lb 6in (HF-C13)	6 in (15.2 cm)	0.5000 (0.1524)	1.0000 (1.730)	140.0 (2243)	0.2 (837)	0.50 (0.088)
Conc HW 140lb 8in (HF-C10)	8 in (20.2 cm)	0.6667 (0.2032)	1.0000 (1.730)	140.0 (2243)	0.2 (837)	0.67 (0.118)
Conc HW 140lb 12in (HF-C11)	12 in (30.5 cm)	1.0000 (0.3048)	1.0000 (1.730)	140.0 (2243)	0.2 (837)	1.00 (0.176)
Concrete, Light Weight, 80 lb.						
ConcLW 80lb 3/4in (CC21)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	0.30 (0.053)
ConcLW 80lb 1.25in (CC22)	1.25 in (3.2 cm)	0.1042 (0.0318)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	0.50 (0.088)
ConcLW 80lb 2in (CC23)	2 in (5.1 cm)	0.1667 (0.0508)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	0.80 (0.141)
ConcLW 80lb 4in (CC24)	4 in (10.2 cm)	0.3333 (0.1016)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	1.60 (0.282)
ConcLW 80lb 6in (CC25)	6 in (15.2 cm)	0.5000 (0.1524)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	2.40 (0.423)
ConcLW 80lb 8in (CC26)	8 in (20.2 cm)	0.6667 (0.2032)	0.2083 (0.360)	80.0 (1282)	0.2 (837)	3.20 (0.564)
Concrete, Light Weight, 30 lb.						
ConcLW 30lb 3/4in (CC31)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0751 (0.130)	30.0 (481)	0.2 (837)	0.83 (0.146)
ConcLW 30lb 1.25in (CC32)	1.25 in (3.2 cm)	0.1042 (0.0191)	0.0751 (0.130)	30.0 (481)	0.2 (837)	1.39 (0.245)
ConcLW 30lb 2in (CC33)	2 in (5.1 cm)	0.1667 (0.0508)	0.0751 (0.130)	30.0 (481)	0.2 (837)	2.22 (0.391)
ConcLW 30lb 4in (CC34)	4 in (10.2 cm)	0.3333 (0.1016)	0.0751 (0.130)	30.0 (481)	0.2 (837)	4.44 (0.782)
ConcLW 30lb 6in (CC35)	6 in (15.2 cm)	0.5000 (0.1524)	0.0751 (0.130)	30.0 (481)	0.2 (837)	6.66 (1.174)
ConcLW 30lb 8in (CC36)	8 in (20.2 cm)	0.6667 (0.2032)	0.0751 (0.130)	30.0 (481)	0.2 (837)	8.88 (1.565)
Concrete, Light Weight, 40 lb.						
ConcLW 40lb 4in (HF-C14)	4 in (10.2 cm)	0.3333 (0.1016)	0.1 (.173)	40.0 (641)	0.2 (837)	3.33 (0.587)
ConcLW 40lb 6in (HF-C15)	6 in (15.2 cm)	0.5000 (0.1524)	0.1 (.173)	40.0 (641)	0.2 (837)	5.00 (0.881)
ConcLW 40lb 8in (HF-C16)	8 in (20.2 cm)	0.6667 (0.2032)	0.1 (.173)	40.0 (641)	0.2 (837)	6.67 (1.175)
Concrete Block, Light Weight						
CMU LW 4in (HF-C2)	4 in (10.2 cm)	0.3333 (0.1016)	0.2200 (0.380)	38.0 (609)	0.2 (837)	1.51 (0.267)
Concrete Block, 4 inch (10.2 cm) Heavy Weight						
CMU HW 4in Hollow (CB01)	Hollow	0.3333 (0.1016)	0.4694 (0.812)	101.0 (1618)	0.2 (837)	0.71 (0.125)
CMU HW 4in ConcFill (CB02)	Concrete Filled	0.3333 (0.1016)	0.7575 (1.310)	140.0 (2234)	0.2 (837)	0.44 (0.078)
CMU HW 4in PerlFill (CB03)	Perlite Filled	0.3333 (0.1016)	0.3001 (0.384)	103.0 (1650)	0.2 (837)	1.11 (0.196)
CMU HW 4in PartFill (CB04)	Part-Filled Concrete *	0.3333 (0.1016)	0.5844 (1.011)	114.0 (1826)	0.2 (837)	0.57 (0.100)
CMU HW 4in Conc/Perl (CB05)	Concrete and Perlite **	0.3333 (0.1016)	0.4772 (0.825)	115.0 (1842)	0.2 (837)	0.70 (0.123)

* One filled and reinforced concrete core every 24 in (61 cm) of wall length
** One filled and reinforced concrete core every 24 in (61 cm) of wall length with the remaining cores filled with Perlite insulation

MATERIALS Library (continued)

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Concrete Block, 6 inch (15.2 cm) Heavy Weight						
CMU HW 6in Hollow (CB06)	Hollow	0.5000 (0.1524)	0.5555 (0.961)	85.0 (1362)	0.2 (837)	0.90 (0.159)
CMU HW 6in ConcFill (CB07)	Concrete Filled	0.5000 (0.1524)	0.7575 (1.310)	140.0 (2243)	0.2 (837)	0.66 (0.116)
CMU HW 6in PerlFill (CB08)	Perlite Filled	0.5000 (0.1524)	0.2222 (0.384)	88.0 (1410)	0.2 (837)	2.25 (0.397)
CMU HW 6in PartFill (CB09)	Part-Filled Concrete*	0.5000 (0.1524)	0.6119 (1.058)	104.0 (1666)	0.2 (837)	0.82 (0.145)
CMU HW 6in Conc/Perl (CB10)	Concrete and Perlite**	0.5000 (0.1524)	0.4238 (0.733)	104.0 (1666)	0.2 (837)	1.18 (0.208)
Concrete Block, 8 inch (20.3 cm) Heavy Weight						
CMU HW 8in Hollow (CB11)	Hollow	0.6667 (0.2032)	0.6060 (1.048)	69.0 (1105)	0.2 (837)	1.10 (0.194)
CMU HW 8in ConcFill (CB12)	Concrete Filled	0.6667 (0.2032)	0.7575 (1.310)	140.0 (2243)	0.2 (837)	0.88 (0.155)
CMU HW 8in PerlFill (CB13)	Perlite Fill	0.6667 (0.2032)	0.2272 (0.393)	70.0 (1121)	0.2 (837)	2.93 (0.516)
CMU HW 8in PartFill (CB14)	Part-Filled Concrete*	0.6667 (0.2032)	0.6746 (1.167)	93.0 (1490)	0.2 (837)	0.99 (0.174)
CMU HW 8in Conc/Perl (CB15)	Concrete and Perlite**	0.6667 (0.2032)	0.4160 (0.720)	93.0 (1490)	0.2 (837)	1.60 (0.282)
Concrete Block, 12 inch (30.5 cm) Heavy Weight						
CMU HW 12in Hollow (CB16)	Hollow	1.0000 (0.3048)	0.7813 (1.350)	76.0 (1218)	0.2 (837)	1.28 (0.226)
CMU HW 12in ConcFill (CB17)	Concrete Filled	1.0000 (0.3048)	0.7575 (1.310)	140.0 (2243)	0.2 (837)	1.32 (0.233)
CMU HW 12in PartFill (CB18)	Part-Filled Concrete*	1.0000 (0.3048)	0.7773 (1.344)	98.0 (1570)	0.2 (837)	1.29 (0.227)
Concrete Block, 4 inch (10.1 cm) Medium Weight						
CMU MW 4in Hollow (CB21)	Hollow	0.3333 (0.1016)	0.3003 (0.519)	76.0 (1218)	0.2 (837)	1.11 (0.196)
CMU MW 4in ConcFill (CB22)	Concrete Filled	0.3333 (0.1016)	0.4456 (0.771)	115.0 (1842)	0.2 (837)	0.75 (0.132)
CMU MW 4in PerlFill (CB23)	Perlite Filled	0.3333 (0.1016)	0.1512 (0.262)	78.0 (1250)	0.2 (837)	2.20 (0.388)
CMU MW 4in PartFill (CB24)	Part-Filled Concrete*	0.3333 (0.1016)	0.3306 (0.572)	89.0 (1426)	0.2 (837)	1.01 (0.178)
CMU MW 4in Conc/Perl (CB25)	Concrete and Perlite**	0.3333 (0.1016)	0.2493 (0.431)	90.0 (1442)	0.2 (837)	1.34 (0.236)

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MATERIALS Library (continued)

Code-Word	Description	Thickness ft (m)	Conductivity Btu/hr-ft^2-F (W/m-K)	Density lb/ft^3 (kg/m^3)	Specific Heat Btu/lb-F (kJ/kg-K)	Resistance hr-ft^2-F/Btu (K-m^2/W)
Concrete Block, 6 inch (15.2 cm) Medium Weight						
CMU MW 6in Hollow (CB26)	Hollow	0.5000 (0.1524)	0.3571 (0.618)	65.0 (1041)	0.2 (837)	1.40 (0.247)
CMU MW 6in ConcFill (CB27)	Concrete Filled	0.5000 (0.1524)	0.4443 (0.768)	119.0 (1906)	0.2 (837)	1.13 (0.199)
CMU MW 6in PerlFill (CB28)	Perlite Filled	0.5000 (0.1524)	0.1166 (0.202)	67.0 (1073)	0.2 (837)	4.29 (0.756)
CMU MW 6in PartFill (CB29)	Part-Filled Concrete*	0.5000 (0.1524)	0.3686 (0.638)	83.0 (1330)	0.2 (837)	1.36 (0.240)
CMU MW 6in Conc/Perl (CB30)	Concrete and Perlite**	0.5000 (0.1524)	0.2259 (0.391)	84.0 (1346)	0.2 (837)	2.21 (0.389)
Concrete Block, 8 inch (20.3 cm) Medium Weight						
CMU MW 8in Hollow (CB31)	Hollow	0.6667 (0.2032)	0.3876 (0.670)	53.0 (849)	0.2 (837)	1.72 (0.303)
CMU MW 8in ConcFill (CB32)	Concrete Filled	0.6667 (0.2032)	0.4957 (0.857)	123.0 (1970)	0.2 (837)	1.34 (0.236)
CMU MW 8in PerlFill (CB33)	Perlite Filled	0.6667 (0.2032)	0.1141 (0.197)	56.0 (897)	0.2 (837)	5.84 (1.029)
CMU MW 8in PartFill (CB34)	Part-Filled Concrete*	0.6667 (0.2032)	0.4348 (0.752)	76.0 (1218)	0.2 (837)	1.53 (0.270)
CMU MW 8in PartFill (CB35)	Concrete and Perlite**	0.6667 (0.2032)	0.2413 (0.417)	77.0 (1234)	0.2 (837)	2.76 (0.486)
Concrete Block, 12 inch (30.5 cm) Medium Weight						
CMU MW 12in Hollow (CB36)	Hollow	1.0000 (0.3048)	0.4959 (0.858)	58.0 (929)	0.2 (837)	2.02 (0.356)
CMU MW 12in ConcFill (CB37)	Concrete Filled	1.0000 (0.3048)	0.4814 (0.833)	121.0 (1938)	0.2 (837)	2.08 (0.367)
CMU MW 12in PartFill (CB38)	Part-Filled Concrete*	1.0000 (0.3048)	0.4919 (0.851)	79.0 (1266)	0.2 (837)	2.03 (0.358)
Concrete Block, 4 inch (10.1 cm) Light Weight						
CMU LW 4in Hollow (CB41)	Hollow	0.3333 (0.1016)	0.2222 (0.384)	65.0 (1041)	0.2 (837)	1.50 (0.264)
CMU LW 4in ConcFill (CB42)	Concrete Filled	0.3333 (0.1016)	0.3695 (0.639)	104.0 (1666)	0.2 (837)	0.90 (0.159)
CMU LW 4in PerlFill (CB43)	Perlite Filled	0.3333 (0.1016)	0.1271 (0.220)	67.0 (1073)	0.2 (837)	2.62 (0.462)
CMU LW 4in PartFill (CB44)	Part-Filled Concrete*	0.3333 (0.1016)	0.2808 (0.486)	78.0 (1250)	0.2 (837)	1.19 (0.210)
CMU LW 4in Conc/Perl (CB45)	Concrete and Perlite**	0.3333 (0.1016)	0.2079 (0.360)	79.0 (1266)	0.2 (837)	1.60 (0.282)

* One filled and reinforced concrete core every 24 in (61 cm) of wall length

** One filled and reinforced concrete core every 24 in (61 cm) of wall length with the remaining cores filled with Perlite insulation

MATERIALS Library (continued)

Code-Word	Description	Thickness ft (m)	Conductivity Btu/hr-ft^2-F (W/m-K)	Density lb/ft^3 (kg/m^3)	Specific Heat Btu/lb-F (kJ/kg-K)	Resistance hr-ft^2-F/Btu (K-m^2/W)
Concrete Block, 6 inch (15.2 cm) Light Weight						
CMU LW 6in Hollow (CB46)	Hollow	0.5000 (0.1524)	0.2777 (0.480)	55.0 (881)	0.2 (837)	1.80 (0.317)
CMU LW 6in ConcFill (CB47)	Concrete Filled	0.5000 (0.1524)	0.3819 (0.661)	110.0 (1762)	0.2 (837)	1.31 (0.231)
CMU LW 6in PerlFill (CB48)	Perlite Filled	0.5000 (0.1524)	0.0985 (0.170)	57.0 (913)	0.2 (837)	5.08 (0.895)
CMU LW 6in PartFill (CB49)	Part-Filled Concrete*	0.5000 (0.1524)	0.3189 (0.552)	73.0 (1169)	0.2 (837)	1.57 (0.277)
CMU LW 6in Conc/Perl (CB50)	Concrete and Perlite**	0.5000 (0.1524)	0.1929 (0.334)	74.0 (1185)	0.2 (837)	2.59 (0.456)
Concrete Block, 8 inch (20.3 cm) Light Weight						
CMU LW 8in Hollow (CB51)	Hollow	0.6667 (0.2032)	0.3333 (0.576)	45.0 (721)	0.2 (837)	2.00 (0.352)
CMU LW 8in ConcFill (CB52)	Concrete Filled	0.6667 (0.2032)	0.4359 (0.754)	115.0 (1842)	0.2 (837)	1.53 (0.270)
CMU LW 8in PerlFill (CB53)	Perlite Filled	0.6667 (0.2032)	0.0963 (0.167)	48.0 (769)	0.2 (837)	6.92 (1.219)
CMU LW 8in PartFill (CB54)	Part-Filled Concrete*	0.6667 (0.2032)	0.3846 (0.665)	68.0 (1089)	0.2 (837)	1.73 (0.305)
CMU LW 8in Conc/Perl (CB55)	Concrete and Perlite**	0.6667 (0.2032)	0.2095 (0.362)	69.0 (1105)	0.2 (837)	3.18 (0.560)
Concrete Block, 12 inch (30.5 cm) Light Weight						
CMU LW 12in Hollow (CB56)	Hollow	1.0000 (0.3048)	0.4405 (0.762)	49.0 (785)	0.2 (837)	2.27 (0.400)
CMU LW 12in ConcFill (CB57)	Concrete Filled	1.0000 (0.3048)	0.4194 (0.725)	113.0 (1810)	0.2 (837)	2.38 (0.419)
CMU LW 12in PartFill (CB58)	Part-Filled Concrete*	1.0000 (0.3048)	0.4274 (0.739)	70.0 (1121)	0.2 (837)	2.34 (0.412)
Felt and Membrane						
Felt 3/8in (HF-E3)	3/8 in (1 cm)	0.0313 (0.0095)	0.1100 (0.190)	70.0 (1121)	0.4 (1674)	0.28 (0.050)
Finish (HF-A6)	1/2 in (1.3 cm)	0.0417 (0.0127)	0.2400 (0.415)	78.0 (1249)	0.26 (1088)	0.17 (0.031)
Gypsum or Plaster Board						
GypBd 1/2in (GP01)	1/2 in (1.3 cm)	0.0417 (0.0127)	0.0926 (0.160)	50.0 (801)	0.2 (837)	0.45 (0.079)
GypBd 5/8in (GP02)	5/8 in (1.6 cm)	0.0521 (0.0159)	0.0926 (0.160)	50.0 (801)	0.2 (837)	0.56 (0.099)
GypBd 3/4in (GP03)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0926 (0.160)	50.0 (801)	0.2 (837)	0.67 (0.118)

* One filled and reinforced concrete core every 24 in (61 cm) of wall length

** One filled and reinforced concrete core every 24 in (61 cm) of wall length with the remaining cores filled with Perlite insulation

MATERIALS Library (continued)

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Gypsum Plaster						
Gypsum LW Agg 3/4in (GP04)	3/4 in (1.9cm) Lt. Wt. Aggregate	0.0625 (0.0191)	0.1330 (0.230)	45.0 (721)	0.2 (837)	0.47 (0.083)
Gypsum LW Agg 1in (GP05)	1 in (2.5 cm) Lt. Wt. Aggregate	0.0833 (0.0254)	0.1330 (0.230)	45.0 (721)	0.2 (837)	0.63 (0.111)
Gypsum Sand Agg 3/4in (GP06)	3/4 in (1.9cm) Sand Aggregate	0.0625 (0.0191)	0.4736 (0.819)	105.0 (1682)	0.2 (837)	0.13 (0.023)
Gypsum Sand Agg 1in (GP07)	1 in (2.5 cm) Sand Aggregate	0.0833 (0.0254)	0.4736 (0.819)	105.0 (1682)	0.2 (837)	0.18 (0.032)
Hard Board, 3/4 inch (1.9 cm)						
Hd Bd 3/4in Md Dens (HB01)	Medium Density Siding	0.0625 (0.0191)	0.0544 (0.094)	40.0 (641)	0.28 (1171)	1.15 (0.203)
Hd Bd 3/4in Md Dens (HB02)	Medium Density Others	0.0625 (0.0191)	0.0608 (0.105)	50.0 (801)	0.31 (1297)	1.03 (0.182)
Hd Bd 3/4in Std Temp (HB03)	High Density Standard Tempered	0.0625 (0.0191)	0.0683 (0.118)	55.0 (881)	0.33 (1381)	0.92 (0.162)
Hd Bd 3/4in Srv Temp (HB04)	High Density Service Tempered	0.0625 (0.0191)	0.0833 (0.144)	63.0 (1009)	0.33 (1381)	0.75 (0.132)
Linoleum Tile						
Linoleum Tile (LT01)						0.05 (0.009)
Particle Board						
PartBd Lo Dens 3/4in (PB01)	Low Density, 3/4 in (1.9 cm)	0.0625 (0.0191)	0.0450 (0.078)	75.0 (1202)	0.31 (1297)	1.39 (0.245)
PartBd Md Dens 3/4in (PB02)	Medium Density, 3/4 in (1.9 cm)	0.0625 (0.0191)	0.7833 (1.355)	75.0 (1202)	0.31 (1297)	0.08 (0.014))
PartBd Hi Dens 3/4in (PB03)	High Density, 3/4 in (1.9 cm)	0.0625 (0.0191)	0.9833 (1.701)	75.0 (1202)	0.31 (1297)	0.06 (0.011)
PartBd Underlay 5/8in (PB04)	Underlayment, 5/8 in (1.6 cm)	0.0521 (0.0159)	0.1796 (0.311)	75.0 (1202)	0.29 (1213)	0.29 (0.051)

MATERIALS Library (continued)

Code-Word	Description	Thickness ft (m)	Conductivity Btu/hr-ft^2-F (W/m-K)	Density lb/ft^3 (kg/m^3)	Specific Heat Btu/lb-F (kJ/kg-K)	Resistance hr-ft^2-F/Btu (K-m^2/W)
Plywood						
Plywd 1/4in (PW01)	1/4 in (0.64 cm)	0.0209 (0.0064)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	0.31 (0.055)
Plywd 3/8in (PW02)	3/8 in (1 cm)	0.0313 (0.0095)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	0.47 (0.083)
Plywd 1/2in (PW03)	1/2 in (1.3 cm)	0.0417 (0.0127)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	0.63 (0.111)
Plywd 5/8in (PW04)	5/8 in (1.6 cm)	0.0521 (0.0159)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	0.78 (0.137)
Plywd 3/4 (PW05)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	0.94 (0.166)
Plywd 1in (PW06)	1 in (2.5 cm)	0.0833 (0.0254)	0.0667 (0.115)	34.0 (545)	0.29 (1213)	1.25 (0.220)
Roof Gravel or Slag						
Gravel 1/2in (RG01)	1/2 in (1.3cm)	0.0417 (0.0127)	0.8340 (1.442)	55.0 (881)	0.4 (1674)	0.05 (0.009)
Gravel 1in (RG02)	1 in (2.5 cm)	0.0833 (0.0254)	0.8340 (1.442)	55.0 (881)	0.4 (1674)	0.10 (0.018)
Rubber Tile						
Rubber Tile (RT01)						0.05 (0.009)
Slate						
Slate 1/2in (SL01)	1/2 in (1.3 cm)	0.0417 (0.0127)	0.8340 (1.442)	100.0 (1602)	0.35 (1464)	0.05 (0.009)
Soil						
Soil 12in	12in (30.5cm)	1.000 (0.3048)	1.000 (1.729)	115.0 (1842)	0.2 (837)	1.0000 (0.176)
Steel Siding						
Steel Siding (HF-A3)	0.06in (0.15cm)	0.0050 (0.0015)	26.000 (45.0)	480.0 (7690)	0.10 (419)	0.0002 (3.5×10^{-5})
Stone						
Stone 1in (ST01)	1 in (2.5 cm)	0.0833 (0.0254)	1.0416 (1.802)	140.0 (2243)	0.2 (837)	0.08 (0.014)
Stone1/2in (HF-E2)	1/2 in(1.3 cm)	0.0417 (0.0127)	0.8300 (1.435)	55.0 (881)	0.4 (1674)	0.05 (0.009)
Stucco						
Stucco 1in (SC01)	1 in (2.5 cm)	0.0833 (0.0254)	0.4167 (0.721)	166.0 (2659)	0.2 (837)	0.20 (0.035)
Terrazzo						
Terrazzo 1in (TZ01)	1 in (2.5 cm)	0.0833 (0.0254)	1.0416 (1.802)	140.0 (2243)	0.2 (837)	0.08 (0.014)
Wood, Soft						
Wood Sft 3/4in (WD01)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0667 (0.115)	32.0 (513)	0.33 (1381)	0.94 (0.166)
Wood Sft 1.5in (WD02	1.5 in (3.8 cm)	0.1250 (0.0381)	0.0667 (0.115)	32.0 (513)	0.33 (1381)	1.87 (0.330)
Wood Sft 2.5in (WD03	2.5 in (6.4 cm)	0.2083 (0.0635)	0.0667 (0.115)	32.0 (513)	0.33 (1381)	3.12 (0.550)
Wood Sft 3.5in (WD04	3.5 in (8.9 cm)	0.2917 (0.0889)	0.0667 (0.115)	32.0 (513)	0.33 (1381)	4.37 (0.770)
Wood Sft 4in (WD05	4 in (10.2 cm)	0.3333 (0.1016)	0.0667 (0.115)	32.0 (513)	0.33 (1381)	5.00 (0.881)
Wood, Hard						
Wood Hd 3/4in (WD11)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0916 (0.158)	45.0 (721)	0.30 (1255)	0.68 (0.120)
Wood Hd 1in (WD12)	1 in (2.5 cm)	0.0833 (0.0254)	0.0916 (0.158)	45.0 (721)	0.30 (1255)	0.91 (0.160
Wood, Shingle						
Wood Shingle (WS01)	For Wall	0.0583(.0178)	0.0667 (0.115)	32.0 (513)	0.30 (1255)	0.87 (0.153)
Wood Shingle (WS02)	For Roof					0.94 (0.166)
Wood						
Wood 1in (HF-B7)	1 in (2.5 cm)	0.0833 (0.0254)	0.0700 (0.121)	37.0 (593)	0.2 (837)	1.19 (0.210)
Wood 2in (HF-B10	2 in (3.1 cm)	0.1667 (0.0508)	0.0700 (0.121)	37.0 (593)	0.2 (837)	2.38 (0.420))
Wood 2.5in (HF-B8	2.5 in (6.4 cm)	0.2083 (0.0635)	0.0700 (0.121)	37.0 (593)	0.2 (837)	2.98 (0.526)
Wood 3in (HF-B11	3 in (7.6 cm)	0.2500 (0.0762)	0.0700 (0.121)	37.0 (593)	0.2 (837)	3.57 (0.630)
Wood 4in (HF-B9	4 in (10.2 cm)	0.3330 (0.1016)	0.0700 (0.121)	37.0 (593)	0.2 (837)	4.76 (0.840)

MATERIALS Library (Insulation)

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Mineral Wool/Fiber						
MinWool Batt R7 (IN01)	Batt, R-7*	0.1882 (0.0574)	0.0250 (0.043)	0.60 (10)	0.2 (837)	7.53 (1.327)
MinWool Batt R11 (IN02)	Batt, R-11	0.2957 (0.0901)	0.0250 (0.043)	0.60 (10)	0.2 (837)	11.83 (2.085)
MinWool Batt R19 (IN03)	Batt, R-19	0.5108 (0.1557)	0.0250 (0.043)	0.60 (10)	0.2 (837)	20.43 (3.600)
MinWool Batt R24 (IN04)	Batt, R-24	0.6969 (0.2124)	0.0250 (0.043)	0.60 (10)	0.2 (837)	27.88 (4.913)
MinWool Batt R30 (IN05)	Batt, R-30	0.8065 (0.2458)	0.0250 (0.043)	0.60 (10)	0.2 (837)	32.26 (5.685)
MinWool Fill 3.5in R11 (IN11)	Fill, 3.5 in (8.9 cm), R-11	0.2917 (0.0889)	0.0270 (0.046)	0.60 (10)	0.2 (837)	10.80 (1.903)
MinWool Fill 5.5in R19 (IN12)	Fill, 5.5 in (13.4 cm), R-19	0.4583 (0.1397)	0.0270 (0.046)	0.63 (11)	0.2 (837)	16.97 (2.991)
Cellulose Fill						
Cellulose 3.5in R-13 (IN13)	3.5 in (8.9 cm), R-13	0.2917 (0.0889)	0.0225 (0.039)	3.0 (48)	0.33 (1381)	12.96 (2.284)
Cellulose 5.5in R-20 (IN14)	5.5 in (13.4 cm), R-20	0.4583 (0.1397)	0.0225 (0.039)	3.0 (48)	0.33 (1381)	20.37 (3.590)
Insulation						
Insul Bd 1in (HF-B2)	1 in (2.5 cm)	0.0830 (0.0254)	0.0250 (0.043)	2.0 (32)	0.2 (837)	3.32 (0.585)
Insul Bd 2in (HF-B3)	2 in (3.1 cm)	0.1670 (0.0508)	0.0250 (0.043)	2.0 (32)	0.2 (837)	6.68 (1.177)
Insul Bd 3in (HF-B4)	3 in (7.6 cm)	0.2500 (0.0762)	0.0250 (0.043)	2.0 (32)	0.2 (837)	10.00 (1.762)
Insul Bd 1in (HF-B5)	1 in (2.5 cm)	0.0830 (0.0254)	0.0250 (0.043)	5.7 (91)	0.2 (837)	3.29 (0.580)
Insul Bd 2in (HF-B6)	2 in (3.1 cm)	0.1670 (0.0508)	0.0250 (0.043)	5.7 (91)	0.2 (837)	6.68 (1.177)
Insul Bd 3in (HF-B12)	3 in (7.6 cm)	0.2500 (0.0762)	0.0250 (0.043)	5.7 (91)	0.2 (837)	10.00 (1.762)
Preformed Mineral Board						
MinBd 7/8in R-3 (N21)	7/8 in (2.2 cm), R-3	0.0729 (0.0222)	0.0240 (0.042)	15.0 (240)	0.17 (711)	3.04 (0.536)
MinBd 1in R-3 (IN22)	1 in (2.5 cm), R-3.5	0.0833 (0.0254)	0.0240 (0.042)	15.0 (240)	0.17 (711)	3.47 (0.612)
MinBd 2in R-7 (IN23)	2 in (2.5 cm), R-7	0.1667 (0.0508)	0.0240 (0.042)	15.0 (240)	0.17 (711)	6.95 (1.225)
MinBd 3in R-10.4 (IN24)	3 in (7.6 cm), R-10.4	0.2500 (0.0762)	0.0240 (0.042)	15.0 (240)	0.17 (711)	10.42 (1.836)
Polystyrene, Expanded						
Polystyrene 1/2in (IN31)	1/2 in (1.3cm)	0.0417 (0.0127)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	2.08 (0.367)
Polystyrene 3/4in (IN32)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	3.12 (0.550)
Polystyrene 1in (IN33)	1 in (2.5 cm)	0.0833 (0.0254)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	4.16 (0.733)
Polystyrene 1.25in (IN34)	1.25 in (3.2 cm)	0.1042 (0.0318)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	5.21 (0.918)
Polystyrene 2in (IN35)	2 in (3.1 cm)	0.1667 (0.0508)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	8.33 (1.468)
Polystyrene 3in (IN36)	3 in (7.6 cm)	0.2500 (0.0762)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	12.50 (2.203)
Polystyrene 4in (IN37)	4 in (10.2 cm)	0.3333 (0.1016)	0.0200 (0.035)	1.8 (29)	0.29 (1213)	16.66 (2.936)
Polyurethane, Expanded						
Polyurethane 1/2in (IN41)	1/2 in (1.3cm)	0.0417 (0.0127)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	3.14 (0.553)
Polyurethane 3/4n (IN42)	3/4 in (1.9 cm)	0.0625 (0.0191)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	4.67 (0.823)
Polyurethane 1in (IN43)	1 in (2.5 cm)	0.0833 (0.0254)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	6.26 (1.103)
Polyurethane 1.25in (IN44)	1.25 in (3.2 cm)	0.1042 (0.0318)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	7.83 (1.380)
Polyurethane 2in (IN45)	2 in (3.1 cm)	0.1667 (0.0508)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	12.53 (2.208)
Polyurethane 3in (IN46)	3 in (7.6 cm)	0.2500 (0.0762)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	18.80 (3.313)
Polyurethane 4in (IN47)	4 in (10.2 cm)	0.3333 (0.1016)	0.0133 (0.023)	1.5 (24)	0.38 (1590)	25.06 (4.416)

* Nominal thickness is 2 to 2-3/4 in (3.1 to 7 cm). Resistance value is based on a thickness of 2.26 in (5.74 cm).

MATERIALS Library (Insulation) - continued

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Urea Formaldehyde						
Urea Formald 3.5in R19 (IN51)	3.5 in (8.9 cm), R-15	0.2910 (0.0887)	0.0200 (0.035)	0.7 (11)	0.3 (1255)	14.55 (2.564)
Urea Formald 5.5in R23 (IN52)	5.5 in (13.4 cm), R-23	0.4580 (0.1396)	0.0200 (0.035)	0.7 (11)	0.3 (1255)	22.90 (4.036)
Insulation Board						
Insul Bd 1/2in (IN61)	Sheathing, 1/2 in (1.3cm)	0.0417 (0.0127)	0.0316 (0.055)	18.0 (288)	0.31 (1297)	1.32 (0.232)
Insul Bd 3/4in (IN62)	Sheathing, 3/4 in (1.9 cm)	0.0625 (0.0191)	0.0316 (0.055)	18.0 (288)	0.31 (1297)	1.98 (0.348)
Insul Bd 3/8in (IN63)	Shingle Backer, 3/8 in (1 cm)	0.0313 (0.0096)	0.0331 (0.058)	18.0 (288)	0.31 (1297)	0.95 (0.167)
Insul Bd 1/2in (IN64)	Nail Base Sheathing, 1/2 in (1.3cm)	0.0417 (0.0127)	0.0366 (0.064)	25.0 (400)	0.31 (1297)	1.14 (0.200)
Roof Insulation, Preformed						
Roof Insul 1/2in (IN71)	1/2 in (1.3cm)	0.0417 (0.0127)	0.0300 (0.052)	16.0 (256)	0.2 (837)	1.39 (0.244)
Roof Insul 1in (IN72)	1 in (2.5 cm)	0.0833 (0.0254)	0.0300 (0.052)	16.0 (256)	0.2 (837)	2.78 (0.489)
Roof Insul 1.5in (IN73)	1.5 in (3.8 cm)	0.1250 (0.0381)	0.0300 (0.052)	16.0 (256)	0.2 (837)	4.17 (0.732)
Roof Insul 2in (IN74)	2 in (3.1 cm)	0.1667 (0.0508)	0.0300 (0.052)	16.0 (256)	0.2 (837)	5.56 (0.977)
Roof Insul 2.5in (IN75)	2.5 in (6.4 cm)	0.2083 (0.0635)	0.0300 (0.052)	16.0 (256)	0.2 (837)	6.94 (1.220)
Roof Insul 3in (IN76)	3 in (7.6 cm)	0.2500 (0.0762)	0.0300 (0.052)	16.0 (256)	0.2 (837)	8.33 (1.464)

MATERIALS Library (Air Spaces)

Code-Word	Description	Thickness	Conductivity	Density	Specific Heat	Resistance
		ft (m)	Btu/hr-ft^2-F (W/m-K)	lb/ft^3 (kg/m^3)	Btu/lb-F (kJ/kg-K)	hr-ft^2-F/Btu (K-m^2/W)
Air Layer, 3/4 in (1.9 cm) or less						
Air Lay <3/4in Vert (AL11)	Vertical Walls					0.90 (0.158)
Air Lay <3/4in Slope (AL12)	Slope 45^o					0.84 (0.148)
Air Lay <3/4in Horiz (AL13)	Horizontal Roofs					0.82 (0.144)
Air Layer, 3/4 in to 4 in (1.9 cm to 10.2 cm)						
Air Lay <4in Vert (AL21)	Vertical Walls					0.89 (0.156)
Air Lay <4in Slope (AL22)	Slope 45^o					0.87 (0.152)
Air Lay <4in Horiz (AL23)	Horizontal Roofs					0.87 (0.152)
Air Layer, 4 in (10.2 cm) or more						
Air Lay >4in Vert (AL31)	Vertical Walls					0.92 (0.162)
Air Lay >4in Slope (AL32)	Slope 45^o					0.89 (0.156)
Air Lay >4in Horiz (AL33)	Horizontal Roofs					0.92 (0.161)
* A more extensive list of data can be found in the 1993 ASHRAE Handbook of Fundamentals, Chap. 22, Table 2						

Glass Type Library* (pg 1 of 9) — (sorted by Glass Type Code)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value Alum No Break	Alum w Break	Alum Clad Wood	Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
Single Clear	1000	1	n/a	n/a	1.11	1.21	1.13	1.05	0.86	1	0.9	0.84	0.08
Single Clear	1001	1	n/a	n/a	1.09	1.18	1.11	1.03	0.81	0.95	0.88	0.77	0.07
Single Low Iron	1002	1	n/a	n/a	1.11	1.21	1.13	1.05	0.90	1.05	0.91	0.9	0.08
Single Low Iron	1003	1	n/a	n/a	1.1	1.20	1.12	1.04	0.90	1.04	0.91	0.89	0.08
Single Tint Bronze	1200	1	n/a	n/a	1.11	1.21	1.13	1.05	0.73	0.84	0.69	0.64	0.06
Single Tint Bronze	1201	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.53	0.48	0.05
Single Tint Green	1202	1	n/a	n/a	1.11	1.21	1.13	1.05	0.72	0.83	0.82	0.63	0.06
Single Tint Green	1203	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.75	0.49	0.06
Single Tint Grey	1204	1	n/a	n/a	1.11	1.21	1.13	1.05	0.71	0.83	0.61	0.63	0.06
Single Tint Grey	1205	1	n/a	n/a	1.09	1.18	1.11	1.03	0.59	0.69	0.43	0.46	0.05
Single Tint Blue	1206	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.57	0.48	0.05
Single Ref-A Clear-L	1400	1	n/a	n/a	0.86	0.93	0.88	0.81	0.19	0.23	0.08	0.07	0.34
Single Ref-A Clear-L	1401	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.14	0.11	0.27
Single Ref-A Clear-L	1402	1	n/a	n/a	0.95	1.03	0.97	0.90	0.31	0.36	0.2	0.16	0.22
Single Ref-A Tint-L	1403	1	n/a	n/a	0.87	0.95	0.89	0.82	0.22	0.26	0.05	0.04	0.15
Single Ref-A Tint-M	1404	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.09	0.06	0.13
Single Ref-A Tint-H	1405	1	n/a	n/a	0.93	1.01	0.95	0.88	0.29	0.34	0.1	0.1	0.11
Single Ref-B Clear-L	1406	1	n/a	n/a	0.96	1.04	0.98	0.91	0.31	0.35	0.2	0.15	0.22
Single Ref-B Clear-H	1407	1	n/a	n/a	0.97	1.05	0.99	0.92	0.39	0.45	0.3	0.24	0.16
Single Ref-B Tint-L	1408	1	n/a	n/a	0.87	0.95	0.89	0.82	0.23	0.26	0.05	0.04	0.13
Single Ref-B Tint-M	1409	1	n/a	n/a	0.89	0.97	0.91	0.84	0.28	0.33	0.13	0.1	0.11
Single Ref-B Tint-H	1410	1	n/a	n/a	0.97	1.05	0.99	0.92	0.34	0.4	0.18	0.15	0.09
Single Ref-C Clear-L	1411	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.13	0.11	0.25
Single Ref-C Clear-M	1412	1	n/a	n/a	0.92	1.00	0.94	0.87	0.32	0.37	0.19	0.17	0.2
Single Ref-C Clear-H	1413	1	n/a	n/a	0.94	1.02	0.96	0.89	0.35	0.41	0.22	0.2	0.16
Single Ref-C Tint-L	1414	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.08	0.07	0.13
Single Ref-C Tint-M	1415	1	n/a	n/a	0.92	1.00	0.94	0.87	0.29	0.34	0.11	0.1	0.1
Single Ref-C Tint-H	1416	1	n/a	n/a	0.94	1.02	0.96	0.89	0.31	0.37	0.13	0.12	0.09
Single Ref-D Clear	1417	1	n/a	n/a	1.08	1.17	1.10	1.02	0.50	0.58	0.33	0.43	0.31
Single Ref-D Tint	1418	1	n/a	n/a	1.08	1.17	1.10	1.02	0.46	0.53	0.25	0.3	0.14
Single Low-E Clear (e2=.4)	1600	1	n/a	n/a	0.88	0.96	0.90	0.83	0.78	0.91	0.85	0.75	0.1
Single Low-E Clear (e2=.2)	1601	1	n/a	n/a	0.76	0.83	0.78	0.72	0.77	0.89	0.82	0.74	0.09
Single Low-E Clear (e2=.2)	1602	1	n/a	n/a	0.75	0.81	0.77	0.71	0.72	0.84	0.81	0.68	0.09
Single Elec-chrom Tinted	1800	1	n/a	n/a	1.09	1.18	1.11	1.03	0.84	0.98	0.85	0.81	0.09
Single Elec-chrom Tinted	1801	1	n/a	n/a	1.09	1.18	1.11	1.03	0.31	0.36	0.13	0.11	0.18
Single Elec-chrom Refl	1802	1	n/a	n/a	1.09	1.18	1.11	1.03	0.73	0.85	0.82	0.69	0.17
Single Elec-chrom Refl	1803	1	n/a	n/a	1.09	1.18	1.11	1.03	0.29	0.34	0.16	0.1	0.22
Double Clear	2000	2	0.25	Air	0.57	0.76	0.62	0.57	0.76	0.88	0.81	0.7	0.13
Double Clear	2001	2	0.50	Air	0.49	0.65	0.53	0.49	0.76	0.89	0.81	0.7	0.13
Double Clear	2002	2	0.50	Argon	0.46	0.61	0.50	0.46	0.76	0.89	0.81	0.7	0.13
Double Clear	2003	2	0.25	Air	0.56	0.75	0.61	0.56	0.69	0.81	0.78	0.6	0.11
Double Clear	2004	2	0.50	Air	0.48	0.64	0.52	0.48	0.70	0.81	0.78	0.6	0.11
Double Clear	2005	2	0.50	Argon	0.45	0.60	0.49	0.45	0.70	0.81	0.78	0.6	0.11
Double Low Iron	2006	2	0.25	Air	0.57	0.76	0.62	0.57	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2007	2	0.50	Air	0.49	0.65	0.53	0.49	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2008	2	0.50	Argon	0.46	0.61	0.50	0.46	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2009	2	0.25	Air	0.56	0.75	0.61	0.56	0.82	0.95	0.83	0.8	0.14
Double Low Iron	2010	2	0.50	Air	0.49	0.65	0.53	0.49	0.82	0.95	0.83	0.8	0.14
Double Low Iron	2011	2	0.50	Argon	0.45	0.60	0.49	0.45	0.82	0.95	0.83	0.8	0.14
Double Tint Bronze	2200	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.62	0.54	0.09
Double Tint Bronze	2201	2	0.50	Air	0.49	0.65	0.53	0.49	0.62	0.72	0.62	0.54	0.09
Double Tint Bronze	2202	2	0.50	Argon	0.46	0.61	0.50	0.46	0.62	0.72	0.62	0.54	0.09
Double Tint Bronze	2203	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.47	0.38	0.07
Double Tint Bronze	2204	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.47	0.38	0.07
Double Tint Bronze	2205	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.47	0.38	0.07
Double Tint Green	2206	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.74	0.53	0.09
Double Tint Green	2207	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.74	0.53	0.09
Double Tint Green	2208	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.71	0.74	0.53	0.09
Double Tint Green	2209	2	0.25	Air	0.56	0.75	0.61	0.56	0.50	0.58	0.66	0.38	0.07
Double Tint Green	2210	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.66	0.38	0.07
Double Tint Green	2211	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.57	0.66	0.38	0.07
Double Tint Grey	2212	2	0.25	Air	0.57	0.76	0.62	0.57	0.61	0.71	0.55	0.53	0.09
Double Tint Grey	2213	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.55	0.53	0.09
Double Tint Grey	2214	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.7	0.55	0.53	0.09
Double Tint Grey	2215	2	0.25	Air	0.56	0.75	0.61	0.56	0.47	0.55	0.38	0.35	0.07
Double Tint Grey	2216	2	0.50	Air	0.48	0.64	0.52	0.48	0.47	0.54	0.38	0.35	0.07
Double Tint Grey	2217	2	0.50	Argon	0.45	0.60	0.49	0.45	0.47	0.54	0.38	0.35	0.07
Double Tint Blue	2218	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.5	0.37	0.07
Double Tint Blue	2219	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.5	0.37	0.07
Double Tint Blue	2220	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.5	0.37	0.07

* *see file:* "DOE2 Glass Library.xls" *for an electronic copy of this table*

Glass Type Library* (pg 2 of 9) — (sorted by Glass Type Code)

	Glass		Gap	Gap	Center	Glass+Frame (NFRC) U-Value			Solar Heat	Shading	Visible	Solar	Solar
Doe-2 Glass Library Entry Name	Type Code	# Panes	Thick (in)	Gas Fill	Glass U-Value	Alum No Break	Alum w Break	Alum Clad Wood	Gain Coeff. SHGC	Coeff. SC	Trans. Tvis	Trans. Tsol	Reflect. Rfsol
Double Ref-A Clear-L	2400	2	0.25	Air	0.49	0.65	0.53	0.49	0.14	0.17	0.07	0.05	0.34
Double Ref-A Clear-L	2401	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.07	0.05	0.34
Double Ref-A Clear-L	2402	2	0.50	Argon	0.36	0.48	0.39	0.36	0.12	0.14	0.07	0.05	0.34
Double Ref-A Clear-M	2403	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.13	0.09	0.27
Double Ref-A Clear-M	2404	2	0.50	Air	0.41	0.55	0.44	0.41	0.17	0.2	0.13	0.09	0.27
Double Ref-A Clear-M	2405	2	0.50	Argon	0.38	0.51	0.41	0.38	0.17	0.2	0.13	0.09	0.27
Double Ref-A Clear-H	2406	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.27	0.18	0.13	0.22
Double Ref-A Clear-H	2407	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.26	0.18	0.13	0.22
Double Ref-A Clear-H	2408	2	0.50	Argon	0.4	0.53	0.43	0.40	0.22	0.25	0.18	0.13	0.22
Double Ref-A Tint-L	2410	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.15
Double Ref-A Tint-L	2411	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.05	0.03	0.15
Double Ref-A Tint-L	2412	2	0.50	Argon	0.36	0.48	0.39	0.36	0.13	0.15	0.05	0.03	0.15
Double Ref-A Tint-M	2413	2	0.25	Air	0.5	0.67	0.54	0.50	0.17	0.2	0.08	0.05	0.13
Double Ref-A Tint-M	2414	2	0.50	Air	0.41	0.55	0.44	0.41	0.15	0.18	0.08	0.05	0.13
Double Ref-A Tint-M	2415	2	0.50	Argon	0.38	0.51	0.41	0.38	0.15	0.17	0.08	0.05	0.13
Double Ref-A Tint-H	2416	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.09	0.08	0.11
Double Ref-A Tint-H	2417	2	0.50	Air	0.43	0.57	0.47	0.43	0.19	0.22	0.09	0.08	0.11
Double Ref-A Tint-H	2418	2	0.50	Argon	0.39	0.52	0.42	0.39	0.19	0.21	0.09	0.08	0.11
Double Ref-B Clear-L	2420	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.27	0.18	0.12	0.22
Double Ref-B Clear-L	2421	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.25	0.18	0.12	0.22
Double Ref-B Clear-L	2422	2	0.50	Argon	0.4	0.53	0.43	0.40	0.21	0.25	0.18	0.12	0.22
Double Ref-B Clear-H	2426	2	0.25	Air	0.53	0.71	0.57	0.53	0.30	0.35	0.27	0.19	0.16
Double Ref-B Clear-H	2427	2	0.50	Air	0.44	0.59	0.48	0.44	0.29	0.34	0.27	0.19	0.16
Double Ref-B Clear-H	2428	2	0.50	Argon	0.41	0.55	0.44	0.41	0.29	0.34	0.27	0.19	0.16
Double Ref-B Tint-L	2430	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.13
Double Ref-B Tint-L	2431	2	0.50	Air	0.4	0.53	0.43	0.40	0.14	0.16	0.05	0.03	0.13
Double Ref-B Tint-L	2432	2	0.50	Argon	0.36	0.48	0.39	0.36	0.13	0.15	0.05	0.03	0.13
Double Ref-B Tint-M	2433	2	0.25	Air	0.5	0.67	0.54	0.50	0.20	0.24	0.12	0.08	0.11
Double Ref-B Tint-M	2434	2	0.50	Air	0.41	0.55	0.44	0.41	0.19	0.22	0.12	0.08	0.11
Double Ref-B Tint-M	2435	2	0.50	Argon	0.37	0.49	0.40	0.37	0.18	0.21	0.12	0.08	0.11
Double Ref-B Tint-H	2436	2	0.25	Air	0.53	0.71	0.57	0.53	0.25	0.29	0.16	0.12	0.09
Double Ref-B Tint-H	2437	2	0.50	Air	0.44	0.59	0.48	0.44	0.23	0.27	0.16	0.12	0.09
Double Ref-B Tint-H	2438	2	0.50	Argon	0.41	0.55	0.44	0.41	0.23	0.27	0.16	0.12	0.09
Double Ref-C Clear-L	2440	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.12	0.09	0.25
Double Ref-C Clear-L	2441	2	0.50	Air	0.41	0.55	0.44	0.41	0.18	0.2	0.12	0.09	0.25
Double Ref-C Clear-L	2442	2	0.50	Argon	0.36	0.48	0.39	0.36	0.17	0.2	0.12	0.09	0.25
Double Ref-C Clear-M	2443	2	0.25	Air	0.51	0.68	0.55	0.51	0.24	0.28	0.17	0.14	0.2
Double Ref-C Clear-M	2444	2	0.50	Air	0.42	0.56	0.45	0.42	0.23	0.27	0.17	0.14	0.2
Double Ref-C Clear-M	2445	2	0.50	Argon	0.38	0.51	0.41	0.38	0.23	0.26	0.17	0.14	0.2
Double Ref-C Clear-H	2446	2	0.25	Air	0.52	0.69	0.56	0.52	0.27	0.32	0.2	0.16	0.16
Double Ref-C Clear-H	2447	2	0.50	Air	0.43	0.57	0.47	0.43	0.26	0.3	0.2	0.16	0.16
Double Ref-C Clear-H	2448	2	0.50	Argon	0.39	0.52	0.42	0.39	0.26	0.3	0.2	0.16	0.16
Double Ref-C Tint-L	2450	2	0.25	Air	0.5	0.67	0.54	0.50	0.18	0.21	0.07	0.06	0.13
Double Ref-C Tint-L	2451	2	0.50	Air	0.41	0.55	0.44	0.41	0.16	0.19	0.07	0.06	0.13
Double Ref-C Tint-L	2452	2	0.50	Argon	0.36	0.48	0.39	0.36	0.15	0.18	0.07	0.06	0.13
Double Ref-C Tint-M	2453	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.1	0.08	0.1
Double Ref-C Tint-M	2454	2	0.50	Air	0.42	0.56	0.45	0.42	0.19	0.22	0.1	0.08	0.1
Double Ref-C Tint-M	2455	2	0.50	Argon	0.38	0.51	0.41	0.38	0.19	0.21	0.1	0.08	0.1
Double Ref-D Tint-H	2456	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.26	0.12	0.1	0.09
Double Ref-D Tint-H	2457	2	0.50	Air	0.43	0.57	0.47	0.43	0.21	0.24	0.12	0.1	0.09
Double Ref-D Tint-H	2458	2	0.50	Argon	0.39	0.52	0.42	0.39	0.20	0.24	0.12	0.1	0.09
Double Ref-D Clear	2460	2	0.25	Air	0.56	0.75	0.61	0.56	0.42	0.49	0.31	0.34	0.32
Double Ref-D Clear	2461	2	0.50	Air	0.48	0.64	0.52	0.48	0.42	0.49	0.31	0.34	0.32
Double Ref-D Clear	2462	2	0.50	Argon	0.45	0.60	0.49	0.45	0.42	0.49	0.31	0.34	0.32
Double Ref-D Tint	2470	2	0.25	Air	0.56	0.75	0.61	0.56	0.35	0.41	0.23	0.24	0.15
Double Ref-D Tint	2471	2	0.50	Air	0.48	0.64	0.52	0.48	0.35	0.4	0.23	0.24	0.15
Double Ref-D Tint	2472	2	0.50	Argon	0.45	0.60	0.49	0.45	0.34	0.4	0.23	0.24	0.15
Double Low-E (e3=.4) Clear	2600	2	0.25	Air	0.5	0.71	0.57	0.53	0.72	0.84	0.77	0.63	0.15
Double Low-E (e3=.4) Clear	2601	2	0.50	Air	0.41	0.59	0.47	0.43	0.73	0.85	0.77	0.63	0.15
Double Low-E (e3=.4) Clear	2602	2	0.50	Argon	0.36	0.51	0.41	0.38	0.73	0.85	0.77	0.63	0.15
Double Low-E (e3=.2) Clear	2610	2	0.25	Air	0.46	0.66	0.53	0.49	0.72	0.84	0.74	0.62	0.15
Double Low-E (e3=.2) Clear	2611	2	0.50	Air	0.35	0.50	0.40	0.37	0.73	0.85	0.74	0.62	0.15
Double Low-E (e3=.2) Clear	2612	2	0.50	Argon	0.3	0.43	0.34	0.32	0.74	0.86	0.74	0.62	0.15
Double Low-E (e3=.2) Clear	2613	2	0.25	Air	0.45	0.64	0.51	0.48	0.66	0.77	0.72	0.53	0.13
Double Low-E (e3=.2) Clear	2614	2	0.50	Air	0.35	0.50	0.40	0.37	0.67	0.78	0.72	0.53	0.13
Double Low-E (e3=.2) Clear	2615	2	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.72	0.53	0.13
Double Low-E (e2=.1) Clear	2630	2	0.25	Air	0.44	0.63	0.50	0.47	0.60	0.69	0.77	0.54	0.22
Double Low-E (e2=.1) Clear	2631	2	0.50	Air	0.32	0.46	0.37	0.34	0.60	0.69	0.77	0.54	0.22
Double Low-E (e2=.1) Clear	2632	2	0.50	Argon	0.26	0.37	0.30	0.27	0.59	0.69	0.77	0.54	0.22
Double Low-E (e2=.1) Clear	2633	2	0.25	Air	0.43	0.61	0.49	0.45	0.56	0.65	0.75	0.47	0.2
Double Low-E (e2=.1) Clear	2634	2	0.50	Air	0.31	0.44	0.35	0.33	0.56	0.65	0.75	0.47	0.2
Double Low-E (e2=.1) Clear	2635	2	0.50	Argon	0.26	0.37	0.30	0.27	0.56	0.66	0.75	0.47	0.2

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Glass Type Library* (pg 3 of 9) — (sorted by Glass Type Code)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value			Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
						Alum No Break	Alum w Break	Alum Clad Wood					
Double Low-E (e2=.1) Tint	2636	2	0.25	Air	0.43	0.61	0.49	0.45	0.39	0.45	0.44	0.28	0.1
Double Low-E (e2=.1) Tint	2637	2	0.50	Air	0.31	0.44	0.35	0.33	0.37	0.43	0.44	0.28	0.1
Double Low-E (e2=.1) Tint	2638	2	0.50	Argon	0.26	0.37	0.30	0.27	0.37	0.43	0.44	0.28	0.1
Double Low-E (e3=.1) Clear	2640	2	0.25	Air	0.44	0.63	0.50	0.47	0.63	0.74	0.77	0.54	0.23
Double Low-E (e3=.1) Clear	2641	2	0.50	Air	0.32	0.46	0.37	0.34	0.64	0.75	0.77	0.54	0.23
Double Low-E (e3=.1) Clear	2642	2	0.50	Argon	0.26	0.37	0.30	0.27	0.65	0.75	0.77	0.54	0.23
Double Low-E (e2=.04) Clear	2660	2	0.25	Air	0.42	0.60	0.48	0.44	0.44	0.51	0.7	0.39	0.36
Double Low-E (e2=.04) Clear	2661	2	0.50	Air	0.3	0.43	0.34	0.32	0.44	0.51	0.7	0.39	0.36
Double Low-E (e2=.04) Clear	2662	2	0.50	Argon	0.24	0.34	0.27	0.25	0.43	0.5	0.7	0.39	0.36
Double Low-E (e3=.04) Clear	2663	2	0.25	Air	0.42	0.60	0.48	0.44	0.42	0.49	0.68	0.34	0.31
Double Low-E (e3=.04) Clear	2664	2	0.50	Air	0.29	0.41	0.33	0.31	0.42	0.48	0.68	0.34	0.31
Double Low-E (e3=.04) Clear	2665	2	0.50	Argon	0.23	0.33	0.26	0.24	0.42	0.48	0.68	0.34	0.31
Double Low-E (e2=.04) Tint	2666	2	0.25	Air	0.42	0.60	0.48	0.44	0.31	0.35	0.41	0.21	0.14
Double Low-E (e2=.04) Tint	2667	2	0.50	Air	0.29	0.41	0.33	0.31	0.29	0.33	0.41	0.21	0.14
Double Low-E (e2=.04) Tint	2668	2	0.50	Argon	0.23	0.33	0.26	0.24	0.28	0.32	0.41	0.21	0.14
Double Elec-chrom Tinted	2800	2	0.25	Air	0.43	0.61	0.49	0.45	0.73	0.85	0.76	0.64	0.14
Double Elec-chrom Tinted	2801	2	0.25	Air	0.43	0.61	0.49	0.45	0.18	0.21	0.12	0.09	0.18
Double Elec-chrom Tinted	2802	2	0.50	Air	0.31	0.44	0.35	0.33	0.74	0.86	0.76	0.64	0.14
Double Elec-chrom Tinted	2803	2	0.50	Air	0.31	0.44	0.35	0.33	0.20	0.19	0.12	0.16	0.18
Double Elec-chrom Tinted	2804	2	0.50	Argon	0.26	0.37	0.30	0.27	0.74	0.86	0.76	0.64	0.14
Double Elec-chrom Tinted	2805	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.18	0.12	0.09	0.18
Double Elec-chrom Refl	2820	2	0.25	Air	0.43	0.61	0.49	0.45	0.63	0.73	0.73	0.55	0.21
Double Elec-chrom Refl	2821	2	0.25	Air	0.43	0.61	0.49	0.45	0.17	0.2	0.14	0.09	0.22
Double Elec-chrom Refl	2822	2	0.50	Air	0.31	0.44	0.35	0.33	0.64	0.74	0.73	0.55	0.21
Double Elec-chrom Refl	2823	2	0.50	Air	0.31	0.44	0.35	0.33	0.15	0.17	0.14	0.09	0.22
Double Elec-chrom Refl	2824	2	0.50	Argon	0.26	0.37	0.30	0.27	0.64	0.74	0.73	0.55	0.21
Double Elec-chrom Refl	2825	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.16	0.14	0.09	0.22
Double Low-E (e2=.029) Elec-chrom Tinted	2840	2	0.25	Air	0.41	0.59	0.47	0.43	0.44	0.51	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Tinted	2841	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Tinted	2842	2	0.50	Air	0.29	0.41	0.33	0.31	0.51	0.59	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Tinted	2843	2	0.50	Air	0.29	0.41	0.33	0.31	0.13	0.15	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Tinted	2844	2	0.50	Argon	0.23	0.33	0.26	0.24	0.52	0.6	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Tinted	2845	2	0.50	Argon	0.23	0.33	0.26	0.24	0.12	0.14	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Refl	2860	2	0.25	Air	0.41	0.59	0.47	0.43	0.46	0.54	0.64	0.32	0.32
Double Low-E (e2=.029) Elec-chrom Refl	2861	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.12	0.07	0.22
Double Low-E (e2=.029) Elec-chrom Refl	2862	2	0.50	Air	0.29	0.41	0.33	0.31	0.47	0.55	0.64	0.32	0.32
Double Low-E (e2=.029) Elec-chrom Refl	2863	2	0.50	Air	0.29	0.41	0.33	0.31	0.14	0.16	0.12	0.07	0.22
Double Low-E (e2=.029) Elec-chrom Refl	2864	2	0.50	Argon	0.23	0.33	0.26	0.24	0.48	0.56	0.64	0.32	0.32
Double Low-E (e2=.029) Elec-chrom Refl	2865	2	0.50	Argon	0.23	0.33	0.26	0.24	0.13	0.15	0.12	0.07	0.22
Triple Clear	3001	3	0.25	Air	0.39	0.56	0.45	0.41	0.68	0.79	0.74	0.6	0.17
Triple Clear	3002	3	0.50	Air	0.32	0.46	0.37	0.34	0.68	0.79	0.74	0.6	0.17
Triple Clear	3002	3	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.74	0.6	0.17
Triple Low-E (e5=.1) Clear	3601	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.67	0.7	0.46	0.24
Triple Low-E (e5=.1) Clear	3602	3	0.50	Air	0.23	0.38	0.29	0.25	0.58	0.67	0.7	0.46	0.24
Triple Low-E (e5=.1) Clear	3603	3	0.50	Argon	0.19	0.32	0.24	0.21	0.58	0.67	0.7	0.46	0.24
Triple Low-E (e2=e5=.1) Clear	3621	3	0.25	Air	0.27	0.45	0.34	0.29	0.47	0.54	0.66	0.36	0.29
Triple Low-E (e2=e5=.1) Clear	3622	3	0.50	Air	0.17	0.28	0.21	0.18	0.47	0.55	0.66	0.36	0.29
Triple Low-E (e2=e5=.1) Clear	3623	3	0.50	Argon	0.14	0.23	0.18	0.15	0.47	0.55	0.66	0.36	0.29
Triple Low-E Film (88) Clear	3641	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.66	0.71	0.48	0.28
Triple Low-E Film (88) Clear	3642	3	0.50	Air	0.23	0.38	0.29	0.25	0.57	0.67	0.71	0.48	0.28
Triple Low-E Film (77) Clear	3651	3	0.25	Air	0.32	0.53	0.40	0.35	0.46	0.53	0.64	0.38	0.38
Triple Low-E Film (77) Clear	3652	3	0.50	Air	0.22	0.37	0.28	0.24	0.47	0.54	0.64	0.38	0.38
Triple Low-E Film (66) Clear	3661	3	0.25	Air	0.31	0.52	0.39	0.34	0.35	0.41	0.54	0.26	0.4
Triple Low-E Film (66) Clear	3662	3	0.50	Air	0.22	0.37	0.28	0.24	0.36	0.42	0.54	0.26	0.4
Triple Low-E Film (66) Tint	3663	3	0.25	Air	0.31	0.52	0.39	0.34	0.26	0.3	0.32	0.16	0.18
Triple Low-E Film (66) Tint	3664	3	0.50	Air	0.22	0.37	0.28	0.24	0.25	0.29	0.32	0.16	0.18
Triple Low-E Film (55) Clear	3671	3	0.25	Air	0.31	0.52	0.39	0.34	0.30	0.35	0.45	0.21	0.44
Triple Low-E Film (55) Clear	3672	3	0.50	Air	0.22	0.37	0.28	0.24	0.31	0.36	0.45	0.21	0.44
Triple Low-E Film (55) Tint	3673	3	0.25	Air	0.31	0.52	0.39	0.34	0.23	0.26	0.27	0.13	0.19
Triple Low-E Film (55) Tint	3674	3	0.50	Air	0.22	0.37	0.28	0.24	0.22	0.25	0.27	0.13	0.19
Triple Low-E Film (44) Tint	3681	3	0.25	Air	0.31	0.52	0.39	0.34	0.20	0.23	0.22	0.1	0.21
Triple Low-E Film (44) Tint	3682	3	0.50	Air	0.21	0.35	0.26	0.23	0.19	0.22	0.22	0.1	0.21
Triple Low-E Film (33) Tint	3691	3	0.25	Air	0.31	0.52	0.39	0.34	0.16	0.19	0.17	0.07	0.23
Triple Low-E Film (33) Tint	3692	3	0.50	Air	0.21	0.35	0.26	0.23	0.15	0.17	0.17	0.07	0.23
Quadruple, dbl Low-E Glass & Film, Clear	4651	4	0.31	Krypton	0.12	0.20	0.15	0.13	0.45	0.52	0.62	0.34	0.34

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Glass Type Library* (pg 4 of 9) — (sorted by U-Value & SHGC)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value Alum No Break	Alum w Break	Alum Clad Wood	Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
Single Low Iron	1002	1	n/a	n/a	1.11	1.21	1.13	1.05	0.90	1.05	0.91	0.9	0.08
Single Clear	1000	1	n/a	n/a	1.11	1.21	1.13	1.05	0.86	1	0.9	0.84	0.08
Single Tint Bronze	1200	1	n/a	n/a	1.11	1.21	1.13	1.05	0.73	0.84	0.69	0.64	0.06
Single Tint Green	1202	1	n/a	n/a	1.11	1.21	1.13	1.05	0.72	0.83	0.82	0.63	0.06
Single Tint Grey	1204	1	n/a	n/a	1.11	1.21	1.13	1.05	0.71	0.83	0.61	0.63	0.06
Single Low Iron	1003	1	n/a	n/a	1.1	1.20	1.12	1.04	0.90	1.04	0.91	0.89	0.08
Single Elec-chrom Tinted	1800	1	n/a	n/a	1.09	1.18	1.11	1.03	0.84	0.98	0.85	0.81	0.09
Single Clear	1001	1	n/a	n/a	1.09	1.18	1.11	1.03	0.81	0.95	0.88	0.77	0.07
Single Elec-chrom Refl	1802	1	n/a	n/a	1.09	1.18	1.11	1.03	0.73	0.85	0.82	0.69	0.17
Single Tint Bronze	1201	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.53	0.48	0.05
Single Tint Green	1203	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.75	0.49	0.06
Single Tint Blue	1206	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.57	0.48	0.05
Single Tint Grey	1205	1	n/a	n/a	1.09	1.18	1.11	1.03	0.59	0.69	0.43	0.46	0.05
Single Elec-chrom Tinted	1801	1	n/a	n/a	1.09	1.18	1.11	1.03	0.31	0.36	0.13	0.11	0.18
Single Elec-chrom Refl	1803	1	n/a	n/a	1.09	1.18	1.11	1.03	0.29	0.34	0.16	0.1	0.22
Single Ref-D Clear	1417	1	n/a	n/a	1.08	1.17	1.10	1.02	0.50	0.58	0.33	0.43	0.31
Single Ref-D Tint	1418	1	n/a	n/a	1.08	1.17	1.10	1.02	0.46	0.53	0.25	0.3	0.14
Single Ref-B Clear-H	1407	1	n/a	n/a	0.97	1.05	0.99	0.92	0.39	0.45	0.3	0.24	0.16
Single Ref-B Tint-H	1410	1	n/a	n/a	0.97	1.05	0.99	0.92	0.34	0.4	0.18	0.15	0.09
Single Ref-B Clear-L	1406	1	n/a	n/a	0.96	1.04	0.98	0.91	0.31	0.35	0.2	0.15	0.22
Single Ref-A Clear-L	1402	1	n/a	n/a	0.95	1.03	0.97	0.90	0.31	0.36	0.2	0.16	0.22
Single Ref-C Clear-H	1413	1	n/a	n/a	0.94	1.02	0.96	0.89	0.35	0.41	0.22	0.2	0.16
Single Ref-C Tint-H	1416	1	n/a	n/a	0.94	1.02	0.96	0.89	0.31	0.37	0.13	0.12	0.09
Single Ref-A Tint-H	1405	1	n/a	n/a	0.93	1.01	0.95	0.88	0.29	0.34	0.1	0.1	0.11
Single Ref-C Clear-M	1412	1	n/a	n/a	0.92	1.00	0.94	0.87	0.32	0.37	0.19	0.17	0.2
Single Ref-C Tint-M	1415	1	n/a	n/a	0.92	1.00	0.94	0.87	0.29	0.34	0.11	0.1	0.1
Single Ref-A Clear-L	1401	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.14	0.11	0.27
Single Ref-A Tint-M	1404	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.09	0.06	0.13
Single Ref-B Tint-M	1409	1	n/a	n/a	0.89	0.97	0.91	0.84	0.28	0.33	0.13	0.1	0.11
Single Low-E Clear (e2=.4)	1600	1	n/a	n/a	0.88	0.96	0.90	0.83	0.78	0.91	0.85	0.75	0.1
Single Ref-C Clear-L	1411	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.13	0.11	0.25
Single Ref-C Tint-L	1414	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.08	0.07	0.13
Single Ref-B Tint-L	1408	1	n/a	n/a	0.87	0.95	0.89	0.82	0.23	0.26	0.05	0.04	0.13
Single Ref-A Tint-L	1403	1	n/a	n/a	0.87	0.95	0.89	0.82	0.22	0.26	0.05	0.04	0.15
Single Ref-A Clear-L	1400	1	n/a	n/a	0.86	0.93	0.88	0.81	0.19	0.23	0.08	0.07	0.34
Single Low-E Clear (e2=.2)	1601	1	n/a	n/a	0.76	0.83	0.78	0.72	0.77	0.89	0.82	0.74	0.09
Single Low-E Clear (e2=.2)	1602	1	n/a	n/a	0.75	0.81	0.77	0.71	0.72	0.84	0.81	0.68	0.09
Double Low Iron	2006	2	0.25	Air	0.57	0.76	0.62	0.57	0.83	0.96	0.84	0.81	0.14
Double Clear	2000	2	0.25	Air	0.57	0.76	0.62	0.57	0.76	0.88	0.81	0.7	0.13
Double Tint Bronze	2200	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.62	0.54	0.09
Double Tint Green	2206	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.74	0.53	0.09
Double Tint Grey	2212	2	0.25	Air	0.57	0.76	0.62	0.57	0.61	0.71	0.55	0.53	0.09
Double Low Iron	2009	2	0.25	Air	0.56	0.75	0.61	0.56	0.82	0.95	0.83	0.8	0.14
Double Clear	2003	2	0.25	Air	0.56	0.75	0.61	0.56	0.69	0.81	0.78	0.6	0.11
Double Tint Green	2209	2	0.25	Air	0.56	0.75	0.61	0.56	0.50	0.58	0.66	0.38	0.07
Double Tint Bronze	2203	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.47	0.38	0.07
Double Tint Blue	2218	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.5	0.37	0.07
Double Tint Grey	2215	2	0.25	Air	0.56	0.75	0.61	0.56	0.47	0.55	0.38	0.35	0.07
Double Ref-D Clear	2460	2	0.25	Air	0.56	0.75	0.61	0.56	0.42	0.49	0.31	0.34	0.32
Double Ref-D Tint	2470	2	0.25	Air	0.56	0.75	0.61	0.56	0.35	0.41	0.23	0.24	0.15
Double Ref-B Clear-H	2426	2	0.25	Air	0.53	0.71	0.57	0.53	0.30	0.35	0.27	0.19	0.16
Double Ref-B Tint-H	2436	2	0.25	Air	0.53	0.71	0.57	0.53	0.25	0.29	0.16	0.12	0.09
Double Ref-C Clear-H	2446	2	0.25	Air	0.52	0.69	0.56	0.52	0.27	0.32	0.2	0.16	0.16
Double Ref-A Clear-H	2406	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.27	0.18	0.13	0.22
Double Ref-B Clear-L	2420	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.27	0.18	0.12	0.22
Double Ref-D Tint-H	2456	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.26	0.12	0.1	0.09
Double Ref-C Clear-M	2443	2	0.25	Air	0.51	0.68	0.55	0.51	0.24	0.28	0.17	0.14	0.2
Double Ref-A Tint-H	2416	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.09	0.08	0.11
Double Ref-C Tint-M	2453	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.1	0.08	0.1
Double Low-E (e3=.4) Clear	2600	2	0.25	Air	0.5	0.71	0.57	0.53	0.72	0.84	0.77	0.63	0.15
Double Ref-B Tint-M	2433	2	0.25	Air	0.5	0.67	0.54	0.50	0.20	0.24	0.12	0.08	0.11
Double Ref-A Clear-M	2403	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.13	0.09	0.27
Double Ref-C Clear-L	2440	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.12	0.09	0.25
Double Ref-C Tint-L	2450	2	0.25	Air	0.5	0.67	0.54	0.50	0.18	0.21	0.07	0.06	0.13
Double Ref-A Tint-M	2413	2	0.25	Air	0.5	0.67	0.54	0.50	0.17	0.2	0.08	0.05	0.13
Double Low Iron	2007	2	0.50	Air	0.49	0.65	0.53	0.49	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2010	2	0.50	Air	0.49	0.65	0.53	0.49	0.82	0.95	0.83	0.8	0.14
Double Clear	2001	2	0.50	Air	0.49	0.65	0.53	0.49	0.76	0.89	0.81	0.7	0.13
Double Tint Bronze	2201	2	0.50	Air	0.49	0.65	0.53	0.49	0.62	0.72	0.62	0.54	0.09
Double Tint Green	2207	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.74	0.53	0.09
Double Tint Grey	2213	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.55	0.53	0.09

* *see file:* "DOE2 Glass Library.xls" *for an electronic copy of this table*

Glass Type Library* (pg 5 of 9) — (sorted by U-Value & SHGC)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value Alum No Break	Alum w Break	Alum Clad Wood	Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
Double Ref-A Tint-L	2410	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.15
Double Ref-B Tint-L	2430	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.13
Double Ref-A Clear-L	2400	2	0.25	Air	0.49	0.65	0.53	0.49	0.14	0.17	0.07	0.05	0.34
Double Clear	2004	2	0.50	Air	0.48	0.64	0.52	0.48	0.70	0.81	0.78	0.6	0.11
Double Tint Bronze	2204	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.47	0.38	0.07
Double Tint Green	2210	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.66	0.38	0.07
Double Tint Blue	2219	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.5	0.37	0.07
Double Tint Grey	2216	2	0.50	Air	0.48	0.64	0.52	0.48	0.47	0.54	0.38	0.35	0.07
Double Ref-D Clear	2461	2	0.50	Air	0.48	0.64	0.52	0.48	0.42	0.49	0.31	0.34	0.32
Double Ref-D Tint	2471	2	0.50	Air	0.48	0.64	0.52	0.48	0.35	0.4	0.23	0.24	0.15
Double Low Iron	2008	2	0.50	Argon	0.46	0.61	0.50	0.46	0.83	0.96	0.84	0.81	0.14
Double Clear	2002	2	0.50	Argon	0.46	0.61	0.50	0.46	0.76	0.89	0.81	0.7	0.13
Double Low-E (e3=.2) Clear	2610	2	0.25	Air	0.46	0.66	0.53	0.49	0.72	0.84	0.74	0.62	0.15
Double Tint Bronze	2202	2	0.50	Argon	0.46	0.61	0.50	0.46	0.62	0.72	0.62	0.54	0.09
Double Tint Green	2208	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.71	0.74	0.53	0.09
Double Tint Grey	2214	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.7	0.55	0.53	0.09
Double Low Iron	2011	2	0.50	Argon	0.45	0.60	0.49	0.45	0.82	0.95	0.83	0.8	0.14
Double Clear	2005	2	0.50	Argon	0.45	0.60	0.49	0.45	0.70	0.81	0.78	0.6	0.11
Double Low-E (e3=.2) Clear	2613	2	0.25	Air	0.45	0.64	0.51	0.48	0.66	0.77	0.72	0.53	0.13
Double Tint Bronze	2205	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.47	0.38	0.07
Double Tint Green	2211	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.57	0.66	0.38	0.07
Double Tint Blue	2220	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.5	0.37	0.07
Double Tint Grey	2217	2	0.50	Argon	0.45	0.60	0.49	0.45	0.47	0.54	0.38	0.35	0.07
Double Ref-D Clear	2462	2	0.50	Argon	0.45	0.60	0.49	0.45	0.42	0.49	0.31	0.34	0.32
Double Ref-D Tint	2472	2	0.50	Argon	0.45	0.60	0.49	0.45	0.34	0.4	0.23	0.24	0.15
Double Low-E (e3=.1) Clear	2640	2	0.25	Air	0.44	0.63	0.50	0.47	0.63	0.74	0.77	0.54	0.23
Double Low-E (e2=.1) Clear	2630	2	0.25	Air	0.44	0.63	0.50	0.47	0.60	0.69	0.77	0.54	0.22
Double Ref-B Clear-H	2427	2	0.50	Air	0.44	0.59	0.48	0.44	0.29	0.34	0.27	0.19	0.16
Double Ref-B Tint-H	2437	2	0.50	Air	0.44	0.59	0.48	0.44	0.23	0.27	0.16	0.12	0.09
Double Ref-A Clear-H	2407	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.26	0.18	0.13	0.22
Double Ref-B Clear-L	2421	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.25	0.18	0.12	0.22
Double Elec-chrom Tinted, 6.3-mm Gap	2800	2	0.25	Air	0.43	0.61	0.49	0.45	0.73	0.85	0.76	0.64	0.14
Double Elec-chrom Refl, 6.3-mm Gap	2820	2	0.25	Air	0.43	0.61	0.49	0.45	0.63	0.73	0.73	0.55	0.21
Double Low-E (e2=.1) Clear	2633	2	0.25	Air	0.43	0.61	0.49	0.45	0.56	0.65	0.75	0.47	0.2
Double Low-E (e2=.1) Tint	2636	2	0.25	Air	0.43	0.61	0.49	0.45	0.39	0.45	0.44	0.28	0.1
Double Ref-C Clear-H	2447	2	0.50	Air	0.43	0.57	0.47	0.43	0.26	0.3	0.2	0.16	0.16
Double Ref-D Tint-H	2457	2	0.50	Air	0.43	0.57	0.47	0.43	0.21	0.24	0.12	0.1	0.09
Double Ref-A Tint-H	2417	2	0.50	Air	0.43	0.57	0.47	0.43	0.19	0.22	0.09	0.08	0.11
Double Elec-chrom Tinted, 6.3-mm Gap	2801	2	0.25	Air	0.43	0.61	0.49	0.45	0.18	0.21	0.12	0.09	0.18
Double Elec-chrom Refl, 6.3-mm Gap	2821	2	0.25	Air	0.43	0.61	0.49	0.45	0.17	0.2	0.14	0.09	0.22
Double Low-E (e2=.04) Clear	2660	2	0.25	Air	0.42	0.60	0.48	0.44	0.44	0.51	0.7	0.39	0.36
Double Low-E (e3=.04) Clear	2663	2	0.25	Air	0.42	0.60	0.48	0.44	0.42	0.49	0.68	0.34	0.31
Double Low-E (e2=.04) Tint	2666	2	0.25	Air	0.42	0.60	0.48	0.44	0.31	0.35	0.41	0.21	0.14
Double Ref-C Clear-M	2444	2	0.50	Air	0.42	0.56	0.45	0.42	0.23	0.27	0.17	0.14	0.2
Double Ref-C Tint-M	2454	2	0.50	Air	0.42	0.56	0.45	0.42	0.19	0.22	0.1	0.08	0.1
Double Low-E (e3=.4) Clear	2601	2	0.50	Air	0.41	0.59	0.47	0.43	0.73	0.85	0.77	0.63	0.15
Double Low-E (e2=.029) Elec-chrom Refl, 6.3-r	2860	2	0.25	Air	0.41	0.59	0.47	0.43	0.46	0.54	0.64	0.32	0.32
Double Low-E (e2=.029) Elec-chrom Tinted, 6.3	2840	2	0.25	Air	0.41	0.59	0.47	0.43	0.44	0.51	0.66	0.34	0.33
Double Ref-B Clear-H	2428	2	0.50	Argon	0.41	0.55	0.44	0.41	0.29	0.34	0.27	0.19	0.16
Double Ref-B Tint-H	2438	2	0.50	Argon	0.41	0.55	0.44	0.41	0.23	0.27	0.16	0.12	0.09
Double Ref-B Tint-M	2434	2	0.50	Air	0.41	0.55	0.44	0.41	0.19	0.22	0.12	0.08	0.11
Double Ref-C Clear-L	2441	2	0.50	Air	0.41	0.55	0.44	0.41	0.18	0.2	0.12	0.09	0.25
Double Ref-A Clear-M	2404	2	0.50	Air	0.41	0.55	0.44	0.41	0.17	0.2	0.13	0.09	0.27
Double Ref-C Tint-L	2451	2	0.50	Air	0.41	0.55	0.44	0.41	0.16	0.19	0.07	0.06	0.13
Double Low-E (e2=.029) Elec-chrom Tinted, 6.3	2841	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Refl, 6.3-r	2861	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.12	0.07	0.22
Double Ref-A Tint-M	2414	2	0.50	Air	0.41	0.55	0.44	0.41	0.15	0.18	0.08	0.05	0.13
Double Ref-A Clear-H	2408	2	0.50	Argon	0.4	0.53	0.43	0.40	0.22	0.25	0.18	0.13	0.22
Double Ref-B Clear-L	2422	2	0.50	Argon	0.4	0.53	0.43	0.40	0.21	0.25	0.18	0.12	0.22
Double Ref-B Tint-L	2431	2	0.50	Air	0.4	0.53	0.43	0.40	0.14	0.16	0.05	0.03	0.13
Double Ref-A Clear-L	2401	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.07	0.05	0.34
Double Ref-A Tint-L	2411	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.05	0.03	0.15
Triple Clear	3001	3	0.25	Air	0.39	0.56	0.45	0.41	0.68	0.79	0.74	0.6	0.17
Double Ref-C Clear-H	2448	2	0.50	Argon	0.39	0.52	0.42	0.39	0.26	0.3	0.2	0.16	0.16
Double Ref-D Tint-H	2458	2	0.50	Argon	0.39	0.52	0.42	0.39	0.20	0.24	0.12	0.1	0.09
Double Ref-A Tint-H	2418	2	0.50	Argon	0.39	0.52	0.42	0.39	0.19	0.21	0.09	0.08	0.11
Double Ref-C Clear-M	2445	2	0.50	Argon	0.38	0.51	0.41	0.38	0.23	0.26	0.17	0.14	0.2
Double Ref-C Tint-M	2455	2	0.50	Argon	0.38	0.51	0.41	0.38	0.19	0.21	0.1	0.08	0.1
Double Ref-A Clear-M	2405	2	0.50	Argon	0.38	0.51	0.41	0.38	0.17	0.2	0.13	0.09	0.27
Double Ref-A Tint-M	2415	2	0.50	Argon	0.38	0.51	0.41	0.38	0.15	0.17	0.08	0.05	0.13
Double Ref-B Tint-M	2435	2	0.50	Argon	0.37	0.49	0.40	0.37	0.18	0.21	0.12	0.08	0.11
Double Low-E (e3=.4) Clear	2602	2	0.50	Argon	0.36	0.51	0.41	0.38	0.73	0.85	0.77	0.63	0.15
Double Ref-C Clear-L	2442	2	0.50	Argon	0.36	0.48	0.39	0.36	0.17	0.2	0.12	0.09	0.25
Double Ref-C Tint-L	2452	2	0.50	Argon	0.36	0.48	0.39	0.36	0.15	0.18	0.07	0.06	0.13

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Glass Type Library* (pg 6 of 9) — (sorted by U-Value & SHGC)

	Glass		Gap	Gap	Center	Glass+Frame (NFRC) U-Value			Solar Heat	Shading	Visible	Solar	Solar
Doe-2 Glass Library Entry Name	Type Code	# Panes	Thick (in)	Gas Fill	Glass U-Value	Alum No Break	Alum w Break	Alum Clad Wood	Gain Coeff. SHGC	Coeff. SC	Trans. Tvis	Trans. Tsol	Reflect. Rfsol
Double Low-E (e3=.2) Clear	2611	2	0.50	Air	0.35	0.50	0.40	0.37	0.73	0.85	0.74	0.62	0.15
Double Low-E (e3=.2) Clear	2614	2	0.50	Air	0.35	0.50	0.40	0.37	0.67	0.78	0.72	0.53	0.13
Triple Clear	3002	3	0.50	Air	0.32	0.46	0.37	0.34	0.68	0.79	0.74	0.6	0.17
Double Low-E (e3=.1) Clear	2641	2	0.50	Air	0.32	0.46	0.37	0.34	0.64	0.75	0.77	0.54	0.23
Double Low-E (e2=.1) Clear	2631	2	0.50	Air	0.32	0.46	0.37	0.34	0.60	0.69	0.77	0.54	0.22
Triple Low-E (e5=.1) Clear	3601	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.67	0.7	0.46	0.24
Triple Low-E Film (88) Clear	3641	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.66	0.71	0.48	0.28
Triple Low-E Film (77) Clear	3651	3	0.25	Air	0.32	0.53	0.40	0.35	0.46	0.53	0.64	0.38	0.38
Double Elec-chrom Tinted, 12.7-mm Gap	2802	2	0.50	Air	0.31	0.44	0.35	0.33	0.74	0.86	0.76	0.64	0.14
Double Elec-chrom Tinted	2822	2	0.50	Air	0.31	0.44	0.35	0.33	0.64	0.74	0.73	0.55	0.21
Double Elec-chrom Tinted	2634	2	0.50	Air	0.31	0.44	0.35	0.33	0.56	0.65	0.75	0.47	0.2
Double Elec-chrom Tinted	2637	2	0.50	Air	0.31	0.44	0.35	0.33	0.37	0.43	0.44	0.28	0.1
Double Elec-chrom Tinted	3661	3	0.25	Air	0.31	0.52	0.39	0.34	0.35	0.41	0.54	0.26	0.4
Double Elec-chrom Tinted	3671	3	0.25	Air	0.31	0.52	0.39	0.34	0.30	0.35	0.45	0.21	0.44
Double Elec-chrom Tinted	3663	3	0.25	Air	0.31	0.52	0.39	0.34	0.26	0.3	0.32	0.16	0.18
Double Elec-chrom Refl	3673	3	0.25	Air	0.31	0.52	0.39	0.34	0.23	0.26	0.27	0.13	0.19
Double Elec-chrom Refl	2803	2	0.50	Air	0.31	0.44	0.35	0.33	0.20	0.19	0.12	0.16	0.18
Double Elec-chrom Refl	3681	3	0.25	Air	0.31	0.52	0.39	0.34	0.20	0.23	0.22	0.1	0.21
Double Elec-chrom Refl	3691	3	0.25	Air	0.31	0.52	0.39	0.34	0.16	0.19	0.17	0.07	0.23
Double Elec-chrom Refl	2823	2	0.50	Air	0.31	0.44	0.35	0.33	0.15	0.17	0.14	0.09	0.22
Double Elec-chrom Refl	2612	2	0.50	Argon	0.3	0.43	0.34	0.32	0.74	0.86	0.74	0.62	0.15
Double Low-E (e2=.029) Elec-chrom Tinted	2661	2	0.50	Air	0.3	0.43	0.34	0.32	0.44	0.51	0.7	0.39	0.36
Double Low-E (e2=.029) Elec-chrom Tinted	2615	2	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.72	0.53	0.13
Double Low-E (e2=.029) Elec-chrom Tinted	3002	3	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.74	0.6	0.17
Double Low-E (e2=.029) Elec-chrom Tinted	2842	2	0.50	Air	0.29	0.41	0.33	0.31	0.51	0.59	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Tinted	2862	2	0.50	Air	0.29	0.41	0.33	0.31	0.47	0.55	0.64	0.32	0.32
Double Low-E (e2=.029) Elec-chrom Tinted	2664	2	0.50	Air	0.29	0.41	0.33	0.31	0.42	0.48	0.68	0.34	0.31
Double Low-E (e2=.029) Elec-chrom Refl	2667	2	0.50	Air	0.29	0.41	0.33	0.31	0.29	0.33	0.41	0.21	0.14
Double Low-E (e2=.029) Elec-chrom Refl	2863	2	0.50	Air	0.29	0.41	0.33	0.31	0.14	0.16	0.12	0.07	0.22
Double Low-E (e2=.029) Elec-chrom Refl	2843	2	0.50	Air	0.29	0.41	0.33	0.31	0.13	0.15	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Refl	3621	3	0.25	Air	0.27	0.45	0.34	0.29	0.47	0.54	0.66	0.36	0.29
Double Low-E (e2=.029) Elec-chrom Refl	2804	2	0.50	Argon	0.26	0.37	0.30	0.27	0.74	0.86	0.76	0.64	0.14
Double Low-E (e2=.029) Elec-chrom Refl	2642	2	0.50	Argon	0.26	0.37	0.30	0.27	0.65	0.75	0.77	0.54	0.23
Double Elec-chrom Refl, 12.7-mm Gap, Argon	2824	2	0.50	Argon	0.26	0.37	0.30	0.27	0.64	0.74	0.73	0.55	0.21
Double Low-E (e2=.1) Clear	2632	2	0.50	Argon	0.26	0.37	0.30	0.27	0.59	0.69	0.77	0.54	0.22
Double Low-E (e2=.1) Clear	2635	2	0.50	Argon	0.26	0.37	0.30	0.27	0.56	0.66	0.75	0.47	0.2
Double Low-E (e2=.1) Tint	2638	2	0.50	Argon	0.26	0.37	0.30	0.27	0.37	0.43	0.44	0.28	0.1
Double Elec-chrom Tinted, 12.7-mm Gap, Argo	2805	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.18	0.12	0.09	0.18
Double Elec-chrom Refl, 12.7-mm Gap, Argon	2825	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.16	0.14	0.09	0.22
Double Low-E (e2=.04) Clear	2662	2	0.50	Argon	0.24	0.34	0.27	0.25	0.43	0.5	0.7	0.39	0.36
Triple Low-E (e5=.1) Clear	3602	3	0.50	Air	0.23	0.38	0.29	0.25	0.58	0.67	0.7	0.46	0.24
Triple Low-E Film (88) Clear	3642	3	0.50	Air	0.23	0.38	0.29	0.25	0.57	0.67	0.71	0.48	0.28
Double Low-E (e2=.029) Elec-chrom Tinted, 12	2844	2	0.50	Argon	0.23	0.33	0.26	0.24	0.52	0.6	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2864	2	0.50	Argon	0.23	0.33	0.26	0.24	0.48	0.56	0.64	0.32	0.32
Double Low-E (e3=.04) Clear	2665	2	0.50	Argon	0.23	0.33	0.26	0.24	0.42	0.48	0.68	0.34	0.31
Double Low-E (e2=.04) Tint	2668	2	0.50	Argon	0.23	0.33	0.26	0.24	0.28	0.32	0.41	0.21	0.14
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2865	2	0.50	Argon	0.23	0.33	0.26	0.24	0.13	0.15	0.12	0.07	0.22
Double Low-E (e2=.029) Elec-chrom Tinted, 12	2845	2	0.50	Argon	0.23	0.33	0.26	0.24	0.12	0.14	0.1	0.06	0.19
Triple Low-E Film (77) Clear	3652	3	0.50	Air	0.22	0.37	0.28	0.24	0.47	0.54	0.64	0.38	0.38
Triple Low-E Film (66) Clear	3662	3	0.50	Air	0.22	0.37	0.28	0.24	0.36	0.42	0.54	0.26	0.4
Triple Low-E Film (55) Clear	3672	3	0.50	Air	0.22	0.37	0.28	0.24	0.31	0.36	0.45	0.21	0.44
Triple Low-E Film (66) Tint	3664	3	0.50	Air	0.22	0.37	0.28	0.24	0.25	0.29	0.32	0.16	0.18
Triple Low-E Film (55) Tint	3674	3	0.50	Air	0.22	0.37	0.28	0.24	0.22	0.25	0.27	0.13	0.19
Triple Low-E Film (44) Tint	3682	3	0.50	Air	0.21	0.35	0.26	0.23	0.19	0.22	0.22	0.1	0.21
Triple Low-E Film (33) Tint	3692	3	0.50	Air	0.21	0.35	0.26	0.23	0.15	0.17	0.17	0.07	0.23
Triple Low-E (e5=.1) Clear	3603	3	0.50	Argon	0.19	0.32	0.24	0.21	0.58	0.67	0.7	0.46	0.24
Triple Low-E (e2=e5=.1) Clear	3622	3	0.50	Air	0.17	0.28	0.21	0.18	0.47	0.55	0.66	0.36	0.29
Triple Low-E (e2=e5=.1) Clear	3623	3	0.50	Argon	0.14	0.23	0.18	0.15	0.47	0.55	0.66	0.36	0.29
Quadruple, dbl Low-E Glass & Film, Clear	4651	4	0.31	Krypton	0.12	0.20	0.15	0.13	0.45	0.52	0.62	0.34	0.34

* *see file:* "DOE2 Glass Library.xls" *for an electronic copy of this table*

Glass Type Library* (pg 7 of 9) — (sorted by SHGC & U-Value)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value			Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
						Alum No Break	Alum w Break	Alum Clad Wood					
Single Low Iron	1002	1	n/a	n/a	1.11	1.21	1.13	1.05	0.90	1.05	0.91	0.9	0.08
Single Low Iron	1003	1	n/a	n/a	1.1	1.20	1.12	1.04	0.90	1.04	0.91	0.89	0.08
Single Clear	1000	1	n/a	n/a	1.11	1.21	1.13	1.05	0.86	1	0.9	0.84	0.08
Single Elec-chrom Tinted	1800	1	n/a	n/a	1.09	1.18	1.11	1.03	0.84	0.98	0.85	0.81	0.09
Double Low Iron	2006	2	0.25	Air	0.57	0.76	0.62	0.57	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2007	2	0.50	Air	0.49	0.65	0.53	0.49	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2008	2	0.50	Argon	0.46	0.61	0.50	0.46	0.83	0.96	0.84	0.81	0.14
Double Low Iron	2009	2	0.25	Air	0.56	0.75	0.61	0.56	0.82	0.95	0.83	0.8	0.14
Double Low Iron	2010	2	0.50	Air	0.49	0.65	0.53	0.49	0.82	0.95	0.83	0.8	0.14
Double Low Iron	2011	2	0.50	Argon	0.45	0.60	0.49	0.45	0.82	0.95	0.83	0.8	0.14
Single Clear	1001	1	n/a	n/a	1.09	1.18	1.11	1.03	0.81	0.95	0.88	0.77	0.07
Single Low-E Clear (e2=.4)	1600	1	n/a	n/a	0.88	0.96	0.90	0.83	0.78	0.91	0.85	0.75	0.1
Single Low-E Clear (e2=.2)	1601	1	n/a	n/a	0.76	0.83	0.78	0.72	0.77	0.89	0.82	0.74	0.09
Double Clear	2000	2	0.25	Air	0.57	0.76	0.62	0.57	0.76	0.88	0.81	0.7	0.13
Double Clear	2001	2	0.50	Air	0.49	0.65	0.53	0.49	0.76	0.89	0.81	0.7	0.13
Double Clear	2002	2	0.50	Argon	0.46	0.61	0.50	0.46	0.76	0.89	0.81	0.7	0.13
Double Elec-chrom Tinted, 12.7-mm Gap	2802	2	0.50	Air	0.31	0.44	0.35	0.33	0.74	0.86	0.76	0.64	0.14
Double Low-E (e3=.2) Clear	2612	2	0.50	Argon	0.3	0.43	0.34	0.32	0.74	0.86	0.74	0.62	0.15
Double Elec-chrom Tinted, 12.7-mm Gap, Argo	2804	2	0.50	Argon	0.26	0.37	0.30	0.27	0.74	0.86	0.76	0.64	0.14
Single Tint Bronze	1200	1	n/a	n/a	1.11	1.21	1.13	1.05	0.73	0.84	0.69	0.64	0.06
Single Elec-chrom Refl	1802	1	n/a	n/a	1.09	1.18	1.11	1.03	0.73	0.85	0.82	0.69	0.17
Double Elec-chrom Tinted, 6.3-mm Gap	2800	2	0.25	Air	0.43	0.61	0.49	0.45	0.73	0.85	0.76	0.64	0.14
Double Low-E (e3=.4) Clear	2601	2	0.50	Air	0.41	0.59	0.47	0.43	0.73	0.85	0.77	0.63	0.15
Double Low-E (e3=.4) Clear	2602	2	0.50	Argon	0.36	0.51	0.41	0.38	0.73	0.85	0.77	0.63	0.15
Double Low-E (e3=.2) Clear	2611	2	0.50	Air	0.35	0.50	0.40	0.37	0.73	0.85	0.74	0.62	0.15
Single Tint Green	1202	1	n/a	n/a	1.11	1.21	1.13	1.05	0.72	0.83	0.82	0.63	0.06
Single Low-E Clear (e2=.2)	1602	1	n/a	n/a	0.75	0.81	0.77	0.71	0.72	0.84	0.81	0.68	0.09
Double Low-E (e3=.4) Clear	2600	2	0.25	Air	0.5	0.71	0.57	0.53	0.72	0.84	0.77	0.63	0.15
Double Low-E (e3=.2) Clear	2610	2	0.25	Air	0.46	0.66	0.53	0.49	0.72	0.84	0.74	0.62	0.15
Single Tint Grey	1204	1	n/a	n/a	1.11	1.21	1.13	1.05	0.71	0.83	0.61	0.63	0.06
Double Clear	2004	2	0.50	Air	0.48	0.64	0.52	0.48	0.70	0.81	0.78	0.6	0.11
Double Clear	2005	2	0.50	Argon	0.45	0.60	0.49	0.45	0.70	0.81	0.78	0.6	0.11
Double Clear	2003	2	0.25	Air	0.56	0.75	0.61	0.56	0.69	0.81	0.78	0.6	0.11
Triple Clear	3001	3	0.25	Air	0.39	0.56	0.45	0.41	0.68	0.79	0.74	0.6	0.17
Triple Clear	3002	3	0.50	Air	0.32	0.46	0.37	0.34	0.68	0.79	0.74	0.6	0.17
Double Low-E (e3=.2) Clear	2615	2	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.72	0.53	0.13
Triple Clear	3002	3	0.50	Argon	0.29	0.41	0.33	0.31	0.68	0.79	0.74	0.6	0.17
Double Low-E (e3=.2) Clear	2614	2	0.50	Air	0.35	0.50	0.40	0.37	0.67	0.78	0.72	0.53	0.13
Double Low-E (e3=.2) Clear	2613	2	0.25	Air	0.45	0.64	0.51	0.48	0.66	0.77	0.72	0.53	0.13
Double Low-E (e3=.1) Clear	2642	2	0.50	Argon	0.26	0.37	0.30	0.27	0.65	0.75	0.77	0.54	0.23
Double Low-E (e3=.1) Clear	2641	2	0.50	Air	0.32	0.46	0.37	0.34	0.64	0.75	0.77	0.54	0.23
Double Elec-chrom Refl, 12.7-mm Gap	2822	2	0.50	Air	0.31	0.44	0.35	0.33	0.64	0.74	0.73	0.55	0.21
Double Elec-chrom Refl, 12.7-mm Gap, Argon	2824	2	0.50	Argon	0.26	0.37	0.30	0.27	0.64	0.74	0.73	0.55	0.21
Double Low-E (e3=.1) Clear	2640	2	0.25	Air	0.44	0.63	0.50	0.47	0.63	0.74	0.77	0.54	0.23
Double Elec-chrom Refl, 6.3-mm Gap	2820	2	0.25	Air	0.43	0.61	0.49	0.45	0.63	0.73	0.73	0.55	0.21
Double Tint Bronze	2200	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.62	0.54	0.09
Double Tint Green	2206	2	0.25	Air	0.57	0.76	0.62	0.57	0.62	0.72	0.74	0.53	0.09
Double Tint Bronze	2201	2	0.50	Air	0.49	0.65	0.53	0.49	0.62	0.72	0.62	0.54	0.09
Double Tint Bronze	2202	2	0.50	Argon	0.46	0.61	0.50	0.46	0.62	0.72	0.62	0.54	0.09
Single Tint Bronze	1201	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.53	0.48	0.05
Single Tint Green	1203	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.75	0.49	0.06
Single Tint Blue	1206	1	n/a	n/a	1.09	1.18	1.11	1.03	0.61	0.71	0.57	0.48	0.05
Double Tint Grey	2212	2	0.25	Air	0.57	0.76	0.62	0.57	0.61	0.71	0.55	0.53	0.09
Double Tint Green	2207	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.74	0.53	0.09
Double Tint Grey	2213	2	0.50	Air	0.49	0.65	0.53	0.49	0.61	0.71	0.55	0.53	0.09
Double Tint Green	2208	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.71	0.74	0.53	0.09
Double Tint Grey	2214	2	0.50	Argon	0.46	0.61	0.50	0.46	0.61	0.7	0.55	0.53	0.09
Double Low-E (e2=.1) Clear	2630	2	0.25	Air	0.44	0.63	0.50	0.47	0.60	0.69	0.77	0.54	0.22
Double Low-E (e2=.1) Clear	2631	2	0.50	Air	0.32	0.46	0.37	0.34	0.60	0.69	0.77	0.54	0.22
Single Tint Grey	1205	1	n/a	n/a	1.09	1.18	1.11	1.03	0.59	0.69	0.43	0.46	0.05
Double Low-E (e2=.1) Clear	2632	2	0.50	Argon	0.26	0.37	0.30	0.27	0.59	0.69	0.77	0.54	0.22
Triple Low-E (e5=.1) Clear	3602	3	0.50	Air	0.23	0.38	0.29	0.25	0.58	0.67	0.7	0.46	0.24
Triple Low-E (e5=.1) Clear	3603	3	0.50	Argon	0.19	0.32	0.24	0.21	0.58	0.67	0.7	0.46	0.24
Triple Low-E (e5=.1) Clear	3601	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.67	0.7	0.46	0.24
Triple Low-E Film (88) Clear	3641	3	0.25	Air	0.32	0.53	0.40	0.35	0.57	0.66	0.71	0.48	0.28
Triple Low-E Film (88) Clear	3642	3	0.50	Air	0.23	0.38	0.29	0.25	0.57	0.67	0.71	0.48	0.28
Double Low-E (e2=.1) Clear	2633	2	0.25	Air	0.43	0.61	0.49	0.45	0.56	0.65	0.75	0.47	0.2
Double Low-E (e2=.1) Clear	2634	2	0.50	Air	0.31	0.44	0.35	0.33	0.56	0.65	0.75	0.47	0.2
Double Low-E (e2=.1) Clear	2635	2	0.50	Argon	0.26	0.37	0.30	0.27	0.56	0.66	0.75	0.47	0.2
Double Low-E (e2=.029) Elec-chrom Tinted, 12	2844	2	0.50	Argon	0.23	0.33	0.26	0.24	0.52	0.6	0.66	0.34	0.33
Double Low-E (e2=.029) Elec-chrom Tinted, 12	2842	2	0.50	Air	0.29	0.41	0.33	0.31	0.51	0.59	0.66	0.34	0.33

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Glass Type Library* (pg 8 of 9) — (sorted by SHGC & U-Value)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value: Alum No Break	Glass+Frame (NFRC) U-Value: Alum w Break	Glass+Frame (NFRC) U-Value: Alum Clad Wood	Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
Single Ref-D Clear	1417	1	n/a	n/a	1.08	1.17	1.10	1.02	0.50	0.58	0.33	0.43	0.31
Double Tint Green	2209	2	0.25	Air	0.56	0.75	0.61	0.56	0.50	0.58	0.66	0.38	0.07
Double Tint Bronze	2203	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.47	0.38	0.07
Double Tint Blue	2218	2	0.25	Air	0.56	0.75	0.61	0.56	0.49	0.57	0.5	0.37	0.07
Double Tint Bronze	2204	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.47	0.38	0.07
Double Tint Green	2210	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.66	0.38	0.07
Double Tint Blue	2219	2	0.50	Air	0.48	0.64	0.52	0.48	0.49	0.57	0.5	0.37	0.07
Double Tint Bronze	2205	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.47	0.38	0.07
Double Tint Green	2211	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.57	0.66	0.38	0.07
Double Tint Blue	2220	2	0.50	Argon	0.45	0.60	0.49	0.45	0.49	0.56	0.5	0.37	0.07
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2864	2	0.50	Argon	0.23	0.33	0.26	0.24	0.48	0.56	0.64	0.32	0.32
Double Tint Grey	2215	2	0.25	Air	0.56	0.75	0.61	0.56	0.47	0.55	0.38	0.35	0.07
Double Tint Grey	2216	2	0.50	Air	0.48	0.64	0.52	0.48	0.47	0.54	0.38	0.35	0.07
Double Tint Grey	2217	2	0.50	Argon	0.45	0.60	0.49	0.45	0.47	0.54	0.38	0.35	0.07
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2862	2	0.50	Air	0.29	0.41	0.33	0.31	0.47	0.55	0.64	0.32	0.32
Triple Low-E (e2=e5=.1) Clear	3621	3	0.25	Air	0.27	0.45	0.34	0.29	0.47	0.54	0.66	0.36	0.29
Triple Low-E Film (77) Clear	3652	3	0.50	Air	0.22	0.37	0.28	0.24	0.47	0.54	0.64	0.38	0.38
Triple Low-E (e2=e5=.1) Clear	3622	3	0.50	Air	0.17	0.28	0.21	0.18	0.47	0.55	0.66	0.36	0.29
Triple Low-E (e2=e5=.1) Clear	3623	3	0.50	Argon	0.14	0.23	0.18	0.15	0.47	0.55	0.66	0.36	0.29
Single Ref-D Tint	1418	1	n/a	n/a	1.08	1.17	1.10	1.02	0.46	0.53	0.25	0.3	0.14
Double Low-E (e2=.029) Elec-chrom Refl, 6.3-r	2860	2	0.25	Air	0.41	0.59	0.47	0.43	0.46	0.54	0.64	0.32	0.32
Triple Low-E Film (77) Clear	3651	3	0.25	Air	0.32	0.53	0.40	0.35	0.46	0.53	0.64	0.38	0.38
Quadruple, Two Low-E Glass, Two Low-E Film,	4651	4	0.31	Krypton	0.12	0.20	0.15	0.13	0.45	0.52	0.62	0.34	0.34
Double Low-E (e2=.04) Clear	2660	2	0.25	Air	0.42	0.60	0.48	0.44	0.44	0.51	0.7	0.39	0.36
Double Low-E (e2=.029) Elec-chrom Tinted, 6.3	2840	2	0.25	Air	0.41	0.59	0.47	0.43	0.44	0.51	0.66	0.34	0.33
Double Low-E (e2=.04) Clear	2661	2	0.50	Air	0.3	0.43	0.34	0.32	0.44	0.51	0.7	0.39	0.36
Double Low-E (e2=.04) Clear	2662	2	0.50	Argon	0.24	0.34	0.27	0.25	0.43	0.5	0.7	0.39	0.36
Double Ref-D Clear	2460	2	0.25	Air	0.56	0.75	0.61	0.56	0.42	0.49	0.31	0.34	0.32
Double Ref-D Clear	2461	2	0.50	Air	0.48	0.64	0.52	0.48	0.42	0.49	0.31	0.34	0.32
Double Ref-D Clear	2462	2	0.50	Argon	0.45	0.60	0.49	0.45	0.42	0.49	0.31	0.34	0.32
Double Low-E (e3=.04) Clear	2663	2	0.25	Air	0.42	0.60	0.48	0.44	0.42	0.49	0.68	0.34	0.31
Double Low-E (e3=.04) Clear	2664	2	0.50	Air	0.29	0.41	0.33	0.31	0.42	0.48	0.68	0.34	0.31
Double Low-E (e3=.04) Clear	2665	2	0.50	Argon	0.23	0.33	0.26	0.24	0.42	0.48	0.68	0.34	0.31
Single Ref-B Clear-H	1407	1	n/a	n/a	0.97	1.05	0.99	0.92	0.39	0.45	0.3	0.24	0.16
Double Low-E (e2=.1) Tint	2636	2	0.25	Air	0.43	0.61	0.49	0.45	0.39	0.45	0.44	0.28	0.1
Double Low-E (e2=.1) Tint	2637	2	0.50	Air	0.31	0.44	0.35	0.33	0.37	0.43	0.44	0.28	0.1
Double Low-E (e2=.1) Tint	2638	2	0.50	Argon	0.26	0.37	0.30	0.27	0.37	0.43	0.44	0.28	0.1
Triple Low-E Film (66) Clear	3662	3	0.50	Air	0.22	0.37	0.28	0.24	0.36	0.42	0.54	0.26	0.4
Single Ref-C Clear-H	1413	1	n/a	n/a	0.94	1.02	0.96	0.89	0.35	0.41	0.22	0.2	0.16
Double Ref-D Tint	2470	2	0.25	Air	0.56	0.75	0.61	0.56	0.35	0.41	0.23	0.24	0.15
Double Ref-D Tint	2471	2	0.50	Air	0.48	0.64	0.52	0.48	0.35	0.4	0.23	0.24	0.15
Triple Low-E Film (66) Clear	3661	3	0.25	Air	0.31	0.52	0.39	0.34	0.35	0.41	0.54	0.26	0.4
Single Ref-B Tint-H	1410	1	n/a	n/a	0.97	1.05	0.99	0.92	0.34	0.4	0.18	0.15	0.09
Double Ref-D Tint	2472	2	0.50	Argon	0.45	0.60	0.49	0.45	0.34	0.4	0.23	0.24	0.15
Single Ref-C Clear-M	1412	1	n/a	n/a	0.92	1.00	0.94	0.87	0.32	0.37	0.19	0.17	0.2
Single Elec-chrom Tinted	1801	1	n/a	n/a	1.09	1.18	1.11	1.03	0.31	0.36	0.13	0.11	0.18
Single Ref-B Clear-L	1406	1	n/a	n/a	0.96	1.04	0.98	0.91	0.31	0.35	0.2	0.15	0.22
Single Ref-A Clear-L	1402	1	n/a	n/a	0.95	1.03	0.97	0.90	0.31	0.36	0.2	0.16	0.22
Single Ref-C Tint-H	1416	1	n/a	n/a	0.94	1.02	0.96	0.89	0.31	0.37	0.13	0.12	0.09
Double Low-E (e2=.04) Tint	2666	2	0.25	Air	0.42	0.60	0.48	0.44	0.31	0.35	0.41	0.21	0.14
Triple Low-E Film (55) Clear	3672	3	0.50	Air	0.22	0.37	0.28	0.24	0.31	0.36	0.45	0.21	0.44
Double Ref-B Clear-H	2426	2	0.25	Air	0.53	0.71	0.57	0.53	0.30	0.35	0.27	0.19	0.16
Triple Low-E Film (55) Clear	3671	3	0.25	Air	0.31	0.52	0.39	0.34	0.30	0.35	0.45	0.21	0.44
Single Elec-chrom Refl	1803	1	n/a	n/a	1.09	1.18	1.11	1.03	0.29	0.34	0.16	0.1	0.22
Single Ref-A Tint-H	1405	1	n/a	n/a	0.93	1.01	0.95	0.88	0.29	0.34	0.1	0.1	0.11
Single Ref-C Tint-M	1415	1	n/a	n/a	0.92	1.00	0.94	0.87	0.29	0.34	0.11	0.1	0.1
Double Ref-B Clear-H	2427	2	0.50	Air	0.44	0.59	0.48	0.44	0.29	0.34	0.27	0.19	0.16
Double Ref-B Clear-H	2428	2	0.50	Argon	0.41	0.55	0.44	0.41	0.29	0.34	0.27	0.19	0.16
Double Low-E (e2=.04) Tint	2667	2	0.50	Air	0.29	0.41	0.33	0.31	0.29	0.33	0.41	0.21	0.14
Single Ref-B Tint-M	1409	1	n/a	n/a	0.89	0.97	0.91	0.84	0.28	0.33	0.13	0.1	0.11
Double Low-E (e2=.04) Tint	2668	2	0.50	Argon	0.23	0.33	0.26	0.24	0.28	0.32	0.41	0.21	0.14
Double Ref-C Clear-H	2446	2	0.25	Air	0.52	0.69	0.56	0.52	0.27	0.32	0.2	0.16	0.16
Double Ref-C Clear-H	2447	2	0.50	Air	0.43	0.57	0.47	0.43	0.26	0.3	0.2	0.16	0.16
Double Ref-C Clear-H	2448	2	0.50	Argon	0.39	0.52	0.42	0.39	0.26	0.3	0.2	0.16	0.16
Triple Low-E Film (66) Tint	3663	3	0.25	Air	0.31	0.52	0.39	0.34	0.26	0.3	0.32	0.16	0.18
Single Ref-A Clear-L	1401	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.14	0.11	0.27
Single Ref-A Tint-M	1404	1	n/a	n/a	0.9	0.98	0.92	0.85	0.25	0.29	0.09	0.06	0.13
Single Ref-C Clear-L	1411	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.13	0.11	0.25
Single Ref-C Tint-L	1414	1	n/a	n/a	0.88	0.96	0.90	0.83	0.25	0.29	0.08	0.07	0.13
Double Ref-B Tint-H	2436	2	0.25	Air	0.53	0.71	0.57	0.53	0.25	0.29	0.16	0.12	0.09
Triple Low-E Film (66) Tint	3664	3	0.50	Air	0.22	0.37	0.28	0.24	0.25	0.29	0.32	0.16	0.18
Double Ref-C Clear-M	2443	2	0.25	Air	0.51	0.68	0.55	0.51	0.24	0.28	0.17	0.14	0.2
Single Ref-B Tint-L	1408	1	n/a	n/a	0.87	0.95	0.89	0.82	0.23	0.26	0.05	0.04	0.13
Double Ref-A Clear-H	2406	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.27	0.18	0.13	0.22

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Glass Type Library* (pg 9 of 9) — (sorted by SHGC & U-Value)

Doe-2 Glass Library Entry Name	Glass Type Code	# Panes	Gap Thick (in)	Gap Gas Fill	Center Glass U-Value	Glass+Frame (NFRC) U-Value: Alum No Break	Glass+Frame (NFRC) U-Value: Alum w Break	Glass+Frame (NFRC) U-Value: Alum Clad Wood	Solar Heat Gain Coeff. SHGC	Shading Coeff. SC	Visible Trans. Tvis	Solar Trans. Tsol	Solar Reflect. Rfsol
Double Ref-D Tint-H	2456	2	0.25	Air	0.52	0.69	0.56	0.52	0.23	0.26	0.12	0.1	0.09
Double Ref-B Tint-H	2437	2	0.50	Air	0.44	0.59	0.48	0.44	0.23	0.27	0.16	0.12	0.09
Double Ref-C Clear-M	2444	2	0.50	Air	0.42	0.56	0.45	0.42	0.23	0.27	0.17	0.14	0.2
Double Ref-B Tint-H	2438	2	0.50	Argon	0.41	0.55	0.44	0.41	0.23	0.27	0.16	0.12	0.09
Double Ref-C Clear-M	2445	2	0.50	Argon	0.38	0.51	0.41	0.38	0.23	0.26	0.17	0.14	0.2
Triple Low-E Film (55) Tint	3673	3	0.25	Air	0.31	0.52	0.39	0.34	0.23	0.26	0.27	0.13	0.19
Single Ref-A Tint-L	1403	1	n/a	n/a	0.87	0.95	0.89	0.82	0.22	0.26	0.05	0.04	0.15
Double Ref-A Clear-H	2407	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.26	0.18	0.13	0.22
Double Ref-B Clear-L	2421	2	0.50	Air	0.44	0.59	0.48	0.44	0.22	0.25	0.18	0.12	0.22
Double Ref-A Clear-H	2408	2	0.50	Argon	0.4	0.53	0.43	0.40	0.22	0.25	0.18	0.13	0.22
Triple Low-E Film (55) Tint	3674	3	0.50	Air	0.22	0.37	0.28	0.24	0.22	0.25	0.27	0.13	0.19
Double Elec-chrom Tinted	2416	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.09	0.08	0.11
Double Elec-chrom Tinted	2453	2	0.25	Air	0.51	0.68	0.55	0.51	0.21	0.24	0.1	0.08	0.1
Double Elec-chrom Tinted	2457	2	0.50	Air	0.43	0.57	0.47	0.43	0.21	0.24	0.12	0.1	0.09
Double Elec-chrom Tinted	2422	2	0.50	Argon	0.4	0.53	0.43	0.40	0.21	0.25	0.18	0.12	0.22
Double Elec-chrom Tinted	2433	2	0.25	Air	0.5	0.67	0.54	0.50	0.20	0.24	0.12	0.08	0.11
Double Elec-chrom Tinted	2458	2	0.50	Argon	0.39	0.52	0.42	0.39	0.20	0.24	0.12	0.1	0.09
Double Elec-chrom Refl	2803	2	0.50	Air	0.31	0.44	0.35	0.33	0.20	0.19	0.12	0.16	0.18
Double Elec-chrom Refl	3681	3	0.25	Air	0.31	0.52	0.39	0.34	0.20	0.23	0.22	0.1	0.21
Double Elec-chrom Refl	1400	1	n/a	n/a	0.86	0.93	0.88	0.81	0.19	0.23	0.08	0.07	0.34
Double Elec-chrom Refl	2403	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.13	0.09	0.27
Double Elec-chrom Refl	2440	2	0.25	Air	0.5	0.67	0.54	0.50	0.19	0.22	0.12	0.09	0.25
Double Elec-chrom Refl	2417	2	0.50	Air	0.43	0.57	0.47	0.43	0.19	0.22	0.09	0.08	0.11
Double Low-E (e2=.029) Elec-chrom Tinted	2454	2	0.50	Air	0.42	0.56	0.45	0.42	0.19	0.22	0.1	0.08	0.1
Double Low-E (e2=.029) Elec-chrom Tinted	2434	2	0.50	Air	0.41	0.55	0.44	0.41	0.19	0.22	0.12	0.08	0.11
Double Low-E (e2=.029) Elec-chrom Tinted	2418	2	0.50	Argon	0.39	0.52	0.42	0.39	0.19	0.21	0.09	0.08	0.11
Double Low-E (e2=.029) Elec-chrom Tinted	2455	2	0.50	Argon	0.38	0.51	0.41	0.38	0.19	0.21	0.1	0.08	0.1
Double Low-E (e2=.029) Elec-chrom Tinted	3682	3	0.50	Air	0.21	0.35	0.26	0.23	0.19	0.22	0.22	0.1	0.21
Double Low-E (e2=.029) Elec-chrom Tinted	2450	2	0.25	Air	0.5	0.67	0.54	0.50	0.18	0.21	0.07	0.06	0.13
Double Low-E (e2=.029) Elec-chrom Refl	2801	2	0.25	Air	0.43	0.61	0.49	0.45	0.18	0.21	0.12	0.09	0.18
Double Low-E (e2=.029) Elec-chrom Refl	2441	2	0.50	Air	0.41	0.55	0.44	0.41	0.18	0.2	0.12	0.09	0.25
Double Low-E (e2=.029) Elec-chrom Refl	2435	2	0.50	Argon	0.37	0.49	0.40	0.37	0.18	0.21	0.12	0.08	0.11
Double Low-E (e2=.029) Elec-chrom Refl	2413	2	0.25	Air	0.5	0.67	0.54	0.50	0.17	0.2	0.08	0.05	0.13
Double Low-E (e2=.029) Elec-chrom Refl	2821	2	0.25	Air	0.43	0.61	0.49	0.45	0.17	0.2	0.14	0.09	0.22
Double Low-E (e2=.029) Elec-chrom Refl	2404	2	0.50	Air	0.41	0.55	0.44	0.41	0.17	0.2	0.13	0.09	0.27
Double Ref-A Clear-M	2405	2	0.50	Argon	0.38	0.51	0.41	0.38	0.17	0.2	0.13	0.09	0.27
Double Ref-C Clear-L	2442	2	0.50	Argon	0.36	0.48	0.39	0.36	0.17	0.2	0.12	0.09	0.25
Double Ref-C Tint-L	2451	2	0.50	Air	0.41	0.55	0.44	0.41	0.16	0.19	0.07	0.06	0.13
Double Low-E (e2=.029) Elec-chrom Tinted, 6.3	2841	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Refl, 6.3-r	2861	2	0.25	Air	0.41	0.59	0.47	0.43	0.16	0.18	0.12	0.07	0.22
Triple Low-E Film (33) Tint	3691	3	0.25	Air	0.31	0.52	0.39	0.34	0.16	0.19	0.17	0.07	0.23
Double Ref-A Tint-L	2410	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.15
Double Ref-B Tint-L	2430	2	0.25	Air	0.49	0.65	0.53	0.49	0.15	0.18	0.05	0.03	0.13
Double Ref-A Tint-M	2414	2	0.50	Air	0.41	0.55	0.44	0.41	0.15	0.18	0.08	0.05	0.13
Double Ref-A Tint-M	2415	2	0.50	Argon	0.38	0.51	0.41	0.38	0.15	0.17	0.08	0.05	0.13
Double Ref-C Tint-L	2452	2	0.50	Argon	0.36	0.48	0.39	0.36	0.15	0.18	0.07	0.06	0.13
Double Elec-chrom Refl, 12.7-mm Gap	2823	2	0.50	Air	0.31	0.44	0.35	0.33	0.15	0.17	0.14	0.09	0.22
Double Elec-chrom Tinted, 12.7-mm Gap, Argo	2805	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.18	0.12	0.09	0.18
Double Elec-chrom Refl, 12.7-mm Gap, Argon	2825	2	0.50	Argon	0.26	0.37	0.30	0.27	0.15	0.16	0.14	0.09	0.22
Triple Low-E Film (33) Tint	3692	3	0.50	Air	0.21	0.35	0.26	0.23	0.15	0.17	0.17	0.07	0.23
Double Ref-A Clear-L	2400	2	0.25	Air	0.49	0.65	0.53	0.49	0.14	0.17	0.07	0.05	0.34
Double Ref-B Tint-L	2431	2	0.50	Air	0.4	0.53	0.43	0.40	0.14	0.16	0.05	0.03	0.13
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2863	2	0.50	Air	0.29	0.41	0.33	0.31	0.14	0.16	0.12	0.07	0.22
Double Ref-A Clear-L	2401	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.07	0.05	0.34
Double Ref-A Tint-L	2411	2	0.50	Air	0.4	0.53	0.43	0.40	0.13	0.15	0.05	0.03	0.15
Double Ref-A Tint-L	2412	2	0.50	Argon	0.36	0.48	0.39	0.36	0.13	0.15	0.05	0.03	0.15
Double Ref-B Tint-L	2432	2	0.50	Argon	0.36	0.48	0.39	0.36	0.13	0.15	0.05	0.03	0.13
Double Low-E (e2=.029) Elec-chrom Tinted, 12	2843	2	0.50	Air	0.29	0.41	0.33	0.31	0.13	0.15	0.1	0.06	0.19
Double Low-E (e2=.029) Elec-chrom Refl, 12.7-	2865	2	0.50	Argon	0.23	0.33	0.26	0.24	0.13	0.15	0.12	0.07	0.22
Double Ref-A Clear-L	2402	2	0.50	Argon	0.36	0.48	0.39	0.36	0.12	0.14	0.07	0.05	0.34
Quadruple, dbl Low-E Glass & Film, Clear	2845	2	0.50	Argon	0.23	0.33	0.26	0.24	0.12	0.14	0.1	0.06	0.19

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Thermal Resistances of Plane Air Spaces

Table 3 Thermal Resistances of Plane Air Spaces[a,b,c], °F·ft²·h/Btu

Position of Air Space	Direction of Heat Flow	Air Space Mean Temp.[d], °F	Air Space Temp. Diff.[d], °F	0.5-in. Air Space[c] Effective Emittance ε_{eff}[d,e] 0.03	0.05	0.2	0.5	0.82	0.75-in. Air Space[c] Effective Emittance ε_{eff}[d,e] 0.03	0.05	0.2	0.5	0.82
Horiz.	Up	90	10	2.13	2.03	1.51	0.99	0.73	2.34	2.22	1.61	1.04	0.75
		50	30	1.62	1.57	1.29	0.96	0.75	1.71	1.66	1.35	0.99	0.77
		50	10	2.13	2.05	1.60	1.11	0.84	2.30	2.21	1.70	1.16	0.87
		0	20	1.73	1.70	1.45	1.12	0.91	1.83	1.79	1.52	1.16	0.93
		0	10	2.10	2.04	1.70	1.27	1.00	2.23	2.16	1.78	1.31	1.02
		−50	20	1.69	1.66	1.49	1.23	1.04	1.77	1.74	1.55	1.27	1.07
		−50	10	2.04	2.00	1.75	1.40	1.16	2.16	2.11	1.84	1.46	1.20
45° Slope	Up	90	10	2.44	2.31	1.65	1.06	0.76	2.96	2.78	1.88	1.15	0.81
		50	30	2.06	1.98	1.56	1.10	0.83	1.99	1.92	1.52	1.08	0.82
		50	10	2.55	2.44	1.83	1.22	0.90	2.90	2.75	2.00	1.29	0.94
		0	20	2.20	2.14	1.76	1.30	1.02	2.13	2.07	1.72	1.28	1.00
		0	10	2.63	2.54	2.03	1.44	1.10	2.72	2.62	2.08	1.47	1.12
		−50	20	2.08	2.04	1.78	1.42	1.17	2.05	2.01	1.76	1.41	1.16
		−50	10	2.62	2.56	2.17	1.66	1.33	2.53	2.47	2.10	1.62	1.30
Vertical	Horiz.	90	10	2.47	2.34	1.67	1.06	0.77	3.50	3.24	2.08	1.22	0.84
		50	30	2.57	2.46	1.84	1.23	0.90	2.91	2.77	2.01	1.30	0.94
		50	10	2.66	2.54	1.88	1.24	0.91	3.70	3.46	2.35	1.43	1.01
		0	20	2.82	2.72	2.14	1.50	1.13	3.14	3.02	2.32	1.58	1.18
		0	10	2.93	2.82	2.20	1.53	1.15	3.77	3.59	2.64	1.73	1.26
		−50	20	2.90	2.82	2.35	1.76	1.39	2.90	2.83	2.36	1.77	1.39
		−50	10	3.20	3.10	2.54	1.87	1.46	3.72	3.60	2.87	2.04	1.56
45° Slope	Down	90	10	2.48	2.34	1.67	1.06	0.77	3.53	3.27	2.10	1.22	0.84
		50	30	2.64	2.52	1.87	1.24	0.91	3.43	3.23	2.24	1.39	0.99
		50	10	2.67	2.55	1.89	1.25	0.92	3.81	3.57	2.40	1.45	1.02
		0	20	2.91	2.80	2.19	1.52	1.15	3.75	3.57	2.63	1.72	1.26
		0	10	2.94	2.83	2.21	1.53	1.15	4.12	3.91	2.81	1.80	1.30
		−50	20	3.16	3.07	2.52	1.86	1.45	3.78	3.65	2.90	2.05	1.57
		−50	10	3.26	3.16	2.58	1.89	1.47	4.35	4.18	3.22	2.21	1.66
Horiz.	Down	90	10	2.48	2.34	1.67	1.06	0.77	3.55	3.29	2.10	1.22	0.85
		50	30	2.66	2.54	1.88	1.24	0.91	3.77	3.52	2.38	1.44	1.02
		50	10	2.67	2.55	1.89	1.25	0.92	3.84	3.59	2.41	1.45	1.02
		0	20	2.94	2.83	2.20	1.53	1.15	4.18	3.96	2.83	1.81	1.30
		0	10	2.96	2.85	2.22	1.53	1.16	4.25	4.02	2.87	1.82	1.31
		−50	20	3.25	3.15	2.58	1.89	1.47	4.60	4.41	3.36	2.28	1.69
		−50	10	3.28	3.18	2.60	1.90	1.47	4.71	4.51	3.42	2.30	1.71
		Air Space		1.5-in. Air Space[c]					3.5-in. Air Space[c]				
Horiz.	Up	90	10	2.55	2.41	1.71	1.08	0.77	2.84	2.66	1.83	1.13	0.80
		50	30	1.87	1.81	1.45	1.04	0.80	2.09	2.01	1.58	1.10	0.84
		50	10	2.50	2.40	1.81	1.21	0.89	2.80	2.66	1.95	1.28	0.93
		0	20	2.01	1.95	1.63	1.23	0.97	2.25	2.18	1.79	1.32	1.03
		0	10	2.43	2.35	1.90	1.38	1.06	2.71	2.62	2.07	1.47	1.12
		−50	20	1.94	1.91	1.68	1.36	1.13	2.19	2.14	1.86	1.47	1.20
		−50	10	2.37	2.31	1.99	1.55	1.26	2.65	2.58	2.18	1.67	1.33
45° Slope	Up	90	10	2.92	2.73	1.86	1.14	0.80	3.18	2.96	1.97	1.18	0.82
		50	30	2.14	2.06	1.61	1.12	0.84	2.26	2.17	1.67	1.15	0.86
		50	10	2.88	2.74	1.99	1.29	0.94	3.12	2.95	2.10	1.34	0.96
		0	20	2.30	2.23	1.82	1.34	1.04	2.42	2.35	1.90	1.38	1.06
		0	10	2.79	2.69	2.12	1.49	1.13	2.98	2.87	2.23	1.54	1.16
		−50	20	2.22	2.17	1.88	1.49	1.21	2.34	2.29	1.97	1.54	1.25
		−50	10	2.71	2.64	2.23	1.69	1.35	2.87	2.79	2.33	1.75	1.39
Vertical	Horiz.	90	10	3.99	3.66	2.25	1.27	0.87	3.69	3.40	2.15	1.24	0.85
		50	30	2.58	2.46	1.84	1.23	0.90	2.67	2.55	1.89	1.25	0.91
		50	10	3.79	3.55	2.39	1.45	1.02	3.63	3.40	2.32	1.42	1.01
		0	20	2.76	2.66	2.10	1.48	1.12	2.88	2.78	2.17	1.51	1.14
		0	10	3.51	3.35	2.51	1.67	1.23	3.49	3.33	2.50	1.67	1.23
		−50	20	2.64	2.58	2.18	1.66	1.33	2.82	2.75	2.30	1.73	1.37
		−50	10	3.31	3.21	2.62	1.91	1.48	3.40	3.30	2.67	1.94	1.50
45° Slope	Down	90	10	5.07	4.55	2.56	1.36	0.91	4.81	4.33	2.49	1.34	0.90
		50	30	3.58	3.36	2.31	1.42	1.00	3.51	3.30	2.28	1.40	1.00
		50	10	5.10	4.66	2.85	1.60	1.09	4.74	4.36	2.73	1.57	1.08
		0	20	3.85	3.66	2.68	1.74	1.27	3.81	3.63	2.66	1.74	1.27
		0	10	4.92	4.62	3.16	1.94	1.37	4.59	4.32	3.02	1.88	1.34
		−50	20	3.62	3.50	2.80	2.01	1.54	3.77	3.64	2.90	2.05	1.57
		−50	10	4.67	4.47	3.40	2.29	1.70	4.50	4.32	3.31	2.25	1.68
Horiz.	Down	90	10	6.09	5.35	2.79	1.43	0.94	10.07	8.19	3.41	1.57	1.00
		50	30	6.27	5.63	3.18	1.70	1.14	9.60	8.17	3.86	1.88	1.22
		50	10	6.61	5.90	3.27	1.73	1.15	11.15	9.27	4.09	1.93	1.24
		0	20	7.03	6.43	3.91	2.19	1.49	10.90	9.52	4.87	2.47	1.62
		0	10	7.31	6.66	4.00	2.22	1.51	11.97	10.32	5.08	2.52	1.64
		−50	20	7.73	7.20	4.77	2.85	1.99	11.64	10.49	6.02	3.25	2.18
		−50	10	8.09	7.52	4.91	2.89	2.01	12.98	11.56	6.36	3.34	2.22

[a]See Chapter 22, section Factors Affecting Heat Transfer across Air Spaces. Thermal resistance values were determined from the relation, $R = 1/C$, where $C = h_c + \varepsilon_{eff} h_r$, h_c is the conduction-convection coefficient, $\varepsilon_{eff} h_r$ is the radiation coefficient $\approx 0.0068\varepsilon_{eff}[(t_m + 460)/100]^3$, and t_m is the mean temperature of the air space. Values for h_c were determined from data developed by Robinson et al. (1954). Equations (5) through (7) in Yarbrough (1983) show the data in this table in analytic form. For extrapolation from this table to air spaces less than 0.5 in. (as in insulating window glass), assume $h_c = 0.159(1 + 0.0016\, t_m)/l$ where l is the air space thickness in inches, and h_c is heat transfer through the air space only.

[b]Values are based on data presented by Robinson et al. (1954). (Also see Chapter 3, Tables 3 and 4, and Chapter 36). Values apply for ideal conditions, i.e., air spaces of uniform thickness bounded by plane, smooth, parallel surfaces with no air leakage to or from the space. When accurate values are required, use overall U-factors determined through calibrated hot box (ASTM C 976) or guarded hot box (ASTM C 236) testing. Thermal resistance values for multiple air spaces must be based on careful estimates of mean temperature differences for each air space.

[c]A single resistance value cannot account for multiple air spaces; each air space requires a separate resistance calculation that applies only for the established boundary conditions. Resistances of horizontal spaces with heat flow downward are substantially independent of temperature difference.

[d]Interpolation is permissible for other values of mean temperature, temperature difference, and effective emittance ε_{eff}. Interpolation and moderate extrapolation for air spaces greater than 3.5 in. are also permissible.

[e]Effective emittance ε_{eff} of the air space is given by $1/\varepsilon_{eff} = 1/\varepsilon_1 + 1/\varepsilon_2 - 1$, where ε_1 and ε_2 are the emittances of the surfaces of the air space (see Table 2).

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Thermal Resistances of Air Films and Air Spaces

Table 1 Surface Conductances and Resistances for Air

Position of Surface	Direction of Heat Flow	Non-reflective $\varepsilon = 0.90$ h_i	R	Reflective $\varepsilon = 0.20$ h_i	R	Reflective $\varepsilon = 0.05$ h_i	R
STILL AIR							
Horizontal	Upward	1.63	0.61	0.91	1.10	0.76	1.32
Sloping—45°	Upward	1.60	0.62	0.88	1.14	0.73	1.37
Vertical	Horizontal	1.46	0.68	0.74	1.35	0.59	1.70
Sloping—45°	Downward	1.32	0.76	0.60	1.67	0.45	2.22
Horizontal	Downward	1.08	0.92	0.37	2.70	0.22	4.55
MOVING AIR (Any position)		h_o	R				
15-mph Wind (for winter)	Any	6.00	0.17	—	—	—	—
7.5-mph Wind (for summer)	Any	4.00	0.25	—	—	—	—

Notes:
1. Surface conductance h_i and h_o measured in Btu/h·ft²·°F; resistance R in °F·ft²·h/Btu.
2. No surface has both an air space resistance value and a surface resistance value.
3. For ventilated attics or spaces above ceilings under summer conditions (heat flow down), see Table 5.
4. Conductances are for surfaces of the stated emittance facing virtual blackbody surroundings at the same temperature as the ambient air. Values are based on a surface-air temperature difference of 10°F and for surface temperatures of 70°F.
5. See Chapter 3 for more detailed information, especially Tables 5 and 6, and see Figure 1 for additional data.
6. Condensate can have a significant impact on surface emittance (see Table 2).

Table 2 Emittance Values of Various Surfaces and Effective Emittances of Air Spaces[a]

Surface	Average Emittance ε	Effective Emittance ε_{eff} of Air Space: One Surface Emittance ε; Other, 0.9	Both Surfaces Emittance ε
Aluminum foil, bright	0.05	0.05	0.03
Aluminum foil, with condensate just visible (> 0.7 gr/ft²)	0.30[b]	0.29	—
Aluminum foil, with condensate clearly visible (> 2.9 gr/ft²)	0.70[b]	0.65	—
Aluminum sheet	0.12	0.12	0.06
Aluminum coated paper, polished	0.20	0.20	0.11
Steel, galvanized, bright	0.25	0.24	0.15
Aluminum paint	0.50	0.47	0.35
Building materials: wood, paper, masonry, nonmetallic paints	0.90	0.82	0.82
Regular glass	0.84	0.77	0.72

[a]These values apply in the 4 to 40 μm range of the electromagnetic spectrum.
[b]Values are based on data presented by Bassett and Trethowen (1984).

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3. Thermal Properties of Air Spaces

DOE-2 Code-word	Description	Thickness Feet	Conductivity Btu-Ft/Hr-Ft²-°F	Density Lb/Ft³	Specific Heat Btu/Lb-°F	Resistance Hr-Ft²-°F/Btu
	Air Layer, 3/4 inch or less					
AL11	Vertical Walls					0.90
AL12	Slope 45°					0.84
AL13	Horizontal Roofs					0.82
	Air Layer, 3/4 inch to 4 inches					
AL21	Vertical Walls					0.89
AL22	Slope 45°					0.87
AL23	Horizontal Roofs					0.87
	Air Layer, 4 inches or more					
AL31	Vertical Walls					0.92
AL32	Slope 45°					0.89
AL33	Horizontal Roofs					0.92

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Guardian Global Performance Data *Single Glazing*

Type	Standard Thickness		U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
					Reflectance					Shading Coefficient			Winter Nighttime	Winter Nighttime	Summer	
			Trans-mittance	Trans-mittance	Indoors	Outdoors	Reflec-tance	Trans-mittance	Absorp-tance		Short	Long	K-Value	U-Value	Solar Heat Gain	Relative Heat Gain
	mm	inches	%	%	%	%	% Out	%	%	Total	Wave	Wave	W/m²K	BTU/hr•ft²•F	Coefficient	BTU/hr•ft²
Float Glass *(Available globally)*																
Clear	1.7		78	91	8	8	8	87	5	1.03	1.02	.01	5.9	1.12	.89	221
	2.0		77	91	8	8	8	87	5	1.03	1.01	.01	5.9	1.12	.88	220
	2.3	SS	75	91	8	8	8	86	6	1.02	1.00	.02	5.9	1.12	.88	218
	3.0	1/8"	72	91	8	8	7	84	9	1.01	0.98	.02	5.8	1.11	.87	215
	3.3	DST	71	91	8	8	7	84	9	1.00	0.97	.03	5.8	1.11	.86	215
	4.0	5/32"	68	90	8	8	7	82	11	0.99	0.95	.03	5.8	1.11	.85	212
	5.0	3/16"	66	90	8	8	7	80	13	0.97	0.93	.04	5.8	1.10	.84	209
	6.0	1/4"	63	89	8	8	7	78	15	0.95	0.91	.04	5.7	1.09	.82	206
	8.0	5/16"	58	89	8	8	7	74	19	0.92	0.87	.06	5.7	1.08	.80	199
	10.0	3/8"	55	88	8	8	7	71	22	0.90	0.83	.07	5.6	1.07	.78	194
	12.0	1/2"	54	86	8	8	6	66	28	0.86	0.77	.09	5.5	1.05	.74	186
Tinted (Colored) Float Glass *(May not be available at all manufacturing facilities)*																
Green	2.0		50	86	8	8	6	68	26	0.87	0.79	.08	5.9	1.12	.75	190
	2.3	SS	47	85	8	8	6	65	29	0.85	0.75	.09	5.9	1.12	.73	184
	3.0	1/8"	40	82	7	7	6	58	36	0.80	0.68	.12	5.8	1.11	.68	174
	4.0	5/23"	35	80	7	7	6	52	42	0.75	0.60	.14	5.8	1.11	.64	165
	5.0	3/16"	31	77	7	7	5	47	47	0.71	0.55	.16	5.8	1.10	.61	158
	6.0	1/4"	26	75	7	7	5	42	52	0.67	0.49	.18	5.7	1.09	.58	150
	8.0	5/16"	20	70	7	7	5	35	60	0.62	0.41	.21	5.7	1.08	.53	139
Bronze	3.0	1/8"	37	69	7	7	6	66	28	0.86	0.77	.09	5.8	1.11	.74	187
	5.0	3/16"	27	60	6	6	6	56	38	0.78	0.66	.13	5.8	1.10	.67	172
	6.0	1/4"	22	54	6	6	6	50	44	0.74	0.59	.15	5.7	1.09	.63	163
	8.0	5/16"	16	46	5	5	5	42	52	0.68	0.49	.19	5.7	1.08	.58	150
	10.0	3/8"	• 12	40	5	5	5	36	59	0.63	0.42	.21	5.6	1.07	.54	141
Gray	3.0	1/8"	44	62	6	6	6	65	29	0.85	0.75	.10	5.8	1.11	.73	184
	5.0	3/16"	34	51	6	6	6	55	40	0.77	0.63	.14	5.8	1.10	.66	169
	6.0	1/4"	29	44	5	5	6	48	46	0.72	0.57	.15	5.7	1.09	.62	159
	8.0	5/16"	23	35	5	5	5	40	55	0.66	0.47	.19	5.7	1.08	.57	147
	10.0	3/8"	19	29	5	5	5	34	61	0.61	0.40	.21	5.6	1.07	.52	137
Blue*	6.0	1/4"	33	57	6	6	5	46	49	0.69	0.53	.16	5.7	1.09	.59	154
Azurlite®*	6.0	1/4"	28	72	7	7	5	34	60	0.60	0.40	.20	5.7	1.09	.51	135

*Non-Reflective Coated Ford Blue or PPG Azurlite shown for performance value comparisons only.

Designlite: Fired Ceramic Decorated Float Glass *(Manufactured in Scarborough, Ontario, Canada)*																
3mm (1/8") Dots on 6mm (1/4") Centers	6.0	1/4"	N/A	72	20	14	11	65	24	0.83	.75	.08	5.7	1.09	.72	181
12mm (1/2") Lines on 25mm (1") Center	6.0	1/4"	N/A	47	27	23	17	45	38	0.65	.53	.12	5.7	1.09	.56	145
3mm (1/8") Holes on 6mm (1/4") Centers	6.0	1/4"	N/A	43	37	25	18	41	41	0.61	.48	.13	5.7	1.09	.53	138

Available only as heat-strenghthened or tempered. Performance data is for the standard white color. Data for other colors, size dots, lines and holes available on request. See additional information on page 10.

Guardian Global Performance Data *Double Glazing*

Type	mm Air Space mm	Total Thickness (mm)	U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflectance Indoors %	Visible Light Reflectance Outdoors %	Solar Energy Reflec-tance % Out	Solar Energy Trans-mittance %	Solar Energy Absorp-tance %	Shading Coefficient Total	Shading Coefficient Short Wave	Shading Coefficient Long Wave	European Winter Nighttime K-Value (air) W/m²K	American (ASHRAE) Winter Nighttime U-Value (air) BTU/hr•ft²•F	American (ASHRAE) Summer Solar Heat Gain Coefficient	American (ASHRAE) Summer Relative Heat Gain BTU/hr•ft²
Float Glass *(Available globally)*																
Clear/Clear	2.3 + 6A + 2.3	10.6	61	83	15	15	13	75	12	0.92	.87	.05	3.3	0.57	.79	192
	2.3 + 12A + 2.3	16.6								0.92	.87	.05	2.8	0.50	.79	191
	3 + 6A + 3	12	57	82	15	15	13	72	15	0.89	.83	.06	3.2	0.57	.77	187
	3 + 12A + 3	18								0.89	.83	.06	2.8	0.49	.77	182
	4 + 6A + 4	14	53	81	15	15	12	68	19	0.87	.80	.07	3.2	0.56	.75	182
	4 + 12A + 4	20								0.87	.80	.07	2.8	0.49	.75	178
	5 + 6A + 5	16	50	81	14	14	12	66	22	0.85	.76	.09	3.2	0.56	.73	178
	5 + 12A + 5	22								0.85	.76	.09	2.8	0.49	.73	178
	6 + 6A + 6	18	47	80	14	14	12	63	25	0.84	.73	.10	3.2	0.56	.71	174
	6 + 12A + 6	24								0.84	.73	.10	2.8	0.49	.71	173
	8 + 12A + 8	28	42	78	14	14	11	57	32	0.79	.67	.12	2.7	0.48	.68	166
	10 + 12A + 10	32	38	77	14	14	10	53	36	0.76	.62	.14	2.7	0.48	.65	160
Heat-Absorbing Float Glass *(May not be available at all manufacturing facilities)*																
Green/Clear	3 + 6A + 3	12	34	75	14	13	9	50	41	0.68	.58	.09	3.2	0.57	.59	145
	3 + 12A + 3	18								0.67	.58	.09	2.8	0.49	.58	143
	4 + 6A + 4	14	29	72	14	12	8	44	47	0.63	.52	.11	3.2	0.56	.54	134
	4 + 12A + 4	20								0.62	.52	.10	2.8	0.49	.53	132
	5 + 6A + 5	16	25	70	14	12	8	40	52	0.59	.47	.12	3.2	0.56	.50	126
	5 + 12A + 5	22								0.58	.47	.11	2.8	0.49	.50	123
	6 + 6A + 6	18	21	67	13	11	7	36	57	0.54	.41	.13	3.2	0.56	.47	118
	6 + 12A + 6	24								0.53	.41	.12	2.8	0.49	.46	115
	8 + 12A + 8	28	16	62	13	11	7	29	64	0.47	.34	.13	2.7	0.48	.41	103
Bronze/Clear	3 + 6A + 3	12	31	63	13	11	10	56	34	0.74	.65	.08	3.2	0.57	.64	158
	3 + 12A + 3	18								0.74	.65	.08	2.8	0.49	.64	156
	5 + 6A + 5	16	22	54	13	9	8	46	46	0.66	.54	.11	3.2	0.56	.56	140
	5 + 12A + 5	22								0.65	.54	.11	2.8	0.49	.56	138
	6 + 6A + 6	18	18	49	12	8	8	41	51	0.61	.47	.13	3.2	0.56	.52	131
	6 + 12A +6	24								0.60	.47	.13	2.8	0.49	.52	128
	8 + 12A + 8	28	13	41	12	7	7	33	61	0.53	.38	.15	2.7	0.48	.45	113
	10 + 12A + 10	32	9	35	12	6	6	27	67	0.47	.31	.15	2.7	0.48	.41	103
Gray/Clear	3 + 6A + 3	12	37	54	13	10	10	55	35	0.73	.64	.09	3.2	0.57	.63	155
	3 + 12A + 3	18								0.73	.64	.08	2.8	0.49	.63	153
	5 + 6A + 5	16	28	44	12	8	8	44	48	0.64	.52	.12	3.2	0.56	.55	137
	5 + 12A + 5	22								0.63	.52	.11	2.8	0.49	.54	135
	6 + 6A + 6	18	24	39	12	7	7	39	54	0.59	.45	.14	3.2	0.56	.51	126
	6 + 12A + 6	24								0.58	.45	.13	2.8	0.49	.50	124
	8 + 12A + 8	28	18	31	12	6	6	30	63	0.51	.35	.14	2.7	0.48	.44	109
	10 + 12A + 10	32	14	25	11	6	6	25	69	0.45	.29	.16	2.7	0.48	.39	98

See additional notes on page 42.

Guardian North American Performance Data *Single Glazing*

Type			Standard Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
						Reflectance					Shading Coefficient			Winter Nighttime	Winter Nighttime	Summer	
				Trans-mittance	Trans-mittance			Reflec-tance	Trans-mittance	Absorp-tance				K-Value	U-Value	Solar Heat Gain	Relative Heat Gain
Description	Coating	Substrate	mm	%	%	Indoors %	Outdoors %	% Out	%	%	Total	Short Wave	Long Wave	W/m²K	BTU/hr•ft²•F	Coefficient	BTU/hr•ft²
Heat-Reflective Glass *(Manufactured in Corsicana, Texas, USA)*																	
Transparent Clear	HR-74	Clear	6.0	49	74	22	21	15	70	15	0.87	0.82	.05	5.7	1.09	.75	188
			8.0	46	73	22	20	14	67	19	0.84	0.78	.06	5.7	1.08	.73	184
			10.0	43	72	22	20	13	65	22	0.83	0.76	.07	5.6	1.07	.71	180
			12.0	40	71	22	22	13	61	26	0.80	0.71	.09	5.5	1.05	.69	174
Transparent Green	HR-74	Green	6.0	19	62	21	16	9	36	54	0.60	0.42	.18	5.7	1.09	.52	136
			8.0	15	58	21	15	8	30	62	0.57	0.35	.22	5.7	1.08	.49	129
Transparent Bronze	HR-74	Bronze	6.0	17	45	21	11	8	45	46	0.68	0.53	.16	5.7	1.09	.59	151
			8.0	12	38	20	9	7	38	55	0.63	0.44	.19	5.7	1.08	.54	141
			10.0	9	33	20	8	6	32	61	0.59	0.37	.22	5.6	1.07	.51	134
Transparent Gray	HR-74	Gray	6.0	22	36	20	9	8	44	48	0.67	0.51	.16	5.7	1.09	.58	148
			8.0	17	28	20	7	7	36	57	0.62	0.42	.20	5.7	1.08	.53	139
			10.0	14	23	20	6	6	30	64	0.58	0.35	.22	5.6	1.07	.49	131
High-Performance Reflective Glass *(Manufactured in Corsicana, Texas, USA)*																	
Silver	SS-08	Clear	6.0	4	8	42	42	33	6	61	0.23	0.07	.16	4.4	0.85	.20	57
			8.0	3	8	42	41	31	6	63	0.23	0.07	.16	4.3	0.84	.20	58
			10.0	3	8	42	40	29	6	65	0.24	0.07	.17	4.3	0.84	.20	59
Silver	SS-14	Clear	6.0	7	14	35	31	26	11	63	0.30	0.12	.17	4.6	0.90	.26	72
			8.0	7	14	35	31	25	10	65	0.30	0.12	.18	4.6	0.89	.26	72
			10.0	6	14	35	30	23	10	67	0.30	0.11	.19	4.6	0.88	.26	73
Silver	SS-20	Clear	6.0	12	20	31	25	21	15	64	0.36	0.18	.19	4.9	0.95	.31	86
			8.0	11	20	31	25	20	15	65	0.36	0.17	.19	4.9	0.94	.31	86
			10.0	10	20	31	24	19	14	67	0.36	0.17	.20	4.9	0.93	.31	86
Silver	SS-22	Clear	6.0	12	22	31	21	19	17	64	0.39	0.20	.19	4.7	0.91	.33	91
			8.0	11	22	31	20	18	16	66	0.39	0.19	.20	4.6	0.90	.33	91
			10.0	10	22	31	20	17	16	67	0.39	0.18	.21	4.6	0.90	.34	91
Green	SS-08	Green*	6.0	2	7	42	31	15	3	81	0.25	0.04	.22	4.4	0.85	.22	63
			8.0	1	6	42	27	13	3	84	0.26	0.03	.22	4.3	0.84	.22	64
Green	SS-14	Green*	6.0	2	12	35	23	13	6	82	0.30	0.07	.23	4.6	0.90	.26	73
			8.0	2	11	35	21	11	5	84	0.30	0.06	.24	4.6	0.89	.25	72
Green	SS-20	Green*	6.0	5	17	31	19	11	9	81	0.34	0.10	.24	4.9	0.95	.29	82
			8.0	4	16	31	17	9	7	84	0.33	0.08	.25	4.9	0.94	.29	81
Bronze	SS-08	Bronze*	6.0	1	5	42	17	15	4	81	0.26	0.04	.21	4.4	0.85	.22	64
			8.0	1	4	42	13	12	3	85	0.26	0.04	.23	4.3	0.84	.23	65
Bronze	SS-14	Bronze*	6.0	3	8	35	14	13	6	81	0.30	0.07	.23	4.6	0.90	.26	73
			8.0	2	7	35	11	10	5	85	0.30	0.06	.24	4.6	0.89	.26	73
Bronze	SS-20	Bronze*	6.0	4	12	31	11	11	9	80	0.35	0.11	.24	4.9	0.95	.30	83
			8.0	3	10	31	9	9	8	84	0.34	0.90	.25	4.9	0.94	.29	82

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Single Glazing*

Type			Standard Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
						Reflectance					Shading Coefficient			Winter Nighttime	Winter Nighttime	Summer	
														K-Value	U-Value		
Description	Coating	Substrate	mm	Trans-mittance %	Trans-mittance %	Indoors %	Outdoors %	Reflec-tance % Out	Trans-mittance %	Absorp-tance %	Total	Short Wave	Long Wave	W/m²K	BTU/hr•ft²•F	Solar Heat Gain Coefficient	Relative Heat Gain BTU/hr•ft²
High-Performance Reflective Glass (Cont.) *(Manufactured in Corsicana, Texas, USA)*																	
Misty Gray	CP-20	Gray*	6.0 8.0	7 6	10 8	41 41	8 6	8 7	12 9	80 84	0.37 0.36	0.14 0.11	.24 .25	4.9 4.9	0.95 0.94	.32 .31	89 86
Misty Gray	CP-35	Gray*	6.0 8.0	12 9	17 13	26 26	6 5	6 5	19 15	75 79	0.46 0.43	0.22 0.18	.24 .25	5.3 5.3	1.02 1.01	.39 .37	106 101
Pewter Blue	CP-08	Blue*	6.0	3	3	53	16	12	4	83	0.27	0.05	.22	4.4	0.86	.23	67
Pewter Blue	CP-14	Blue*	6.0	6	9	47	12	10	8	82	0.33	0.09	.23	4.7	0.91	.28	78
Pewter Blue	CP-20	Blue*	6.0	8	13	41	10	8	11	80	0.37	0.13	.24	4.9	0.95	.32	88
Pewter Blue	CP-35	Blue*	6.0	14	23	26	7	6	18	76	0.45	0.21	.24	5.3	1.02	.39	106
Pewter Tourmaline Blue-Green	CP-08	Azurlite®*	6.0	3	6	53	22	11	3	86	0.27	0.03	.23	4.4	0.86	.23	66
	CP-14		6.0	5	11	47	17	9	5	86	0.31	0.06	.24	4.7	0.91	.26	75
	CP-20		6.0	7	16	41	14	8	8	85	0.34	0.09	.25	4.9	0.95	.29	82
	CP-35		6.0	11	28	26	8	6	13	81	0.41	0.15	.26	5.3	1.02	.36	97
Bronze	CB-08	Clear	6.0 8.0 10.0	5 5 5	8 8 8	55 55 55	29 28 28	26 24 23	7 7 6	67 69 71	0.26 0.26 0.26	0.08 0.08 0.08	.18 .18 .19	4.4 4.4 4.4	0.86 0.85 0.85	.22 .23 .23	64 65 65
Bronze	CB-14	Clear	6.0 8.0 10.0	11 10 10	14 14 14	50 50 50	21 20 20	19 17 16	13 12 11	69 71 72	0.34 0.34 0.34	0.15 0.14 0.13	.19 .20 .20	4.7 4.7 4.6	0.91 0.90 0.89	.29 .29 .29	81 80 80
Bronze	CB-20	Clear	6.0 8.0 10.0	14 13 12	20 20 20	44 44 44	15 14 14	13 12 12	19 18 17	68 70 71	0.42 0.41 0.41	0.22 0.21 0.20	.20 .21 .21	4.9 4.9 4.8	0.95 0.94 0.93	.36 .35 .35	97 96 95
Sandstone Green	CB-08	Green*	6.0 8.0	2 2	7 6	55 55	21 19	11 10	4 3	85 87	0.27 0.27	0.04 0.04	.23 .24	4.4 4.4	0.86 0.85	.23 .23	67 67
Sandstone Green	CB-14	Green*	6.0 8.0	5 3	12 11	50 50	16 14	9 8	7 5	84 87	0.32 0.31	0.08 0.06	.24 .25	4.7 4.7	0.91 0.90	.27 .27	77 76
Sandstone Green	CB-20	Green*	6.0 8.0	6 4	17 16	44 44	11 11	7 6	10 8	83 85	0.36 0.35	0.11 0.09	.25 .26	4.9 4.9	0.95 0.94	.31 .30	86 83
Harvest Bronze	CB-08	Bronze*	6.0 8.0	2 1	5 4	55 55	13 10	13 10	4 3	83 87	0.27 0.27	0.05 0.04	.22 .23	4.4 4.4	0.86 0.85	.23 .24	67 67
Harvest Bronze	CB-14	Bronze*	6.0 8.0	4 3	8 7	50 50	10 8	10 8	8 6	83 86	0.32 0.32	0.09 0.07	.24 .25	4.7 4.7	0.91 0.90	.28 .27	78 77
Harvest Bronze	CB-20	Bronze*	6.0 8.0	5 4	12 10	44 44	8 7	8 7	11 9	81 84	0.37 0.36	0.13 0.11	.24 .25	4.9 4.9	0.95 0.94	.32 .31	88 86

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Charren Gray	CB-08	Gray*	6.0 8.0	3 2	4 3	55 55	10 8	13 10	4 3	83 87	0.27 0.27	0.05 0.04	.22 .23	4.4 4.4	0.86 0.85	.23 .24	67 67
Charren Gray	CB-14	Gray*	6.0 8.0	5 4	7 5	50 50	8 7	10 8	8 6	83 86	0.32 0.32	0.09 0.07	.24 .25	4.7 4.7	0.91 0.90	.28 .27	78 77
Charren Gray	CB-20	Gray*	6.0 8.0	7 5	10 8	44 44	7 6	8 7	11 9	81 84	0.37 0.36	0.13 0.11	.24 .25	4.9 4.9	0.95 0.94	.32 .31	88 85
Royal	CR-08	Clear	6.0 8.0 10.0	3 3 3	8 8 8	55 55 55	26 25 25	22 21 20	8 8 7	70 71 73	0.28 0.28 0.28	0.09 0.09 0.09	.18 .19 .20	4.4 4.4 4.4	0.86 0.85 0.85	.24 .24 .24	68 68 68
Royal	CR-14	Clear	6.0 8.0 10.0	6 6 6	14 14 14	50 50 50	18 18 18	15 14 14	13 13 12	72 73 74	0.35 0.35 0.35	0.15 0.15 0.14	20 21 21	4.7 4.7 4.6	0.91 0.90 0.89	.31 .30 .30	84 83 83
Royal	CR-20	Clear	6.0 8.0 10.0	10 10 9	20 20 20	44 44 44	13 13 12	12 12 11	18 17 17	69 71 72	0.42 0.41 0.41	0.21 0.20 0.20	.20 .21 .21	4.9 4.9 4.9	0.95 0.94 0.93	.36 .36 .35	97 96 95
Royal	CR-35	Clear	6.0 8.0 10.0	18 17 16	35 35 34	28 28 28	8 8 8	7 7 6	31 30 29	62 64 65	0.56 0.54 0.54	0.36 0.34 0.33	.19 .20 .20	5.3 5.2 5.2	1.01 1.00 0.99	.48 .47 .46	126 123 121
Royal Teal	CR-08	Green*	6.0 8.0	1 1	7 6	55 55	19 18	11 10	4 3	85 87	0.28 0.27	0.05 0.04	.23 .24	4.4 4.4	0.86 0.85	.24 .24	68 67
Royal Teal	CR-14	Green*	6.0 8.0	3 2	12 11	50 50	14 13	9 8	7 6	85 87	0.32 0.31	0.08 0.06	.24 .25	4.7 4.7	0.91 0.90	.28 .27	77 76
Royal Teal	CR-20	Green*	6.0 8.0	4 3	17 16	44 44	10 10	7 7	10 8	83 85	0.36 0.35	0.11 0.09	.25 .26	4.9 4.9	0.95 0.94	.31 .30	86 83
Royal Teal	CR-35	Green*	6.0 8.0	8 6	29 27	27 27	7 7	5 5	17 14	78 81	0.44 0.42	0.19 0.16	.25 .26	5.3 5.2	1.01 1.00	.38 .36	103 98
Royal Indigo Gray	CR-08	Gray*	6.0 8.0	2 1	4 3	55 55	9 7	11 9	5 4	84 87	0.28 0.28	0.06 0.05	.23 .24	4.4 4.4	0.86 0.85	.24 .24	69 69
Royal Indigo Gray	CR-14	Gray*	6.0 8.0	3 2	7 5	50 50	8 6	8 7	8 7	84 87	0.33 0.32	0.09 0.08	.24 .25	4.7 4.7	0.91 0.90	.29 .28	80 78
Royal Indigo Gray	CR-20	Gray*	6.0 8.0	5 4	10 8	43 43	6 5	7 6	11 9	82 85	0.37 0.36	0.13 0.11	.24 .25	4.9 4.9	0.95 0.94	.32 .31	89 86
Royal Indigo Gray	CR-35	Gray*	6.0 8.0	9 7	17 13	27 27	5 5	5 5	19 15	76 80	0.46 0.43	0.22 0.18	.24 .25	5.3 5.2	1.01 1.00	.40 .37	107 101
Cobalt Blue	CR-08	Blue*	6.0	2	5	55	13	11	5	84	0.28	0.25	.23	4.4	0.86	.24	69
Cobalt Blue	CR-14	Blue*	6.0	3	9	50	10	9	8	84	0.33	0.09	.24	4.7	0.91	.28	79
Cobalt Blue	CR-20	Blue*	6.0	6	13	43	8	7	11	82	0.37	0.12	.24	4.9	0.95	.32	88
Cobalt Blue	CR-35	Blue*	6.0	10	23	27	6	5	18	76	0.45	0.21	.24	5.3	1.01	.39	106
Royal Tourmaline Blue-Green	CR-08	Azurlite®*	6.0	1	6	55	19	10	3	87	0.27	0.03	.23	4.4	0.86	.23	66
	CR-14		6.0	3	11	50	14	8	5	87	0.31	0.06	.25	4.7	0.91	.26	75
	CR-20		6.0	5	16	44	10	7	7	86	0.34	0.09	.26	4.9	0.95	.29	82
	CR-35		6.0	8	28	27	7	5	13	82	0.41	0.15	.26	5.3	1.01	.35	97

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Single Glazing*

Type			Standard Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
						Reflectance					Shading Coefficient			Winter Nighttime K-Value	Winter Nighttime U-Value	Summer	
Description	Coating	Substrate	mm	Trans-mittance %	Trans-mittance %	Indoors %	Outdoors %	Reflec-tance % Out	Trans-mittance %	Absorp-tance %	Total	Short Wave	Long Wave	W/m²K	BTU/hr•ft²•F	Solar Heat Gain Coefficient	Relative Heat Gain BTU/hr•ft²
High-Performance Reflective Glass (Cont.) *(Manufactured in Corsicana, Texas, USA)*																	
Platinum	SP-13	Clear	6.0	10	13	43	29	22	11	66	0.32	0.13	.18	4.7	0.91	.27	76
			8.0	9	13	43	29	21	11	68	0.32	0.13	.19	4.6	0.90	.27	76
			10.0	8	13	43	28	20	10	69	0.32	0.12	.20	4.6	0.89	.27	76
Platinum	SP-18	Clear	6.0	15	18	38	24	20	16	64	0.37	0.18	.18	4.9	0.94	.32	87
			8.0	14	18	38	24	19	15	66	0.36	0.17	.19	4.8	0.93	.31	86
			10.0	13	18	38	23	18	14	68	0.36	0.17	.20	4.8	0.92	.31	86
Platinum	SP-22	Clear	6.0	18	22	36	19	16	19	65	0.42	0.23	.19	5.0	0.96	.36	97
			8.0	17	22	36	19	15	19	66	0.41	0.22	.20	4.9	0.95	.35	96
			10.0	16	22	36	19	14	18	68	0.41	0.21	.20	4.9	0.94	.35	95
Platinum	SP-33	Clear	6.0	26	33	27	11	9	29	62	0.53	0.34	.19	5.2	1.00	.45	119
			8.0	24	33	27	11	9	28	63	0.52	0.32	.20	5.2	0.99	.44	117
			10.0	23	32	27	11	9	27	65	0.51	0.31	.20	5.1	0.98	.44	116
Serenity Green	SP-13	Green*	6.0	4	11	43	22	11	6	82	0.31	0.07	.23	4.7	0.91	.26	74
			8.0	3	10	43	20	10	5	85	0.30	0.06	.24	4.6	0.90	.26	73
Serenity Green	SP-18	Green*	6.0	6	15	38	18	10	8	81	0.34	0.10	.24	4.9	0.94	.29	81
			8.0	5	14	38	17	9	7	84	0.33	0.08	.25	4.8	0.93	.28	79
Serenity Green	SP-22	Green*	6.0	7	19	36	15	9	10	81	0.36	0.12	.24	5.0	0.96	.31	87
			8.0	6	17	36	14	8	9	84	0.35	0.10	.25	4.9	0.95	.30	84
Serenity Green	SP-33	Green*	6.0	11	28	27	9	6	16	78	0.43	0.18	.25	5.2	1.00	.37	100
			8.0	8	26	27	8	6	13	81	0.41	0.15	.26	5.2	0.99	.35	96
Satin Bronze	SP-13	Bronze*	6.0	3	8	43	13	11	7	82	0.31	0.08	.23	4.7	0.91	.27	76
			8.0	2	7	43	10	9	6	85	0.31	0.07	.24	4.6	0.90	.27	75
Satin Bronze	SP-18	Bronze*	6.0	5	11	38	11	10	9	80	0.35	0.11	.24	4.9	0.94	.30	83
			8.0	4	9	38	9	8	8	84	0.34	0.09	.25	4.8	0.93	.29	81
Satin Bronze	SP-22	Bronze*	6.0	6	13	35	10	9	12	80	0.38	0.14	.24	5.0	0.96	.32	89
			8.0	5	11	35	8	7	10	83	0.36	0.11	.25	4.9	0.95	.31	86
Satin Bronze	SP-33	Bronze*	6.0	9	20	27	7	6	18	76	0.44	0.20	.24	5.2	1.00	.38	103
			8.0	7	16	27	6	6	14	80	0.42	0.17	.25	5.2	0.99	.36	98
Starlite Gray	SP-13	Gray*	6.0	4	6	43	10	11	7	82	0.31	0.08	.23	4.7	0.91	.27	76
			8.0	3	5	43	8	9	6	86	0.31	0.06	.24	4.6	0.90	.27	75
Starlite Gray	SP-18	Gray*	6.0	7	9	38	9	10	9	80	0.35	0.11	.24	4.9	0.94	.30	83
			8.0	5	7	38	7	8	8	84	0.34	0.09	.25	4.8	0.93	.29	81
Starlite Gray	SP-22	Gray*	6.0	8	11	35	8	8	12	80	0.38	0.14	.24	5.0	0.96	.32	89
			8.0	6	8	35	6	7	10	83	0.36	0.11	.25	4.9	0.95	.31	86
Starlite Gray	SP-33	Gray*	6.0	12	16	27	6	6	17	76	0.44	0.20	.24	5.2	1.00	.38	103
			8.0	9	13	27	5	5	14	80	0.42	0.16	.25	5.2	0.99	.36	98

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Laminated Glass*

Type: Description Coating (Substrate)	0.76mm PVB interlayer (mm + mm)	Total Thickness (mm)	U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflectance Indoors %	Visible Light Reflectance Outdoors %	Solar Energy Reflec-tance % Out	Solar Energy Trans-mittance %	Solar Energy Absorp-tance %	Shading Coefficient Total	Shading Coefficient Short Wave	Shading Coefficient Long Wave	European Winter Nighttime K-Value W/m²K	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F	American (ASHRAE) Summer Solar Heat Gain Coefficient	American (ASHRAE) Summer Relative Heat Gain BTU/hr•ft²
Float Glass *(Available globally)*																
Clear/Clear	3 + 3	6.8	1	89	8	8	7	73	21	0.91	0.84	.06	5.6	1.06	.78	197
	4 + 4	8.8	1	88	8	8	7	69	24	0.89	0.81	.08	5.6	1.05	.76	192
	5 + 5	10.8	1	87	8	8	6	67	27	0.87	0.78	.09	5.5	1.04	.74	187
	6 + 6	12.8	1	86	8	8	6	64	30	0.84	0.74	.10	5.4	1.03	.72	182
	8 + 8	16.8	<1	85	8	8	6	58	36	0.80	0.68	.12	5.3	1.01	.69	174
Tinted (Colored) Float Glass *(May not be available at all manufacturing facilities)*																
Green/Clear	3 + 3	6.8	<1	81	7	7	6	51	43	0.73	0.60	.14	5.6	1.06	.63	162
	4 + 4	8.8	<1	78	7	7	6	45	49	0.69	0.53	.16	5.6	1.05	.59	152
	5 + 5	10.8	<1	75	7	7	5	41	54	0.65	0.48	.17	5.5	1.04	.56	145
	6 + 6	12.8	<1	72	7	7	5	36	58	0.61	0.42	.19	5.4	1.03	.52	137
	8 + 8	16.8	<1	67	6	6	5	30	65	0.56	0.35	.20	5.3	1.01	.48	125
Bronze/Clear	3 + 3	6.8	<1	68	6	7	6	57	37	0.78	0.66	.12	5.6	1.06	.67	171
	4 + 4	8.8	<1	63	6	6	6	52	42	0.74	0.60	.14	5.6	1.05	.64	163
	5 + 5	10.8	<1	58	6	6	5	47	48	0.70	0.55	.15	5.5	1.04	.60	155
	6 + 6	12.8	<1	53	6	6	5	42	53	0.66	0.48	.17	5.4	1.03	.56	146
Gray/Clear	3 + 3	6.8	<1	61	6	6	6	55	39	0.77	0.65	.12	5.6	1.06	.66	169
	4 + 4	8.8	<1	55	6	6	6	50	44	0.73	0.58	.14	5.6	1.05	.62	160
	5 + 5	10.8	<1	49	5	6	5	45	50	0.68	0.52	.16	5.5	1.04	.59	151
	6 + 6	12.8	<1	43	5	5	5	39	56	0.64	0.46	.18	5.4	1.03	.55	142
High-Performance Reflective Glass *(Manufactured in Corsicana, Texas, USA)*																
Silver SS-08 Clear	5 + 5	10.8	<1	9	25	42	36	6	58	.27	.07	.20	5.5	1.04	.23	68
	6 + 6	12.8	<1	9	25	41	34	6	60	.27	.07	.20	5.4	1.03	.23	69
Silver SS-14 Clear	5 + 5	10.8	<1	16	24	32	30	11	59	.33	.13	.20	5.5	1.04	.28	81
	6 + 6	12.8	<1	16	23	32	29	11	61	.33	.12	.21	5.4	1.03	.28	81
Silver SS-20 Clear	5 + 5	10.8	<1	22	21	27	25	16	62	.40	.19	.21	5.5	1.04	.35	96
	6 + 6	12.8	<1	22	21	27	24	16	64	.40	.18	.22	5.4	1.03	.34	95
Pewter CP-08 Clear	5 + 5	10.8	<1	10	38	38	35	8	57	.28	.09	.19	5.5	1.04	.24	71
	6 + 6	12.8	<1	10	37	37	33	7	59	.28	.08	.20	5.4	1.03	.24	72
Pewter CP-14 Clear	5 + 5	10.8	<1	16	29	28	25	13	62	.36	.15	.21	5.5	1.04	.31	87
	6 + 6	12.8	<1	16	29	27	24	12	63	.36	.14	.22	5.4	1.03	.31	86
Pewter CP-20 Clear	5 + 5	10.8	<1	23	25	23	21	18	61	.41	.21	.21	5.5	1.04	.36	98
	6 + 6	12.8	<1	23	25	23	20	17	73	.41	.20	.21	5.4	1.03	.35	97
Silver Blue TS-20 Clear	5 + 5	10.8	<1	23	21	23	26	14	59	.37	.17	.20	5.5	1.04	.32	88
	6 + 6	12.8	<1	22	21	23	25	14	61	.37	.16	.21	5.4	1.03	.32	88
Blue TS-30 Clear	5 + 5	10.8	<1	34	18	19	19	23	58	.46	.26	.20	5.5	1.04	.40	107
	6 + 6	12.8	<1	34	18	19	19	22	60	.45	.25	.20	5.4	1.03	.39	106
Deep Blue TS-40 Clear	5 + 5	10.8	<1	43	13	13	13	30	57	.54	.34	.20	5.5	1.04	.46	123
	6 + 6	12.8	<1	42	13	13	13	28	59	.53	.33	.20	5.4	1.03	.46	121

See additional notes on page 42.

Guardian North American Performance Data *Laminated Glass*

Type: Description Coating (Substrate)	0.76mm PVB interlayer: mm + mm	Total Thickness: mm	U.V. Transmittance %	Visible Light Transmittance %	Visible Light Reflectance Indoors %	Visible Light Reflectance Outdoors %	Solar Energy Reflectance % Out	Solar Energy Transmittance %	Solar Energy Absorptance %	Shading Coefficient Total	Shading Coefficient Short Wave	Shading Coefficient Long Wave	European Winter Nighttime K-Value W/m²K	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F	American (ASHRAE) Summer Solar Heat Gain Coefficient	American (ASHRAE) Summer Relative Heat Gain BTU/hr•ft²
Float Glass *(Available globally)*																
Clear/Clear	3 + 3	6.8	1	89	8	8	7	73	21	0.91	0.84	.06	5.6	1.06	.78	197
	4 + 4	8.8	1	88	8	8	7	69	24	0.89	0.81	.08	5.6	1.05	.76	192
	5 + 5	10.8	1	87	8	8	6	67	27	0.87	0.78	.09	5.5	1.04	.74	187
	6 + 6	12.8	1	86	8	8	6	64	30	0.84	0.74	.10	5.4	1.03	.72	182
	8 + 8	16.8	<1	85	8	8	6	58	36	0.80	0.68	.12	5.3	1.01	.69	174
Tinted (Colored) Float Glass *(May not be available at all manufacturing facilities)*																
Green/Clear	3 + 3	6.8	<1	81	7	7	6	51	43	0.73	0.60	.14	5.6	1.06	.63	162
	4 + 4	8.8	<1	78	7	7	6	45	49	0.69	0.53	.16	5.6	1.05	.59	152
	5 + 5	10.8	<1	75	7	7	5	41	54	0.65	0.48	.17	5.5	1.04	.56	145
	6 + 6	12.8	<1	72	7	7	5	36	58	0.61	0.42	.19	5.4	1.03	.52	137
	8 + 8	16.8	<1	67	6	6	5	30	65	0.56	0.35	.20	5.3	1.01	.48	125
Bronze/Clear	3 + 3	6.8	<1	68	6	7	6	57	37	0.78	0.66	.12	5.6	1.06	.67	171
	4 + 4	8.8	<1	63	6	6	6	52	42	0.74	0.60	.14	5.6	1.05	.64	163
	5 + 5	10.8	<1	58	6	6	5	47	48	0.70	0.55	.15	5.5	1.04	.60	155
	6 + 6	12.8	<1	53	6	6	5	42	53	0.66	0.48	.17	5.4	1.03	.56	146
Gray/Clear	3 + 3	6.8	<1	61	6	6	6	55	39	0.77	0.65	.12	5.6	1.06	.66	169
	4 + 4	8.8	<1	55	6	6	6	50	44	0.73	0.58	.14	5.6	1.05	.62	160
	5 + 5	10.8	<1	49	5	6	5	45	50	0.68	0.52	.16	5.5	1.04	.59	151
	6 + 6	12.8	<1	43	5	5	5	39	56	0.64	0.46	.18	5.4	1.03	.55	142
High-Performance Reflective Glass *(Manufactured in Corsicana, Texas, USA)*																
Silver	5 + 5	10.8	<1	9	25	42	36	6	58	.27	.07	.20	5.5	1.04	.23	68
SS-08 Clear	6 + 6	12.8	<1	9	25	41	34	6	60	.27	.07	.20	5.4	1.03	.23	69
Silver	5 + 5	10.8	<1	16	24	32	30	11	59	.33	.13	.20	5.5	1.04	.28	81
SS-14 Clear	6 + 6	12.8	<1	16	23	32	29	11	61	.33	.12	.21	5.4	1.03	.28	81
Silver	5 + 5	10.8	<1	22	21	27	25	16	62	.40	.19	.21	5.5	1.04	.35	96
SS-20 Clear	6 + 6	12.8	<1	22	21	27	24	16	64	.40	.18	.22	5.4	1.03	.34	95
Pewter	5 + 5	10.8	<1	10	38	38	35	8	57	.28	.09	.19	5.5	1.04	.24	71
CP-08 Clear	6 + 6	12.8	<1	10	37	37	33	7	59	.28	.08	.20	5.4	1.03	.24	72
Pewter	5 + 5	10.8	<1	16	29	28	25	13	62	.36	.15	.21	5.5	1.04	.31	87
CP-14 Clear	6 + 6	12.8	<1	16	29	27	24	12	63	.36	.14	.22	5.4	1.03	.31	86
Pewter	5 + 5	10.8	<1	23	25	23	21	18	61	.41	.21	.21	5.5	1.04	.36	98
CP-20 Clear	6 + 6	12.8	<1	23	25	23	20	17	73	.41	.20	.21	5.4	1.03	.35	97
Silver Blue	5 + 5	10.8	<1	23	21	23	26	14	59	.37	.17	.20	5.5	1.04	.32	88
TS-20 Clear	6 + 6	12.8	<1	22	21	23	25	14	61	.37	.16	.21	5.4	1.03	.32	88
Blue	5 + 5	10.8	<1	34	18	19	19	23	58	.46	.26	.20	5.5	1.04	.40	107
TS-30 Clear	6 + 6	12.8	<1	34	18	19	19	22	60	.45	.25	.20	5.4	1.03	.39	106
Deep Blue	5 + 5	10.8	<1	43	13	13	13	30	57	.54	.34	.20	5.5	1.04	.46	123
TS-40 Clear	6 + 6	12.8	<1	42	13	13	13	28	59	.53	.33	.20	5.4	1.03	.46	121

See additional notes on page 42.

Sterling Blue	SS-08	Blue*	6 + 6	24	2	5	42	20	15	3	82	0.15	.04	.12	2.1	0.39	.13	37
	SS-14		6 + 6	24	3	8	36	16	13	5	82	0.19	.06	.13	2.2	0.41	.16	45
	SS-20		6 + 6	24	5	12	33	13	11	8	82	0.23	.09	.14	2.2	0.44	.19	53
Tourmaline Blue-Green	SS-08	Azurlite**	6 + 6	24	1	6	42	29	14	2	84	0.15	.03	.12	2.1	0.39	.13	36
	SS-14		6 + 6	24	3	10	36	22	11	4	84	0.18	.05	.13	2.2	0.41	.15	43
	SS-20		6 + 6	24	4	15	33	18	10	6	84	0.21	.07	.14	2.2	0.44	.18	49

Sterling	CS-08	Clear	6 + 6	24	5	7	40	43	34	5	60	0.15	.06	.09	2.1	0.39	.13	36
			8 + 8	28	5	7	40	42	32	5	63	0.15	.06	.09	2.1	0.39	.13	37
Sterling	CS-14	Clear	6 + 6	24	9	13	38	33	27	10	63	0.22	.11	.10	2.1	0.41	.19	50
			8 + 8	28	8	13	38	32	25	9	66	0.22	.11	.11	2.1	0.41	.19	50
Sterling	CS-20	Clear	6 + 6	24	12	18	34	27	22	14	64	0.27	.16	.11	2.2	0.42	.24	62
			8 + 8	28	11	18	34	27	20	13	66	0.27	.16	.11	2.2	0.42	.23	61
Sterling	CS-35	Clear	6 + 6	24	20	32	23	17	14	25	62	0.41	.29	.12	2.3	0.45	.35	89
			8 + 8	28	18	31	23	17	13	24	63	0.40	.27	.13	2.3	0.45	.34	88

Silver-Blue	TS-20	Clear	6 + 6	24	6	18	35	23	22	11	67	0.24	.13	.11	2.2	0.42	.21	55
			8 + 8	28	5	18	35	23	20	11	69	0.24	.13	.11	2.1	0.41	.21	55
Blue	TS-30	Clear	6 + 6	24	9	27	31	17	15	19	66	0.34	.22	.12	2.2	0.44	.29	76
			8 + 8	28	8	27	31	17	14	18	68	0.34	.21	.12	2.2	0.44	.29	74
Deep-Blue	TS-40	Clear	6 + 6	24	14	36	26	11	11	26	63	0.43	.30	.13	2.3	0.45	.37	93
			8 + 8	28	13	36	26	11	10	25	65	0.42	.29	.13	2.3	0.45	.36	91
Blue-Green	TS-20	Green*	6 + 6	24	3	15	34	18	10	7	83	0.21	.08	.13	2.2	0.42	.18	49
			8 + 8	28	2	14	34	16	9	6	85	0.20	.07	.13	2.1	0.41	.17	47
Blue-Green	TS-30	Green*	6 + 6	24	4	23	31	14	8	11	81	0.26	.13	.14	2.2	0.44	.23	60
			8 + 8	28	3	21	31	13	8	9	83	0.25	.11	.14	2.2	0.44	.21	57
Blue-Green	TS-40	Green*	6 + 6	24	6	30	26	9	7	15	79	0.31	.17	.14	2.3	0.45	.27	70
			8 + 8	28	5	28	26	8	6	13	81	0.29	.15	.14	2.3	0.45	.25	66
Silver Blue-Gray	TS-20	Gray*	6 + 6	24	3	9	34	9	11	7	82	0.21	.08	.13	2.2	0.42	.18	49
			8 + 8	28	2	7	34	7	9	5	86	0.20	.06	.14	2.2	0.41	.17	47
Sapphire Blue-Gray	TS-30	Gray*	6 + 6	24	5	13	31	7	8	11	81	0.27	.13	.14	2.2	0.44	.23	62
			8 + 8	28	4	10	31	6	7	9	84	0.25	.11	.15	2.2	0.44	.22	58
Soft Blue-Gray	TS-40	Gray*	6 + 6	24	7	18	26	6	7	15	78	0.32	.18	.15	2.3	0.45	.28	72
			8 + 8	28	5	14	25	5	6	12	82	0.30	.14	.15	2.3	0.45	.25	67
Sapphire Blue	TS-20	Blue*	6 + 6	24	3	12	34	12	11	7	83	0.21	.08	.13	2.2	0.42	.18	49
	TS-30		6 + 6	24	5	18	31	10	8	11	80	0.27	.13	.14	2.2	0.44	.23	61
	TS-40		6 + 6	24	8	23	26	7	7	15	78	0.32	.18	.14	2.3	0.45	.28	72
Sapphire Azurlite	TS-20	Azurlite**	6 + 6	24	3	15	34	17	9	6	85	0.20	.07	.13	2.2	0.42	.17	47
	TS-30		6 + 6	24	5	22	31	13	8	9	83	0.24	.10	.14	2.2	0.44	.21	56
	TS-40		6 + 6	24	7	29	26	9	6	12	82	0.28	.14	.14	2.3	0.45	.24	64

Pewter	CP-08	Clear	6 + 6	24	5	7	52	32	27	6	67	0.17	.07	.10	2.1	0.40	.15	41
			8 + 8	28	4	7	52	31	25	6	69	0.17	.07	.11	2.1	0.39	.15	41
Pewter	CP-14	Clear	6 + 6	24	8	13	47	24	20	11	69	0.25	.13	.12	2.2	0.42	.21	56
			8 + 8	28	7	13	47	24	19	11	71	0.24	.12	.12	2.2	0.41	.21	55
Pewter	CP-20	Clear	6 + 6	24	12	18	42	19	16	16	68	0.31	.18	.12	2.2	0.44	.26	69
			8 + 8	28	11	18	42	19	15	15	70	0.30	.18	.13	2.2	0.43	.26	68
Pewter	CP-35	Clear	6 + 6	24	19	32	29	11	10	25	65	0.43	.30	.13	2.3	0.46	.37	93
			8 + 8	28	17	31	29	11	9	24	66	0.42	.28	.13	2.3	0.45	.36	91

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Double Glazing*

Type			12mm Airspace	Total Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
															Winter Nighttime	Winter Nighttime	Summer	
					Trans-mittance	Trans-mittance	Reflectance		Reflec-tance	Trans-mittance	Absorp-tance	Shading Coefficient			K-Value (air)	U-Value (air)	Solar Heat Gain Coefficient	Relative Heat Gain
Description	Coating	Outboard Lite	mm + mm	mm	%	%	Indoors %	Outdoors %	% Out	%	%	Total	Short Wave	Long Wave	W/m²K	BTU/hr•ft²•F		BTU/hr•ft²
High-Performance Reflective Glass (Cont.) *(Manufactured in Carsicana, Texas, USA)*																		
Misty Green	CP-08	Green*	6 + 6	24	2	6	52	24	12	3	84	0.16	.04	.12	2.1	0.40	.14	39
			8 + 8	28	2	6	52	21	11	3	87	0.16	.03	.13	2.1	0.39	.14	39
Misty Green	CP-14	Green*	6 + 6	24	8	11	47	18	10	6	84	0.20	.07	.13	2.2	0.42	.17	48
			8 + 8	28	7	10	47	16	9	5	86	0.20	.06	.14	2.2	0.41	.17	46
Misty Green	CP-20	Green*	6 + 6	24	5	15	42	15	9	9	83	0.24	.10	.14	2.2	0.44	.20	55
			8 + 8	28	4	14	42	14	8	7	85	0.23	.08	.14	2.2	0.43	.19	52
Misty Bronze	CP-08	Bronze*	6 + 6	24	2	4	52	14	13	4	83	0.17	.04	.12	2.1	0.40	.14	40
			8 + 8	28	1	4	52	11	10	3	87	0.17	.04	.13	2.1	0.39	.14	40
Misty Bronze	CP-14	Bronze*	6 + 6	24	3	8	47	11	10	7	83	0.21	.08	.13	2.2	0.42	.18	50
			8 + 8	28	2	6	47	9	8	6	86	0.20	.06	.14	2.2	0.41	.18	48
Misty Bronze	CP-20	Bronze*	6 + 6	24	5	11	42	10	9	10	82	0.25	.11	.14	2.2	0.44	.22	58
			8 + 8	28	3	9	42	8	7	8	85	0.24	.09	.15	2.2	0.43	.20	55
Misty Gray	CP-08	Gray*	6 + 6	24	2	4	52	11	13	4	84	0.17	.04	.12	2.1	0.40	.14	40
			8 + 8	28	2	3	52	8	10	3	87	0.16	.03	.13	2.1	0.39	.14	40
Misty Gray	CP-14	Gray*	6 + 6	24	4	6	47	9	10	7	83	0.21	.08	.14	2.2	0.42	.18	50
			8 + 8	28	3	5	47	7	8	5	86	0.20	.06	.14	2.2	0.41	.18	48
Misty Gray	CP-20	Gray*	6 + 6	24	6	9	42	8	8	10	82	0.25	.11	.14	2.2	0.44	.22	58
			8 + 8	28	4	7	42	6	7	8	85	0.24	.09	.15	2.2	0.43	.20	55
Pewter Blue	CP-08	Blue*	6 + 6	24	3	5	52	16	12	4	84	0.17	.04	.12	2.1	0.40	.14	40
Pewter Blue	CP-14	Blue*	6 + 6	24	5	8	47	13	10	7	83	0.21	.08	.13	2.2	0.42	.18	49
Pewter Blue	CP-20	Blue*	6 + 6	24	7	12	42	11	8	9	82	0.25	.11	.14	2.2	0.44	.21	57
Pewter Tourmaline Blue-Green	CP-08	Azurlite®*	6 + 6	24	2	6	52	22	11	3	87	0.16	.03	.13	2.1	0.40	.14	38
	CP-14		6 + 6	24	4	10	47	17	9	5	86	0.19	.06	.13	2.2	0.42	.16	45
	CP-20		6 + 6	24	6	15	42	14	8	7	85	0.22	.08	.14	2.2	0.44	.19	51
	CP-35		6 + 6	24	9	26	29	9	6	12	83	0.28	.13	.15	2.3	0.46	.24	64
Bronze	CB-08	Clear	6 + 6	24	4	7	54	29	26	6	68	0.17	.07	.10	2.1	0.40	.15	41
			8 + 8	28	4	7	54	28	24	6	70	0.17	.07	.11	2.1	0.39	.15	41
Bronze	CB-14	Clear	6 + 6	24	8	13	49	21	19	10	71	0.24	.12	.12	2.2	0.42	.21	55
			8 + 8	28	8	13	49	20	17	10	73	0.24	.12	.12	2.2	0.41	.20	54
Bronze	CB-20	Clear	6 + 6	24	11	18	44	15	13	15	71	0.31	.18	.13	2.2	0.43	.26	69
			8 + 8	28	10	18	44	15	13	15	73	0.30	.17	.13	2.2	0.43	.26	68
Sandstone Green	CB-08	Green*	6 + 6	24	2	6	54	21	11	3	85	0.16	.04	.13	2.1	0.40	.14	39
			8 + 8	28	1	6	54	19	10	3	88	0.16	.03	.13	2.1	0.39	.14	39
Sandstone Green	CB-14	Green*	6 + 6	24	4	11	49	16	9	6	85	0.20	.07	.13	2.2	0.42	.17	47
			8 + 8	28	3	10	49	14	8	5	87	0.19	.06	.14	2.2	0.41	.17	46
Sandstone Green	CB-20	Green*	6 + 6	24	5	15	44	12	7	8	84	0.24	.10	.14	2.2	0.43	.21	55
			8 + 8	28	4	14	44	11	7	7	86	0.23	.08	.14	2.2	0.43	.19	52

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Harvest Bronze	CB-08	Bronze*	6 + 6	24	2	4	54	13	13	4	84	0.17	.04	.12	2.1	0.40	.14	40
			8 + 8	28	1	4	54	10	10	3	87	0.16	.03	.13	2.1	0.39	.14	39
Harvest Bronze	CB-14	Bronze*	6 + 6	24	3	8	49	10	10	6	84	0.21	.07	.14	2.2	0.42	.18	49
			8 + 8	28	2	6	49	8	8	5	87	0.20	.06	.14	2.2	0.41	.17	47
Harvest Bronze	CB-20	Bronze*	6 + 6	24	4	11	44	8	8	9	83	0.25	.11	.14	2.2	0.43	.22	58
			8 + 8	28	3	9	44	7	7	8	86	0.24	.09	.15	2.2	0.43	.20	54
Charren Gray	CB-08	Gray*	6 + 6	24	2	4	54	10	13	4	84	0.17	.04	.12	2.1	0.40	.14	40
			8 + 8	28	1	3	54	8	10	3	87	0.16	.03	.13	2.1	0.39	.14	39
Charren Gray	CB-14	Gray*	6 + 6	24	4	6	49	8	10	6	84	0.21	.07	.14	2.2	0.42	.18	49
			8 + 8	28	3	5	49	7	8	5	87	0.20	.06	.14	2.2	0.41	.17	47
Charren Gray	CB-20	Gray*	6 + 6	24	5	9	44	7	8	9	83	0.25	.11	.14	2.2	0.43	.22	57
			8 + 8	28	4	7	44	6	7	8	86	0.23	.09	.15	2.2	0.43	.20	54
Royal	CR-08	Clear	6 + 6	24	3	7	54	26	22	7	71	0.19	.08	.11	2.1	0.40	.16	44
			8 + 8	28	2	7	54	25	21	6	73	0.19	0.7	.11	2.1	0.39	.16	44
Royal	CR-14	Clear	6 + 6	24	5	13	49	18	15	11	74	0.25	.13	.12	2.2	0.42	.22	57
			8 + 8	28	4	13	49	18	14	10	75	0.25	.12	.13	2.2	0.41	.21	56
Royal	CR-20	Clear	6 + 6	24	8	18	44	13	12	15	72	0.31	.18	.13	2.2	0.44	.26	68
			8 + 8	28	7	18	44	13	12	15	74	0.30	.17	.13	2.2	0.43	.26	67
Royal	CR-35	Clear	6 + 6	24	14	32	30	9	7	26	67	0.43	.30	.14	2.3	0.46	.37	94
			8 + 8	28	12	32	30	9	7	25	68	0.42	.29	.14	2.3	0.45	.36	92
Royal Teal	CR-08	Green*	6 + 6	24	1	6	54	19	11	3	85	0.17	.04	.13	2.1	0.40	.14	40
			8 + 8	28	1	6	54	18	10	3	88	0.16	.03	.13	2.1	0.39	.14	39
Royal Teal	CR-14	Green*	6 + 6	24	2	11	49	14	9	6	85	0.20	.07	.14	2.2	0.42	.17	48
			8 + 8	28	2	10	49	13	8	5	87	0.20	.06	.14	2.2	0.41	.17	46
Royal Teal	CR-20	Green*	6 + 6	24	4	15	44	11	7	8	84	0.24	.10	.14	2.2	0.44	.20	55
			8 + 8	28	3	14	44	10	7	7	86	0.22	.08	.14	2.2	0.43	.19	52
Royal Teal	CR-35	Green*	6 + 6	24	6	27	30	8	6	14	80	0.31	.16	.14	2.3	0.46	.27	70
			8 + 8	28	5	25	30	7	5	12	83	0.29	.14	.15	2.3	0.45	.25	65
Royal Indigo Gray	CR-08	Gray*	6 + 6	24	1	4	54	9	11	4	85	0.17	.05	.13	2.1	0.40	.15	42
			8 + 8	28	1	3	54	7	9	3	88	0.17	.04	.13	2.1	0.39	.15	41
Royal Indigo Gray	CR-14	Gray*	6 + 6	24	2	6	49	8	8	7	85	0.22	.08	.14	2.2	0.42	.18	50
			8 + 8	28	2	5	49	6	7	5	88	0.21	.06	.14	2.2	0.41	.18	48
Royal Indigo Gray	CR-20	Gray*	6 + 6	24	4	9	44	6	7	9	84	0.25	.11	.14	2.2	0.44	.22	57
			8 + 8	28	3	7	44	6	6	7	86	0.24	.09	.15	2.2	0.43	.20	54
Royal Indigo Gray	CR-35	Gray*	6 + 6	24	7	16	30	5	5	15	79	0.33	.18	.15	2.3	0.46	.28	73
			8 + 8	28	5	12	30	5	5	13	83	0.30	.15	.15	2.3	0.45	.26	68
Cobalt Blue	CR-08	Blue*	6 + 6	24	2	5	54	13	11	4	85	0.17	.05	.13	2.1	0.40	.15	41
Cobalt Blue	CR-14	Blue*	6 + 6	24	3	8	49	10	9	6	85	0.21	.07	.14	2.2	0.42	.18	49
Cobalt Blue	CR-20	Blue*	6 + 6	24	5	12	44	8	7	9	84	0.25	.10	.14	2.2	0.44	.21	57
Cobalt Blue	CR-35	Blue*	6 + 6	24	8	21	30	6	6	15	79	0.32	.18	.15	2.3	0.46	.28	72
Royal Tourmaline Blue-Green	CR-08	Azurlite®*	6 + 6	24	1	6	54	19	10	10	3	87	0.16	.03	2.1	0.40	.14	38
	CR-14		6 + 6	24	2	10	49	14	8	5	87	0.19	.05	.14	2.2	0.42	.16	45
	CR-20		6 + 6	24	4	15	44	10	7	6	86	0.22	.08	.14	2.2	0.44	.19	51
	CR-35		6 + 6	24	7	26	30	8	6	11	83	0.28	.13	.15	2.3	0.46	.24	63
Platinum	SP-13[2]	Clear	6 + 6	24	7	12	43	29	23	10	68	0.22	.11	.11	2.2	0.42	.19	51
	SP-13[3]				7	12	29	43	37	10	53	0.42	.11	.31	2.2	0.42	.36	91
	SP-18[2]				12	17	39	24	20	13	67	0.27	.15	.12	2.2	0.43	.23	60
	SP-18[3]				12	17	24	39	34	13	53	0.46	.15	.31	2.2	0.43	.40	99
	SP-22[2]				14	20	37	20	16	16	68	0.31	.19	.12	2.2	0.44	.27	60
	SP-22[3]				14	20	20	37	31	16	53	0.50	.19	.31	2.2	0.44	.43	107
	SP-33[2]				20	30	30	12	10	24	66	0.41	.28	.13	2.3	0.45	.35	89
	SP-33[3]				20	30	12	30	25	24	52	0.57	.28	.30	2.3	0.45	.49	122

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Double Glazing*

Type: Description	Type: Coating	Type: Outboard Lite	12mm Airspace (mm + mm)	Total Thickness (mm)	U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflectance Indoors %	Visible Light Reflectance Outdoors %	Solar Energy Reflec-tance % Out	Solar Energy Trans-mittance %	Solar Energy Absorp-tance %	Shading Coefficient Total	Shading Coefficient Short Wave	Shading Coefficient Long Wave	European Winter Nighttime K-Value (air) W/m²K	American (ASHRAE) Winter Nighttime U-Value (air) BTU/hr•ft²•F	American (ASHRAE) Summer Solar Heat Gain Coefficient	American (ASHRAE) Summer Relative Heat Gain BTU/hr•ft²
High-Performance Reflective Glass (Cont.) *(Manufactured in Corsicana, Texas, USA)*																		
Serenity	SP-13[2]	Green*	6 + 6	24	3	10	43	22	11	05	83	0.19	.06	.13	2.2	0.42	.17	45
	SP-13[3]				3	10	29	31	16	05	79	0.30	.06	.24	2.2	0.42	.26	68
	SP-18[2]				5	14	39	18	10	7	83	0.22	.08	.13	2.2	0.43	.19	51
	SP-18[3]				5	14	24	29	15	7	78	0.33	.08	.24	2.2	0.43	.28	73
	SP-22[2]				6	17	37	15	9	9	82	0.24	.10	.14	2.2	0.44	.21	56
	SP-22[3]				6	17	20	27	14	9	77	0.35	.10	.24	2.2	0.44	.30	77
	SP-33[2]				9	25	30	10	6	13	80	0.30	.16	.14	2.3	0.45	.26	67
	SP-33[3]				9	25	12	22	12	13	75	0.39	.15	.23	2.3	0.45	.33	85
Satin Bronze	SP-13[2]	Bronze*	6 + 6	24	3	7	43	13	11	6	83	0.20	.07	.13	2.2	0.42	.17	47
	SP-13[3]				3	7	29	18	17	6	77	0.32	.07	.25	2.2	0.42	.28	71
	SP-18[2]				4	10	39	11	10	8	82	0.23	.09	.14	2.2	0.43	.20	53
	SP-18[3]				4	10	24	17	15	8	77	0.35	.09	.26	2.2	0.43	.30	77
	SP-22[2]				5	12	37	10	9	10	81	0.25	.11	.14	2.2	0.44	.22	58
	SP-22[3]				5	12	20	16	14	10	76	0.37	.11	.26	2.2	0.44	.32	82
	SP-33[2]				8	18	30	7	6	14	79	0.31	.17	.15	2.3	0.45	.27	70
	SP-33[3]				8	18	11	13	12	14	74	0.42	.17	.25	2.3	0.45	.36	92
Starlite Gray	SP-13[2]	Gray*	6 + 6	24	4	6	43	10	11	6	83	0.20	.07	.13	2.2	0.42	.17	47
	SP-13[3]				4	6	29	13	17	6	78	0.32	.07	.25	2.2	0.42	.27	71
	SP-18[2]				6	8	39	9	10	8	82	0.23	.09	.14	2.2	0.43	.20	53
	SP-18[3]				6	8	24	13	15	8	77	0.34	.09	.26	2.2	0.43	.30	76
	SP-22[2]				7	10	37	8	9	10	82	0.25	.11	.14	2.2	0.44	.22	58
	SP-22[3]				7	10	20	12	14	10	76	0.37	.11	.26	2.2	0.44	.32	81
	SP-33[2]				10	15	30	6	6	14	79	0.31	.17	.15	2.3	0.45	.27	70
	SP-33[3]				10	15	11	10	12	14	74	0.42	.16	.25	2.3	0.45	.36	91
Sunset Rose	RP-20[2]	Clear	6 + 6	24	9	18	45	38	51	8	41	0.14	.10	.04	1.6	0.30	.12	33
	RP-20[3]				9	18	38	45	52	8	39	0.28	.10	.18	1.6	0.30	.24	60
	RP-30[3]				13	29	26	36	45	15	40	0.37	.17	.19	1.7	0.31	.32	79
Mara Rose	RP-20[2]	Green*	6 + 6	24	4	15	45	28	17	6	77	0.14	.07	.08	1.6	0.30	.12	33
	RP-20[3]				4	15	38	32	18	6	76	0.23	.07	.17	1.6	0.30	.20	51
	RP-30[3]				6	24	26	27	16	10	74	0.28	.11	.17	1.7	0.31	.24	61
Terra Rose	RP-20[2]	Bronze*	6 + 6	24	3	11	45	17	23	5	72	0.13	.06	.07	1.6	0.30	.11	31
	RP-20[3]				3	11	38	19	23	5	72	0.21	.06	.15	1.6	0.30	.18	46
	RP-30[3]				5	17	26	16	20	9	71	0.27	.10	.16	1.7	0.31	.23	58
Cinder Rose	RP-20[2]	Gray*	6 + 6	24	4	9	45	12	23	5	72	0.13	.05	.07	1.6	0.30	.11	30
	RP-20[3]				4	9	38	14	23	5	72	0.20	.05	.15	1.6	0.30	.17	44
	RP-30[3]				7	14	26	12	21	8	71	0.26	.10	.16	1.7	0.31	.22	56

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

High-Performance Low Emissivity *(Manufactured in Corsicana, Texas, USA)*

Neutral	NU-40	Clear	6 + 6	24	17	35	25	14	17	23	60	0.35	.26	.09	1.7	0.32	.30	75
		Green			8	29	25	11	8	13	78	0.25	.16	.09	1.8	0.32	.22	55
		Bronze			8	21	25	8	9	14	77	0.26	.16	.10	1.8	0.32	.22	56
		Gray			8	17	25	7	9	13	77	0.25	.15	.10	1.8	0.32	.22	55
Neutral	NU-52	Clear	6 + 6	24	25	50	12	14	17	33	50	0.46	.38	.09	1.7	0.32	.40	98
		Green			12	42	12	11	8	20	72	0.32	.23	.09	1.8	0.32	.27	69
		Bronze			10	30	11	8	10	20	71	0.32	.23	.10	1.8	0.32	.28	70
		Gray			13	24	11	7	10	19	71	0.32	.22	.10	1.8	0.32	.27	68
High Performance Silver	AG-40	Clear	6 + 6	24	15	40	25	43	42	21	37	0.30	.24	.05	1.6	0.30	.25	63
		Green			7	33	25	31	17	14	70	0.23	.16	.07	1.6	0.30	.20	51
		Bronze			7	23	25	18	19	13	69	0.22	.15	.08	1.6	0.30	.19	49
		Gray			7	19	25	13	19	12	69	0.21	.14	.08	1.6	0.30	.18	47
High Performance Silver	AG-46	Clear	6 + 6	24	17	46	12	29	33	26	41	0.37	.30	.06	1.6	0.31	.32	78
		Green			8	38	12	22	13	17	71	0.27	.19	.08	1.7	0.31	.23	59
		Bronze			7	27	12	13	15	16	69	0.27	.18	.08	1.7	0.31	.23	58
		Gray			8	22	11	10	16	15	70	0.26	.17	.08	1.7	0.31	.22	56

Commercial Low-E

Performance Plus Low-E	LE-70(2)	Clear	6 + 6	24	37	68	11	13	20	42	38	0.57	.49	.08	1.8	0.32	.49	120
		Green			17	57	10	11	9	26	66	0.39	.30	.09	1.8	0.32	.33	83
		Bronze			15	40	10	8	11	25	64	0.39	.29	.09	1.8	0.32	.33	83
		Gray			19	33	9	7	11	24	65	0.38	.28	.10	1.8	0.32	.33	81
Performance Plus Low-E	LE-70(3)	Clear	6 + 6	24	37	68	13	11	21	42	37	0.68	.49	.19	1.8	0.32	.58	140
		Green			17	57	12	9	8	26	66	0.44	.30	.14	1.8	0.32	.38	94
		Bronze			15	40	12	7	12	25	63	0.47	.29	.18	1.8	0.32	.40	99
		Gray			19	33	11	6	12	24	64	0.45	.28	.17	1.8	0.32	.39	96
Commercial Low-E	LE-75(2)	Clear	6 + 6	24	33	75	12	13	21	47	32	0.62	.55	.08	1.7	0.31	.54	130
		Green			15	63	12	11	9	29	63	0.41	.33	.08	1.7	0.31	.36	88
		Bronze			13	44	11	7	11	28	61	0.42	.33	.09	1.7	0.31	.36	89
		Gray			17	37	10	6	11	27	62	0.41	.32	.09	1.7	0.31	.35	86
Commercial Low-E	LE-75(3)	Clear	6 + 6	24	33	75	13	12	21	47	32	0.69	.54	.15	1.7	0.31	.60	144
		Green			15	63	13	10	8	29	63	0.45	.33	.12	1.7	0.31	.39	94
		Bronze			13	44	12	7	11	28	60	0.46	.33	.13	1.7	0.31	.40	97
		Gray			17	37	11	6	12	27	61	0.45	.32	.14	1.7	0.31	.39	95

Residential Insulating Glass Performance Plus Low-E *(Manufactured in Carleton, Michigan, USA)*

Type	Air Space	Total Thickness	Transmittance (%)			Exterior Reflectance (%)				Solar Heat Gain Coeff.		Shading Coefficient		Relative Heat Gain		Winter U-Values (ASHRAE)						
						Visible		Solar		Coated Surface		Coated Surface		Coated Surface		Air			Argon			Krypton
						Coated Surface		Coated Surface														
Outboard Lite Tint	mm Space mm	mm	U.V.	Visible	Solar	#2	#3	#2	#3	#2	#3	#2	#3	#2	#3	10mm 3/8"	12mm 1/2"	19mm 3/4"	10mm 3/8"	12mm 1/2"	19mm 3/4"	10mm 3/8"
Low-E Clear	2.3 + 12A + 2.3	17	48	71	49	14	11	24	26	.53	.63	.62	.73	128	151	.36	.33	.34	.29	.28	.29	.25
	3.0 + 12A + 3.0	18	45	70	47	13	11	23	25	.52	.62	.61	.72	126	148	.36	.33	.34	.29	.28	.29	.25
	4.0 + 12A + 4.0	20	42	70	45	13	11	22	23	.51	.61	.60	.70	124	146	.35	.33	.34	.29	.27	.28	.25
	5.0 + 12A + 5.0	22	40	69	44	13	11	21	22	.50	.60	.59	.69	122	143	.35	.32	.33	.29	.27	.28	.25
	6.0 + 12A + 6.0	24	37	68	42	13	11	20	21	.49	.58	.57	.68	120	140	.35	.32	.33	.29	.27	.28	.25
Low-E Green	2.3 + 12A + 2.3	17	32	66	39	12	10	12	15	.44	.51	.51	.60	107	124	.36	.33	.34	.29	.28	.29	.25
	3.0 + 12A + 3.0	18	27	64	35	12	10	12	13	.41	.48	.48	.55	100	116	.36	.33	.34	.29	.28	.29	.25
	4.0 + 12A + 3.0	20	23	62	31	11	10	11	10	.38	.44	.44	.51	94	107	.35	.33	.34	.29	.27	.28	.25
	5.0 + 12A + 5.0	22	20	60	29	11	9	10	9	.36	.41	.42	.48	88	101	.35	.32	.33	.29	.27	.28	.25
	6.0 + 12A + 6.0	24	17	57	26	11	9	9	8	.33	.38	.39	.44	83	94	.35	.32	.33	.29	.27	.28	.25

See additional notes on page 42.

Guardian North American Performance Data *Double Glazing – Low-E Enhanced*

Type: Description	Type: Coating	Type: Outboard Lite	12mm Airspace: mm + mm	Total Thickness: mm	U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflectance Indoors %	Visible Light Reflectance Outdoors %	Solar Energy Reflec-tance % Out	Solar Energy Trans-mittance %	Solar Energy Absorp-tance %	Shading Coefficient Total	Shading Coefficient Short Wave	Shading Coefficient Long Wave	European Winter Nighttime K-Value (air) W/m²K	American (ASHRAE) Winter Nighttime U-Value (air) BTU/hr•ft²•F	American (ASHRAE) Summer Solar Heat Gain Coefficient	American (ASHRAE) Summer Relative Heat Gain BTU/hr•ft²
Heat-Reflective Glass *(Manufactured in Corsicana, Texas, USA)*																		
Transparent Clear	HR-74	Clear	6 + 6	24	25	62	25	26	29	41	30	0.61	.48	.14	1.7	0.31	.53	127
			8 + 8	28	23	62	25	26	27	39	34	0.59	.46	.14	1.7	0.31	.51	123
			10 + 10	32	21	61	25	25	25	38	27	0.58	.44	.13	1.7	0.31	.50	120
Green	HR-74	Green	6 + 6	24	12	52	24	20	12	24	64	0.39	.28	.11	1.7	0.31	.34	83
			8 + 8	28	9	49	24	18	10	21	69	0.35	.24	.11	1.7	0.31	.30	74
Bronze	HR-74	Bronze	6 + 6	24	10	37	24	12	14	25	61	0.42	.29	.13	1.7	0.31	.36	88
			8 + 8	28	7	31	24	10	11	20	69	0.36	.24	.12	1.7	0.31	.31	77
			10 + 10	32	5	26	23	8	9	17	74	0.32	.20	.12	1.7	0.31	.28	69
Gray	HR-74	Gray	6 + 6	24	13	30	24	9	14	24	62	0.41	.28	.13	1.7	0.31	.35	86
			8 + 8	28	10	24	23	7	11	19	70	0.35	.22	.13	1.7	0.31	.30	75
			10 + 10	32	81	9	23	6	9	16	75	0.31	.19	.12	1.7	0.31	.27	67
High-Performance Reflective Float Glass *(Manufactured in Corsicana, Texas, USA)*																		
Silver	SS-08	Clear	6 + 6	24	2	7	38	42	33	4	63	0.12	.05	.07	1.7	0.31	.10	29
			8 + 8	28	2	7	38	41	31	4	65	0.12	.05	.08	1.7	0.31	.10	29
Silver	SS-14	Clear	6 + 6	24	4	12	33	31	27	7	66	0.17	.08	.08	1.7	0.31	.14	38
			8 + 8	28	4	12	33	31	25	7	68	0.17	.08	.09	1.7	0.31	.14	38
Silver	SS-20	Clear	6 + 6	24	6	17	30	25	22	10	68	0.21	.12	.09	1.7	0.31	.18	47
			8 + 8	28	6	17	30	25	20	10	70	0.21	.11	.10	1.7	0.31	.18	46
Silver	SS-22	Clear	6 + 6	24	6	19	29	21	20	11	69	0.23	.13	.10	1.7	0.31	.20	51
			8 + 8	28	6	18	28	21	19	10	71	0.23	.12	.10	1.7	0.31	.20	50
Green	SS-08	Green*	6 + 6	24	1	6	38	31	15	2	82	0.12	.03	.09	1.7	0.31	.10	28
			8 + 8	28	1	5	38	27	13	2	85	0.12	.02	.09	1.7	0.31	.10	28
Green	SS-14	Green*	6 + 6	24	2	10	33	23	13	4	83	0.14	.05	.09	1.7	0.31	.12	33
			8 + 8	28	1	9	33	21	11	4	85	0.14	.04	.10	1.7	0.31	.12	32
Green	SS-20	Green*	6 + 6	24	3	14	30	19	11	6	83	0.17	.07	.10	1.7	0.31	.15	38
			8 + 8	28	2	13	30	17	9	5	85	0.16	.06	.10	1.7	0.31	.14	37
Bronze	SS-08	Bronze*	6 + 6	24	1	4	38	17	15	2	82	0.12	.03	.09	1.7	0.31	.10	28
			8 + 8	28	1	3	38	13	12	2	86	0.12	.02	.09	1.7	0.31	.10	28
Bronze	SS-14	Bronze*	6 + 6	24	2	7	33	14	13	4	83	0.15	.05	.10	1.7	0.31	.12	34
			8 + 8	28	1	6	33	11	10	4	86	0.14	.04	.10	1.7	0.31	.12	33
Bronze	SS-20	Bronze*	6 + 6	24	3	10	30	12	11	6	83	0.17	.07	.10	1.7	0.31	.15	39
			8 + 8	28	2	8	30	9	9	5	86	0.16	.06	.10	1.7	0.31	.14	37
Gray	SS-08	Gray*	6 + 6	24	1	3	38	13	15	2	83	0.12	.03	.09	1.7	0.31	.10	28
			8 + 8	28	1	3	38	10	11	2	87	0.12	.02	.10	1.7	0.31	.10	28
Gray	SS-14	Gray*	6 + 6	24	2	6	33	11	13	4	83	0.14	.05	.10	1.7	0.31	.12	33
			8 + 8	28	2	5	33	8	10	3	87	0.14	.04	.10	1.7	0.31	.12	32
Gray	SS-20	Gray*	6 + 6	24	3	8	30	9	11	6	84	0.17	.07	.10	1.7	0.31	.14	38
			8 + 8	28	2	6	30	7	9	5	87	0.16	.05	.10	1.7	0.31	.14	36

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Sterling Blue	SS-08	Blue*	6 + 6	24	1	4	38	20	15	2	82	0.12	.03	.09	1.7	0.31	.10	28
	SS-14		6 + 6	24	2	8	33	16	13	4	83	0.14	.05	.09	1.7	0.31	.12	34
	SS-20		6 + 6	24	4	11	30	13	11	6	83	0.17	.07	.10	1.7	0.31	.15	39
Tourmaline Blue-Green	SS-08	Azurlite®*	6 + 6	24	1	6	38	29	14	2	84	0.11	.02	.09	1.7	0.31	.10	27
	SS-14		6 + 6	24	2	10	33	22	11	4	85	0.14	.04	.09	1.7	0.31	.12	32
	SS-20		6 + 6	24	3	14	30	18	10	5	85	0.16	.06	.10	1.7	0.31	.14	36

Sterling	CS-08	Clear	6 + 6	24	4	7	36	43	34	4	62	0.12	.05	.07	1.7	0.31	.10	28
			8 + 8	28	3	7	36	42	32	4	64	0.12	.05	.07	1.7	0.31	.10	29
Sterling	CS-14	Clear	6 + 6	24	6	12	34	33	27	8	65	0.17	.09	.09	1.7	0.31	.15	39
			8 + 8	28	6	12	34	32	25	7	68	0.17	.08	.09	1.7	0.31	.15	39
Sterling	CS-20	Clear	6 + 6	24	9	17	30	27	22	11	67	0.22	.12	.10	1.7	0.31	.19	49
			8 + 8	28	8	17	30	27	21	10	69	0.22	.12	.10	1.7	0.31	.19	48
Sterling	CS-35	Clear	6 + 6	24	14	30	21	17	15	18	66	0.33	.21	.11	1.7	0.31	.28	70
			8 + 8	28	13	29	21	17	14	18	68	0.32	.21	.11	1.7	0.31	.28	69

Silver-Blue	TS-20	Clear	6 + 6	24	4	17	31	23	22	9	69	0.20	.11	.09	1.7	0.31	.17	44
			8 + 8	28	4	17	31	23	20	9	71	0.20	.10	.09	1.7	0.31	.17	44
Blue	TS-30	Clear	6 + 6	24	7	26	28	17	15	15	70	0.28	.17	.11	1.7	0.31	.24	61
			8 + 8	28	6	25	28	17	15	14	71	0.28	.17	.11	1.7	0.31	.24	60
Deep-Blue	TS-40	Clear	6 + 6	24	10	34	24	10	12	20	68	0.35	.24	.12	1.7	0.31	.30	75
			8 + 8	28	9	34	24	10	11	20	69	0.35	.23	.12	1.7	0.31	.30	74
Blue-Green	TS-20	Green*	6 + 6	24	2	14	31	18	10	6	84	0.16	.07	.10	1.7	0.31	.14	38
			8 + 8	28	1	13	31	16	9	5	86	0.16	.06	.10	1.7	0.31	.14	36
Blue-Green	TS-30	Green*	6 + 6	24	3	21	28	14	8	9	82	0.21	.11	.10	1.7	0.31	.18	46
			8 + 8	28	2	20	28	12	8	8	84	0.19	.09	.10	1.7	0.31	.17	44
BlueGreen	TS-40	Green*	6 + 6	24	5	28	24	9	7	12	81	0.25	.14	.11	1.7	0.31	.22	55
			8 + 8	28	3	27	24	8	6	11	83	0.23	.12	.10	1.7	0.31	.20	51
Silver Blue-Gray	TS-20	Gray*	6 + 6	24	2	8	31	9	11	5	84	0.16	.06	.10	1.7	0.31	.14	37
			8 + 8	28	2	6	31	7	9	4	87	0.15	.05	.10	1.7	0.31	.13	35
Sapphire Blue-Gray	TS-30	Gray*	6 + 6	24	3	12	28	7	8	9	83	0.21	.10	.11	1.7	0.31	.18	46
			8 + 8	28	3	10	28	6	7	7	86	0.19	.08	.11	1.7	0.31	.16	43
Soft Blue-Gray	TS-40	Gray*	6 + 6	24	5	17	23	6	7	12	81	0.25	.14	.11	1.7	0.31	.22	55
			8 + 8	28	4	13	23	5	6	9	84	0.22	.11	.11	1.7	0.31	.19	49
Sapphire Blue	TS-20	Blue*	6 + 6	24	2	11	31	12	11	6	84	0.16	.07	.10	1.7	0.31	.14	37
	TS-30		6 + 6	24	4	16	28	10	8	9	82	0.21	.11	.10	1.7	0.31	.18	47
	TS-40		6 + 6	24	6	22	23	7	7	12	81	0.25	.14	.11	1.7	0.31	.22	55
Sapphire Azurlite	TS-20	Azurlite®*	6 + 6	24	2	14	31	17	9	5	86	0.15	.06	.10	1.7	0.31	.13	36
	TS-30		6 + 6	24	3	20	28	13	8	8	84	0.19	.09	.10	1.7	0.31	.16	43
	TS-40		6 + 6	24	5	27	24	9	6	11	83	0.22	.12	.10	1.7	0.31	.19	50

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Double Glazing – Low-E Enhanced*

Type			12mm Airspace	Total Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
							Reflectance					Shading Coefficient			Winter Nighttime	Winter Nighttime	Summer	
Description	Coating	Outboard Lite	mm + mm	mm	Trans-mittance %	Trans-mittance %	Indoors %	Outdoors %	Reflec-tance % Out	Trans-mittance %	Absorp-tance %	Total	Short Wave	Long Wave	K-Value (air) W/m²K	U-Value (air) BTU/hr•ft²•F	Solar Heat Gain Coefficient	Relative Heat Gain BTU/hr•ft²
High-Performance Reflective Float Glass (Cont.) *(Manufactured in Corsicana, Texas, USA)*																		
Pewter	CP-08	Clear	6 + 6	24	3	7	46	32	27	5	68	0.13	.05	.08	1.7	0.31	.12	32
			8 + 8	28	3	7	46	31	25	4	70	0.14	.05	.08	1.7	0.31	.12	32
Pewter	CP-14	Clear	6 + 6	24	6	12	42	24	20	8	72	0.19	.10	.10	1.7	0.31	.16	43
			8 + 8	28	5	12	42	24	19	8	73	0.19	.09	.10	1.7	0.31	.16	42
Pewter	CP-20	Clear	6 + 6	24	9	17	38	19	17	12	72	0.24	.13	.10	1.7	0.31	.21	53
			8 + 8	28	8	17	38	19	16	11	73	0.24	.13	.11	1.7	0.31	.20	52
Pewter	CP-35	Clear	6 + 6	24	14	30	26	11	11	19	70	0.34	.22	.12	1.7	0.31	.29	73
			8 + 8	28	12	29	26	10	11	18	71	0.33	.21	.12	1.7	0.31	.29	71
Misty Green	CP-08	Green*	6 + 6	24	1	6	46	24	12	3	85	0.12	.03	.09	1.7	0.31	.11	29
			8 + 8	28	1	5	46	21	11	2	87	0.12	.03	.09	1.7	0.31	.10	29
Misty Green	CP-14	Green*	6 + 6	24	3	10	42	18	10	5	85	0.15	.06	.10	1.7	0.31	.13	35
			8 + 8	28	2	9	42	16	9	4	87	0.15	.05	.10	1.7	0.31	.13	34
Misty Green	CP-35	Green*	6 + 6	24	4	14	38	15	9	7	84	0.18	.08	.10	1.7	0.31	.15	41
			8 + 8	28	3	13	38	14	8	6	86	0.17	.07	.10	1.7	0.31	.15	38
Misty Green	CP-35	Green*	6 + 6	24	6	25	26	9	6	11	82	0.24	.13	.11	1.7	0.31	.21	53
			8 + 8	28	5	23	26	8	6	10	84	0.22	.11	.11	1.7	0.31	.19	49
Misty Bronze	CP-08	Bronze*	6 + 6	24	1	4	46	14	13	3	84	0.13	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	3	46	11	10	2	88	0.12	.03	.10	1.7	0.31	.11	29
Misty Bronze	CP-14	Bronze*	6 + 6	24	2	7	42	11	10	5	85	0.16	.06	.10	1.7	0.31	.14	36
			8 + 8	28	2	6	42	9	8	4	88	0.15	.05	.10	1.7	0.31	.13	35
Misty Bronze	CP-20	Bronze*	6 + 6	24	3	10	38	10	9	7	84	0.19	.08	.11	1.7	0.31	.16	42
			8 + 8	28	2	8	37	8	7	6	87	0.17	.07	.11	1.7	0.31	.15	39
Misty Bronze	CP-35	Bronze*	6 + 6	24	5	18	26	6	7	11	82	0.25	.13	.11	1.7	0.31	.21	54
			8 + 8	28	4	15	26	6	6	9	84	0.22	.11	.11	1.7	0.31	.19	49
Misty Gray	CP-08	Gray*	6 + 6	24	2	3	46	11	13	3	85	0.13	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	3	46	8	10	2	88	0.12	.03	.10	1.7	0.31	.11	29
Misty Gray	CP-14	Gray*	6 + 6	24	3	6	42	9	10	5	85	0.16	.06	.10	1.7	0.31	.14	36
			8 + 8	28	2	5	42	7	8	4	88	0.15	.05	.10	1.7	0.31	.13	34
Misty Gray	CP-20	Gray*	6 + 6	24	4	8	37	8	9	7	84	0.19	.08	.11	1.7	0.31	.16	42
			8 + 8	28	3	7	37	6	7	5	87	0.17	.06	.11	1.7	0.31	.15	39
Misty Gray	CP-35	Gray*	6 + 6	24	7	15	26	6	7	11	82	0.24	.13	.11	1.7	0.31	.21	53
			8 + 8	28	5	11	26	5	6	9	85	0.22	.10	.11	1.7	0.31	.19	48
Pewter Blue	CP-08	Blue*	6 + 6	24	2	4	46	16	12	3	85	0.13	.03	.09	1.7	0.31	.11	30
Pewter Blue	CP-14	Blue*	6 + 6	24	3	8	42	13	10	5	85	0.16	.06	.10	1.7	0.31	.13	36
Pewter Blue	CP-20	Blue*	6 + 6	24	5	11	38	11	9	7	84	0.19	.08	.10	1.7	0.31	.16	42
Pewter Blue	CP-35	Blue*	6 + 6	24	8	19	26	7	7	12	82	0.25	.13	.11	1.7	0.31	.21	54
Pewter Tourmaline Blue-Green	CP-08	Azurlite®*	6 + 6	24	2	6	46	22	11	2	87	0.12	.03	.09	1.7	0.31	.10	28
	CP-14		6 + 6	24	3	10	42	17	9	4	87	0.14	.05	.10	1.7	0.31	.12	33
	CP-20		6 + 6	24	4	14	38	14	8	6	86	0.16	.07	.10	1.7	0.31	.14	38
	CP-35		6 + 6	24	7	24	26	8	6	10	84	0.22	.11	.10	1.7	0.31	.19	48

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Bronze	CB-08	Clear	6 + 6	24	3	7	48	29	26	5	69	0.14	.05	.08	1.7	0.31	.12	32
			8 + 8	28	3	7	48	28	24	4	72	0.14	.05	.08	1.7	0.31	.12	32
Bronze	CB-14	Clear	6 + 6	24	6	12	44	21	19	8	73	0.19	.09	.10	1.7	0.31	.16	42
			8 + 8	28	5	12	44	20	18	8	75	0.18	.09	.10	1.7	0.31	.16	42
Bronze	CB-20	Clear	6 + 6	24	8	17	39	15	14	11	74	0.24	.13	.11	1.7	0.31	.21	53
			8 + 8	28	7	17	39	15	13	11	76	0.24	.13	.11	1.7	0.31	.20	52
Sandstone Green	CB-08	Green*	6 + 6	24	1	6	48	21	11	3	86	0.12	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	5	48	19	10	2	88	0.12	.03	.10	1.7	0.31	.11	29
Sandstone Green	CB-14	Green*	6 + 6	24	3	10	44	16	9	5	86	0.15	.05	.10	1.7	0.31	.13	35
			8 + 8	28	2	9	44	14	8	4	88	0.15	.05	.10	1.7	0.31	.13	34
Sandstone Green	CB-20	Green*	6 + 6	24	4	14	39	12	7	7	86	0.18	.08	.10	1.7	0.31	.15	41
			8 + 8	28	3	13	39	11	7	6	88	0.17	.07	.10	1.7	0.31	.15	39
Harvest Bronze	CB-08	Bronze*	6 + 6	24	1	4	48	13	13	3	85	0.13	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	3	48	10	10	2	88	0.12	.03	.10	1.7	0.31	.11	29
Harvest Bronze	CB-14	Bronze*	6 + 6	24	2	7	44	10	10	5	85	0.16	.06	.10	1.7	0.31	.13	36
			8 + 8	28	2	6	44	8	8	4	88	0.15	.05	.10	1.7	0.31	.13	34
Harvest Bronze	CB-20	Bronze*	6 + 6	24	3	10	39	8	8	7	85	0.19	.08	.11	1.7	0.31	.16	42
			8 + 8	28	2	9	39	7	7	6	87	0.17	.07	.11	1.7	0.31	.15	39
Charren Gray	CB-08	Gray*	6 + 6	24	2	3	48	10	13	3	85	0.12	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	3	48	8	10	2	88	0.12	.02	.10	1.7	0.31	.11	29
Charren Gray	CB-14	Gray*	6 + 6	24	3	6	44	8	10	5	85	0.15	.05	.10	1.7	0.31	.13	35
			8 + 8	28	2	5	44	7	8	4	88	0.15	.04	.10	1.7	0.31	.13	34
Charren Gray	CB-20	Gray*	6 + 6	24	4	8	39	7	8	7	85	0.18	.08	.11	1.7	0.31	.16	42
			8 + 8	28	3	7	39	6	7	5	88	0.17	.06	.11	1.7	0.31	.15	39

Royal	CR-08	Clear	6 + 6	24	2	7	48	26	23	5	72	0.15	.06	.09	1.7	0.31	.13	34
			8 + 8	28	2	7	48	25	21	5	74	0.15	.06	.09	1.7	0.31	.13	34
Royal	CR-14	Clear	6 + 6	24	4	12	44	18	16	8	76	0.20	.10	.10	1.7	0.31	.17	44
			8 + 8	28	3	12	44	18	15	8	77	0.19	.09	.10	1.7	0.31	.17	43
Royal	CR-20	Clear	6 + 6	24	6	17	39	13	13	11	75	0.24	.13	.11	1.7	0.31	.21	43
			8 + 8	28	5	17	39	13	13	11	77	0.23	.13	.11	1.7	0.31	.20	52
Royal	CR-35	Clear	6 + 6	24	10	30	27	9	9	19	72	0.35	.22	.12	1.7	0.31	.30	74
			8 + 8	28	9	30	27	9	9	19	73	0.34	.22	.12	1.7	0.31	.29	72
Royal Teal	CR-08	Green*	6 + 6	24	1	6	48	19	11	3	86	0.13	.03	.09	1.7	0.31	.11	30
			8 + 8	28	1	5	48	18	10	2	88	0.12	.03	.10	1.7	0.31	.11	29
Royal Teal	CR-14	Green*	6 + 6	24	2	10	44	14	9	5	86	0.15	.05	.10	1.7	0.31	.13	35
			8 + 8	28	1	9	44	13	8	4	88	0.15	.05	.10	1.7	0.31	.13	34
Royal Teal	CR-20	Green*	6 + 6	24	3	14	39	11	8	7	86	0.18	.08	.10	1.7	0.31	.15	40
			8 + 8	28	2	13	39	10	7	6	88	0.17	.07	.10	1.7	0.31	.14	38
Royal Teal	CR-35	Green*	6 + 6	24	5	25	27	8	6	11	83	0.24	.13	.11	1.7	0.31	.21	53
			8 + 8	28	3	23	27	7	6	10	85	0.22	.11	.11	1.7	0.31	.19	49
Royal Indigo Gray	CR-08	Gray*	6 + 6	24	1	3	48	9	11	3	86	0.13	.04	.10	1.7	0.31	.11	31
			8 + 8	28	1	3	48	7	9	2	89	0.13	.03	.10	1.7	0.31	.11	30
Royal Indigo Gray	CR-14	Gray*	6 + 6	24	2	6	44	8	8	5	87	0.16	.06	.10	1.7	0.31	.14	37
			8 + 8	28	1	5	44	6	7	4	89	0.15	.05	.10	1.7	0.31	.13	35
Royal Indigo Gray	CR-20	Gray*	6 + 6	24	3	8	39	6	8	7	86	0.18	.08	.11	1.7	0.31	.16	42
			8 + 8	28	2	7	39	6	7	5	88	0.17	.06	.11	1.7	0.31	.15	39
Royal Indigo Gray	CR-35	Gray*	6 + 6	24	5	15	27	5	6	11	83	0.25	.13	.12	1.7	0.31	.21	54
			8 + 8	28	4	11	27	5	6	9	85	0.22	.11	.11	1.7	0.31	.19	49
Cobalt Blue	CR-08	Blue*	6 + 6	24	1	4	48	13	11	3	86	0.13	.03	.10	1.7	0.31	.11	31
Cobalt Blue	CR-14	Blue*	6 + 6	24	2	8	44	10	9	5	86	0.16	.06	.10	1.7	0.31	.14	36
Cobalt Blue	CR-20	Blue*	6 + 6	24	3	11	39	8	8	7	86	0.18	.08	.10	1.7	0.31	.16	41
Cobalt Blue	CR-35	Blue*	6 + 6	24	6	19	27	6	6	12	82	0.25	.14	.11	1.7	0.31	.21	54

*Heat strengthening or tempering of colored substrate required. See additional notes on page 42.

Guardian North American Performance Data *Double Glazing – Low-E Enhanced*

Type			12mm Airspace	Total Thickness	U.V.	Visible Light			Solar Energy						European	American (ASHRAE)		
															Winter Nighttime	Winter Nighttime	Summer	
							Reflectance					Shading Coefficient			K-Value (air)	U-Value (air)		
Description	Coating	Outboard Lite	mm + mm	mm	Trans-mittance %	Trans-mittance %	Indoors %	Outdoors %	Reflec-tance % Out	Trans-mittance %	Absorp-tance %	Total	Short Wave	Long Wave	W/m²K	BTU/hr•ft²•F	Solar Heat Gain Coefficient	Relative Heat Gain BTU/hr•ft²
High-Performance Reflective Float Glass (Cont.) *(Manufactured in Corsicana, Texas, USA)*																		
Royal	CR-08	Azurlite®*	6 + 6	24	1	6	48	19	10	2	88	0.12	.03	.09	1.7	0.31	.10	29
Tourmaline	CR-14		6 + 6	24	2	10	44	14	8	4	88	0.14	.05	.10	1.7	0.31	.12	33
Blue-Green	CR-20		6 + 6	24	3	14	39	10	7	5	87	0.16	.06	.10	1.7	0.31	.14	37
	CR-35		6 + 6	24	5	24	27	8	6	10	85	0.21	.11	.10	1.7	0.31	.18	48
Platinum	SP-13	Clear	6 + 6	24	5	11	38	29	23	7	70	0.18	.09	.09	1.7	0.31	.15	40
	SP-18				8	15	35	24	21	10	69	0.21	.11	.10	1.7	0.31	.18	47
	SP-22				10	19	33	20	17	12	71	0.24	.14	.10	1.7	0.31	.21	54
	SP-33				14	28	27	11	12	18	71	0.32	.21	.12	1.7	0.31	.28	69
Serenity Green	SP-13	Green*	6 + 6	24	2	10	38	22	11	4	84	0.15	.05	.09	1.7	0.31	.13	34
	SP-18				4	13	35	18	10	6	84	0.17	.07	.10	1.7	0.31	.14	38
	SP-22				4	16	33	15	9	7	84	0.19	.09	.10	1.7	0.31	.16	42
	SP-33				6	24	27	9	7	11	83	0.23	.13	.11	1.7	0.31	.20	51
Satin Bronze	SP-13	Bronze*	6 + 6	24	2	7	38	13	11	4	84	0.15	.05	.10	1.7	0.31	.13	35
	SP-18				3	9	35	11	11	6	83	0.17	.07	.10	1.7	0.31	.15	39
	SP-22				4	11	33	10	9	7	84	0.19	.09	.10	1.7	0.31	.16	43
	SP-33				6	17	27	7	7	11	82	0.24	.12	.11	1.7	0.31	.20	52
Starlite Gray	SP-13	Gray*	6 + 6	24	3	6	38	10	11	4	85	0.15	.05	.10	1.7	0.31	.13	34
	SP-18				4	8	35	9	10	6	84	0.17	.07	.10	1.7	0.31	.14	38
	SP-22				5	9	33	8	9	7	84	0.19	.08	.11	1.7	0.31	.16	42
	SP-33				7	14	27	6	7	10	83	0.23	.12	.11	1.7	0.31	.20	51

*Heat-strengthening or tempering of colored substrate required.

Global and North American Notes:
- The performance values shown on pages 23-42 were measured and calculated at Guardian's Central Product Development Center in Carleton, Michigan USA in accordance with LBL Window 4.1 computer analysis using an air mass of 1.5 and represent nominal values.
- Slight variations in values may occur due to manufacturing tolerances, point of manufacture and type of instrumentation used to measure the thermal and optical properties.
- PPG Azurlite® and Ford Blue® available with other coatings.
- *Tolerances:* To maximize building color uniformity, outdoor visible reflectance is controlled within 3.0 percentage points on an individual project basis.
- Double Glazing, Low-E Enhanced: The reflective coating is on #2 surface with Low-E coating on surface #3.

Guardian European Performance Data *Coated Glass*

Type: Description	Type: Coating Clear Substrate	Standard Thickness mm	European (DIN Standards) U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflec-tance % Out	Solar Energy Solar Factor (g-Value)	Solar Energy Reflec-tance % Out	Solar Energy Transmit Direct %	Solar Energy Absorp-tance %	Shading Coefficient Total (b-Value)	Shading Coefficient Short Wave	Shading Coefficient Long Wave	Winter Nighttime K-Value W/m²K Air	Winter Nighttime K-Value W/m²K Argon	Winter Nighttime K-Value W/m²K Argon	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F Air	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F Argon	Summer Solar Heat Gain Coefficient	Summer Relative Heat Gain BTU/hr•ft²
Single Glazing High-Performance Reflective Glass *(Manufactured in Bascharage, Luxembourg)*																			
Silver	CS-11	6.0	6	11	45	20	40	9	51	.23	.11	.12	4.5	–	–	.87	–	.21	61
		8.0	6	11	44	20	37	9	54	.23	.10	.13	4.5	–	–	.86	–	.22	62
	CS-14	6.0	11	14	35	25	30	12	58	.29	.14	.15	4.7	–	–	.91	–	.26	74
		8.0	10	14	34	25	28	12	61	.29	.13	.16	4.7	–	–	.90	–	.27	75
	CS-20	6.0	9	20	28	30	23	16	61	.34	.18	.16	4.9	–	–	.95	–	.32	87
		8.0	9	20	27	30	22	15	63	.34	.17	.17	4.9	–	–	.94	–	.32	87
	CS-35	6.0	24	35	16	44	14	31	56	.51	.35	.16	5.3	–	–	1.00	–	.46	120
		8.0	22	35	16	44	13	29	57	.50	.34	.16	5.2	–	–	.99	–	.45	119
	RDS-52	6.0	31	54	17	59	13	49	38	.68	.57	.11	5.6	–	–	1.06	–	.60	155
		8.0	29	54	17	58	12	47	41	.66	.54	.12	5.5	–	–	1.05	–	.59	152
Gray	CP-20	6.0	15	20	20	33	18	18	64	.38	.21	.17	5.0	–	–	.96	–	.35	95
		8.0	13	20	19	33	16	17	66	.38	.20	.18	5.0	–	–	.95	–	.35	95
	CP-35	6.0	23	35	10	46	9	32	59	.53	.36	.17	5.3	–	–	1.02	–	.48	126
		8.0	21	35	10	46	9	30	61	.52	.35	.18	5.3	–	–	1.01	–	.47	124
Bronze	CB-20	6.0	15	20	16	33	16	17	67	.38	.20	.18	5.0	–	–	.95	–	.35	94
		8.0	14	20	16	33	15	17	69	.38	.19	.18	4.9	–	–	.94	–	.34	94
Blue	CR-14	6.0	6	14	21	27	19	12	69	.31	.14	.17	4.7	–	–	.91	–	.30	82
		8.0	6	14	21	27	18	12	70	.31	.14	.18	4.7	–	–	.90	–	.30	82
	CR-20	6.0	9	20	14	34	13	18	70	.39	.20	.18	5.0	–	–	.95	–	.36	98
		8.0	8	20	14	34	12	17	71	.39	.20	.19	4.9	–	–	.94	–	.36	98
Green	CM-18	6.0	5	18	38	27	28	15	57	.31	.17	.14	4.6	–	–	.89	–	.29	80
		8.0	5	18	37	27	27	14	59	.31	.16	.15	4.6	–	–	.89	–	.29	80

Type: Description	Type: Coating Clear Substrate	12mm Airspace mm+mm	European (DIN Standards) U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflec-tance % Out	Solar Energy Solar Factor (g-Value)	Solar Energy Reflec-tance % Out	Solar Energy Transmit Direct %	Solar Energy Absorp-tance %	Shading Coefficient Total (b-Value)	Shading Coefficient Short Wave	Shading Coefficient Long Wave	Winter Nighttime K-Value W/m²K 12mm Air	Winter Nighttime K-Value W/m²K 12mm Argon	Winter Nighttime K-Value W/m²K 16mm Argon	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F Air	American (ASHRAE) Winter Nighttime U-Value BTU/hr•ft²•F Argon	Summer Solar Heat Gain Coefficient	Summer Relative Heat Gain BTU/hr•ft²
Double Glazing High-Performance Reflective Glass *(Manufactured in Bascharage, Luxembourg)*																			
Silver	CS-11	6 + 6	5	10	45	15	40	8	52	.17	.09	.08	2.3	2.1	2.0	.41	.37	.15	41
		8 + 8	4	10	44	15	37	7	56	.17	.08	.09	2.3	2.1	2.0	.40	.36	.15	41
	CS-14	6 + 6	8	13	35	19	30	10	60	.21	.12	.09	2.4	2.2	2.1	.42	.39	.19	50
		8 + 8	7	12	35	18	28	9	63	.21	.11	.10	2.4	2.2	2.1	.42	.38	.18	50
	CS-20	6 + 6	7	18	28	22	23	13	63	.26	.15	.11	2.5	2.3	2.2	.44	.40	.23	60
		8 + 8	6	17	28	22	22	12	66	.25	.14	.11	2.5	2.3	2.2	.43	.40	.22	59
	CS-35	6 + 6	18	32	17	35	15	25	60	.41	.29	.11	2.6	2.4	2.3	.46	.42	.35	90
		8 + 8	16	31	17	34	14	24	63	.39	.27	.12	2.6	2.4	2.3	.45	.42	.34	87
	RDS-52	6 + 6	23	49	20	50	15	41	45	.57	.47	.10	2.8	2.6	2.5	.48	.45	.50	124
		8 + 8	21	48	19	48	14	37	49	.55	.43	.12	2.7	2.5	2.4	.47	.44	.48	119

See additional notes on page 45.

Guardian European Performance Data *Coated Glass*

Type		12mm Airspace	European (DIN Standards)													American (ASHRAE)			
			U.V.	Visible Light		Solar Energy							Winter Nighttime			Winter Nighttime		Summer	
										Shading Coefficient			K-Value W/m²K			U-Value BTU/hr•ft²•F			
Description	Coating Clear Substrate	mm+mm	Trans-mittance %	Trans-mittance %	Reflec-tance % Out	Solar Factor (g-Value)	Reflec-tance % Out	Transmit Direct %	Absorp-tance %	Total (b-Value)	Short Wave	Long Wave	12mm Air	12mm Argon	16mm Argon	Air	Argon	Solar Heat Gain Coefficient	Relative Heat Gain BTU/hr•ft²
Double Glazing High-Performance Reflective Glass (Cont.) *(Manufactured in Bascharage, Luxembourg)*																			
Gray	CP-20	6 + 6	11	18	20	25	18	15	67	.29	.17	.12	2.5	2.3	2.2	.44	.41	.25	66
		8 + 8	10	18	20	25	17	14	69	.28	.16	.12	2.5	2.3	2.2	.44	.40	.25	65
	CP-35	6 + 6	17	32	11	37	10	26	64	.42	.30	.12	2.7	2.5	2.4	.46	.43	.37	94
		8 + 8	15	31	11	36	9	24	66	.41	.28	.13	2.6	2.4	2.3	.46	.42	.36	91
Bronze	CB-20	6 + 6	11	18	17	25	16	15	69	.29	.17	.12	2.5	2.3	2.2	.44	.40	.25	65
		8 + 8	10	18	16	24	15	14	72	.28	.16	.13	2.5	2.3	2.2	.43	.40	.24	64
Blue	CR-14	6 + 6	5	13	22	20	19	10	71	.23	.12	.11	2.4	2.2	2.1	.42	.39	.21	55
		8 + 8	4	12	21	20	18	10	72	.23	.11	.12	2.4	2.2	2.1	.42	.38	.20	54
	CR-20	6 + 6	7	18	14	26	13	15	72	.29	.17	.12	2.5	2.3	2.2	.44	.40	.26	68
		8 + 8	6	18	14	25	12	14	74	.29	.16	.13	2.5	2.3	2.2	.43	.40	.26	67
Green	CM-18	6 + 6	4	16	38	21	28	12	59	.24	.14	.10	2.4	2.2	2.0	.41	.38	.21	56
		8 + 8	4	16	38	20	27	11	62	.23	.13	.10	2.4	2.1	2.0	.41	.37	.21	55
Double Glazing–Low-E Enhanced *(Manufactured in Bascharage, Luxembourg)*																			
Silver	CS-11	6 + 6	3	9	45	12	40	6	54	.14	.07	.07	1.7	1.4	1.3	.32	.27	.12	33
		8 + 8	3	9	44	12	37	6	57	.14	.07	.07	1.7	1.4	1.2	.31	.26	.12	33
	CS-14	6 + 6	6	12	35	15	30	8	62	.17	.09	.08	1.7	1.4	1.3	.32	.27	.15	40
		8 + 8	5	11	34	15	28	7	65	.17	.08	.09	1.7	1.4	1.3	.31	.26	.15	39
	CS-20	6 + 6	5	17	28	18	24	10	66	.21	.12	.09	1.7	1.4	1.3	.32	.27	.18	47
		8 + 8	4	16	27	18	22	10	68	.21	.11	.10	1.7	1.4	1.3	.32	.27	.18	47
	CS-35	6 + 6	12	29	17	29	16	19	65	.33	.22	.11	1.7	1.4	1.3	.32	.27	.29	72
		8 + 8	11	29	17	28	15	18	67	.32	.21	.12	1.7	1.4	1.3	.32	.27	.28	70
	RDS-52	6 + 6	16	45	19	41	19	30	52	.47	.34	.12	1.7	1.4	1.3	.32	.27	.41	99
		8 + 8	14	44	18	39	17	28	55	.45	.32	.13	1.7	1.4	1.3	.32	.27	.39	96
Gray	CP-20	6 + 6	7	17	20	20	18	11	70	.23	.13	.10	1.7	1.4	1.3	.32	.27	.20	51
		8 + 8	7	16	20	20	17	11	72	.23	.12	.11	1.7	1.4	1.3	.32	.27	.20	51
	CP-35	6 + 6	12	29	11	30	12	20	69	.34	.22	.12	1.7	1.4	1.3	.32	.27	.30	74
		8 + 8	10	29	10	29	11	18	71	.33	.21	.12	1.7	1.4	1.3	.32	.27	.29	72
Bronze	CB-20	6 + 6	8	17	16	20	16	11	72	.23	.13	.10	1.7	1.4	1.3	.32	.27	.20	51
		8 + 8	7	16	16	20	15	11	74	.23	.12	.11	1.7	1.4	1.3	.32	.27	.20	50
Blue	CR-14	6 + 6	3	12	21	16	19	8	73	.19	.09	.10	1.7	1.4	1.3	.32	.27	.16	43
		8 + 8	3	12	21	16	18	7	74	.18	.09	.10	1.7	1.4	1.3	.31	.26	.16	43
	CR-20	6 + 6	5	17	14	21	13	11	75	.24	.13	.11	1.7	1.4	1.3	.32	.27	.21	53
		8 + 8	4	17	14	20	13	11	77	.23	.12	.11	1.7	1.4	1.3	.32	.27	.20	52
Green	CM-18	6 + 6	3	15	38	17	29	10	62	.20	.11	.09	1.7	1.4	1.3	.32	.27	.18	46
		8 + 8	3	14	38	17	27	9	64	.20	.10	.09	1.7	1.4	1.3	.31	.26	.17	45

See additional notes on page 45.

Description /Coating	Outboard Lite	Thickness mm+mm (12mm Airspace)	U.V. Trans-mittance %	Visible Light Trans-mittance %	Visible Light Reflec-tance % Out	Solar Energy Solar Factor (g-Value)	Solar Energy Reflec-tance % Out	Solar Energy Transmit Direct %	Solar Energy Absorp-tance %	Shading Coefficient Total (b-Value)	Shading Coefficient Short Wave	Shading Coefficient Long Wave	Winter Nighttime K-Value W/m²K 12mm Air	K-Value 12mm Argon	K-Value 16mm Argon	Winter Nighttime U-Value BTU/hr•ft²•F Air	U-Value Argon	Summer Solar Heat Gain Coefficient	Summer Relative Heat Gain BTU/hr•ft²
Double Glazing – High-Performance Low Emissivity *(Manufactured in Bascharage, Luxembourg)*																			
Silver 43	Clear	6 + 6	14	43	43	27	46	23	31	.31	.27	.05	1.6	1.3	1.1	.30	.25	.27	66
		8 + 8	13	42	42	27	42	22	35	.31	.25	.06	1.6	1.3	1.1	.30	.25	.26	65
Silver 50	Clear	6 + 6	17	50	38	32	44	27	29	.36	.32	.05	1.7	1.3	1.2	.31	.25	.31	76
		8 + 8	15	49	38	31	40	26	34	.36	.30	.06	1.6	1.3	1.2	.30	.25	.30	75
Neutral 52	Clear	6 + 6	21	52	14	42	18	35	47	.48	.40	.08	1.9	1.6	1.5	.34	.29	.42	103
		8 + 8	19	51	14	41	17	33	50	.47	.38	.09	1.9	1.6	1.5	.34	.29	.41	100
Super-Neutral 63	Clear	6 + 6	11	63	13	34	31	29	40	.39	.33	.05	1.6	1.3	1.1	.30	.25	.32	79
		8 + 8	10	61	13	33	28	28	44	.38	.32	.06	1.6	1.3	1.1	.30	.25	.32	78
Natural 62	Clear	6 + 6	19	62	16	43	26	38	36	.50	.43	.07	1.7	1.4	1.3	.32	.27	.43	104
		8 + 8	17	61	16	42	24	35	41	.49	.41	.08	1.7	1.4	1.3	.32	.27	.42	102
Blue 59	Clear	6 + 6	22	59	23	44	27	38	35	.51	.44	.07	1.8	1.5	1.4	.33	.28	.44	108
		8 + 8	20	57	23	43	25	36	39	.49	.41	.08	1.8	1.5	1.4	.33	.28	.43	105
Green 41	Green	6 + 6	7	42	28	24	17	18	65	.28	.21	.07	1.7	1.3	1.2	.31	.25	.24	59
		8 + 8	5	39	25	23	14	16	70	.26	.18	.08	1.6	1.3	1.2	.30	.25	.22	55
Green 52	Green	6 + 6	8	52	12	31	10	24	66	.35	.27	.08	1.7	1.4	1.3	.32	.27	.30	74
		8 + 8	6	48	11	28	8	21	71	.32	.23	.09	1.7	1.4	1.3	.32	.27	.27	68
Double Glazing – Low-E *(Manufactured in Bascharage, Luxembourg)*																			
Low-E on #3	Clear	4 + 4	32	76	12	63	24	52	24	.72	.60	.13	1.8	1.5	1.4	.33	.28	.63	150
		6 + 6	28	74	12	60	22	48	30	.69	.55	.14	1.8	1.5	1.4	.33	.28	.60	145
		8 + 8	25	72	12	58	20	45	35	.67	.52	.15	1.8	1.5	1.4	.33	.28	.58	140
Low-E on #2	Clear	4 + 4	32	76	12	57	22	52	26	.65	.60	.06	1.8	1.5	1.4	.33	.28	.57	136
		6 + 6	28	74	11	55	20	48	32	.63	.55	.08	1.8	1.5	1.4	.33	.28	.54	131
		8 + 8	25	72	11	53	18	45	37	.61	.52	.09	1.8	1.5	1.4	.33	.28	.53	127
Low-E on #2/#3	Clear	4 + 4	22	70	10	53	24	43	33	.61	.50	.11	1.7	1.3	1.2	.31	.26	.52	126
		6 + 6	19	69	9	51	21	40	38	.59	.47	.12	1.7	1.3	1.2	.31	.26	.51	122
		8 + 8	17	67	9	50	19	38	43	.57	.44	.13	1.7	1.3	1.2	.31	.26	.49	119

European Notes:

- The performance values shown on pages 43-45 were measured and calculated at Guardian's Central Product Development Center in Carleton, Michigan USA and represent nominal values. Slight variations in values may occur due to manufacturing tolerances, point of manufacture and type of instrumentation used to measure the thermal and optical properties. *This may be particularly true for European performance data published in the "European Product Selection Guide," which, in most instances, represents values certified by an independent institution as required by current European standards.*
- Selectivity Number: A European expression for the ratio of visible light transmittance (Tvis) to the g-Value. Selectivity number = Tvis/g-Value. A number greater than 1 shows that the glass selectivity transmits visible light and filters out a significant portion of the infrared solar heat.
- All coatings on #2 surface and Low-E #3 unless otherwise specified.
- Additional performance data on units with 16mm air or argon available in Luxguard brochure.
- The K-values for monolithic glazings are valid only if glass is assured to be free of condensation.

Thermal Properties of Building Materials

Table 4 Typical Thermal Properties of Common Building and Insulating Materials—Design Values[a]

Description	Density, lb/ft^3	Conductivity[b] (k), Btu·in / h·ft^2·°F	Conductance (C), Btu / h·ft^2·°F	Resistance[c] (R) Per Inch Thickness ($1/k$), °F·ft^2·h / Btu·in	Resistance[c] (R) For Thickness Listed ($1/C$), °F·ft^2·h / Btu	Specific Heat, Btu / lb·°F
BUILDING BOARD						
Asbestos-cement board	120	4.0	—	0.25	—	0.24
Asbestos-cement board ... 0.125 in.	120	—	33.00	—	0.03	
Asbestos-cement board ... 0.25 in.	120	—	16.50	—	0.06	
Gypsum or plaster board ... 0.375 in.	50	—	3.10	—	0.32	0.26
Gypsum or plaster board ... 0.5 in.	50	—	2.22	—	0.45	
Gypsum or plaster board ... 0.625 in.	50	—	1.78	—	0.56	
Plywood (Douglas Fir)[d]	34	0.80	—	1.25	—	0.29
Plywood (Douglas Fir) ... 0.25 in.	34	—	3.20	—	0.31	
Plywood (Douglas Fir) ... 0.375 in.	34	—	2.13	—	0.47	
Plywood (Douglas Fir) ... 0.5 in.	34	—	1.60	—	0.62	
Plywood (Douglas Fir) ... 0.625 in.	34	—	1.29	—	0.77	
Plywood or wood panels ... 0.75 in.	34	—	1.07	—	0.93	0.29
Vegetable fiber board						
Sheathing, regular density[e] ... 0.5 in.	18	—	0.76	—	1.32	0.31
... 0.78125 in.	18	—	0.49	—	2.06	
Sheathing intermediate density[e] ... 0.5 in.	22	—	0.92	—	1.09	0.31
Nail-base sheathing[e] ... 0.5 in.	25	—	0.94	—	1.06	0.31
Shingle backer ... 0.375 in.	18	—	1.06	—	0.94	0.31
Shingle backer ... 0.3125 in.	18	—	1.28	—	0.78	
Sound deadening board ... 0.5 in.	15	—	0.74	—	1.35	0.30
Tile and lay-in panels, plain or acoustic	18	0.40	—	2.50	—	0.14
... 0.5 in.	18	—	0.80	—	1.25	
... 0.75 in.	18	—	0.53	—	1.89	
Laminated paperboard	30	0.50	—	2.00	—	0.33
Homogeneous board from repulped paper	30	0.50	—	2.00	—	0.28
Hardboard[e]						
Medium density	50	0.73	—	1.37	—	0.31
High density, service-tempered grade and service grade	55	0.82	—	1.22	—	0.32
High density, standard-tempered grade	63	1.00	—	1.00	—	0.32
Particleboard[e]						
Low density	37	0.71	—	1.41	—	0.31
Medium density	50	0.94	—	1.06	—	0.31
High density	62	.5	1.18	—	0.85	—
Underlayment ... 0.625 in.	40	—	1.22	—	0.82	0.29
Waferboard	37	0.63	—	1.59	—	—
Wood subfloor ... 0.75 in.	—	—	1.06	—	0.94	0.33
BUILDING MEMBRANE						
Vapor—permeable felt	—	—	16.70	—	0.06	
Vapor—seal, 2 layers of mopped 15-lb felt	—	—	8.35	—	0.12	
Vapor—seal, plastic film	—	—	—	—	Negl.	
FINISH FLOORING MATERIALS						
Carpet and fibrous pad	—	—	0.48	—	2.08	0.34
Carpet and rubber pad	—	—	0.81	—	1.23	0.33
Cork tile ... 0.125 in.	—	—	3.60	—	0.28	0.48
Terrazzo ... 1 in.	—	—	12.50	—	0.08	0.19
Tile—asphalt, linoleum, vinyl, rubber	—	—	20.00	—	0.05	0.30
vinyl asbestos						0.24
ceramic						0.19
Wood, hardwood finish ... 0.75 in.	—	—	1.47	—	0.68	
INSULATING MATERIALS						
Blanket and Batt[f,g]						
Mineral fiber, fibrous form processed from rock, slag, or glass						
approx. 3-4 in.	0.4-2.0	—	0.091	—	11	
approx. 3.5 in.	0.4-2.0	—	0.077	—	13	
approx. 3.5 in.	1.2-1.6	—	0.067	—	15	
approx. 5.5-6.5 in.	0.4-2.0	—	0.053	—	19	
approx. 5.5 in.	0.6-1.0	—	0.048	—	21	
approx. 6-7.5 in.	0.4-2.0	—	0.045	—	22	
approx. 8.25-10 in.	0.4-2.0	—	0.033	—	30	
approx. 10-13 in.	0.4-2.0	—	0.026	—	38	
Board and Slabs						
Cellular glass	8.0	0.33	—	3.03	—	0.18
Glass fiber, organic bonded	4.0-9.0	0.25	—	4.00	—	0.23
Expanded perlite, organic bonded	1.0	0.36	—	2.78	—	0.30
Expanded rubber (rigid)	4.5	0.22	—	4.55	—	0.40
Expanded polystyrene, extruded (smooth skin surface) (CFC-12 exp.)	1.8-3.5	0.20	—	5.00	—	0.29

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Thermal Properties of Building Materials (continued)

Table 4 Typical Thermal Properties of Common Building and Insulating Materials—Design Values[a] (Continued)

Description	Density, lb/ft³	Conductivity[b] (k), Btu·in / h·ft²·°F	Conductance (C), Btu / h·ft²·°F	Resistance[c] (R) Per Inch Thickness (1/k), °F·ft²·h / Btu·in	Resistance[c] (R) For Thickness Listed (1/C), °F·ft²·h / Btu	Specific Heat, Btu / lb·°F
Expanded polystyrene, extruded (smooth skin surface) (HCFC-142b exp.)[h]	1.8-3.5	0.20	—	5.00	—	0.29
Expanded polystyrene, molded beads	1.0	0.26	—	3.85	—	—
	1.25	0.25	—	4.00	—	—
	1.5	0.24	—	4.17	—	—
	1.75	0.24	—	4.17	—	—
	2.0	0.23	—	4.35	—	—
Cellular polyurethane/polyisocyanurate[i] (CFC-11 exp.) (unfaced)	1.5	0.16-0.18	—	6.25-5.56	—	0.38
Cellular polyisocyanurate[i] (CFC-11 exp.) (gas-permeable facers)	1.5-2.5	0.16-0.18	—	6.25-5.56	—	0.22
Cellular polyisocyanurate[j] (CFC-11 exp.) (gas-impermeable facers)	2.0	0.14	—	7.04	—	0.22
Cellular phenolic (closed cell) (CFC-11, CFC-113 exp.)[k]	3.0	0.12	—	8.20	—	—
Cellular phenolic (open cell)	1.8-2.2	0.23	—	4.40	—	—
Mineral fiber with resin binder	15.0	0.29	—	3.45	—	0.17
Mineral fiberboard, wet felted						
Core or roof insulation	16-17	0.34	—	2.94	—	—
Acoustical tile	18.0	0.35	—	2.86	—	0.19
Acoustical tile	21.0	0.37	—	2.70	—	—
Mineral fiberboard, wet molded						
Acoustical tile[l]	23.0	0.42	—	2.38	—	0.14
Wood or cane fiberboard						
Acoustical tile[l] 0.5 in.	—	—	0.80	—	1.25	0.31
Acoustical tile[l] 0.75 in.	—	—	0.53	—	1.89	—
Interior finish (plank, tile)	15.0	0.35	—	2.86	—	0.32
Cement fiber slabs (shredded wood with Portland cement binder)	25-27.0	0.50-0.53		2.0-1.89	—	
Cement fiber slabs (shredded wood with magnesia oxysulfide binder)	22.0	0.57	—	1.75	—	0.31
Loose Fill						
Cellulosic insulation (milled paper or wood pulp)	2.3-3.2	0.27-0.32	—	3.70-3.13	—	0.33
Perlite, expanded	2.0-4.1	0.27-0.31	—	3.7-3.3	—	0.26
	4.1-7.4	0.31-0.36	—	3.3-2.8	—	—
	7.4-11.0	0.36-0.42	—	2.8-2.4	—	—
Mineral fiber (rock, slag, or glass)[g]						
approx. 3.75-5 in.	0.6-2.0	—	—	—	11.0	0.17
approx. 6.5-8.75 in.	0.6-2.0	—	—	—	19.0	—
approx. 7.5-10 in.	0.6-2.0	—	—	—	22.0	—
approx. 10.25-13.75 in.	0.6-2.0	—	—	—	30.0	—
Mineral fiber (rock, slag, or glass)[g]						
approx. 3.5 in. (closed sidewall application)	2.0-3.5	—	—	—	12.0-14.0	—
Vermiculite, exfoliated	7.0-8.2	0.47	—	2.13	—	0.32
	4.0-6.0	0.44	—	2.27	—	—
Spray Applied						
Polyurethane foam	1.5-2.5	0.16-0.18	—	6.25-5.56	—	—
Ureaformaldehyde foam	0.7-1.6	0.22-0.28	—	4.55-3.57	—	—
Cellulosic fiber	3.5-6.0	0.29-0.34	—	3.45-2.94	—	—
Glass fiber	3.5-4.5	0.26-0.27	—	3.85-3.70	—	—
Reflective Insulation						
Reflective material (ε < 0.5) in center of 3/4 in. cavity forms two 3/8 in. vertical air spaces[m]	—	—	0.31	—	3.2	—
METALS (See Chapter 36, Table 3)						
ROOFING						
Asbestos-cement shingles	120	—	4.76	—	0.21	0.24
Asphalt roll roofing	70	—	6.50	—	0.15	0.36
Asphalt shingles	70	—	2.27	—	0.44	0.30
Built-up roofing 0.375 in.	70	—	3.00	—	0.33	0.35
Slate 0.5 in.	—	—	20.00	—	0.05	0.30
Wood shingles, plain and plastic film faced	—	—	1.06	—	0.94	0.31
PLASTERING MATERIALS						
Cement plaster, sand aggregate	116	5.0	—	0.20	—	0.20
Sand aggregate 0.375 in.	—	—	13.3	—	0.08	0.20
Sand aggregate 0.75 in.	—	—	6.66	—	0.15	0.20

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Thermal Properties of Building Materials (continued)

Table 4 Typical Thermal Properties of Common Building and Insulating Materials—Design Values[a] (Continued)

Description	Density, lb/ft³	Conductivity[b] (k), Btu·in/(h·ft²·°F)	Conductance (C), Btu/(h·ft²·°F)	Resistance[c] (R): Per Inch Thickness (1/k), °F·ft²·h/(Btu·in)	Resistance[c] (R): For Thickness Listed (1/C), °F·ft²·h/Btu	Specific Heat, Btu/(lb·°F)
Gypsum plaster:						
Lightweight aggregate ....0.5 in.	45	—	3.12	—	0.32	—
Lightweight aggregate ....0.625 in.	45	—	2.67	—	0.39	—
Lightweight aggregate on metal lath ....0.75 in.	—	—	2.13	—	0.47	—
Perlite aggregate	45	1.5	—	0.67	—	0.32
Sand aggregate....	105	5.6	—	0.18	—	0.20
Sand aggregate....0.5 in.	105	—	11.10	—	0.09	—
Sand aggregate....0.625 in.	105	—	9.10	—	0.11	—
Sand aggregate on metal lath ....0.75 in.	—	—	7.70	—	0.13	—
Vermiculite aggregate....	45	1.7	—	0.59	—	—
MASONRY MATERIALS						
Masonry Units						
Brick, fired clay	150	8.4-10.2	—	0.12-0.10	—	—
	140	7.4-9.0	—	0.14-0.11	—	—
	130	6.4-7.8	—	0.16-0.12	—	—
	120	5.6-6.8	—	0.18-0.15	—	0.19
	110	4.9-5.9	—	0.20-0.17	—	—
	100	4.2-5.1	—	0.24-0.20	—	—
	90	3.6-4.3	—	0.28-0.24	—	—
	80	3.0-3.7	—	0.33-0.27	—	—
	70	2.5-3.1	—	0.40-0.33	—	—
Clay tile, hollow						
1 cell deep ....3 in.	—	—	1.25	—	0.80	0.21
1 cell deep ....4 in.	—	—	0.90	—	1.11	—
2 cells deep....6 in.	—	—	0.66	—	1.52	—
2 cells deep....8 in.	—	—	0.54	—	1.85	—
2 cells deep....10 in.	—	—	0.45	—	2.22	—
3 cells deep....12 in.	—	—	0.40	—	2.50	—
Concrete blocks[n, o]						
Limestone aggregate						
8 in., 36 lb, 138 lb/ft³ concrete, 2 cores	—	—	—	—	—	—
Same with perlite filled cores	—	—	0.48	—	2.1	—
12 in., 55 lb, 138 lb/ft³ concrete, 2 cores	—	—	—	—	—	—
Same with perlite filled cores	—	—	0.27	—	3.7	—
Normal weight aggregate (sand and gravel)						
8 in., 33-36 lb, 126-136 lb/ft³ concrete, 2 or 3 cores	—	—	0.90-1.03	—	1.11-0.97	0.22
Same with perlite filled cores	—	—	0.50	—	2.0	—
Same with vermiculite filled cores	—	—	0.52-0.73	—	1.92-1.37	—
12 in., 50 lb, 125 lb/ft³ concrete, 2 cores	—	—	0.81	—	1.23	0.22
Medium weight aggregate (combinations of normal weight and lightweight aggregate)						
8 in., 26-29 lb, 97-112 lb/ft³ concrete, 2 or 3 cores..	—	—	0.58-0.78	—	1.71-1.28	—
Same with perlite filled cores	—	—	0.27-0.44	—	3.7-2.3	—
Same with vermiculite filled cores	—	—	0.30	—	3.3	—
Same with molded EPS (beads) filled cores....	—	—	0.32	—	3.2	—
Same with molded EPS inserts in cores....	—	—	0.37	—	2.7	—
Lightweight aggregate (expanded shale, clay, slate or slag, pumice)						
6 in., 16-17 lb 85-87 lb/ft³ concrete, 2 or 3 cores	—	—	0.52-0.61	—	1.93-1.65	—
Same with perlite filled cores	—	—	0.24	—	4.2	—
Same with vermiculite filled cores	—	—	0.33	—	3.0	—
8 in., 19-22 lb, 72-86 lb/ft³ concrete....	—	—	0.32-0.54	—	3.2-1.90	0.21
Same with perlite filled cores	—	—	0.15-0.23	—	6.8-4.4	—
Same with vermiculite filled cores	—	—	0.19-0.26	—	5.3-3.9	—
Same with molded EPS (beads) filled cores....	—	—	0.21	—	4.8	—
Same with UF foam filled cores	—	—	0.22	—	4.5	—
Same with molded EPS inserts in cores....	—	—	0.29	—	3.5	—
12 in., 32-36 lb, 80-90 lb/ft³ concrete, 2 or 3 cores...	—	—	0.38-0.44	—	2.6-2.3	—
Same with perlite filled cores	—	—	0.11-0.16	—	9.2-6.3	—
Same with vermiculite filled cores	—	—	0.17	—	5.8	—
Stone, lime, or sand....	180	72	—	0.01	—	—
Quartzitic and sandstone	160	43	—	0.02	—	—
	140	24	—	0.04	—	—
	120	13	—	0.08	—	0.19
Calcitic, dolomitic, limestone, marble, and granite	180	30	—	0.03	—	—
	160	22	—	0.05	—	—
	140	16	—	0.06	—	—
	120	11	—	0.09	—	0.19
	100	8	—	0.13	—	—

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Thermal Properties of Building Materials (continued)

Table 4 Typical Thermal Properties of Common Building and Insulating Materials—Design Values[a] (Continued)

Description	Density, lb/ft³	Conductivity[b] (k), Btu·in / h·ft²·°F	Conductance (C), Btu / h·ft²·°F	Resistance[c] (R): Per Inch Thickness (1/k), °F·ft²·h / Btu·in	Resistance[c] (R): For Thickness Listed (1/C), °F·ft²·h / Btu	Specific Heat, Btu / lb·°F
Gypsum partition tile						
3 by 12 by 30 in., solid	—	—	0.79	—	1.26	0.19
3 by 12 by 30 in., 4 cells	—	—	0.74	—	1.35	—
4 by 12 by 30 in., 3 cells	—	—	0.60	—	1.67	—
Concretes[o]						
Sand and gravel or stone aggregate concretes (concretes	150	10.0-20.0	—	0.10-0.05	—	—
with more than 50% quartz or quartzite sand have	140	9.0-18.0	—	0.11-0.06	—	0.19-0.24
conductivities in the higher end of the range)	130	7.0-13.0	—	0.14-0.08	—	—
Limestone concretes	140	11.1	—	0.09	—	—
	120	7.9	—	0.13	—	—
	100	5.5	—	0.18	—	—
Gypsum-fiber concrete (87.5% gypsum, 12.5% wood chips)	51	1.66	—	0.60	—	0.21
Cement/lime, mortar, and stucco	120	9.7	—	0.10	—	—
	100	6.7	—	0.15	—	—
	80	4.5	—	0.22	—	—
Lightweight aggregate concretes						
Expanded shale, clay, or slate; expanded slags;	120	6.4-9.1	—	0.16-0.11	—	—
cinders; pumice (with density up to 100 lb/ft³); and	100	4.7-6.2	—	0.21-0.16	—	0.20
scoria (sanded concretes have conductivities in the	80	3.3-4.1	—	0.30-0.24	—	0.20
higher end of the range)	60	2.1-2.5	—	0.48-0.40	—	—
	40	1.3	—	0.78	—	—
Perlite, vermiculite, and polystyrene beads	50	1.8-1.9	—	0.55-0.53	—	—
	40	1.4-1.5	—	0.71-0.67	—	0.15-0.23
	30	1.1	—	0.91	—	—
	20	0.8	—	1.25	—	—
Foam concretes	120	5.4	—	0.19	—	—
	100	4.1	—	0.24	—	—
	80	3.0	—	0.33	—	—
	70	2.5	—	0.40	—	—
Foam concretes and cellular concretes	60	2.1	—	0.48	—	—
	40	1.4	—	0.71	—	—
	20	0.8	—	1.25	—	—
SIDING MATERIALS (on flat surface)						
Shingles						
Asbestos-cement	120	—	4.75	—	0.21	—
Wood, 16 in., 7.5 exposure	—	—	1.15	—	0.87	0.31
Wood, double, 16-in., 12-in. exposure	—	—	0.84	—	1.19	0.28
Wood, plus ins. backer board, 0.312 in.	—	—	0.71	—	1.40	0.31
Siding						
Asbestos-cement, 0.25 in., lapped	—	—	4.76	—	0.21	0.24
Asphalt roll siding	—	—	6.50	—	0.15	0.35
Asphalt insulating siding (0.5 in. bed.)	—	—	0.69	—	1.46	0.35
Hardboard siding, 0.4375 in.	—	—	1.49	—	0.67	0.28
Wood, drop, 1 by 8 in.	—	—	1.27	—	0.79	0.28
Wood, bevel, 0.5 by 8 in., lapped	—	—	1.23	—	0.81	0.28
Wood, bevel, 0.75 by 10 in., lapped	—	—	0.95	—	1.05	0.28
Wood, plywood, 0.375 in., lapped	—	—	1.69	—	0.59	0.29
Aluminum, steel, or vinyl[p, q], over sheathing						
Hollow-backed	—	—	1.64	—	0.61	0.29[q]
Insulating-board backed nominal 0.375 in.	—	—	0.55	—	1.82	0.32
Insulating-board backed nominal 0.375 in., foil backed	—	—	0.34	—	2.96	—
Architectural (soda-lime float) glass	158	6.9	—	—	—	0.21
WOODS (12% moisture content)[e,r]						
Hardwoods						0.39[s]
Oak	41.2-46.8	1.12-1.25	—	0.89-0.80	—	
Birch	42.6-45.4	1.16-1.22	—	0.87-0.82	—	
Maple	39.8-44.0	1.09-1.19	—	0.92-0.84	—	
Ash	38.4-41.9	1.06-1.14	—	0.94-0.88	—	
Softwoods						0.39[s]
Southern Pine	35.6-41.2	1.00-1.12	—	1.00-0.89	—	
Douglas Fir-Larch	33.5-36.3	0.95-1.01	—	1.06-0.99	—	
Southern Cypress	31.4-32.1	0.90-0.92	—	1.11-1.09	—	
Hem-Fir, Spruce-Pine-Fir	24.5-31.4	0.74-0.90	—	1.35-1.11	—	
West Coast Woods, Cedars	21.7-31.4	0.68-0.90	—	1.48-1.11	—	
California Redwood	24.5-28.0	0.74-0.82	—	1.35-1.22	—	

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Thermal Properties of Building Materials (continued)

Notes for Table 4

[a]Values are for a mean temperature of 75°F. Representative values for dry materials are intended as design (not specification) values for materials in normal use. Thermal values of insulating materials may differ from design values depending on their in-situ properties (e.g., density and moisture content, orientation, etc.) and variability experienced during manufacture. For properties of a particular product, use the value supplied by the manufacturer or by unbiased tests.

[b]To obtain thermal conductivities in Btu/h · ft · °F, divide the k-factor by 12 in/ft.

[c]Resistance values are the reciprocals of C before rounding off C to two decimal places.

[d]Lewis (1967).

[e]U.S. Department of Agriculture (1974).

[f]Does not include paper backing and facing, if any. Where insulation forms a boundary (reflective or otherwise) of an airspace, see Tables 2 and 3 for the insulating value of an airspace with the appropriate effective emittance and temperature conditions of the space.

[g]Conductivity varies with fiber diameter. (See Chapter 22, Factors Affecting Thermal Performance.) Batt, blanket, and loose-fill mineral fiber insulations are manufactured to achieve specified R-values, the most common of which are listed in the table. Due to differences in manufacturing processes and materials, the product thicknesses, densities, and thermal conductivities vary over considerable ranges for a specified R-value.

[h]This material is relatively new and data are based on limited testing.

[i]For additional information, see Society of Plastics Engineers (SPI) *Bulletin* U108. Values are for aged, unfaced board stock. For change in conductivity with age of expanded polyurethane/polyisocyanurate, see Chapter 22, Factors Affecting Thermal Performance.

[j]Values are for aged products with gas-impermeable facers on the two major surfaces. An aluminum foil facer of 0.001 in. thickness or greater is generally considered impermeable to gases. For change in conductivity with age of expanded polyisocyanurate, see Chapter 22, Factors Affecting Thermal Performance, and SPI *Bulletin* U108.

[k]Cellular phenolic insulation may no longer be manufactured. The thermal conductivity and resistance values do not represent aged insulation, which may have a higher thermal conductivity and lower thermal resistance.

[l]Insulating values of acoustical tile vary, depending on density of the board and on type, size, and depth of perforations.

[m]Cavity is framed with 0.75 in. wood furring strips. Caution should be used in applying this value for other framing materials. The reported value was derived from tests and applies to the reflective path only. The effect of studs or furring strips must be included in determining the overall performance of the wall.

[n]Values for fully grouted block may be approximated using values for concrete with a similar unit weight.

[o]Values for concrete block and concrete are at moisture contents representative of normal use.

[p]Values for metal or vinyl siding applied over flat surfaces vary widely, depending on amount of ventilation of airspace beneath the siding; whether airspace is reflective or nonreflective; and on thickness, type, and application of insulating backing used. Values are averages for use as design guides, and were obtained from several guarded hot box tests (ASTM C 236) or calibrated hot box (ASTM C 976) on hollow-backed types and types made using backing-boards of wood fiber, foamed plastic, and glass fiber. Departures of ±50% or more from these values may occur.

[q]Vinyl specific heat = 0.25 Btu/lb · °F

[r]See Adams (1971), MacLean (1941), and Wilkes (1979). The conductivity values listed are for heat transfer across the grain. The thermal conductivity of wood varies linearly with the density, and the density ranges listed are those normally found for the wood species given. If the density of the wood species is not known, use the mean conductivity value. For extrapolation to other moisture contents, the following empirical equation developed by Wilkes (1979) may be used:

$$k = 0.1791 + \frac{(1.874 \times 10^{-2} + 5.753 \times 10^{-4} M)\rho}{1 + 0.01M}$$

where ρ is density of the moist wood in lb/ft^3, and M is the moisture content in percent.

[s]From Wilkes (1979), an empirical equation for the specific heat of moist wood at 75°F is as follows:

$$c_p = \frac{(0.299 + 0.01M)}{(1 + 0.01M)} + \Delta c_p$$

where Δc_p accounts for the heat of sorption and is denoted by

$$\Delta c_p = M(1.921 \times 10^{-3} - 3.168 \times 10^{-5} M)$$

where M is the moisture content in percent by mass.

Thermal Properties of Industrial Insulations

Table 10 Typical Thermal Conductivity for Industrial Insulations at Various Mean Temperatures—Design Values[a]

Material	Max. Temp.,[b] °F	Typical Density, lb/ft³	Typical Conductivity in Btu·in/h·ft²·°F at Mean Temp., °F: −100	−75	−50	−25	0	25	50	75	100	200	300	500	700	900
BLANKETS AND FELTS																
ALUMINOSILICATE FIBER																
7 to 10 μm diameter fiber	1800	4								0.24		0.32		0.54	0.99	1.03
	2000	6-8								0.25		0.30		0.48	0.78	0.95
3 μm diameter fiber	2200	4								0.22		0.29		0.45	0.59	0.74
MINERAL FIBER (Rock, slag, or glass)																
Blanket, metal reinforced	1200	6-12									0.26	0.32	0.39	0.54		
	1000	2.5-6									0.24	0.31	0.40	0.61		
Blanket, flexible, fine-fiber organic bonded	350	0.75				0.25	0.26	0.28	0.30	0.33	0.36	0.53				
		0.75				0.24	0.25	0.27	0.29	0.32	0.34	0.48				
		1.0				0.23	0.24	0.25	0.27	0.29	0.32	0.43				
		1.5				0.21	0.22	0.23	0.25	0.27	0.28	0.37				
		2.0				0.20	0.21	0.22	0.23	0.25	0.26	0.33				
		3.0				0.19	0.20	0.21	0.22	0.23	0.24	0.31				
Blanket, flexible, textile fiber, organic bonded	350	0.65				0.27	0.28	0.29	0.30	0.31	0.32	0.50	0.68			
		0.75				0.26	0.27	0.28	0.29	0.31	0.32	0.48	0.66			
		1.0				0.24	0.25	0.26	0.27	0.29	0.31	0.45	0.60			
		1.5				0.22	0.23	0.24	0.25	0.27	0.29	0.39	0.51			
		3.0				0.20	0.21	0.22	0.23	0.24	0.25	0.32	0.41			
Felt, semirigid organic bonded	400	3-8						0.24	0.25	0.26	0.27	0.35	0.44			
Laminated and felted without binder	850	3	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.35	0.55			
	1200	7.5											0.35	0.45	0.60	
BLOCKS, BOARDS, AND PIPE INSULATION																
MAGNESIA	600	11-12									0.35	0.38	0.42			
85% CALCIUM SILICATE	1200	11-15									0.38	0.41	0.44	0.52	0.62	0.72
	1800	12-15												0.63	0.74	0.95
CELLULAR GLASS	900	7.8-8.2	0.24	0.25	0.26	0.28	0.29	0.30	0.32	0.33	0.34	0.41	0.49	0.70	1.01	
DIATOMACEOUS SILICA	1600	21-22												0.64	0.68	0.72
	1900	23-25												0.70	0.75	0.80
MINERAL FIBER (Glass)																
Organic bonded, block and boards	400	3-10	0.16	0.17	0.18	0.19	0.20	0.22	0.24	0.25	0.26	0.33	0.40			
Nonpunking binder	1000	3-10									0.26	0.31	0.38	0.52		
Pipe insulation, slag, or glass	350	3-4					0.20	0.21	0.22	0.23	0.24	0.29				
	500	3-10					0.20	0.22	0.24	0.25	0.26	0.33	0.40			
Inorganic bonded block	1000	10-15									0.33	0.38	0.45	0.55		
	1800	15-24									0.32	0.37	0.42	0.52	0.62	0.74
Pipe insulation, slag, or glass	1000	10-15									0.33	0.38	0.45	0.55		
Resin binder		15	0.23	0.24	0.25	0.26	0.28	0.29								
RIGID POLYSTYRENE																
Extruded (CFC-12 exp.)(smooth skin surface)	165	1.8-3.5	0.16	0.16	0.17	0.16	0.17	0.18	0.19	0.20						
Molded beads	165	1	0.17	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.28					
		1.25	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.25	0.27					
		1.5	0.16	0.17	0.19	0.20	0.21	0.22	0.23	0.24	0.26					
		1.75	0.16	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.25					
		2.0	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.23	0.24					
RIGID POLYURETHANE/POLYISOCYANURATE[c,d]																
Unfaced (CFC-11 exp.)	210	1.5-2.5	0.16	0.17	0.18	0.18	0.18	0.17	0.16	0.16	0.17					
RIGID POLYISOCYANURATE																
Gas-impermeable facers (CFC-11 exp.)	250	2.0						0.12	0.13	0.14	0.15					
RIGID PHENOLIC																
Closed cell (CFC-11, CFC-113 exp.)		3.0						0.11	0.115	0.12	0.125					
RUBBER, Rigid foamed	150	4.5						0.20	0.21	0.22	0.23					
VEGETABLE AND ANIMAL FIBER																
Wool felt (pipe insulation)	180	20						0.28	0.30	0.31	0.33					
INSULATING CEMENTS																
MINERAL FIBER (Rock, slag, or glass)																
With colloidal clay binder	1800	24-30									0.49	0.55	0.61	0.73	0.85	
With hydraulic setting binder	1200	30-40									0.75	0.80	0.85	0.95		
LOOSE FILL																
Cellulose insulation (milled pulverized paper or wood pulp)		2.5-3							0.26	0.27	0.29					
Mineral fiber, slag, rock, or glass		2-5			0.19	0.21	0.23	0.25	0.26	0.28	0.31					
Perlite (expanded)		3-5	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.35					
Silica aerogel		7.6			0.13	0.14	0.15	0.15	0.16	0.17	0.18					
Vermiculite (expanded)		7-8.2			0.39	0.40	0.42	0.44	0.45	0.47	0.49					
		4-6			0.34	0.35	0.38	0.40	0.42	0.44	0.46					

[a]Representative values for dry materials, which are intended as design (not specification) values for materials in normal use. Insulation materials in actual service may have thermal values that vary from design values depending on their in-situ properties (e.g., density and moisture content). For properties of a particular product, use the value supplied by the manufacturer or by unbiased tests.

[b]These temperatures are generally accepted as maximum. When operating temperature approaches these limits, follow the manufacturers' recommendations.

[c]Some polyurethane foams are formed by means that produce a stable product (with respect to k), but most are blown with refrigerant and will change with time.

[d]See Table 4, footnote i.

[e]See Table 4, footnote j.

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Soil Thermal Properties

Table 4 Thermal Properties of Soils, Rocks, and Concrete

Material Descriptor	Thermal Conductivity Btu/h · ft · °F (W/m · K)	Thermal Diffusivity ft²/h (mm²/s)	Density lb/ft³ (kg/m³)	Specific Heat Btu/lb · °F (kJ/kg · K)
Dense Rock	2.00 (3.46)	0.050 (1.29)	200 (3200)	0.20 (0.84)
Average Rock	1.40 (2.42)	0.040 (1.03)	175 (2800)	0.20 (0.84)
Dense Concrete	1.00 (1.73)	0.033 (0.85)	150 (2410)	0.20 (0.84)
Solid Masonry Heavy Soil, Damp	0.75 (1.30)	0.025 (0.65)	143 (2290) 131 (2100)	0.21 (0.88) 0.23 (0.96)
Heavy Soil, Dry Light Soil, Damp	0.50 (0.865)	0.020 (0.52)	125 (2000) 100 (1600)	0.20 (0.84) 0.25 (1.05)
Light Soil, Dry	0.20 (0.346)	0.011 (0.28)	90 (1440)	0.20 (0.84)

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Table 7 Typical Apparent Thermal Conductivity Values for Soils, Btu · in/h · ft² · °F

		Recommended Values for Design[a]	
	Normal Range	Low[b]	High[c]
Sands	4.2 to 17.4	5.4	15.6
Silts	6 to 17.4	11.4	15.6
Clays	6 to 11.4	7.8	10.8
Loams	6 to 17.4	6.6	15.6

[a]Reasonable values for use when no site- or soil-specific data are available.
[b]Moderately conservative values for minimum heat loss through soil (e.g., use in soil heat exchanger or earth-contact cooling calculations). Values are from Salomone and Marlowe (1989).
[c]Moderately conservative values for maximum heat loss through soil (e.g., use in peak winter heat loss calculations). Values are from Salomone and Marlowe (1989).

Table 8 Typical Apparent Thermal Conductivity Values for Rocks, Btu · in/h · ft² · °F

	Normal Range
Pumice, tuff, obsidian	3.6 to 15.6
Basalt	3.6 to 18.0
Shale	6 to 27.6
Granite	12 to 30
Limestone, dolomite, marble	8.4 to 30
Quartzose sandstone	9.6 to 54

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Table 12 Apparent Thermal Conductivity (k) for Various Soils[a], Btu · in./h · ft² · °F

Soil Designation	Mechanical Analysis % by Weight				Moisture Content, %						
	Gravel	Sand	Silt	Clay	4			10		20	
					Dry Density, lb/ft³						
	Over 0.079 in.	0.020 to 0.079 in.	0.0002 to 0.002 in.	Under 0.0002 in.	100	110	120	90	110	90	100
Fine Crushed Quartz	0.0	100.0	0.0	0.0	12.0	16.0					
Crushed Quartz	15.5	79.0	5.5		11.5	16.0	22.0				
Graded Ottawa Sand	0.0	99.9	0.1		10.0	14.0					
Fairbanks Sand	27.5	70.0	2.5		8.5±	10.5	13.5		15.0		
Lowell Sand	0.0	100.0	0.0	0.0	8.5	11.0			13.5		
Chena River Gravel	80.0	19.4	0.6			9.0±	13.0				
Crushed Feldspar	25.5	70.3	4.2		6.0	7.5	9.5				
Crushed Granite	16.2	77.0	6.8		5.5	7.5	10.0				
Dakota Sandy Loam	10.9	57.9	21.2	10.0		6.5	9.5		13±		
Crushed Trap Rock	27.0	63.0	10.0		5.0	6.0	7.0				
Ramsey Sandy Loam	0.4	53.6	27.5	18.5	4.5	6.5			10.0		
Northway Fine Sand	0.0	97.0	3.0	0.0	4.5	5.5			8.5		
Northway Sand	3.0	97.0	0.0	0.0	4.5	6.0			7.5±		
Healy Clay	0.0	1.9	20.1	78.0	4.0±			5.5	9.0±	8.0	10.0
Fairbanks Silt Loam	0.0	7.6	80.9	11.5				5.0	9.0±	7.5	10.0
Fairbanks Silty Clay Loam	0.0	9.2	63.8	27.0				5.0	9.0±	7.5	9.5
Northway Silt Loam	1.0	21.0	64.4	13.6				4.0±	7.0±	6.0±	7.0±

[a]Measured at a mean temperature of 40 °F.

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Frame WALL Thermal Properties (Framing Effects)

Table 8-Y U-Values for Opaque Walls (Btu/h-ft^2-°F)

Nominal R-value	Effective R-value	U-value	Expanded Polystyrene 1.0" R3.8	Expanded Polystyrene 1.5" R5.7	Expanded Polystyrene 2.0" R7.6	Extruded Polystyrene 0.75 R3.7	Extruded Polystyrene 1.0" R5.0	Extruded Polystyrene 1.5" R7.5	Extruded Polystyrene 2.0" R10.0	Polyisocyanurate 0.5" R3.6	Polyisocyanurate 0.75 R5.4	Polyisocyanurate 1.0" R7.2	Polyisocyanurate 1.5" R10.8	Polyisocyanurate 2.0" R14.4
2x4 Metal Framing at 16 in on center (3.5 in cavity depth)														
None	(0.0)	0.403	0.159	0.122	0.099	0.162	0.134	0.100	0.080	0.164	0.127	0.103	0.075	0.059
R-11	(5.5)	0.133	0.088	0.076	0.066	0.089	0.080	0.067	0.057	0.090	0.077	0.068	0.055	0.046
R-13	(6.0)	0.125	0.085	0.073	0.064	0.085	0.077	0.064	0.055	0.086	0.074	0.066	0.053	0.045
R-15	(6.4)	0.119	0.082	0.071	0.062	0.082	0.074	0.063	0.054	0.083	0.072	0.064	0.052	0.044
2x4 Metal Framing at 24 in on center (3.5 in cavity depth)														
R-11	(6.6)	0.116	0.080	0.070	0.062	0.081	0.073	0.062	0.054	0.082	0.071	0.063	0.051	0.043
R-13	(7.2)	0.108	0.077	0.067	0.059	0.077	0.070	0.060	0.052	0.078	0.068	0.061	0.050	0.042
R-15	(7.8)	0.102	0.073	0.064	0.057	0.074	0.067	0.058	0.050	0.074	0.066	0.059	0.048	0.041
2x6 Metal Framing at 16 in on center (6.0 in cavity depth)														
R-19	(7.1)	0.110	0.077	0.067	0.060	0.078	0.071	0.060	0.052	0.079	0.069	0.061	0.050	0.042
R-21	(7.4)	0.106	0.076	0.066	0.059	0.076	0.069	0.059	0.051	0.077	0.067	0.060	0.049	0.042
2x6 Metal Framing at 24 in on center (6.0 in cavity depth)														
R-19	(8.6)	0.094	0.069	0.061	0.055	0.070	0.064	0.055	0.048	0.070	0.062	0.056	0.047	0.040
R-21	(9.0)	0.091	0.067	0.060	0.054	0.068	0.062	0.054	0.048	0.068	0.061	0.055	0.046	0.039
2x4 Wood Framing at 16 in on center (3.5 in cavity depth)														
None	(0.0)	0.263	0.132	0.105	0.088	0.133	0.114	0.088	0.072	0.135	0.109	0.091	0.068	0.055
R-11	(11.0)	0.088	0.066	0.059	0.053	0.066	0.061	0.053	0.047	0.067	0.060	0.054	0.045	0.039
R-13	(12.7)	0.079	0.061	0.054	0.049	0.061	0.057	0.050	0.044	0.062	0.055	0.050	0.043	0.037
R-15	(15.0)	0.070	0.055	0.050	0.046	0.055	0.052	0.046	0.041	0.056	0.051	0.046	0.040	0.035
2x4 Wood Framing at 24 in on center (3.5 in cavity depth)														
R-11	(11.0)	0.086	0.065	0.058	0.052	0.065	0.060	0.052	0.046	0.066	0.059	0.053	0.045	0.039
R-13	(12.7)	0.078	0.060	0.054	0.049	0.060	0.056	0.049	0.044	0.061	0.055	0.050	0.042	0.037
R-15	(15.0)	0.068	0.054	0.049	0.045	0.054	0.051	0.045	0.040	0.055	0.050	0.046	0.039	0.034
2x6 Wood Framing at 16 in on center (5.5 in cavity depth)														
R-19	(18.0)	0.058	0.048	0.044	0.040	0.048	0.045	0.041	0.037	0.048	0.044	0.041	0.036	0.032
R-21	(21.0)	0.052	0.043	0.040	0.037	0.043	0.041	0.037	0.034	0.043	0.040	0.038	0.033	0.030
2x6 Wood Framing at 16 in on center (5.5 in cavity depth) plus R-10 headers														
R-19	(18.0)	0.057	0.047	0.043	0.040	0.047	0.044	0.040	0.036	0.047	0.044	0.040	0.035	0.031
R-21	(21.0)	0.051	0.042	0.039	0.037	0.043	0.040	0.037	0.034	0.043	0.040	0.037	0.033	0.029
2x6 Wood Framing at 24 in on center (5.5 in cavity depth)														
R-19	(18.0)	0.057	0.047	0.043	0.040	0.047	0.044	0.040	0.036	0.047	0.044	0.040	0.035	0.031
R-21	(21.0)	0.050	0.042	0.039	0.036	0.042	0.040	0.037	0.034	0.043	0.040	0.037	0.033	0.029
2x6 Wood Framing at 24 in on center (5.5 in cavity depth) plus R-10 headers														
R-19	(18.0)	0.056	0.046	0.042	0.039	0.046	0.044	0.039	0.036	0.047	0.043	0.040	0.035	0.031
R-21	(21.0)	0.050	0.042	0.039	0.036	0.042	0.040	0.036	0.033	0.042	0.039	0.036	0.032	0.029

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Mass WALL Thermal Properties (Framing Effects)

Effective R-values for Interior Insulation Layers on Structural Mass Walls

Type Thick	Frame	Furring space R-value without framing effects: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Any	None	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5
0.5"	Wood	1.3	1.3	1.9	2.4	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	0.9	0.9	1.1	1.1	1.2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
0.75"	Wood	1.4	1.4	2.1	2.7	3.1	3.5	3.8	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.0	1.3	1.4	1.5	1.5	1.6	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1.0"	Wood	1.3	1.5	2.2	2.9	3.4	3.9	4.3	4.6	4.9	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.1	1.4	1.6	1.7	1.8	1.8	1.9	1.9	na	na	na	na	na	na	na	na	na	na	na	na	na
1.5"	Wood	1.3	1.5	2.4	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.5	6.8	7.1	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.6	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	na	na	na	na	na	na	na	na	na
2"	Wood	1.4	1.5	2.5	3.3	4.0	4.7	5.3	5.9	6.4	6.9	7.3	7.7	8.1	8.4	8.7	9.0	9.3	na	na	na	na	na
	Metal	1.1	1.2	1.7	2.1	2.3	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.4	na	na	na	na	na
2.5"	Wood	1.4	1.5	2.5	3.4	4.2	4.9	5.6	6.3	6.8	7.4	7.9	8.4	8.8	9.2	9.6	10.0	10.3	10.6	10.9	11.2	11.5	na
	Metal	1.2	1.3	1.8	2.3	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	na
3"	Wood	1.4	1.5	2.5	3.5	4.3	5.1	5.8	6.5	7.2	7.8	8.3	8.9	9.4	9.9	10.3	10.7	11.1	11.5	11.9	12.2	12.5	12.9
	Metal	1.2	1.3	1.9	2.4	2.8	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8
3.5"	Wood	1.4	1.5	2.6	3.5	4.4	5.2	6.0	6.7	7.4	8.1	8.7	9.3	9.8	10.4	10.9	11.3	11.8	12.2	12.6	13.0	13.4	13.8
	Metal	1.2	1.3	2.0	2.5	2.9	3.2	3.5	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.2	5.3
4"	Wood	1.4	1.6	2.6	3.6	4.5	5.3	6.1	6.9	7.6	8.3	9.0	9.6	10.2	10.8	11.3	11.9	12.4	12.8	13.3	13.7	14.2	14.6
	Metal	1.2	1.3	2.0	2.6	3.0	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.8
4.5"	Wood	1.4	1.6	2.6	3.6	4.5	5.4	6.2	7.1	7.8	8.5	9.2	9.9	10.5	11.2	11.7	12.3	12.8	13.3	13.8	14.3	14.8	15.2
	Metal	1.2	1.3	2.1	2.6	3.1	3.5	3.9	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3
5"	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.3	7.2	8.0	8.7	9.4	10.1	10.8	11.5	12.1	12.7	13.2	13.8	14.3	14.8	15.3	15.8
	Metal	1.2	1.4	2.1	2.7	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.8
5.5"	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.4	7.3	8.1	8.9	9.6	10.3	11.0	11.7	12.4	13.0	13.6	14.2	14.7	15.3	15.8	16.3
	Metal	1.3	1.4	2.1	2.8	3.3	3.8	4.2	4.6	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.2

All values include .5" gypbd on the inner surface, interior surface resistances not included

24" OC Furring 24 Gage, Z - type Metal Furring Douglas-Fir Larch Wood Furring, density=34.9 lb/cu. ft.

Insulation assumed to fill the furring space

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada]

ROOF Thermal Properties (Framing Effects)

Table 8-W Default U-Values for Roofs Attics and Single-Rafter/Vaulted (Btu/h-ft²-°F)

Nominal R-value	Effective R-value	U-value	Expanded Polystyr 1.0" R3.8	1.5" R5.7	2.0" R7.6	Extruded Polystyrene 0.75" R3.7	1.0" R5.0	1.5" R7.5	2.0" R10.0	Polyisocyanurate 0.5" R3.6	0.75" R5.4	1.0" R7.2	1.5" R10.8	2.0" R14.4
Standard Wood Framed Attic (3.5" bottom chord)														
None	(0.0)	0.606	0.183	0.136	0.108	0.187	0.150	0.109	0.086	0.190	0.142	0.113	0.080	0.062
R-11	(11.0)	0.085	0.064	0.057	0.052	0.065	0.060	0.052	0.046	0.065	0.058	0.053	0.044	0.038
R-19	(18.0)	0.051	0.043	0.040	0.037	0.043	0.041	0.037	0.034	0.043	0.040	0.037	0.033	0.029
R-30	(30.0)	0.033	0.029	0.028	0.026	0.029	0.028	0.026	0.025	0.030	0.028	0.027	0.024	0.022
R-38	(38.0)	0.026	0.023	0.022	0.021	0.023	0.023	0.022	0.020	0.023	0.023	0.022	0.020	0.019
R-49	(49.0)	0.021	0.019	0.018	0.018	0.019	0.019	0.018	0.017	0.019	0.018	0.018	0.017	0.016
R-60	(60.0)	0.017	0.016	0.015	0.015	0.016	0.016	0.015	0.014	0.016	0.015	0.015	0.014	0.014
Raised Heel Attic (3.5" joist depth)														
None	(0.0)	0.479	0.170	0.128	0.103	0.173	0.141	0.104	0.083	0.176	0.134	0.108	0.078	0.061
R-11	(11.0)	0.083	0.063	0.057	0.051	0.064	0.059	0.051	0.045	0.064	0.058	0.052	0.044	0.038
R-19	(18.0)	0.050	0.042	0.039	0.036	0.042	0.040	0.036	0.033	0.042	0.039	0.037	0.032	0.029
R-30	(30.0)	0.032	0.029	0.027	0.026	0.029	0.028	0.026	0.024	0.029	0.027	0.026	0.024	0.022
R-38	(38.0)	0.026	0.023	0.022	0.021	0.023	0.023	0.022	0.020	0.023	0.023	0.022	0.02	0.019
R-49	(49.0)	0.020	0.019	0.018	0.017	0.019	0.018	0.017	0.017	0.019	0.018	0.017	0.016	0.016
R-60	(60.0)	0.016	0.015	0.015	0.015	0.015	0.015	0.015	0.014	0.015	0.015	0.015	0.014	0.013
Single Rafter Wood Joists (5.5" depth)														
None	(0.0)	0.407	0.160	0.123	0.099	0.162	0.134	0.100	0.080	0.165	0.127	0.104	0.075	0.059
R-11	(11.0)	0.083	0.063	0.057	0.051	0.064	0.059	0.051	0.045	0.064	0.058	0.052	0.044	0.038
R-13	(13.0)	0.073	0.057	0.051	0.047	0.057	0.053	0.047	0.042	0.058	0.052	0.048	0.041	0.035
R-15	(15.0)	0.064	0.052	0.047	0.043	0.052	0.049	0.043	0.039	0.052	0.048	0.044	0.038	0.033
Single Rafter Wood Joists (7.25" depth)														
R-19	(18.0)	0.051	0.043	0.040	0.037	0.043	0.041	0.037	0.034	0.043	0.040	0.038	0.033	0.030
R-21	(21.0)	0.047	0.040	0.037	0.035	0.040	0.038	0.035	0.032	0.040	0.038	0.035	0.031	0.028
Single Rafter Wood Joists (9.25" depth)														
R-25	(25.0)	0.040	0.035	0.033	0.031	0.035	0.033	0.031	0.029	0.035	0.033	0.031	0.028	0.025
R-30C	(30.0)	0.034	0.030	0.028	0.027	0.030	0.029	0.027	0.025	0.030	0.029	0.027	0.025	0.023
Single Rafter Wood Joists (11.25" depth)														
R-30	(30.0)	0.034	0.030	0.028	0.027	0.030	0.029	0.027	0.025	0.030	0.028	0.027	0.025	0.023
Single Rafter Wood Joists (13.25" depth)														
R-38	(38.0)	0.027	0.024	0.023	0.022	0.024	0.024	0.022	0.021	0.024	0.023	0.022	0.021	0.019

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WINDOW Thermal Properties (Frame Effects)

Table 5 U-Factors for Various Fenestration Products in Btu/h·ft²·°F

Product Type		Glass Only		Vertical Installation: Operable (including sliding and swinging glass doors)					Vertical Installation: Fixed				
Frame Type		Center of Glass	Edge of Glass	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/ Vinyl	Insulated Fiberglass/ Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/ Vinyl	Insulated Fiberglass/ Vinyl
ID	Glazing Type												
	Single Glazing												
1	1/8 in. glass	*1.04*	*1.04*	1.27	1.08	0.90	0.89	0.81	1.13	1.07	0.98	0.98	0.94
2	1/4 in. acrylic/polycarb	*0.88*	*0.88*	1.14	0.96	0.79	0.78	0.71	0.99	0.92	0.84	0.84	0.81
3	1/8 in. acrylic/polycarb	*0.96*	*0.96*	1.21	1.02	0.85	0.83	0.76	1.06	1.00	0.91	0.91	0.87
	Double Glazing												
4	1/4 in. airspace	*0.55*	*0.64*	0.87	0.65	0.57	0.55	0.49	0.69	0.63	0.56	0.56	0.53
5	1/2 in. airspace	*0.48*	*0.59*	0.81	0.60	0.53	0.51	0.44	0.64	0.57	0.50	0.50	0.48
6	1/4 in. argon space	*0.51*	*0.61*	0.84	0.62	0.55	0.53	0.46	0.66	0.59	0.53	0.52	0.50
7	1/2 in. argon space	*0.45*	*0.57*	0.79	0.58	0.51	0.49	0.43	0.61	0.54	0.48	0.48	0.45
	Double Glazing, *e* = 0.60 on surface 2 or 3												
8	1/4 in. airspace	*0.52*	*0.62*	0.84	0.63	0.55	0.53	0.47	0.67	0.60	0.54	0.53	0.51
9	1/2 in. airspace	*0.44*	*0.56*	0.78	0.57	0.50	0.48	0.42	0.60	0.53	0.47	0.47	0.45
10	1/4 in. argon space	*0.47*	*0.58*	0.81	0.59	0.52	0.50	0.44	0.63	0.56	0.50	0.49	0.47
11	1/2 in. argon space	*0.41*	*0.54*	0.76	0.55	0.48	0.46	0.40	0.58	0.51	0.45	0.44	0.42
	Double Glazing, *e* = 0.40 on surface 2 or 3												
12	1/4 in. airspace	*0.49*	*0.60*	0.82	0.61	0.53	0.51	0.45	0.64	0.58	0.51	0.51	0.49
13	1/2 in. airspace	*0.40*	*0.54*	0.75	0.54	0.48	0.45	0.40	0.57	0.50	0.44	0.44	0.41
14	1/4 in. argon space	*0.43*	*0.56*	0.78	0.57	0.50	0.47	0.41	0.59	0.53	0.46	0.46	0.44
15	1/2 in. argon space	*0.36*	*0.51*	0.72	0.52	0.45	0.43	0.37	0.53	0.47	0.41	0.40	0.38
	Double Glazing, *e* = 0.20 on surface 2 or 3												
16	1/4 in. airspace	*0.45*	*0.57*	0.79	0.58	0.51	0.49	0.43	0.61	0.54	0.48	0.48	0.45
17	1/2 in. airspace	*0.35*	*0.50*	0.71	0.51	0.44	0.42	0.36	0.53	0.46	0.40	0.39	0.37
18	1/4 in. argon space	*0.38*	*0.52*	0.74	0.53	0.46	0.44	0.38	0.55	0.48	0.42	0.42	0.40
19	1/2 in. argon space	*0.30*	*0.46*	0.67	0.47	0.41	0.39	0.33	0.48	0.41	0.36	0.35	0.33
	Double Glazing, *e* = 0.10 on surface 2 or 3												
20	1/4 in. airspace	*0.42*	*0.55*	0.77	0.56	0.49	0.47	0.41	0.59	0.52	0.46	0.45	0.43
21	1/2 in. airspace	*0.32*	*0.48*	0.69	0.49	0.42	0.40	0.35	0.50	0.43	0.37	0.37	0.35
22	1/4 in. argon space	*0.35*	*0.50*	0.71	0.51	0.44	0.42	0.36	0.53	0.46	0.40	0.39	0.37
23	1/2 in. argon space	*0.27*	*0.44*	0.65	0.45	0.39	0.37	0.31	0.46	0.39	0.33	0.33	0.31
	Double Glazing, *e* = 0.05 on surface 2 or 3												
24	1/4 in. airspace	*0.41*	*0.54*	0.76	0.55	0.48	0.46	0.40	0.58	0.51	0.45	0.44	0.42
25	1/2 in. airspace	*0.30*	*0.46*	0.67	0.47	0.41	0.39	0.33	0.48	0.41	0.36	0.35	0.33
26	1/4 in. argon space	*0.33*	*0.48*	0.70	0.49	0.43	0.41	0.35	0.51	0.44	0.38	0.38	0.36
27	1/2 in. argon space	*0.25*	*0.42*	0.63	0.44	0.38	0.36	0.30	0.44	0.37	0.32	0.31	0.29
	Triple Glazing												
28	1/4 in. airspaces	*0.38*	*0.52*	0.72	0.51	0.44	0.43	0.38	0.55	0.48	0.42	0.41	0.40
29	1/2 in. airspaces	*0.31*	*0.47*	0.67	0.46	0.40	0.39	0.34	0.49	0.42	0.36	0.35	0.34
30	1/4 in. argon spaces	*0.34*	*0.49*	0.69	0.48	0.42	0.41	0.35	0.51	0.45	0.39	0.38	0.36
31	1/2 in. argon spaces	*0.29*	*0.45*	0.65	0.44	0.38	0.37	0.32	0.47	0.40	0.34	0.34	0.32
	Triple Glazing, *e* = 0.20 on surface 2,3,4, or 5												
32	1/4 in. airspaces	*0.33*	*0.48*	0.69	0.47	0.41	0.40	0.35	0.50	0.44	0.38	0.37	0.36
33	1/2 in. airspaces	*0.25*	*0.42*	0.62	0.41	0.36	0.35	0.30	0.43	0.37	0.31	0.30	0.29
34	1/4 in. argon spaces	*0.28*	*0.45*	0.65	0.44	0.38	0.37	0.32	0.46	0.40	0.34	0.33	0.32
35	1/2 in. argon spaces	*0.22*	*0.40*	0.60	0.39	0.34	0.33	0.28	0.41	0.34	0.29	0.28	0.27
	Triple Glazing, *e* = 0.20 on surfaces 2 or 3 and 4 or 5												
36	1/4 in. airspaces	*0.29*	*0.45*	0.65	0.44	0.38	0.37	0.32	0.47	0.40	0.34	0.34	0.32
37	1/2 in. airspaces	*0.20*	*0.39*	0.58	0.38	0.32	0.31	0.27	0.39	0.33	0.27	0.26	0.25
38	1/4 in. argon spaces	*0.23*	*0.41*	0.61	0.40	0.34	0.33	0.29	0.42	0.35	0.30	0.29	0.28
39	1/2 in. argon spaces	*0.17*	*0.36*	0.56	0.36	0.30	0.29	0.25	0.37	0.30	0.25	0.24	0.23
	Triple Glazing, *e* = 0.10 on surfaces 2 or 3 and 4 or 5												
40	1/4 in. airspaces	*0.27*	*0.44*	0.64	0.43	0.37	0.36	0.31	0.45	0.39	0.33	0.32	0.31
41	1/2 in. airspaces	*0.18*	*0.37*	0.57	0.36	0.31	0.30	0.25	0.37	0.31	0.25	0.25	0.23
42	1/4 in. argon spaces	*0.21*	*0.39*	0.59	0.39	0.33	0.32	0.27	0.40	0.34	0.28	0.27	0.26
43	1/2 in. argon spaces	*0.14*	*0.34*	0.54	0.33	0.28	0.27	0.23	0.34	0.28	0.22	0.21	0.20
	Quadruple Glazing, *e* = 0.10 on surfaces 2 or 3 and 4 or 5												
44	1/4 in. airspaces	*0.22*	*0.40*	0.60	0.39	0.34	0.33	0.28	0.41	0.34	0.29	0.28	0.27
45	1/2 in. airspaces	*0.15*	*0.35*	0.54	0.34	0.29	0.28	0.24	0.35	0.28	0.23	0.22	0.21
46	1/4 in. argon spaces	*0.17*	*0.36*	0.56	0.36	0.30	0.29	0.25	0.37	0.30	0.25	0.24	0.23
47	1/2 in. argon spaces	*0.12*	*0.32*	0.52	0.32	0.27	0.26	0.22	0.32	0.26	0.20	0.20	0.19
48	1/4 in. krypton spaces	*0.12*	*0.32*	0.52	0.32	0.27	0.26	0.22	0.32	0.26	0.20	0.20	0.19

Notes:

1. All heat transmission coefficients in this table include film resistances and are based on winter conditions of 0 °F outdoor air temperature and 70 °F indoor air temperature, with 15 mph outdoor air velocity and zero solar flux. With the exception of single glazing, small changes in the indoor and outdoor temperatures will not significantly affect overall U-factors. The coefficients are for vertical position except skylight and sloped glazing values, which are for 20° from horizontal with heat flow up.

2. Glazing layer surfaces are numbered from the outdoor to the indoor. Double, triple and quadruple refer to the number of glazing panels. All data are based on 1/8 inch glass, unless otherwise noted. Thermal conductivities are: 0.53 Btu/(h·ft·°F) for glass, and 0.11 Btu/(h·ft·°F) for acrylic and polycarbonate.

3. Standard spacers are metal. Edge-of-glass effects assumed to extend over the 2 1/2 inch band around perimeter of each glazing unit as in Figure 3.

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WINDOW Thermal Properties (Frame Effects - continued)

Table 5 U-Factors for Various Fenestration Products in Btu/h·ft²·°F (*Concluded*)

Vertical Installation					Sloped Installation										
Garden Windows		Curtainwall			Glass Only (Skylights)		Manufactured Skylight				Site-Assembled Sloped/Overhead Glazing			
Aluminum without Thermal Break	Wood/ Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing	Center of Glass	Edge of Glass	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/ Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing	ID
2.60	2.31	1.22	1.11	1.11	*1.19*	*1.19*	1.98	1.89	1.75	1.47	1.36	1.25	1.25	1
2.33	2.06	1.08	0.96	0.96	*1.03*	*1.03*	1.82	1.73	1.60	1.31	1.21	1.10	1.10	2
2.46	2.19	1.15	1.04	1.04	*1.11*	*1.11*	1.90	1.81	1.68	1.39	1.29	1.18	1.18	3
1.81	1.61	0.79	0.68	0.63	*0.58*	*0.66*	1.31	1.11	1.05	0.84	0.82	0.70	0.66	4
1.71	1.53	0.73	0.62	0.57	*0.57*	*0.65*	1.30	1.10	1.04	0.84	0.81	0.69	0.65	5
1.76	1.56	0.75	0.64	0.60	*0.53*	*0.63*	1.27	1.07	1.00	0.80	0.77	0.66	0.62	6
1.67	1.49	0.70	0.59	0.55	*0.53*	*0.63*	1.27	1.07	1.00	0.80	0.77	0.66	0.62	7
1.77	1.58	0.76	0.65	0.61	*0.54*	*0.63*	1.27	1.08	1.01	0.81	0.78	0.67	0.63	8
1.65	1.48	0.69	0.58	0.54	*0.53*	*0.63*	1.27	1.07	1.00	0.80	0.77	0.66	0.62	9
1.70	1.52	0.72	0.61	0.56	*0.49*	*0.60*	1.23	1.03	0.97	0.76	0.74	0.63	0.58	10
1.61	1.44	0.67	0.56	0.51	*0.49*	*0.60*	1.23	1.03	0.97	0.76	0.74	0.63	0.58	11
1.73	1.54	0.74	0.63	0.58	*0.51*	*0.61*	1.25	1.05	0.99	0.78	0.76	0.64	0.60	12
1.59	1.43	0.66	0.55	0.51	*0.50*	*0.61*	1.24	1.04	0.98	0.77	0.75	0.64	0.59	13
1.64	1.47	0.69	0.57	0.53	*0.44*	*0.56*	1.18	0.99	0.92	0.72	0.70	0.58	0.54	14
1.53	1.38	0.63	0.51	0.47	*0.46*	*0.58*	1.20	1.00	0.94	0.74	0.71	0.60	0.56	15
1.67	1.49	0.70	0.59	0.55	*0.46*	*0.58*	1.20	1.00	0.94	0.74	0.71	0.60	0.56	16
1.52	1.37	0.62	0.51	0.46	*0.46*	*0.58*	1.20	1.00	0.94	0.74	0.71	0.60	0.56	17
1.56	1.40	0.64	0.53	0.49	*0.39*	*0.53*	1.14	0.94	0.88	0.68	0.65	0.54	0.50	18
1.44	1.30	0.57	0.46	0.42	*0.40*	*0.54*	1.15	0.95	0.89	0.68	0.66	0.55	0.51	19
1.62	1.45	0.68	0.57	0.52	*0.44*	*0.56*	1.18	0.99	0.92	0.72	0.70	0.58	0.54	20
1.47	1.33	0.59	0.48	0.44	*0.44*	*0.56*	1.18	0.99	0.92	0.72	0.70	0.58	0.54	21
1.52	1.37	0.62	0.51	0.46	*0.36*	*0.51*	1.11	0.91	0.85	0.65	0.63	0.52	0.47	22
1.40	1.26	0.55	0.44	0.39	*0.38*	*0.52*	1.13	0.93	0.87	0.67	0.65	0.53	0.49	23
1.61	1.44	0.67	0.56	0.51	*0.42*	*0.55*	1.17	0.97	0.91	0.70	0.68	0.57	0.52	24
1.44	1.30	0.57	0.46	0.42	*0.43*	*0.56*	1.17	0.98	0.91	0.71	0.69	0.58	0.53	25
1.49	1.34	0.60	0.49	0.44	*0.34*	*0.49*	1.09	0.89	0.83	0.63	0.61	0.50	0.45	26
1.37	1.24	0.53	0.42	0.38	*0.36*	*0.51*	1.11	0.91	0.85	0.65	0.63	0.52	0.47	27
see	see	0.63	0.52	0.47	*0.39*	*0.53*	1.12	0.89	0.84	0.64	0.64	0.53	0.48	28
note	note	0.57	0.46	0.41	*0.36*	*0.51*	1.10	0.87	0.81	0.61	0.62	0.51	0.45	29
7	7	0.60	0.49	0.43	*0.35*	*0.50*	1.09	0.86	0.80	0.60	0.61	0.50	0.44	30
		0.55	0.45	0.39	*0.33*	*0.48*	1.07	0.84	0.79	0.59	0.59	0.48	0.42	31
see	see	0.59	0.48	0.42	*0.34*	*0.49*	1.08	0.85	0.79	0.59	0.60	0.49	0.43	32
note	note	0.52	0.41	0.35	*0.31*	*0.47*	1.05	0.82	0.77	0.57	0.57	0.46	0.41	33
7	7	0.54	0.44	0.38	*0.28*	*0.45*	1.02	0.79	0.74	0.54	0.55	0.44	0.38	34
		0.49	0.38	0.33	*0.27*	*0.44*	1.01	0.78	0.73	0.53	0.54	0.43	0.37	35
see	see	0.55	0.45	0.39	*0.29*	*0.45*	1.03	0.80	0.75	0.55	0.56	0.45	0.39	36
note	note	0.48	0.37	0.31	*0.27*	*0.44*	1.01	0.78	0.73	0.53	0.54	0.43	0.37	37
7	7	0.50	0.39	0.34	*0.24*	*0.42*	0.99	0.75	0.70	0.50	0.51	0.40	0.35	38
		0.45	0.34	0.29	*0.22*	*0.40*	0.97	0.74	0.69	0.49	0.50	0.39	0.33	39
see	see	0.54	0.43	0.37	*0.27*	*0.44*	1.01	0.78	0.73	0.53	0.54	0.43	0.37	40
note	note	0.46	0.35	0.29	*0.25*	*0.42*	0.99	0.76	0.71	0.51	0.52	0.41	0.36	41
7	7	0.48	0.38	0.32	*0.21*	*0.39*	0.96	0.73	0.68	0.48	0.49	0.38	0.32	42
		0.42	0.32	0.26	*0.20*	*0.39*	0.95	0.72	0.67	0.47	0.48	0.37	0.31	43
		0.49	0.38	0.33	*0.22*	*0.40*	0.97	0.74	0.69	0.49	0.50	0.39	0.33	44
see	see	0.43	0.32	0.27	*0.19*	*0.38*	0.94	0.71	0.66	0.46	0.47	0.36	0.30	45
note	note	0.45	0.34	0.29	*0.18*	*0.37*	0.93	0.70	0.65	0.45	0.46	0.35	0.30	46
7	7	0.41	0.30	0.24	*0.16*	*0.35*	0.91	0.68	0.63	0.43	0.44	0.33	0.28	47
		0.41	0.30	0.24	*0.13*	*0.33*	0.88	0.65	0.60	0.40	0.42	0.31	0.25	48

4. Product sizes are described in Figure 3 and frame U-factors are from Table 2.
5. Use $U = 0.60$ Btu/h·ft²·°F for glass block with mortar but without reinforcing or framing.
6. The use of this table should be limited to that of an estimating tool for the early phases of design.
7. Values for triple- and quadruple-glazed garden windows are not listed as these are not common products.
8. Minor differences exist between the data in Table 5 and U-factors determined using NFRC 100-91 because the data in Table 5 are generated using modified heat transfer correlations for glazing cavities (Wright 1996) and indoor fenestration surfaces (Curcija and Goss 1995b)

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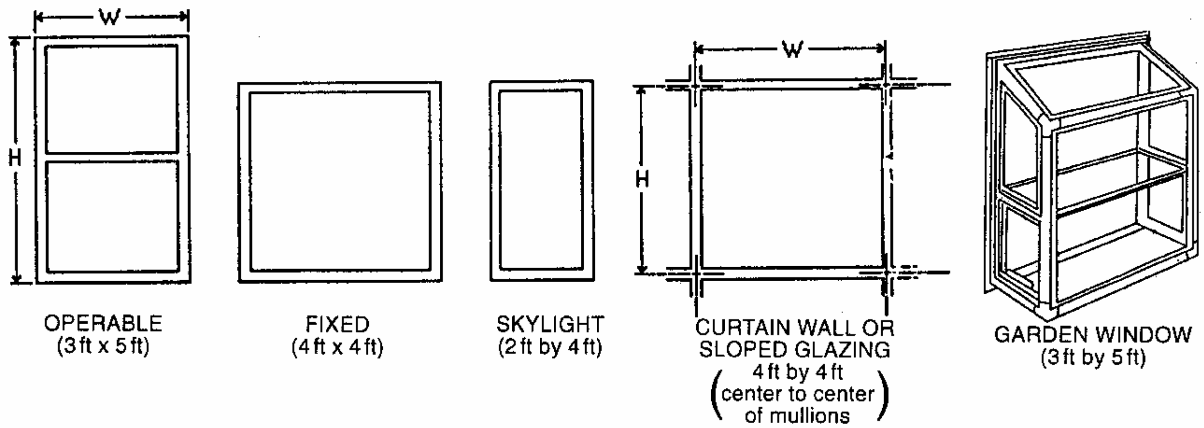
WINDOW Thermal Properties (Frame Effects - continued)



Frame Material	Frame Width, inches					
	Operable	Fixed	Garden Window	Skylight	Curtainwall	Sloped/Overhead Glazing
Aluminum without thermal break	1.5	1.3	1.75	0.7	2.25	2.25
Aluminum with thermal break	2.1	1.3	n/a	0.7	2.25	2.25
Aluminum-clad wood/reinforcing vinyl	2.8	1.6	n/a	0.9	n/a	n/a
Wood/vinyl	2.8	1.6	1.75	0.9	n/a	n/a
Insulated fiberglass/vinyl	3.1	1.8	n/a	n/a	n/a	n/a
Structural glazing	n/a	n/a	n/a	n/a	2.25	2.5

Fig. 5 Standard Fenestration Units

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Weather Data: Hourly Data Formats

An extensive weather database is available for use with DOE-2/eQUEST. All of this database is available at http://DOE2.com/download/weather. A total of 663 weather files are included in this database:

- 238 Typical Meteorological Year (TMY) locations
- 239 Revised Typical Meteorological Year (TMY2) locations
- 51 Weather Year for Energy Calculations (WYEC) locations
- 51 Revised Weather Year for Energy Calculations (WYEC2) locations
- 60 Test Reference Year (TRY) locations
- 16 California Thermal Zones (CTZ) non-residential locations
- 12 Canadian Typical Meteorological Year (CTMY) locations

Test Reference Year (TRY). The TRY data set is an early attempt to create a typical year database. A TRY year is data for a real year for the location, selected from the period 1948 to 1975. The selection procedure involves eliminating years in the period of record containing months with extremely high or low mean temperatures until only one year remains. Rather than representing a statistically average weather year, TRY represent a "least extreme" year for the location in question. Thus, TRY years do not necessarily yield reliable estimates of average annual energy requirements for a building. The data is useful, however, for comparison of different heating and cooling systems, control strategies, envelope features and so on. TRY data does not include solar data, therefore, DOE-2 calculates insolation using the ASHRAE clear sky model, attenuated using a cloud cover model. In general, TRY data should not be used for applications in which solar radiation is expected to contribute significantly to simulation results.

Typical Meteorological Year (TMY). TMY represents a more recent attempt by the National Climatic Data Center to provide a typical year data set for use in energy calculations. The coverage is much better for TMY than for TRY as data for 238 locations are available. TMY years are not real years; rather they are ersatz years assembled from typical (real) months. The selection method involves statistically comparing 9 indicies (daily max., min., mean for dry bulb and dew point temperatures, daily max. and mean wind velocity, and daily global solar radiation) for candidate month with the indicies for the entire period of record (23 years). In the comparison, the indicies were given different weights. It is noteworthy that the weighting is 50% solar, 50% all other indicies, thus TMYs are strongly biased toward "typical" solar years. The statistical comparison was used to select a small group of candidate months; the final selection of the typical month was done subjectively. Twenty-six of the TMY locations contain measured solar radiation from the SOLMET database; all other locations contain ersatz solar data obtained from models applied to cloud cover applications or measurements of hours of sunshine. The ersatz data is more accurate than the solar radiation calculations done in DOE-2. For this reason alone, the TMY data is preferable to the TRY data. In addition, the coverage is better and the selection or creation of the typical year is done in a statistically reasonable manner. Unfortunately, the data integrity for TMY is not as good as for TRY. Possible problems include missing data, anomalous temperature changes, bad solar values, etc. Nonetheless, overall the TMY data sets are more representative of weather for any given area than the TRY.

Weather Data: Hourly Data Formats (continued)

Revised Typical Meteorological year (TMY2). TMY2 revises and updates the earlier TMY data set. Completed in 1991, the TMY data set covers the 30 years from 1961-1990. The same overall selection procedure was used for TMY2 as was used for TMY, except that the weighting for solar data was reduced. Data integrity for TMY2 is also improved.

California Thermal Zone (CTZ). The original CTZ data was generated by Loren Crow for the California Energy Commission in 1976. California was divided into 16 climate zones, and a representative year for each zone was created from long term local weather data. The current CTZ data is derived from TMY data as well as the original CTZ data.

Weather Year for Energy Calculation (WYEC). Work on WYEC was completed in 1983 as a ASHRAE-funded research project. The coverage is sparser than TMY (51 locations), but five locations in Canada are included. Like TMY, the WYEC "year" is composed of typical months of real data, including solar data. These months were chosen so that the mean monthly dry bulb temperature and the mean global solar radiation for the month were near the long term means. The candidate month was then altered by substituting days from the same month in other years to bring the monthly averages for dry bulb temperature and global insolation into very close agreement with the long term averages. In addition, the wet bulb temperatures during the months June through September were adjusted to match the long term recorded means. The data integrity of the WYEC files is good.

Actual year data. When a typical year is needed, TMY2 or WYEC2 data are recommended. In some cases you may want a specific year for a given location rather than a typical year. If so, you may create your own DOE-2 weather files from a wide variety of standard format weather data using the DOE-2 weather processor utility program.

Data sources. The primary source for actual year weather data in the United States is the National Climatic Data Center (NCDC) which is a branch of the National Oceanic and Atmospheric Administration (NOAA). The address for NCDC is:

National Climatic Data Center
Federal Building
Asheville, North Carolina 28801
Telephone: (704) 259-0682
www.ncdc.noaa.gov

The NCDC can supply data for specific years for hundreds of locations within the US and around the world. This data is available in a variety of formats. To use any weather data obtained directly from NCDC (or any source other than EPSC), your will need to preprocess the "raw" data to produce a format readable by DOE-2. This is done using the WTHUTIL.EXE program. The weather program can handle data in many formats including TRY, TMY, CTZ, SOLMET, CD1440, and TD9685. Information about NCDC weather data publications can be obtained from the Printing and Publications Distribution Section of NCDC.

Revised Typical Meteorological Year (TMY2) Data

There are 239 TMY2 stations for the United States and its territories. These are the same stations as for the NSRDB, from which the TMY2 data sets were derived. The stations are National Weather Service stations that collected meteorological data for the period of 1961–1990. Table 2-1 lists the stations by state or territory and provides information describing the station location and the NSRDB and TMY2 classifications.

Compared to the SOLMET/ERSATZ TMYs, there is a net gain of five stations, and some of the station locations have changed. The TMY2 data sets include 37 new stations, but 32 previous SOLMET/ERSATZ TMY stations were not included because these stations were not included in the NSRDB.

Locations

The station locations are described in Table 2-1 by the city and state name, the station Weather Bureau Army Navy (WBAN) identification number, the latitude and longitude in degrees and minutes, and the elevation in meters.

NSRDB Classification

Stations are classified with respect to being NSRDB primary (P) or secondary (S) stations. The 56 primary stations measured solar radiation for a part (from 1 to 27 years) of the 30-year period of 1961–1990. The remaining 183 secondary stations made no solar radiation measurements and therefore use modeled solar radiation data that are derived from meteorological data such as cloud cover.

TMY2 Classification

This classification pertains to the amount of measured meteorological data available for a station to select typical months to form the typical meteorological year. Class A stations, of which there are 216, had a minimum of 15 candidate months without more than 2 consecutive hours of missing data. For the 23 Class B stations to achieve a minimum of 15 candidate months, data filling for periods of up to 47 hours were required. For some elements not required for the selection of the typical meteorological months, the data are unfilled in the TMY2 data files. The elements horizontal visibility, ceiling height, and present weather may be missing for up to 2 consecutive hours for Class A stations and for up to 47 hours for Class B stations. No data are missing for more than 47 hours, except for snow depth and days since last snowfall for Colorado Springs, Colorado.

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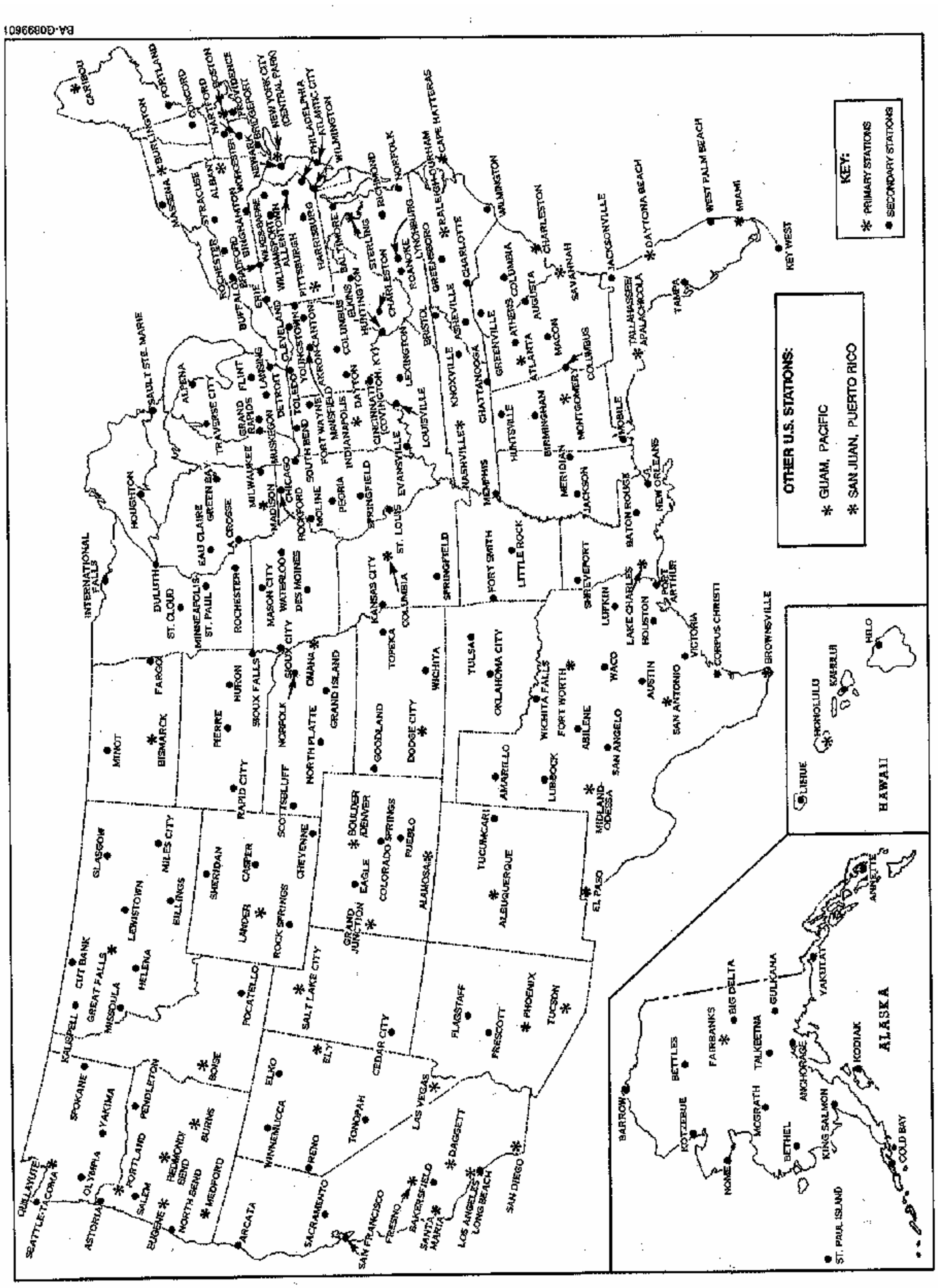
Revised Typical Meteorological Year (TMY2) Locations



Revised Typical Meteorological Year (TMY2) Locations

State	City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Alabama									
	Birmingham	13876	N33	34	W 86	45	192	S	A
	Huntsville	03856	N34	39	W 86	46	190	S	A
	Mobile	13894	N30	41	W 88	15	67	S	A
	Montgomery	13895	N32	18	W 86	24	62	P	A
Alaska									
	Anchorage	26451	N61	10	W150	1	35	S	A
	Annette	25308	N55	2	W131	34	34	S	A
	Barrow	27502	N71	18	W156	47	4	S	A
	Bethel	26615	N60	47	W161	48	46	S	A
	Bettles	26533	N66	55	W151	31	205	S	B
	Big Delta	26415	N64	0	W145	44	388	S	B
	Cold Bay	25624	N55	12	W162	43	29	S	A
	Fairbanks	26411	N64	49	W147	52	138	P	A
	Gulkana	26425	N62	9	W145	27	481	S	B
	King Salmon	25503	N58	41	W156	39	15	S	A
	Kodiak	25501	N57	45	W152	20	34	S	A
	Kotzebue	26616	N66	52	W162	38	5	S	A
	McGrath	26510	N62	58	W155	37	103	S	A
	Nome	26617	N64	30	W165	26	7	S	A
	St. Paul Island	25713	N57	9	W170	13	7	S	A
	Talkeetna	26528	N62	18	W150	6	105	S	B
	Yakutat	25339	N59	31	W139	40	9	S	A
Arizona									
	Flagstaff	03103	N35	8	W111	40	2135	S	B
	Phoenix	23183	N33	26	W112	1	339	P	A
	Prescott	23184	N34	39	W112	26	1531	S	A
	Tucson	23160	N32	7	W110	56	779	P	A
Arkansas									
	Fort Smith	13964	N35	20	W 94	22	141	S	A
	Little Rock	13963	N34	44	W 92	14	81	S	A
California									
	Arcata	24283	N40	59	W124	6	69	S	A
	Bakersfield	23155	N35	25	W119	3	150	S	A
	Daggett	23161	N34	52	W116	47	588	P	A
	Fresno	93193	N36	46	W119	43	100	P	A
	Long Beach	23129	N33	49	W118	9	17	S	A
	Los Angeles	23174	N33	56	W118	24	32	P	A
	Sacramento	23232	N38	31	W121	30	8	S	A
	San Diego	23188	N32	44	W117	10	9	P	A
	San Francisco	23234	N37	37	W122	23	5	S	A
	Santa Maria	23273	N34	54	W120	27	72	P	B
Colorado									
	Alamosa	23061	N37	27	W105	52	2297	P	B
	Boulder	94018	N40	1	W105	15	1634	P	A
	Colorado Springs	93037	N38	49	W104	43	1881	S	B
	Eagle	23063	N39	39	W106	55	1985	S	A
	Grand Junction	23066	N39	7	W108	32	1475	P	A
	Pueblo	93058	N38	17	W104	31	1439	S	A

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Revised Typical Meteorological Year (TMY2) Locations

State	City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Connecticut									
	Bridgeport	94702	N41	10	W 73	8	2	S	A
	Hartford	14740	N41	56	W 72	41	55	S	A
Delaware									
	Wilmington	13781	N39	40	W 75	36	24	S	A
Florida									
	Daytona Beach	12834	N29	11	W 81	3	12	P	A
	Jacksonville	13889	N30	30	W 81	42	9	S	A
	Key West	12836	N24	33	W 81	45	1	S	A
	Miami	12839	N25	48	W 80	16	2	P	A
	Tallahassee	93805	N30	23	W 84	22	21	P	A
	Tampa	12842	N27	58	W 82	32	3	S	A
	West Palm Beach	12844	N26	41	W 80	6	6	S	A
Georgia									
	Athens	13873	N33	57	W 83	19	244	S	A
	Atlanta	13874	N33	39	W 84	26	315	P	A
	Augusta	03820	N33	22	W 81	58	45	S	A
	Columbus	93842	N32	31	W 84	57	136	S	B
	Macon	03813	N32	42	W 83	39	110	S	A
	Savannah	03822	N32	8	W 81	12	16	P	A
Hawaii									
	Hilo	21504	N19	43	W155	4	11	S	A
	Honolulu	22521	N21	20	W157	55	5	P	A
	Kahului	22516	N20	54	W156	26	15	S	B
	Lihue	22536	N21	59	W159	21	45	S	A
Idaho									
	Boise	24131	N43	34	W116	13	874	P	A
	Pocatello	24156	N42	55	W112	36	1365	S	A
Illinois									
	Chicago	94846	N41	47	W 87	45	190	S	A
	Moline	14923	N41	27	W 90	31	181	S	A
	Peoria	14842	N40	40	W 89	41	199	S	A
	Rockford	94822	N42	12	W 89	6	221	S	A
	Springfield	93822	N39	50	W 89	40	187	S	A
Indiana									
	Evansville	93817	N38	3	W 87	32	118	S	A
	Fort Wayne	14827	N41	0	W 85	12	252	S	A
	Indianapolis	93819	N39	44	W 86	17	246	P	A
	South Bend	14848	N41	42	W 86	19	236	S	A
Iowa									
	Des Moines	14933	N41	32	W 93	39	294	S	A
	Mason City	14940	N43	9	W 93	20	373	S	A
	Sioux City	14943	N42	24	W 96	23	336	S	A
	Waterloo	94910	N42	33	W 92	24	265	S	A
Kansas									
	Dodge City	13985	N37	46	W 99	58	787	P	A
	Goodland	23065	N39	22	W101	42	1124	S	A
	Topeka	13996	N39	4	W 95	38	270	S	A
	Wichita	03928	N37	39	W 97	25	408	S	A

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Revised Typical Meteorological Year (TMY2) Locations

State	City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Kentucky									
	Covington	93814	N39	4	W 84	40	271	S	A
	Lexington	93820	N38	2	W 84	36	301	S	A
	Louisville	93821	N38	11	W 85	44	149	S	A
Louisiana									
	Baton Rouge	13970	N30	32	W 91	9	23	S	A
	Lake Charles	03937	N30	7	W 93	13	3	P	A
	New Orleans	12916	N29	59	W 90	15	3	S	A
	Shreveport	13957	N32	28	W 93	49	79	S	A
Maine									
	Caribou	14607	N46	52	W 68	1	190	P	B
	Portland	14764	N43	39	W 70	19	19	S	A
Maryland									
	Baltimore	93721	N39	11	W 76	40	47	S	A
Massachusetts									
	Boston	14739	N42	22	W 71	2	5	P	A
	Worchester	94746	N42	16	W 71	52	301	S	B
Michigan									
	Alpena	94849	N45	4	W 83	34	210	S	A
	Detroit	94847	N42	25	W 83	1	191	S	A
	Flint	14826	N42	58	W 83	44	233	S	A
	Grand Rapids	94860	N42	53	W 85	31	245	S	A
	Houghton	94814	N47	10	W 88	30	329	S	A
	Lansing	14836	N42	47	W 84	36	256	S	A
	Muskegon	14840	N43	10	W 86	15	191	S	A
	Sault Ste. Marie	14847	N46	28	W 84	22	221	S	A
	Traverse City	14850	N44	44	W 85	35	192	S	A
Minnesota									
	Duluth	14913	N46	50	W 92	11	432	S	A
	International Falls	14918	N48	34	W 93	23	361	S	A
	Minneapolis	14922	N44	53	W 93	13	255	S	A
	Rochester	14925	N43	55	W 92	30	402	S	A
	Saint Cloud	14926	N45	33	W 94	4	313	S	B
Mississippi									
	Jackson	03940	N32	19	W 90	5	101	S	A
	Meridian	13865	N32	20	W 88	45	94	S	A
Missouri									
	Columbia	03945	N38	49	W 92	13	270	P	A
	Kansas City	03947	N39	18	W 94	43	315	S	A
	Springfield	13995	N37	14	W 93	23	387	S	A
	St. Louis	13994	N38	45	W 90	23	172	S	A
Montana									
	Billings	24033	N45	48	W108	32	1088	S	A
	Cut Bank	24137	N48	36	W112	22	1170	S	B
	Glasgow	94008	N48	13	W106	37	700	S	A
	Great Falls	24143	N47	29	W111	22	1116	P	A
	Helena	24144	N46	36	W112	0	1188	S	A
	Kalispell	24146	N48	18	W114	16	904	S	A
	Lewistown	24036	N47	3	W109	27	1264	S	A
	Miles City	24037	N46	26	W105	52	803	S	A

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Revised Typical Meteorological Year (TMY2) Locations

State City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Montana (continued)								
Missoula	24153	N46	55	W114	5	972	S	A
Nebraska								
Grand Island	14935	N40	58	W 98	19	566	S	A
Norfolk	14941	N41	59	W 97	26	471	S	B
North Platte	24023	N41	8	W100	41	849	S	A
Omaha	94918	N41	22	W 96	31	404	P	A
Scottsbluff	24028	N41	52	W103	36	1206	S	A
Nevada								
Elko	24121	N40	50	W115	47	1547	S	A
Ely	23154	N39	17	W114	51	1906	P	A
Las Vegas	23169	N36	5	W115	10	664	P	A
Reno	23185	N39	30	W119	47	1341	S	A
Tonopah	23153	N38	4	W117	8	1653	S	A
Winnemucca	24128	N40	54	W117	48	1323	S	A
New Hampshire								
Concord	14745	N43	12	W 71	30	105	S	A
New Jersey								
Atlantic City	93730	N39	27	W 74	34	20	S	A
Newark	14734	N40	42	W 74	10	9	S	A
New Mexico								
Albuquerque	23050	N35	3	W106	37	1619	P	A
Tucumcari	23048	N35	11	W103	36	1231	S	B
New York								
Albany	14735	N42	45	W 73	48	89	P	A
Binghamton	04725	N42	13	W 75	59	499	S	A
Buffalo	14733	N42	56	W 78	44	215	S	A
Massena	94725	N44	56	W 74	51	63	S	A
New York City	94728	N40	47	W 73	58	57	P	A
Rochester	14768	N43	7	W 77	40	169	S	A
Syracuse	14771	N43	7	W 76	7	124	S	A
North Carolina								
Asheville	03812	N35	26	W 82	32	661	S	A
Cape Hatteras	93729	N35	16	W 75	33	2	P	A
Charlotte	13881	N35	13	W 80	56	234	S	A
Greensboro	13723	N36	5	W 79	57	270	S	A
Raleigh	13722	N35	52	W 78	47	134	P	A
Wilmington	13748	N34	16	W 77	54	9	S	A
North Dakota								
Bismarck	24011	N46	46	W100	45	502	P	A
Fargo	14914	N46	54	W 96	48	274	S	A
Minot	24013	N48	16	W101	17	522	S	A
Ohio								
Akron	14895	N40	55	W 81	26	377	S	A
Cleveland	14820	N41	24	W 81	51	245	S	A
Columbus	14821	N40	0	W 82	53	254	S	A
Dayton	93815	N39	54	W 84	13	306	S	A
Mansfield	14891	N40	49	W 82	31	395	S	B
Toledo	94830	N41	36	W 83	48	211	S	A
Youngstown	14852	N41	16	W 80	40	361	S	A

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Revised Typical Meteorological Year (TMY2) Locations

State	City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Oklahoma									
	Oklahoma City	13967	N35	24	W 97	36	397	S	A
	Tulsa	13968	N36	12	W 95	54	206	S	A
Oregon									
	Astoria	94224	N46	.9	W123	53	7	S	A
	Burns	94185	N43	35	W119	3	1271	P	B
	Eugene	24221	N44	7	W123	13	109	P	A
	Medford	24225	N42	22	W122	52	396	P	A
	North Bend	24284	N43	25	W124	15	5	S	A
	Pendleton	24155	N45	41	W118	51	456	S	A
	Portland	24229	N45	36	W122	36	12	P	A
	Redmond	24230	N44	16	W121	9	940	P	A
	Salem	24232	N44	55	W123	1	61	S	A
Pacific Islands									
	Guam	41415	N13	33	E144	50	110	P	B
Pennsylvania									
	Allentown	14737	N40	39	W 75	26	117	S	A
	Bradford	04751	N41	48	W 78	38	600	S	A
	Erie	14860	N42	5	W 80	11	225	S	A
	Harrisburg	14751	N40	13	W 76	51	106	S	A
	Philadelphia	13739	N39	53	W 75	15	9	S	A
	Pittsburgh	94823	N40	30	W 80	13	373	P	A
	Wilkes-Barre	14777	N41	20	W 75	44	289	S	A
	Williamsport	14778	N41	16	W 77	3	243	S	A
Puerto Rico									
	San Juan	11641	N18	26	W 66	0	19	P	A
Rhode Island									
	Providence	14765	N41	44	W 71	26	19	S	A
South Carolina									
	Charleston	13880	N32	54	W 80	2	12	P	A
	Columbia	13883	N33	57	W 81	7	69	S	A
	Greenville	03870	N34	54	W 82	13	296	S	A
South Dakota									
	Huron	14936	N44	23	W 98	13	393	S	A
	Pierre	24025	N44	23	W100	17	526	S	A
	Rapid City	24090	N44	3	W103	4	966	S	A
	Sioux Falls	14944	N43	34	W 96	44	435	S	A
Tennessee									
	Bristol	13877	N36	29	W 82	24	459	S	A
	Chattanooga	13882	N35	2	W 85	12	210	S	A
	Knoxville	13891	N35	49	W 83	59	299	S	A
	Memphis	13893	N35	3	W 89	59	87	S	A
	Nashville	13897	N36	7	W 86	41	180	P	A
Texas									
	Abilene	13962	N32	26	W 99	41	534	S	A
	Amarillo	23047	N35	14	W101	42	1098	S	A
	Austin	13958	N30	18	W 97	42	189	S	A
	Brownsville	12919	N25	54	W 97	26	6	P	A
	Corpus Christi	12924	N27	46	W 97	30	13	S	A
	El Paso	23044	N31	48	W106	24	1194	P	A

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Revised Typical Meteorological Year (TMY2) Locations

State	City	WBAN No.	Latitude Deg	Latitude Min	Longitude Deg	Longitude Min	Elev (m)	Classification NSRDB	Classification TMY2
Texas (continued)									
	Fort Worth	03927	N32	50	W 97	3	164	P	A
	Houston	12960	N29	59	W 95	22	33	S	A
	Lubbock	23042	N33	39	W101	49	988	S	A
	Lufkin	93987	N31	14	W 94	45	96	S	A
	Midland	23023	N31	56	W102	12	871	P	A
	Port Arthur	12917	N29	57	W 94	1	7	S	B
	San Angelo	23034	N31	22	W100	30	582	S	A
	San Antonio	12921	N29	32	W 98	28	242	P	A
	Victoria	12912	N28	51	W 96	55	32	S	A
	Waco	13959	N31	37	W 97	13	155	S	A
	Wichita Falls	13966	N33	58	W 98	29	314	S	A
Utah									
	Cedar City	93129	N37	42	W113	6	1712	S	A
	Salt Lake City	24127	N40	46	W111	58	1288	P	A
Vermont									
	Burlington	14742	N44	28	W 73	9	104	P	A
Virginia									
	Lynchburg	13733	N37	20	W 79	12	279	S	B
	Norfolk	13737	N36	54	W 76	12	9	S	A
	Richmond	13740	N37	30	W 77	20	50	S	A
	Roanoke	13741	N37	19	W 79	58	358	S	A
	Sterling	93738	N38	57	W 77	27	82	P	A
Washington									
	Olympia	24227	N46	58	W122	54	61	S	A
	Quillayute	94240	N47	57	W124	33	55	S	A
	Seattle	24233	N47	27	W122	18	122	P	A
	Spokane	24157	N47	38	W117	32	721	S	A
	Yakima	24243	N46	34	W120	32	325	S	A
West Virginia									
	Charleston	13866	N38	22	W 81	36	290	S	A
	Elkins	13729	N38	53	W 79	51	594	S	B
	Huntington	03860	N38	22	W 82	33	255	S	A
Wisconsin									
	Eau Claire	14991	N44	52	W 91	29	273	S	A
	Green Bay	14898	N44	29	W 88	8	214	S	A
	La Crosse	14920	N43	52	W 91	15	205	S	A
	Madison	14837	N43	8	W 89	20	262	P	A
	Milwaukee	14839	N42	57	W 87	54	211	S	A
Wyoming									
	Casper	24089	N42	55	W106	28	1612	S	A
	Cheyenne	24018	N41	9	W104	49	1872	S	A
	Lander	24021	N42	49	W108	44	1696	P	A
	Rock Springs	24027	N41	36	W109	4	2056	S	A
	Sheridan	24029	N44	46	W106	58	1209	S	B

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California Climate Zones (CTZ)

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Adin RS	16	41.2	120.57	4195	96	61	-7	43
Alameda NAS	3	37.8	122.19	15	88	65	35	21
Alamo	12	37.9	122.55	410	102	69	23	30
Albany	3	37.9	122.15	40	88	65	30	16
Alderpoint	2	40.2	123.37	460	100	69	21	39
Alhambra	9	34	117.2	483	100	71	30	25
Almaden AFS	3	37.2	121.54	3470	95	62	20	20
Alondra Park	6	33.9	118.4	50	91	69	35	17
Alpine	10	32.8	116.46	1735	99	69	27	35
Altadena	9	34.2	117.2	1200	99	68	32	31
Alturas RS	16	41.5	120.33	4400	99	62	-10	43
Alum Rock	4	37.4	121.5	70	95	68	28	22
Anaheim	8	33.8	117.7	158	99	69	32	26
Anderson	11	40.5	122.15	430	107	71	26	30
Angwin	2	38.5	122.25	1815	98	66	25	33
Antioch	12	38	121.46	60	102	70	22	34
Apple Valley	14	34.5	117.7	2935	105	66	14	38
Aptos	3	37	122.2	500	94	67	27	30
Arcadia	9	34.2	117.2	475	100	69	31	30
Arcata	1	41	124.06	218	75	61	28	11
Arden	12	38.5	121.5	80	104	70	28	35
Arroyo Grande	5	35.1	120.4	105	92	66	28	18
Artesia	8	33.8	117.7	50	99	71	33	23
Arvin	13	35.2	119.7	445	106	71	26	30
Ash Mtn	13	36.5	118.5	1708	105	69	25	30
Atascadero	4	35.5	120.42	837	94	66	25	42
Atherton	3	37.5	122.14	50	90	66	23	27
Atwater	12	37.3	121.5	150	102	72	24	38
Auberry	13	37.1	119.3	2140	102	69	21	36
Auburn	11	38.9	121.04	1292	103	69	25	33
Avalon	6	33.4	118.19	25	83	64	37	11
Azusa	9	34.1	118.09	605	101	70	31	36
Baker	14	35.3	116.06	940	115	73	23	29
Bakersfield AP	13	35.4	119.03	475	106	71	26	34
Balch PH	14	36.9	119.05	1720	100	67	26	26
Baldwin Park	9	34	117.2	394	100	69	31	32
Banning	15	33.9	116.53	2349	104	69	20	34
Barrett Dam	10	32.7	116.4	1623	103	69	22	35
Barstow	14	34.9	117.02	2162	107	69	16	35
Beale AFB	11	39.1	121.26	113	105	71	25	34
Beaumont	10	33.9	116.58	2605	103	68	22	38
Bell	8	33.9	117.7	143	97	70	33	22
Bell Gardens	8	33.9	117.7	160	97	70	29	24
Bellflower	8	33.8	117.7	73	98	70	32	21
Belmont	3	37.5	122.2	33	90	66	29	24
Ben Lomond	3	37.1	122.06	450	92	67	25	30
Benicia	12	38.1	122.06	55	99	69	28	30
Berkeley	3	37.9	122.15	345	90	64	33	16
Berryessa Lake	2	38.6	122.03	480	102	70	26	35
Beverly Hills	9	34.1	118.1	268	94	69	39	20
Big Bar RS	16	40.8	121.48	1260	102	68	19	46

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Big Bear Lake	16	34.2	116.53	6745	87	59	-3	32
Bishop AP	16	37.4	118.22	4108	103	61	5	40
Blackwells Corner	13	35.6	119.54	644	99	68	23	31
Bloomington	10	34	117.3	980	106	71	30	34
Blue Canyon AP	16	39.3	120.42	5280	88	60	13	20
Blythe AP	15	33.6	114.43	395	115	74	28	27
Blythe CO	15	33.6	114.36	268	115	74	24	27
Boca	16	39.4	120.06	5575	92	58	-18	46
Bodie	16	38.2	119.01	8370	83	50	-21	42
Bonita	13	32.7	117.02	105	91	69	28	20
Boron AFS	14	35.1	117.35	3015	106	70	18	35
Borrego Desert PK	15	33.2	116.24	805	112	76	25	36
Bowman Dam	11	39.4	120.39	5347	89	59	9	26
Brannan Island	12	38.1	121.42	30	100	69	24	10
Brawley 2 SW	15	33	115.33	-100	113	74	25	32
Brea Dam	8	33.9	117.7	275	100	69	30	29
Bridgeport	16	38.2	119.13	6470	89	56	-20	41
Broderick-Bryte	12	38.6	121.3	20	104	71	25	36
Brooks Ranch	12	38.8	122.09	294	104	71	19	35
Buena Park	8	33.9	117.7	75	98	69	31	25
Burbank AP	9	34.2	118.21	699	101	70	29	28
Burbank Vly Pump	9	34.2	118.21	655	101	69	29	28
Burlingame	3	37.6	122.21	10	88	67	30	20
Burney	16	40.9	121.4	3127	95	64	0	42
Buttonwillow	13	35.4	119.28	269	103	71	20	36
Cabrillo NM	7	32.7	117.14	410	89	69	39	12
Cachuma Lake	5	34.6	119.59	781	97	69	26	19
Calabasas	9	34.2	117.2	1100	102	71	26	26
Calaveras Big Trees	12	38.3	120.19	4696	92	61	11	33
Calexico	15	32.7	115.6	12	114	74	26	28
Callahan	16	41.3	122.48	3185	97	63	7	35
Calwa	13	36.8	119.7	330	105	73	23	34
Camarillo	6	34.2	119.12	147	91	69	28	22
Cambria AFS	5	35.5	121.04	690	78	62	30	16
Camp Roberts	4	35.8	120.45	765	106	72	16	45
Campbell	4	37.3	121.5	195	93	69	28	30
Campo	14	32.6	116.28	2630	101	67	16	41
Canoga Park	9	34.2	118.34	790	104	71	25	38
Cantil	14	35.3	117.58	2010	111	71	12	32
Canyon Dam	16	40.1	121.05	4555	93	60	1	39
Capitola	3	37	122.2	64	94	67	27	24
Cardiff-by-the-Sea	7	33	117.2	80	87	68	35	12
Carlsbad	7	33.2	117.2	44	87	68	34	10
Carmel Valley	3	36.5	121.44	425	94	68	25	20
Carmichael	12	38.6	121.27	100	104	70	25	35
Carpinteria	6	34.4	118.4	385	90	69	30	15
Carson	6	33.8	118.4	60	96	69	33	19
Castle AFB	12	37.4	120.34	188	105	71	24	33

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Castro Valley	3	37.6	122.12	177	93	67	24	25
Catheys Valley	12	37.4	120.03	1000	102	69	21	38
Cecilville	16	41.1	123.08	3000	95	63	13	44
Cedarville	16	41.5	120.1	4670	97	61	1	35
Centerville PH	11	39.8	121.4	522	105	70	25	40
Ceres	12	37.6	121.5	90	101	72	24	36
Cerritos	8	33.9	117.7	34	99	71	33	23
Cherry Valley Dam	10	38	120.1	4765	96	62	9	32
Cherryland	3	37.5	122.2	100	93	67	26	24
Chester	16	40.3	121.14	4525	94	62	-3	33
Chico Exp Sta	11	39.7	121.47	205	105	70	22	37
China Lake	14	35.7	117.41	2220	112	70	15	33
Chino	10	34	117.3	714	104	70	27	35
Chula Vista	7	32.6	117.05	9	90	70	33	9
Citrus Heights	12	38.7	121.27	138	104	71	24	36
Claremont	9	34.1	117.43	1201	101	69	29	34
Clarksburg	12	38.4	121.32	14	102	70	24	35
Clearlake Highlands	2	39	122.43	1360	101	69	15	36
Cloverdale	2	38.8	122.59	320	102	70	26	37
Clovis	13	36.8	119.43	404	105	72	22	36
Coachella	15	33.7	115.6	-76	114	74	25	28
Coalinga	13	36.2	120.21	671	103	70	23	34
Colfax	11	39.1	120.57	2418	100	66	22	29
Colton	10	34.1	117.3	978	105	70	28	35
Colusa	11	39.2	122.01	60	103	72	23	36
Commerce	8	33.9	117.7	175	98	69	33	23
Compton	8	33.9	118.13	71	97	69	33	21
Concord	12	38	112	195	102	70	27	34
Corcoran	13	36.1	119.42	200	106	72	22	36
Corona	10	33.9	117.34	710	104	70	26	35
Coronado	7	32.7	117.1	20	89	69	36	10
Corte Madera	2	37.9	122.7	55	97	68	28	34
Costa Mesa	6	33.7	117.53	100	88	68	31	16
Covelo	2	39.8	123.15	1385	99	67	15	43
Covina	9	34.1	117.2	575	101	70	29	34
Crescent City	1	41.8	124.12	40	75	61	28	18
Crockett	12	38	122.13	9	96	68	28	23
Crows Landing	12	37.4	121.06	140	101	70	23	33
Cucamonga	10	34.1	117.3	1450	103	69	29	31
Cudahy	8	33.9	117.7	130	98	70	33	21
Culver City	8	34	118.24	106	96	70	35	18
Cupertino	4	37.3	122	70	96	68	28	30
Cuyama	4	34.9	116.35	2255	99	68	13	42
Cuyamaca	7	33	116.35	4650	92	64	11	29
Cypress	8	33.8	117.7	75	98	70	31	24
Daggett AP	14	34.9	116.47	1915	109	68	21	33
Daly City	3	37.6	122.3	410	84	65	34	16
Davis	12	38.5	121.46	60	103	72	24	41

California Climate Zones (CTZ)

City	CTZ	Lattitude	Longitude	Elevation	Design Summer DryBulb	Design Summer WetBulb	Design Winter Extrm	Range
De Sabla	11	39.9	121.37	2713	97	66	18	35
Death Valley	14	36.5	116.52	-194	121	77	27	28
Deep Springs Clg	16	37.5	117.59	5225	98	60	-3	35
Deer Creek PH	16	39.3	120.51	4455	93	61	10	39
Del Aire	6	34	118.4	100	91	69	37	15
Delano	13	35.8	119.7	323	106	71	22	36
Denair	12	37.6	120.47	137	100	70	22	38
Diamond Bar	9	34	117.2	880	101	69	28	33
Dinuba	13	36.5	119.7	340	104	73	24	36
Dixon	12	38.4	121.51	100	104	72	24	36
Dobbins	11	39.4	121.12	1640	104	70	24	31
Donner Mem Stt Pk	16	39.3	120.15	5937	85	56	-3	40
Donner summit	16	39.4	120.2	7239	80	53	-8	40
Downey	8	33.9	118	110	98	71	32	21
Downieville RS	16	39.6	120.48	2895	98	64	13	42
Doyle	16	40	120.06	4390	96	63	0	42
Dry Canyon Res	16	34.5	118.32	1455	105	71	24	32
Duarte	9	34.1	117.2	500	100	69	31	33
Dublin	12	37.7	121.3	200	99	69	24	35
Dudleys	12	37.7	120.06	3000	97	65	10	44
Duttons Landing	2	38.2	122.18	20	96	68	26	31
Eagle Mtn	14	33.8	115.27	973	113	72	32	24
East Los Angeles	9	34	118.15	250	99	69	38	21
East Park Res	11	39.4	122.31	1205	101	69	19	38
Edwards AFB	14	34.9	117.52	2316	107	69	10	35
El Cajon	10	32.7	116.57	525	96	70	29	30
El Capitan Dam	14	32.9	116.49	600	105	71	29	35
El Centro	15	32.8	115.34	-30	115	74	26	34
El Cerrito	3	37.8	122.2	70	91	66	30	17
El Mirage	14	34.6	117.7	2910	105	69	9	31
El Monte	9	34.1	117.2	271	101	71	31	30
El Rio	6	34.3	118.4	50	95	69	30	20
El Segundo	6	33.9	118.4	105	91	69	37	14
El Toro MCAS	8	33.7	117.44	380	96	69	34	26
Electra PH	12	38.3	120.4	715	106	70	23	41
Elk Valley	16	42	123.43	1705	96	65	16	39
Elsinore	10	33.7	117.2	1285	105	71	22	39
Encinitas	7	33	117.2	50	87	68	35	10
Enterprise	11	40.6	122.2	470	107	69	26	29
Escondido	10	33.1	117.05	660	97	69	26	29
Eureka	1	40.8	124.1	43	75	61	30	11
Fair Oaks	12	38.7	121.16	50	104	70	23	36
Fairfax	2	38	122.7	110	96	68	26	34
Fairfield FS	12	38.3	122.02	38	103	69	24	34
Fairmont	14	34.7	118.26	3060	100	67	22	22
Fallbrook	10	33.6	117.15	660	94	68	26	29
Ferndale	1	40.5	124.18	1445	76	57	28	12
Fillmore	9	34.4	117.2	435	100	70	28	30

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Five Points	13	36.4	120.09	285	103	71	21	36
Fleming Fish & Game	16	40.4	120.19	4000	96	62	-3	40
Florence-Graham	8	34	117.7	175	98	69	35	19
Florin	12	38.5	121.5	100	104	71	29	35
Folsom Dam	12	38.7	121.1	350	104	70	25	36
Fontana	10	34.1	117.26	1090	105	70	30	33
Forest Glen	16	40.4	123.2	2340	96	65	12	42
Fort Baker	3	37.8	122.28	15	87	66	33	12
Fort Bidwell	16	41.9	120.08	4498	93	60	-2	38
Fort Bragg	1	39.5	123.49	80	75	60	29	15
Fort Jones RS	16	41.6	122.51	2725	98	64	5	44
Fort Ord	3	36.7	121.46	134	86	65	24	18
Fort Ross	1	38.5	123.15	116	79	63	30	19
Foster City	3	37.5	122.14	20	92	67	29	22
Fountain Valley	6	33.7	118.4	60	97	70	33	18
Freedom	3	37	122.2	1495	89	67	27	22
Fremont	3	37.5	122	56	94	67	25	24
Fresno AP	13	36.8	119.43	328	104	73	24	34
Friant Gov Camp	13	37	119.43	410	106	72	23	40
Fullerton	8	33.9	117.7	340	100	70	30	26
Garden Grove	8	33.6	117.7	85	98	70	31	23
Gardena	8	33.9	117.7	40	92	69	32	18
Georgetown RS	12	38.9	120.47	3001	98	64	18	31
Giant Forest	16	36.6	118.46	6412	84	56	5	26
Gilroy	4	37	121.34	194	101	70	23	25
Glendale	9	34.2	117.2	563	101	70	30	28
Glendora	9	34.1	117.2	822	102	69	30	35
Glenville	16	35.7	118.44	3140	97	67	11	43
Grass Valley	11	39.2	121.04	2400	99	67	19	29
Graton	2	38.4	122.52	200	95	68	22	34
Grossmont	7	32.7	117.2	530	96	69	31	23
Grover City	5	35.1	120.4	100	93	69	30	18
Hacienda Hts	9	34	117.2	300	100	69	31	28
Haiwee	16	36.1	117.57	3825	102	65	15	27
Half Moon Bay	3	37.5	122.26	60	83	64	32	15
Hamilton AFB	2	38.1	122.3	3	95	69	27	28
Hanford	13	36.3	119.4	242	102	71	22	37
Happy Camp RS	16	41.8	123.22	1150	103	67	18	41
Hat Creek PH 1	16	40.9	121.33	3015	99	65	2	48
Hawaiian Gardens	8	33.8	117.7	75	97	70	32	23
Hawthorne	8	33.9	117.7	70	92	69	37	16
Hayfield Pumps	14	33.7	115.38	1370	112	71	24	31
Hayward	3	37.7	122.07	530	92	66	26	24
Healdsburg	2	38.6	122.52	102	102	69	26	37
Hemet	10	33.7	117.3	1655	109	70	20	40
Hermosa Beach	6	33.9	118.4	16	92	69	38	12
Hetch Hetchy	16	38	119.47	3870	93	62	14	32
Highland	10	34.1	117.3	1315	106	70	26	36

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Hillsborough	3	37.6	122.18	352	90	66	30	23
Hilts	16	42	122.38	2900	97	64	5	39
Hollister	4	36.9	121.25	280	96	68	21	30
Hollywood	9	34	118.23	384	96	70	36	20
Hoopa	2	41	123.4	360	100	67	23	25
Huntington Beach	6	33.7	117.48	40	91	69	34	14
Huntington Lake	16	37.2	119.13	7020	80	55	3	25
Huntington Park	8	34	118	175	98	70	38	20
Idlewild	1	41.9	124	1250	103	68	18	40
Idria	4	36.4	120.4	2650	97	66	24	27
Idyllwild	16	33.7	116.43	5397	93	62	9	35
Imperial AP	15	32.8	115.34	-59	114	74	26	31
Imperial Beach	7	32.5	117.07	23	87	69	35	10
Imperial CO	16	32.9	115.34	-64	112	73	29	31
Inglewood	8	33.9	118	105	92	68	37	15
Inyokern NAS	14	35.7	117.49	2440	110	71	15	37
Iron Mtn	11	34.1	115.08	922	116	75	29	26
Irvine	8	33.7	118	50	96	69	33	27
Julian Wynola	14	33.1	116.48	3650	96	66	20	39
Kentfield	2	38	122.33	120	97	66	27	35
Kern River PH 1	13	35.5	118.47	970	106	72	30	26
Kern River PH 3	16	35.8	118.34	2703	103	69	19	34
Kettleman Stn	13	36.1	120.05	508	104	71	26	31
King City	4	36.2	121.08	320	94	67	20	36
Klamath	1	41.5	124.05	25	79	62	26	18
Knights Ferry	12	37.8	120.34	315	103	70	19	37
La Canada-Flintridge	9	34.2	118	1365	99	69	32	30
La Crescenta-Montrose	9	34.2	118	1565	98	69	31	33
La Habra	8	33.9	118	305	100	69	30	27
La Mesa	7	32.8	117.01	530	94	70	34	23
La Mirada	9	33.9	118	115	99	70	31	26
La Palma	8	33.9	118	75	98	69	31	25
La Puente	9	34	118	320	101	71	31	28
La Verne	9	34.1	118	1235	101	69	29	34
Lafayette	12	37.9	122.08	535	100	69	24	32
Laguna Beach	6	33.5	117.47	35	91	69	30	18
Laguna Hills	8	33.6	118	390	95	68	34	22
Lake Arrowhead	16	34.2	117.11	5205	90	62	13	26
Lakeport	2	39	122.55	1347	97	67	20	41
Lakeshore	16	40.9	122.3	1075	104	69	29	28
Lakeside	10	32.8	117	690	95	69	26	20
Lakewood	8	33.9	118	45	98	70	33	22
Lamont	13	35.3	120	500	106	72	26	34
Lancaster	14	34.7	118.12	2340	106	68	12	35
Larkspur	2	37.9	122.3	20	97	68	28	34
Lava Beds	16	41.7	121.31	4770	93	59	-1	41
Lawndale	8	33.9	118	66	92	69	37	16
Le Grand	12	37.2	120.15	255	101	70	23	38

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Lemon Grove	7	32.7	117.12	437	96	71	34	19
Lemoncove	13	36.4	119.02	513	105	72	25	38
Lemoore NAS	13	36.3	119.57	228	104	72	19	37
Lennox	8	33.9	117.45	71	92	69	37	16
Lindsay	13	36.2	119.04	395	105	72	24	40
Livermore	12	37.7	121.57	490	100	69	22	35
Llano Shawnee	14	34.5	117.45	3820	104	68	21	31
Lodgepole	16	36.6	118.43	6735	84	57	-4	26
Lodi	12	38.1	121.17	40	101	70	23	38
Loma Linda	10	34	117.3	1150	106	70	27	36
Lomita	6	33.8	119	56	95	69	33	18
Lompoc	5	34.9	120.27	95	84	63	26	18
Long Beach AP	6	33.8	118.14	25	99	71	33	21
Long Beach CO	6	33.7	118.09	34	97	70	35	18
Los Alamitos NAS	8	33.8	118.03	30	98	71	32	23
Los Altos	4	37.3	122	163	96	68	28	26
Los Angeles AP	6	33.9	118.24	97	91	67	37	14
Los Angeles CO	9	34	118.14	270	99	69	38	21
Los Banos	12	37	120.52	120	100	70	22	42
Los Banos Res	12	37	120.52	407	101	70	23	42
Los Gatos	4	37.2	121.58	365	98	69	26	32
Lucerne Valley	14	34.5	116.57	2957	105	67	12	38
Lynwood	8	33.9	118	88	98	70	32	21
Madera	13	37	120.04	268	105	72	24	40
Manhattan Beach	6	33.9	118	120	91	69	38	12
Manteca	12	37.8	121.12	34	102	70	24	37
Manzanita Lake	16	40.5	121.34	5850	87	58	-3	34
Maricopa	13	35.1	119.23	675	106	71	25	29
Marina	3	36.7	122.2	20	86	66	32	18
Markley Cove	2	38.5	122.07	480	104	70	23	39
Martinez FS	12	38	122.08	40	99	67	28	36
Marysville	11	39.2	121.35	60	105	72	27	36
Mather AFB	12	38.6	121.18	96	104	71	28	35
Maywood	8	34	118	170	97	70	34	21
McClellan AFB	12	38.7	121.24	86	105	71	23	35
McCloud	16	41.3	122.08	3300	96	63	5	42
Mecca FS	15	33.6	116.04	-180	115	75	24	30
Menlo Park	3	37.4	122.2	65	94	67	27	25
Merced AP	12	37.3	120.34	153	103	71	21	36
Mill Creek	16	35.1	117.01	2940	102	67	28	28
Mill Valley	3	37.9	122.35	80	97	68	28	28
Millbrae	3	37.6	122.21	10	90	66	30	24
Milpitas	4	37.4	121.54	15	94	68	27	27
Mineral	16	40.4	121.36	4911	90	60	2	38
Miramir AFS	7	32.9	117.08	477	97	69	32	22
Mission Viejo	8	33.6	118	350	95	67	33	22
Mitchell Caverns	16	34.9	115.32	4350	102	64	21	29
Modesto	12	37.6	121	91	102	73	25	36

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Moffett Field NAS	4	37.4	122.03	39	89	68	30	23
Mojave	14	35.1	118.11	2735	106	68	16	35
Mono Lake	16	38	119.09	6450	91	58	4	32
Monrovia	9	34.2	118.18	562	100	69	33	30
Montague	16	41.8	122.28	2648	99	66	3	39
Montclair	10	34	117	1220	104	69	28	35
Montebello	9	34	118.06	205	98	69	33	24
Monterey AP	3	36.6	121.52	245	86	65	30	20
Monterey CO	3	36.6	121.52	345	87	65	32	20
Monterey Park	9	34	118	380	99	69	30	23
Monticello Dam	2	38.5	122.07	505	105	71	26	39
Moraga	12	37.8	122.1	600	99	68	21	27
Morgan Hill	4	37.1	120	350	100	69	26	25
Morro Bay FD	5	35.4	120.51	115	88	65	31	14
Mount Baldy Notch	16	34.4	117.37	7735	80	58	4	32
Mount Diablo	12	37.9	121.55	2100	101	68	27	28
Mount Hamilton	4	37.3	121.39	4206	95	59	18	18
Mount Hebron RS	16	41.8	122.01	4250	92	60	-10	42
Mount Shasta	16	41.3	122.19	3535	93	62	8	34
Mount Wilson	16	34.2	118.04	5709	90	63	15	21
Mountain Pass	14	35.5	115.32	4730	100	65	11	29
Mountain View	4	37.5	121.54	95	93	67	28	25
Nacimiento Dam	4	35.8	120.53	770	100	68	22	35
Napa State Hospital	2	37.3	122.16	60	94	67	26	29
National City	7	32.7	117	34	87	70	36	10
Needles AP	15	34.8	114.37	913	117	73	27	26
Nevada City	11	39.3	121.01	2600	97	66	14	41
Newark	3	37.5	122.02	10	94	68	29	24
Newhall Soledad	9	34.4	118.33	1243	104	70	27	42
Newman	12	37.3	121.03	90	104	71	22	38
Newport Beach	6	33.6	117.53	10	87	68	34	12
Norco	10	33.9	117	700	103	70	27	34
North Fork RS	16	37.2	119.3	2630	98	66	15	36
North Highlands	12	38.6	121.25	45	104	71	23	35
North Hollywood	9	34.2	118.23	619	102	70	28	31
Norwalk	8	33.9	118	97	99	69	31	26
Novato	2	38.1	122.31	370	94	64	25	30
Oakdale	12	37.8	120.52	215	102	71	22	37
Oakland AP	3	37.7	122.12	6	91	66	32	20
Oakland Museum	3	37.8	122.1	30	96	68	31	20
Oceanside	7	33.2	117.24	10	84	69	33	10
Oildale	13	35.5	119	450	106	71	26	34
Ojai	9	34.5	119.15	750	102	71	25	38
Ontario AP	10	34	117	934	105	70	26	34
Orange	8	33.6	118	194	99	70	33	27
Orange Cove	13	36.6	119.18	431	104	71	25	38
Orangevale	12	38.7	121.12	140	105	72	24	36
Orick Prairie Creek	1	41.4	124.01	161	80	61	25	23

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Orinda	12	37.9	122.1	550	99	68	21	32
Orland	11	39.8	122.12	254	105	71	22	36
Orleans	2	41.3	123.32	403	104	70	21	42
Oroville RS	11	39.5	121.33	300	106	71	25	37
Otay-Castle Pk	7	32.6	117	500	87	68	33	10
Oxnard AFB	6	34.2	119.11	49	94	69	30	21
Pacific Grove	3	36.7	122	114	87	66	31	19
Pacifica	3	37.6	122	13	87	65	31	16
Palm Desert	15	33.7	116.3	200	116	74	26	34
Palm Springs	15	33.8	116.32	411	117	74	26	35
Palmdale AP	14	34.6	118.06	2517	107	67	12	33
Palmdale CO	14	34.6	118.06	2596	106	67	13	35
Palo Alto	4	37.5	122.08	25	93	66	26	25
Palomar Obsy	14	33.4	116.52	5545	90	62	16	22
Palos Verdes	6	33.8	119	216	92	69	38	14
Paradise	11	39.8	121.36	1750	102	69	25	34
Paramount	8	33.9	117	70	98	70	32	22
Parker Res	15	34.3	114.1	738	115	74	32	26
Pasadena	9	34.2	118.09	864	99	69	32	30
Paso Robles AP	4	35.7	120.41	815	104	66	19	40
Paso Robles CO	4	35.6	120.41	700	102	65	16	44
Perris	10	33.8	117.13	1470	105	70	22	39
Petaluma FS 2	2	38.2	122.38	16	98	69	24	31
Pico Rivera	9	34	118	180	98	70	31	24
Piedmont	3	37.8	122	325	96	68	31	23
Pinole	3	38	122.18	10	91	66	30	25
Pismo Beach	5	35.1	120.37	80	92	66	30	16
Pittsburg	12	38	121.48	50	102	70	26	34
Placentia	8	33.9	118	323	101	69	30	28
Placerville	12	38.7	120.48	1890	101	67	20	42
Placerville IFG	12	38.7	120.48	2755	100	66	23	42
Platina	11	40.4	122.53	2260	96	65	13	36
Pleasant Hill	12	37.9	122	102	96	68	25	34
Pleasanton	12	37.6	121.47	350	97	68	24	35
Point Arena	1	38.9	123.44	100	76	62	29	19
Point Arguello	5	34.6	120.4	76	75	64	29	17
Point Mugu	6	34.1	119.07	14	88	68	33	15
Pomona Cal Poly	9	34.1	117.49	740	102	70	27	36
Port Chicago ND	12	38	122.01	50	98	69	28	34
Port Hueneme	6	34.2	119	13	88	68	33	15
Porterville	13	36.1	119.01	393	106	71	25	36
Portola	16	39.8	120.28	4850	92	63	-9	48
Posey 3 E	13	35.8	119	4960	89	62	9	26
Potter Valley PH	2	39.4	123.08	1015	101	68	20	40
Poway Valley	10	33	117	500	100	70	29	26
Priest Valley	4	36.2	120.42	2300	97	66	13	34
Quincy	16	39.9	120.56	3409	101	64	1	45
Ramona Spaulding	10	33.1	116.49	1480	103	70	22	40

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Rancho Cordova	12	38.6	121.18	190	104	72	26	35
Rancho Palos Verdes	6	33.7	118.1	216	92	69	38	14
Randsburg	14	35.3	117.39	3570	105	67	19	30
Red Bluff AP	11	40.2	122.15	342	107	70	24	31
Redding FS 4	11	40.6	122.24	470	107	69	26	30
Redlands	10	34.1	117.11	1318	106	70	27	34
Redondo Beach	6	33.8	118.19	45	92	69	37	12
Redwood City	3	37.5	122.14	31	90	67	28	28
Reedley	13	36.6	119.42	344	104	71	24	40
Rialto	10	34.1	117	1254	105	70	28	35
Richardson Grove	2	40	123.47	500	96	67	25	28
Richmond	3	37.9	121.36	55	88	65	31	17
Ridgecrest	14	35.6	117.48	2340	110	70	15	35
Riverside Exp Sta	10	34	117.23	986	106	71	29	36
Riverside FS 3	10	34	117.23	840	104	70	27	37
Rocklin	11	38.8	121.14	239	108	72	20	39
Rohnert Park	2	38.4	122.33	106	99	69	24	33
Rolling Hills	6	33.6	119	216	92	69	38	15
Rosemead	9	34	118	275	98	70	30	27
Roseville	11	38.7	121.13	160	105	71	24	36
Rowland Hts	9	33.9	118	540	99	70	29	27
Rubidoux	10	34	117	792	106	71	27	36
Sacramento AP	12	38.5	121.3	17	104	72	26	35
Sacramento CO	12	38.6	121.3	84	104	71	30	32
Saint Helena	2	38.5	122.28	225	102	70	22	40
Saint Mary's College	12	37.8	122.07	623	98	69	21	28
Salinas 3 E	3	36.7	121.36	85	86	66	26	20
Salinas AP	3	36.7	121.36	69	85	67	28	20
Salt Springs PH	16	38.5	120.13	3700	95	62	19	27
Salyer RS	16	40.9	123.34	623	102	69	22	33
San Anselmo	2	38	122	50	95	67	26	32
San Antonio Canyon	16	34.2	117.4	2394	100	68	29	33
San Antonio Mission	4	36	117.4	1060	99	69	19	28
San Bernardino	10	34.1	117.19	1125	106	70	27	39
San Bruno	3	37.7	122.25	20	86	66	30	23
San Carlos	3	37.5	122.2	26	92	67	28	28
San Clemente	6	33.4	118.35	208	91	68	31	12
San Diego AP	7	32.7	117.1	13	88	70	38	13
San Dimas	9	34	117.2	955	102	70	30	35
San Fernando	9	34.3	118.28	977	104	71	30	37
San Francisco AP	3	37.6	122.23	8	89	66	31	20
San Francisco CO	3	37.8	122.25	52	84	65	38	14
San Gabriel FD	9	34.1	118.06	450	99	70	30	30
San Gregorio 2 SE	3	37.3	122.22	275	87	66	27	30
San Jacinto	10	33.8	116.58	1535	110	70	20	41
San Jose	4	37.4	121.56	67	94	68	29	26
San Leandro	3	37.7	122.2	45	89	67	28	22
San Lorenzo	3	37.7	122.2	45	89	67	28	23

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
San Luis Dam	12	37.1	121.04	277	97	68	25	32
San Luis Obispo	5	35.3	120.43	320	94	63	30	26
San Marino	9	34.2	117.2	300	100	69	30	28
San Mateo	3	37.5	122.18	21	92	67	31	24
San Nicholas Island	6	33.2	119.28	504	85	66	39	11
San Pablo	3	37.6	122.2	30	90	65	29	17
San Pedro	6	33.7	118.16	10	92	69	35	13
San Rafael	2	38	122.33	40	96	67	30	29
Sandberg	16	34.8	118.44	4517	95	63	17	32
Sanger	13	36.7	119.7	364	105	72	24	37
Santa Ana FS	8	33.8	117.5	115	98	70	33	26
Santa Barbara AP	6	34.4	119.5	9	90	69	29	20
Santa Barbara CO	6	34.4	119.41	5	91	69	33	22
Santa Clara Univ	4	37.4	121.56	88	90	67	29	30
Santa Cruz	3	37	122.01	125	94	68	27	28
Santa Fe Springs	9	33.9	117.2	280	99	69	31	24
Santa Maria AP	5	34.9	120.27	236	90	66	25	23
Santa Monica	6	34	118.3	15	85	67	39	15
Santa Paula	9	34.4	119.09	263	101	71	28	28
Santa Rosa	2	38.5	122.49	167	99	69	24	35
Santee	10	32.8	117.3	400	96	69	25	20
Saratoga	4	37.3	122.1	500	96	67	27	31
Sausalito	3	37.9	122.2	10	85	66	30	12
Sawyer's Bar RS	16	41.3	123.08	2169	100	66	14	38
Scotia	1	40.5	124.22	139	78	61	28	19
Seal Beach	6	33.8	118.05	21	94	69	35	15
Seaside	4	36.6	122.1	17	85	66	30	20
Selma	13	36.6	119.7	305	104	73	24	38
Shafter	13	35.5	119.1	345	106	71	24	28
Shasta Dam	16	40.7	122.25	1076	105	69	29	27
Shelter Cove	1	40	124.04	110	80	61	34	15
Sierra City	16	39.6	120.07	4230	96	62	12	43
Sierra Madre	9	34.2	117.2	1153	102	69	32	27
Sierraville RS	16	39.6	120.22	4975	94	60	-10	44
Signal Hill	6	33.5	118.4	100	99	70	35	19
Simi Valley	9	34.4	117.2	500	98	70	28	30
Sonoma	2	38.3	122.28	70	101	70	22	40
Sonora RS	12	38	120.23	1749	103	68	20	34
South El Monte	9	34	117.2	270	101	72	31	28
South Entr Yosemite	16	37.5	119.38	5120	92	61	8	36
South Gate	8	33.9	117.7	120	97	70	32	21
South Lake Tahoe	16	38.9	122.3	6200	85	56	-2	33
South Pasadena	9	34	117.2	657	99	69	31	30
South San Francisco	3	37.7	122.2	10	87	67	32	20
Spring Valley	10	32.7	117.3	300	94	69	34	30
Squaw Valley	16	39.2	122.3	6235	88	57	-10	40
Stanton	8	33.6	117.7	45	98	69	31	24
Stockton AP	12	37.9	121.15	22	103	71	24	35

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Stockton FS 4	12	38	121.19	12	101	70	24	37
Stony Gorge Res	11	39.6	122.32	791	104	70	21	37
Strawberry Valley	16	39.6	121.06	3808	96	63	14	32
Sunland	9	34.3	117.2	1460	107	71	28	36
Sunnyvale	4	37.3	122.02	97	96	68	29	26
Susanville AP	16	40.4	120.34	4148	98	62	-1	38
Tahoe City	16	39.2	120.08	6230	84	56	2	36
Tahoe Valley AP	16	38.9	120.08	6254	85	56	-5	38
Tehachapi	16	35.1	118.27	3975	97	66	13	33
Tejon Rancho	16	35	118.45	1425	107	71	24	27
Temple City	9	34.1	117.2	403	101	70	30	27
Termo	16	40.9	120.26	5300	95	60	-17	37
Thermal AP	15	33.6	116.1	-112	114	74	26	29
Thousand Oaks	9	34.2	117.2	810	98	69	27	30
Three Rivers PH 1	13	36.5	118.52	1140	105	70	24	38
Tiburon	3	37.9	122.2	90	85	66	30	12
Torrance	6	33.8	118.2	110	93	69	32	18
Tracy Carbona	12	37.7	121.25	140	102	70	24	38
Tracy Pumps	12	37.8	121.35	61	104	71	23	39
Travis AFB	12	38.3	121.56	72	103	71	24	35
Trinity Dam	16	40.8	122.3	2500	99	65	17	37
Trona	14	35.8	117.23	1695	113	72	18	35
Truckee RS	16	39.3	120.11	5995	90	58	-10	40
Tulare	13	36.2	119.7	290	105	72	24	39
Tulelake	16	42	121.28	4035	92	60	-5	41
Turlock	12	37.5	121.5	100	104	72	24	40
Tustin Irvine Rch	8	33.7	117.47	118	99	71	28	27
Twin Lakes	16	38.7	120.02	7829	73	49	-7	30
Twitchell Dam	5	35	120.19	582	99	70	26	26
UCLA	9	34.1	118.27	430	93	69	39	20
Ukiah	2	39.2	123.12	623	100	70	22	42
Union City	3	37.6	122.2	5	90	67	25	20
Upland	10	34.1	117.3	1605	102	69	29	31
Upper Lake RS	2	39.2	122.57	1347	98	68	18	39
Upper San Leandro	3	37.8	122.1	394	93	67	28	22
Vacaville	12	38.4	121.5	105	103	71	23	40
Valinda	9	34	117.2	340	102	70	31	28
Vallejo	3	38.1	122.2	85	93	67	28	23
Valyermo RS	14	34.5	117.7	3600	100	67	12	41
Vandenburg AFB	5	34.7	122.48	368	85	62	30	16
Ventura	6	34.3	118.4	341	89	68	29	15
Victorville Pumps	14	34.5	117.18	2858	105	67	14	39
Visalia	13	36.3	119.18	325	103	71	25	38
Vista	7	33.2	117.14	510	96	69	30	16
Volta PH	12	40.5	121.52	2220	101	66	21	33
Walnut	9	34	117.2	550	101	70	28	30
Walnut Creek	12	37.9	121.5	245	100	69	23	32
Walnut Grove	12	38.2	121.5	23	102	70	24	37

California Climate Zones (CTZ)

					Design			
					Summer		Winter	
City	CTZ	Lattitude	Longitude	Elevation	DryBulb	WetBulb	Extrm	Range
Warner Springs	14	33.3	117.7	3180	100	67	15	40
Wasco	13	35.6	119.2	333	105	71	23	36
Watsonville	3	36.9	121.46	95	86	66	28	22
Weaverville RS	16	40.7	122.56	2050	100	67	10	46
Weed FD	16	41.4	122.23	3590	92	63	4	35
West Covina	9	34	117.2	365	102	70	29	34
West Hollywood	9	34	117.2	290	95	70	38	20
Westminster	6	33.8	118.4	38	95	70	33	23
Whiskeytown Res	11	40.6	122.32	1295	105	69	25	31
White Mtn 1	16	37.5	122.3	10150	73	49	-15	37
White Mtn 2	16	37.6	122.3	12470	61	42	-20	38
Whittier	9	34	117.2	320	99	69	31	24
Wildrose RS	16	36.3	122.3	4100	100	64	13	33
Williams	11	39.2	122.2	85	104	71	24	36
Willits	2	39.4	123.19	1350	95	66	18	38
Willow Brook	8	33.9	117.7	60	97	70	35	21
Willow Creek	2	41	123.38	461	104	70	22	35
Willows	11	39.5	122.18	140	104	71	22	36
Winters	12	38.5	121.58	135	104	71	24	38
Woodfords	16	38.8	119.48	5671	92	59	0	32
Woodland	12	38.7	121.48	69	106	72	25	40
Woodside	3	37.5	122.2	75	92	67	22	24
Yorba Linda	8	33.9	117.7	350	102	70	30	31
Yosemite Park Hq	16	37.7	119.35	3970	97	63	11	38
Yreka	16	41.7	122.38	2625	99	66	8	39
Yuba City	11	39.1	122.2	70	105	69	24	36
Yucaipa	10	34	117.3	2600	106	68	27	35

International Hourly Weather Data

International locations. Additional DOE-2 weather data files are maintained on the DOE-2 web site (www.doe2.com) for international locations. These international location weather files are supplied "as-is", i.e., with no warranty whatsoever. These files are created from data supplied by others and the DOE-2 development team has no knowledge of the accuracy, completeness, or correctness of these files or their data. Users must check these for themselves prior to any use to ensure they can be used for the energy modeling of buildings in the area you have under study. A list of the currently available (i.e., 1st quarter 1999) locations is provided below.

	Filename	Location Description on Weather File	Year	Lattitude	Longitude	Time Zone
EUROPE	BARI	BARI	*n/a*	41.1	-16.5	-1
	BRESCIA	BRESCIA	*n/a*	45.3	-10.2	-1
	DUBROV78	DUBROVNIK 1440/1978	1978	42.7	-18.1	-1
	FRANKFUR	FRANKFURT AIRPORT	*n/a*	50.0	-8.6	-1
	GENOVA	GENOVA	*n/a*	44.3	-8.5	-1
	MILANO	MILANO LINATE	*n/a*	45.3	-9.2	-1
	NAPOLI	NAPOLI	*n/a*	40.5	-14.2	-1
	PALERMO	PALERMO_BOCCA DI F.	*n/a*	38.1	-13.1	-1
	REVENNA	RAVENNA (MARINA DI)	*n/a*	44.3	-12.2	-1
	RIJEKA78	RIJEKA 1440/1978	1978	45.3	-14.5	-1
	ROMA	ROMA_CIAMPINO	*n/a*	41.5	-12.4	-1
	TRAPPES	TRAPPES	1970	48.9	-2.4	0
	ZAGRTRY	ZAGREB TRY 1973 2.1C	1973	45.8	-16.0	-1
MEXICO	MERIDA88	MERIDA	*n/a*	20.6	89.4	6
	MERIDA90	MERIDA	*n/a*	20.6	89.4	6
	MERIDA91	MERIDA	*n/a*	20.6	89.4	6
	MEXICO88	MEXICO	*n/a*	19.2	99.1	6
	MEXICO90	MEXICO	*n/a*	19.2	99.1	6
	MEXICO91	MEXICO	*n/a*	19.2	99.1	6
	MONTER80	MONTERREY	*n/a*	25.4	100.2	6
	MONTER81	MONTERREY	*n/a*	25.4	100.2	6
	MONTER86	MONTERREY	*n/a*	25.4	100.2	6
MIDEAST	KISR	KUWAIT	*n/a*	29.2	-48.0	-3
	KUWAITS	KUWAIT	*n/a*	29.2	-48.0	-3
	JEDDAH80	JEDDAH,	1980	21.5	-39.2	-3
	RIYADH83	RIYADH,	1983	24.7	-46.7	-3
SOUTH AMERICA	SAOPAU51	SAO PAULO	1951	-23.5	46.6	3
	SAOPAU70	SAO PAULO	1970	-23.5	46.6	3

International Hourly Weather Data (continued)

	Filename	Location Description on Weather File	Year	Lattitude	Longitude	Time Zone
ASIA	BEIJIN	BEIJINGTMY	*n/a*	39.8	-116.5	-8
	BEIWYE	BEIJINGTMY	*n/a*	39.8	-116.5	-8
	CHENGDU	Chengdu 1440	1988	30.4	-104.0	-8
	CHENGDU8	Chengdu 1440	1988	30.4	-104.0	-8
	DUBROV78	DUBROVNIK 1440/1978	1978	42.7	-18.1	-1
	HARBIN	HARBIN, CHINA 1981	1981	45.8	-126.7	-7
	ISLAMABA	ISLAMABAD 1986	1986	33.8	-73.0	-5
	JAKART87	1987 JAKARTA W/SOLAR	*n/a*	-6.2	-106.8	-7
	KARACH86	KARACHI 1986	1986	24.8	-67.1	-5
	KINGSTON	84/85 KINGSTON UWI	*n/a*	18.0	76.6	5
	K-LUMPNS	OTHER MALAYSIA	*n/a*	3.1	-101.6	-7
	K-LUMPUR	OTHER MALAYSIA	*n/a*	3.1	-101.6	-7
	LAHORE86	LAHORE 1986 ENERCON	1986	31.5	-74.3	-5
	HONGKONG	HK89 (TMY Format)	1989	22.3	-112.4	-8
	MANIL83S	1983 MANILA W/SOLAR	*n/a*	14.5	-121.0	-8
	MOBAY	84 MONTEGO BAY	*n/a*	18.5	78.0	5
	MULTAN86	MULTAN 1986	1986	30.2	-71.5	-5
	NANJING	Nanjing 1440/1988	1988	32.0	-118.5	-8
	NANJING8	Nanjing 1440/1988	1988	32.0	-118.5	-8
	PESHAWAR	PESHAWAR 1986 DATA	1986	34.0	-71.6	-5
	RIJEKA78	RIJEKA 1440/1978	1978	45.3	-14.5	-1
	SHANGHAI	SHANGHAI OTHER	*n/a*	31.1	-121.3	-8
	SINGAPOR	1988 SINGAPORE W/SOL	*n/a*	1.3	-103.8	-8
	URUMQI88	Urumqi 1440/1988	1988	43.5	-87.4	-8
	XIAN	Xian 1440/1988	1988	34.2	-108.6	-8
	ZAGRTRY	ZAGREB TRY 1973 2.1C	1973	45.8	-16.0	-1
AUSTRALIA	ADELAIDE	ADELAIDE AUSTRALIA	1987	-34.9	-138.6	-9
	ALBANY	ALBANY AMO AUSTRALIA	1987	-35.0	-117.8	-8
	ALICESPR	ALICE SPRINGS AUST.	1979	-23.8	-133.9	-9
	BRISBANE	BRISBANE AUSTRALIA	1986	-27.4	-153.1	-10
	BROOME	BROOME AUSTRALIA	1981	-18.0	-122.2	-8
	CAIRNS	CAIRNS AMO AUSTRALIA	1984	-16.9	-145.8	-10
	CANBERRA	CANBERRA CITY AUST.	1978	-35.3	-149.1	-10
	COFFSHAR	COFFS HARBOUR AUST.	1984	-30.3	-153.1	-10
	DARWIN	DARWIN RO AUSTRALIA	1973	-12.5	-130.8	-9
	EASTSALE	EAST SALE AUSTRALIA	1987	-38.1	-147.1	-10
	GERALDTO	GERALDTON AUSTRALIA	1983	-28.8	-114.7	-8
	HOBART	HOBART AUSTRALIA	1984	-42.9	-147.3	-10
	LAUNCEST	LAUNCESTON AUSTRALIA	1985	-41.6	-147.2	-10
	MACKAY	MACKAY AUSTRALIA	1984	-21.1	-149.2	-10
	MELBOURN	MELBOURNE AUSTRALIA	1971	-37.8	-145.0	-10
	MILDURA	MILDURA AUSTRALIA	1981	-34.2	-142.1	-10
	MTGAMBIE	MT. GAMBIER AUST.	1984	-37.8	-140.8	-9
	NOWRA	NOWRA AUSTRALIA	1984	-35.0	-150.5	-10
	PERTH	PERTH RO AUSTRALIA	1982	-32.0	-115.9	-8
	PORTHEDL	PORT HEDLAND AUST.	1984	-20.4	-118.6	-8
	ROCKHAMP	ROCKHAMPTON AUST.	1983	-23.4	-150.5	-10
	SYDNEY	SYDNEY AUSTRALIA	1981	-33.9	-151.2	-10
	TOWNSVIL	TOWNSVILLE AUST.	1986	-19.3	-146.8	-10
	WILLIAMT	WILLIAMTOWN AUST.	1982	-32.8	-151.8	-10

DOE-2.2 Results Quality Control

DOE-2.2 sample Output

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DOE2 Output Quality Control

Ensuring the validity of DOE2 analysis results requires our best engineering and systems experience. There are several general principles that can help assure quality analysis with any detailed simulation tool, including:

- thorough insight into the inner workings of the simulation tool.
- thorough knowledge of the technologies being modeled
- focus on those portions of the model that are critical to your analysis
- use modeling procedures that will help prevent errors of omission

In addition to these general principles, there are at least three procedures you can use to check and assess the quality of simulation results. These include:

1) Develop and use output QC check lists and rules of thumb.
2) Report analysis results in a format that facilitates your own internal QC procedures (e.g., check the incremental impacts reported for each modeled measure).
3) Use output differencing or delta utilities to check key model features and measures.

Examples of each of these are provided in this section.

"10 Minute" DOE2 Output QC Checklist

Report	Check	Comments
BEPU	Percent of hours outside throttling range	Eq. size, control (see SS-R, SS-F, and SS-O)
BEPU	Percent of hours loads not satisfied	Equip sizing, control (see PS-C, and PS-H)
BEPS	Energy use & cost intensity	Btu/sqft/year from BEPS, ($/sqft/year from ES-D)
BEPU	Energy use by category	Compare relative magnitudes
PS-E	kW and kWh by end-use (annual & monthly)	to check W/sqft, get conditioned area from LS-C
PS-D	Peak loads on loops	compare peak load (PS-D) with equip size (PV-A)
PS-C	Peak load & equipment sizes	compare peak load (PS-C) with equip size (PV-A)
PS-C	Calculate overall equipment efficiencies	Load met / energy used (see SS-P for unitary eq.)
PS-C	Equipment part-load ranges (annual)	for monthly - see PS-H, for unitary equip - see SS-P
PS-C	Total equipment operating hours	for monthly - see PS-H, for unitary equip - see SS-P
PS-A	Monthly pattern of heating and cooling loads	confirm realistic pattern (compare also SS-D & LS-D)
SS-N	Hours at Relative Humidity Levels	check RH levels by time of day
SS-J	System load and size checks	sqft/ton, cfm/sqft, min osa/per, cool/heat pk (Btuh/sf)
* any *	Proper weather file used	reported at top right corner of most reports

"30 Minute" DOE2 Output QC Checklist

Report	Check	Comments
⑩ LV-A	Proper weather file used	also reported at top right corner of most reports
LV-B	Lighting density in each space	0.6 - 2.5 W/sf, confirm no lights in plenums
LV-C	Average space height for each space	DOE2 bases this on volume/area
LV-D	Total (opaque + glass) wall area by orientation	approx equal areas for opposite orientations
LS-B	Peak space load per sqft for each space	perimeter: ~25 Btu/sf*win/flr ratio*SC+Internal
LS-C	Peak space load per sqft (building total)	% core*core Btuh/sf + % perim*perim Btuh/sf
LS-C	Outdoor temperatures coincident with peak	these are used in outdoor air design load calcs.
LS-C	Building net area (modeled area)	compare to known gross building area
LS-D	Peak lighting + plug load density	compare to inputs for lights & plugs (see also PS-F)
❽ LS-D	Monthly pattern of heating and cooling loads	confirm realistic pattern (see also SS-D & PS-A)
SV-A	Amount of outside air (if not scheduled)	check or reasonable values
SV-A	Sensible heat ratio	check or reasonable values
SS-D	Peak cooling load, square feet per ton	compare with PS-D and/or PS-C (if built-up equip)
❽ SS-D	Monthly pattern of heating and cooling loads	confirm realistic pattern (see also LS-D & PS-A)
SS-E	Cooling/heating/simultaneous hrs & availability	ensure realistic hours (check for too much simulataneous)
SS-A	For unitary DX, monthly pattern of loads	unitary loads are not totaled in SS-D
❺ SS-P	Average EER for unitary DX	cooling load / (compressor+fan kWh)
⑨ SS-J	System load and size checks	sqft/ton, cfm/sqft, min osa/per, cool/heat pk (Btuh/sf)
❶ SS-K	Avg temperature, cooling and heating hours	Compare to t-stat set points (includes unconditioned!)
❶ SS-O	Hours under cooled/heated by time-of-day	Compare to t-stat set points & throttling range
❶ SS-F	Hours under cooled/heated by zone	Excessive hours indicate faulty control
❶ SS-R	Hours under cooled/heated by system	Excessive hours indicate faulty control
SS-N	Hours at relative humidity levels	check RH levels by time of day
PV-A	Equipment sizes	compare with peak loads on PS-C and PS-D
⑧ PS-A	Monthly pattern of heating and cooling loads	confirm realistic pattern (compare SS-D & LS-D)
⑤ PS-C	Calculate overall equipment efficiencies	Load met / energy used (see SS-P for unitary eq.)
⑥ PS-C	Equipment part-load ranges (annual)	for monthly - see PS-H, for unitary equip - see SS-P
⑦ PS-C	Total equipment operating hours	for monthly - see PS-H, for unitary equip - see SS-P
④ PS-E	kW and kWh by end-use (annual & monthly)	to check W/sqft, get conditioned area from LS-C
③ PS-H	Average operating ratios	Equip sizing & load management check
PS-H	Peak load & equipment sizes	peak load & equipment size, 300 to 700 sqft/ton
①BEPU	Percent of hours outside throttling range	Eq. size, control, schedules (see SS-R, SS-F, SS-O)
① "	Percent of hours loads not satisfied	Equip sizing, control & schedules (see PS-C, PS-H)
②BEPU	Energy use by category	Compare relative magnitudes
② "	Energy use & cost intensity	Btu/sqft/year from BEPU, ($/sqft/year from ES-D)

①*primary check item*

❶*secondary check item (related to a primary check)*

Suggested Reporting Format

Annual Energy Use Detailed Results - Example Office Building

15 September 1998 (page 1 of 3)

	Ambient			**Annual HVAC Energy**					**Annual Energy Total**			
	Lights kWh	Misc Eq. kWh	SHW Therms	Heating kWh	Cooling kWh	Fans kWh	Twr Fans kWh	Pumps kWh	Nat Gas Therms	Elect kWh	Total Site Mbtu	Total Source Mbtu
Annual Energy Use												
0 Base Case	166,654	48,526	0	0	108,632	26,050	1,171	44,540	5,860	395,573	1,936	4,636
1 0+3' Overhang	166,654	48,526	0	0	83,393	20,734	809	36,650	4,800	356,766	1,698	4,133
2 1+6' Overhang	166,654	48,526	0	0	71,077	18,338	682	31,625	4,070	336,902	1,557	3,857
3 2+Reduced LPD	133,324	48,526	0	0	65,068	16,357	605	29,841	4,500	293,720	1,452	3,457
4 3+Daylighting	84,042	48,526	0	0	55,513	14,648	468	26,291	5,020	229,488	1,285	2,852
5 4+0.6 kW/ton Chiller	84,042	48,526	0	0	34,663	14,648	403	25,227	5,020	207,509	1,210	2,627
Incremental Savings *(negative entries indicate increased use)*												
1 0+3' Overhang	0	0	0	0	25,239	5,316	362	7,890	1,060	38,807	238	503
2 1+6' Overhang	0	0	0	0	12,316	2,396	127	5,025	730	19,864	141	276
3 2+Reduced LPD	33,330	0	0	0	6,009	1,981	77	1,784	(430)	43,182	104	399
4 3+Daylighting	49,282	0	0	0	9,555	1,709	137	3,550	(520)	64,232	167	606
5 4+0.6 kW/ton Chiller	0	0	0	0	20,850	0	65	1,064	0	21,979	75	225
Cumulative Savings *(relative to Case 0, negative entries indicate increased use)*												
1 0+3' Overhang	0	0	0	0	25,239	5,316	362	7,890	1,060	38,807	238	503
2 1+6' Overhang	0	0	0	0	37,555	7,712	489	12,915	1,790	58,671	379	780
3 2+Reduced LPD	33,330	0	0	0	43,564	9,693	566	14,699	1,360	101,853	484	1,179
4 3+Daylighting	82,612	0	0	0	53,119	11,402	703	18,249	840	166,085	651	1,785
5 4+0.6 kW/ton Chiller	82,612	0	0	0	73,969	11,402	768	19,313	840	188,064	726	2,010

Peak Demand PRELIMINARY Detailed Results - Example Office Building

15 September 1998 (page 2 of 3)

	Ambient		**Annual HVAC Demands (Non-Coincident)**						**Total**
	Lights kW	Misc Eq. kW	Peak Load Tons	Heating kW	Cooling kW	Fans kW	Clg Twrs kW	Pumps kW	Elect kW
Annual Peak Demand									
0 Base Case	54	15	67	0	71	14	2	10	162
1 0+3' Overhang	54	15	51	0	55	10	2	8	140
2 1+6' Overhang	53	15	43	0	47	9	1	7	131
3 2+Reduced LPD	42	15	38	0	43	8	1	7	116
4 3+Daylighting	42	15	32	0	38	6	1	6	88
5 4+0.6 kW/ton Chiller	42	15	32	0	25	6	1	6	75
Incremental Savings *(negative entries indicate increased demand)*									
1 0+3' Overhang	0	0	16	0	16	4	1	2	22
2 1+6' Overhang	1	0	7	0	8	1	0	1	9
3 2+Reduced LPD	11	0	5	0	4	1	0	0	15
4 3+Daylighting	0	0	6	0	6	2	0	1	28
5 4+0.6 kW/ton Chiller	0	0	0	0	13	0	0	0	13
Cumulative Savings *(relative to Case 0, negative entries indicate increased demand)*									
1 0+3' Overhang	0	0	16	0	16	4	1	2	22
2 1+6' Overhang	1	0	24	0	24	5	1	3	31
3 2+Reduced LPD	12	0	28	0	28	6	1	3	46
4 3+Daylighting	12	0	35	0	34	7	1	4	74
5 4+0.6 kW/ton Chiller	12	0	35	0	46	7	1	4	86

Annual Utility Costs PRELIMINARY Detailed Results - Example Office Building

15 September 1998 (page 3 of 3)

	Annual Utility Cost Total ($)					**Incremental**	
	Nat Gas Total	Electric Energy	Electric Demand	Electric Total	Utility Total	First Cost ($)	Simple Payback
Annual Costs							
0 Base Case	$3,558	$30,427	$13,578	$44,729	$48,287	$0	*n/a*
1 0+3' Overhang	$3,022	$27,442	$11,891	$40,057	$43,079	$50,000	*n/a*
2 1+6' Overhang	$2,625	$25,914	$11,054	$37,692	$40,317	$50,000	*n/a*
3 2+Reduced LPD	$2,854	$22,593	$9,621	$32,938	$35,792	$12,000	*n/a*
4 3+Daylighting	$3,128	$17,652	$7,242	$25,618	$28,746	$40,000	*n/a*
5 4+0.6 kW/ton Chiller	$3,128	$15,962	$6,415	$23,100	$26,228	$8,000	*n/a*
Incremental Savings *(negative entries indicate increased costs)*							
1 0+3' Overhang	$536	$2,985	$1,687	$4,672	$5,208	($50,000)	9.6
2 1+6' Overhang	$397	$1,528	$837	$2,365	$2,762	($50,000)	18.1
3 2+Reduced LPD	($229)	$3,321	$1,433	$4,754	$4,525	($12,000)	2.7
4 3+Daylighting	($274)	$4,941	$2,379	$7,320	$7,046	($40,000)	5.7
5 4+0.6 kW/ton Chiller	$0	$1,690	$827	$2,518	$2,518	($8,000)	3.2
Cumulative Savings *(relative to Case 0, negative entries indicate increased costs)*							
1 0+3' Overhang	$536	$2,985	$1,687	$4,672	$5,208	($50,000)	9.6
2 1+6' Overhang	$933	$4,513	$2,524	$7,037	$7,970	($100,000)	12.5
3 2+Reduced LPD	$704	$7,834	$3,957	$11,791	$12,495	($112,000)	9.0
4 3+Daylighting	$430	$12,775	$6,336	$19,111	$19,541	($152,000)	7.8
5 4+0.6 kW/ton Chiller	$430	$14,465	$7,163	$21,629	$22,059	($160,000)	7.3

Delta Reporting Format

The example output that follows presents DOE2 results from a chiller alternative where a base case reciprocating machine (1.0 kW/ton) was replaced with a newer model (0.6 kW/ton). Two PLANT reports are presented, PS-C and BEPU.

The reports are ordered to present the base case first, followed by the alternative, followed by the delta between them. For this example, the delta is equal to the alternative minus the base case. Therefore, any savings will appear as negative quantities in the delta report.

Note that the deltas are reported for any numeric characters not embedded within a character string.

Example PS-C Delta Output

Base Case (chiller kW/ton = 1.0)

Simple Office Practice Example w Expressions for overall bldg dimensions DOE-B2.2NT30 9/16/1998 6:24:15 BDL RUN 1
and daylighting in all perimieter zones
REPORT- PS-C Equipment Loads and Energy Use WEATHER FILE- LOS ANGELES, CA

MON	SUM PEAK	COOL LOAD (MBTU) (KBTU/HR)	HEAT LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	FUEL USE (MBTU) (KBTU/HR)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
Boiler 1																		
	SUM		-196.1		489.9	LOAD	2618	563	142	62	12	6	3	0	0	0	0	3406
	PEAK		-572.7		840.1	FUEL	1584	1322	270	102	90	26	9	3	0	0	0	3406
MON/DAY			12/28		12/28													
Chiller 1																		
	SUM	396.8		52120.4		LOAD	1632	1419	919	490	137	19	4	0	0	0	0	4620
	PEAK	332.2		31.3		ELEC	285	1523	1223	877	532	158	20	2	0	0	0	4620
MON/DAY		8/31		8/31														
Cooling Tower 1																		
	SUM	663.5		468.4		LOAD	0	0	0	0	4619	1	0	0	0	0	0	4620
	PEAK	447.1		1.0		ELEC	1063	604	271	51	10	0	0	0	0	0	0	1999
MON/DAY		8/31		8/31														
CHW Pump																		
	SUM			9850.1		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			2.1		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620
HW Pump																		
	SUM			2662.8		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			0.6		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620
CW Pump																		
	SUM			13755.5		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			3.0		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620

Example PS-C Delta Output

Alternative (chiller kW/ton = 0.6)

Simple Office Practice Example w Expressions for overall bldg dimensions DOE-B2.2NT30 9/16/1998 6:27:52 BDL RUN 1
and daylighting in all perimieter zones
REPORT- PS-C Equipment Loads and Energy Use WEATHER FILE- LOS ANGELES, CA

MON	SUM PEAK	COOL LOAD (MBTU) (KBTU/HR)	HEAT LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	FUEL USE (MBTU) (KBTU/HR)	-------- Number of hours within each PART LOAD range ---------	00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
Boiler 1																		
	SUM		-196.1		489.9	LOAD	2618	563	142	62	12	6	3	0	0	0	0	3406
	PEAK		-572.7		840.1	FUEL	1584	1322	270	102	90	26	9	3	0	0	0	3406
MON/DAY			12/28		12/28													
Chiller 1																		
	SUM	396.8		31270.5		LOAD	1632	1419	919	490	137	19	4	0	0	0	0	4620
	PEAK	332.2		18.8		ELEC	285	1523	1223	877	532	158	20	2	0	0	0	4620
MON/DAY		8/31		8/31														
Cooling Tower 1																		
	SUM	589.0		403.3		LOAD	0	0	0	0	4620	0	0	0	0	0	0	4620
	PEAK	403.6		0.9		ELEC	1022	601	245	43	10	0	0	0	0	0	0	1921
MON/DAY		8/31		8/31														
CHW Pump																		
	SUM			9850.1		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			2.1		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620
HW Pump																		
	SUM			2662.8		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			0.6		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620
CW Pump																		
	SUM			12691.8		FLOW	0	0	0	0	0	0	0	0	0	0	4620	4620
	PEAK			2.7		RPM	0	0	0	0	0	0	0	0	0	0	4620	4620
MON/DAY				1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	4620	4620

Example PS-C Delta Output

Delta Case (= Alternative - Base)

```
Simple Office Practice Example w Expressions for overall bldg dimensions        DOE-B2.2NT30   9/16/1998     6:24:15  BDL RUN  0
and daylighting in all perimieter zones
REPORT- PS-C Equipment Loads and Energy Use                                                 WEATHER FILE- LOS ANGELES, CA
---------------------------------------------------------------------------------------------------------------------------------

            COOL LOAD   HEAT LOAD   ELEC USE    FUEL USE     --------  Number of hours within each PART LOAD range  --------- TOTAL
       SUM   (MBTU)      (MBTU)      (KWH)       (MBTU)           0     0     0     0     0     0     0     0     0     0     0   RUN
MON  PEAK  (KBTU/HR)   (KBTU/HR)     (KW)      (KBTU/HR)          0     0     0     0     0     0     0     0     0     0     +  HOURS
---  ----  ----------  ----------  ----------  ----------      ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----

Boiler 0
      SUM                     .0                      .0 LOAD2618     0     0     0     0     0     0     0     0     0     0     0
     PEAK                     .0                      .0 FUEL1584     0     0     0     0     0     0     0     0     0     0     0
  MON/DAY                  12/28                   12/28

Chiller 0
      SUM          .0                 20849.9            LOAD1632     0     0     0     0     0     0     0     0     0     0     0
     PEAK          .0                    12.5            ELEC    0    0     0     0     0     0     0     0     0     0     0     0
  MON/DAY        8/31                    8/31

Cooling Tower 0
      SUM        74.5                    65.1            LOAD    0    0     0     0    -1     1     0     0     0     0     0     0
     PEAK        43.5                      .1            ELEC1063     3    26     8     0     0     0     0     0     0     0    78
  MON/DAY        8/31                    8/31

CHW Pump
      SUM                                  .0            FLOW    0    0     0     0     0     0     0     0     0     0     0     0
     PEAK                                  .0             RPM    0    0     0     0     0     0     0     0     0     0     0     0
  MON/DAY                                1/ 0            ELEC    0    0     0     0     0     0     0     0     0     0     0     0

HW Pump
      SUM                                  .0            FLOW    0    0     0     0     0     0     0     0     0     0     0     0
     PEAK                                  .0             RPM    0    0     0     0     0     0     0     0     0     0     0     0
  MON/DAY                                1/ 0            ELEC    0    0     0     0     0     0     0     0     0     0     0     0

CW Pump
      SUM                              1063.7            FLOW    0    0     0     0     0     0     0     0     0     0     0     0
     PEAK                                  .3             RPM    0    0     0     0     0     0     0     0     0     0     0     0
  MON/DAY                                1/ 0            ELEC    0    0     0     0     0     0     0     0     0     0     0     0
```

Example BEPU Delta Output

Base Case (chiller kW/ton = 1.0)

```
Simple Office Practice Example w Expressions for overall bldg dimensions        DOE-B2.2NT30   9/16/1998    6:24:15  BDL RUN  1
and daylighting in all perimieter zones
REPORT- BEPU Building Utility Performance                                                  WEATHER FILE- LOS ANGELES, CA
---------------------------------------------------------------------------------------------------------------------------------

                       TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
             LIGHTS  LIGHTS    EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE     TOTAL
            -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      84042.       0.   48526.       0.   55513.     468.   26291.   14648.       0.       0.       0.       0.   229488.

FM1  NATURAL-GAS
    THERM        0.       0.       0.    4955.       0.       0.      70.       0.       0.       0.       0.       0.     5024.


           TOTAL ELECTRICITY    229488. KWH        5.884 KWH     /SQFT-YR GROSS-AREA    5.884 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS      5024. THERM      0.129 THERM   /SQFT-YR GROSS-AREA    0.129 THERM   /SQFT-YR NET-AREA

           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.1
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

Alternative (chiller kW/ton = 0.6)

```
Simple Office Practice Example w Expressions for overall bldg dimensions        DOE-B2.2NT30   9/16/1998    6:27:52  BDL RUN  1
and daylighting in all perimieter zones
REPORT- BEPU Building Utility Performance                                                  WEATHER FILE- LOS ANGELES, CA
---------------------------------------------------------------------------------------------------------------------------------

                       TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
             LIGHTS  LIGHTS    EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE     TOTAL
            -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH      84042.       0.   48526.       0.   34663.     403.   25227.   14648.       0.       0.       0.       0.   207509.

FM1  NATURAL-GAS
    THERM        0.       0.       0.    4955.       0.       0.      70.       0.       0.       0.       0.       0.     5024.


           TOTAL ELECTRICITY    207509. KWH        5.321 KWH     /SQFT-YR GROSS-AREA    5.321 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS      5024. THERM      0.129 THERM   /SQFT-YR GROSS-AREA    0.129 THERM   /SQFT-YR NET-AREA

           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.1
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

Example BEPU Delta Output

Delta Case (= Base - Alternative)

```
Simple Office Practice Example w Expressions for overall bldg dimensions        DOE-B2.2NT30   9/16/1998     6:24:15  BDL RUN  0
and daylighting in all perimieter zones                                                                                             1
REPORT- BEPU Building Utility Performance                                                  WEATHER FILE- LOS ANGELES, CA
------------------------------------------------------------------------------------------------------------------------------

                          TASK     MISC    SPACE    SPACE     HEAT    PUMPS     VENT   REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS   LIGHTS    EQUIP  HEATING  COOLING   REJECT    & AUX     FANS  DISPLAY  SUPPLEM  HOT WTR    USAGE     TOTAL
              -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  --------

EM1  ELECTRICITY
    KWH            0.       0.       0.       0.   20850.      65.    1064.       0.       0.       0.       0.       0.    21979.

FM1  NATURAL-GAS
    THERM          0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.        0.



           TOTAL ELECTRICITY     21979. KWH         .563 KWH     /SQFT-YR GROSS-AREA     .563 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS         0. THERM       .000 THERM   /SQFT-YR GROSS-AREA     .000 THERM   /SQFT-YR NET-AREA


           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =   .0
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =   .0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

Table of Contents to eQUEST/DOE-2.2
LOADS Summary Reports

left-to-right order of columns indicates top-down order of reports printed in ".SIM" output files,*
*** indicates most important reports*

LOADS SUMMARY REPORTS

		Space Peak Loads	Space Peak Load Components	Bldg Peak Load Components	Building Monthly Loads	Space Monthly Load Components	Bldg Monthly Load Components	Space Daylighting Summary	Space Energy Reduction by Daylight	Bldg Energy Reduction by Daylight	Daylight Illuminance Frequency	Space Inputs Fuel Summary	Window Management & Solar
	Bldg Level Info	**LS-A****		**LS-C****	**LS-D****		**LS-F****			LS-I		LS-K	
	Space Level Info	**LS-A****	LS-B			LS-E		LS-G	LS-H		LS-J	LS-K	LS-L
THERMAL LOAD	Total (Sens&Lat) Heat/Cool Space Load		*P*	*P*		*T*	*T*						
	Sensible Heat/Cool Space Load	*P*	*P*	*P*	*P/T*	*T*	*T*						
	Latent Cooling Space Load		*P*	*P*		*T*	*T*						
	Heat/Cool Space Load Components		*P*	*P*		*T*	*T*						
	Heat/Cool Peak Hour, Date, OA	■	■	■									
ELECTRIC ENERGY	Total (Lights/Plugs/Process)				*P/T*								
	Lights											*T*	
	Equipment / Plugs											*T*	
	Process Electric											*T*	
OTHER ENERGY	Process Fuel											*T*	
	Domestic Hot Water											*T*	
	Solar Gain												*P/T*
DAYLIGHTING	% Lighting Reduction							■					
	% Lighting Reduction Scatter Plot								■	■			
	Ave. Daylight Illuminance							■					
	Ave. Glare Index							■					
	% Hrs. Glare Too High							■					
	Frequency of Illuminance Levels										■		
OTHER	Floor Area & Volume		■	■									
	Weather File Name	■	■	■	■	■	■	■	■	■	■	■	■
	DESIGN-DAY reports provided ①	■	■	■	■	■	■	■	■	■	■	■	■

NOTES:

T *Total energy or Total load reported for these items*
P *Peak demand or Peak load reported for these items*
① *Duplicate reports are provided for each LOADS report (if DESIGN-DAYs are used) where the first set of reports provides results for the design day conditions. A complete second set reports the annual simulation results.*

Table of Contents to eQUEST/DOE-2.2
SYSTEMS Summary Reports

left-to-right order of columns indicates top-down order of reports in ".SIM" output files,*
*** indicates most important reports*

SYSTEMS SUMMARY REPORTS

		Building HVAC Load Summary	Building HVAC Load Hours	Building HVAC Fan Electric	System Loads Summary	System Loads Summary	System Load Hours	System Utility Energy Use	Sensible/Latent Summary	Peak Heating & Cooling	Space Temperature Summary	Zone Performance Summary	Fan Electric Energy Use	Relative Humidity Summary	System Heat/Cool Performance	HP Heat/Cool Performance	Zone Loads Summary	Zone Demand Summary	Space Temperature Summary	Bldg HVAC Equip. Performance
		BUILDING			**AIR HANDLER**												**ZONE**			
		SS-D**	**SS-E****	SS-M	**SS-A****	SS-B	SS-C	**SS-H****	SS-I	**SS-J****	SS-K	**SS-R****	**SS-L****	SS-N	**SS-P ①**	SS-Q	SS-G	**SS-F****	**SS-O****	**SS-P ②**
THERMAL ENERGY	Total (Sens&Lat) Heat/Cool Coil Load	*P/T*			*P/T*				*P*	*P*					*P/T*	*T*	*P/T*			*P/T*
	Sensible Heat/Cool Coil Load								*T*											
	Latent Heat/Cool Coil Load								*T*											
	Zone Coil Heat/Cool Load					*P/T*														
	Baseboard Heat					*P/T*												*P/T*		
	Pre-heat					*P/T*														
	Heat/Cool Addition/Extraction																	*T*		
	Cooling Peak Hour, Date, OA	■			■				■	■					■		■			■
	Heating Peak Hour, Date, OA	■			■					■					■		■			■
	Heat/Cool Peak Load Hourly Profile									*P*										
	Max Daily Integrated Cooling Load	*P*								*P*										
	Heat Coincident w Cool Peak		*P*				*P*													
	Natural Ventilation Cooling ③					*P/T*														
ELECTRIC ENERGY	Total Elec (LOADS + Fans, DX, Reheat)	*P/T*			*P/T*										*T*		*P/T*			*T*
	Total Elec Coincident w Cool Peak		*P*				*P*													
	Heating/Cooling Elec Use							*P/T*							*P/T*					*P/T*
	Fan Total Elec							*P/T*							*P/T*	*T*				*P/T*
	Fan Elec for H/C/Coincident/Float			*T*									*T*							
	Fan Elec for Supply/Return/Hot Deck												*T*							
	Auxiliary/Fan/Pump Elec					*P/T*									*P/T*	*T*				*P/T*
OTHER ENERGY	Heating/Cooling Fuel Use							*P/T*							*T*					*T*
	Waste Heat															*T*				
HOURS	Hours Heat/Cool/Float/Available		■				■									■				
	Fan Hours		■				■						■							
	Hours Night Venting/Night Cycle On		■				■													
	Hours Loads Not Met											■						■		
	Zone Hrs at Max Demand											■						■		
	Hours at RH ranges													■				■		
SPACE TEMPERATURE	Average (H/C/Fans On/Off)										■									
	Min / Max																	■		
	Indoor/Outdoor Temp. Delta										■									
	Scatter Plot																		■	
OTHER	Air Flow									*P*					■					■
	Heat/Cool Capacity														■					■
	Heat/Cool E-I-R														■	■				■
	Relative Humidity Scatter Plot													■						
	Sensible Heat Ratio								■	■										
	Delta Humidity Ratio										■									
	Equipment Part Load Ratio											■	■		■					■

NOTES:

T *Total energy or Total load reported for these items*
P *Peak demand or Peak load reported for these items*
① *SS-P at air handler level is provided for unitary systems*
② *SS-P at zone level is provided for water loop heat pumps and heat pump PTACs*
③ *Ventilative Cooling is provided only for system types: RESYS, PSZ*

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PLANT Summary Reports

left-to-right order of columns indicates top-down order of reports printed in ".SIM" output files,*
*** indicates most important reports*

PLANT SUMMARY REPORTS

			Plant Energy Utilization PS-A	Utility & Fuel Use Summary PS-B	Equipment Loads & Energy Use **PS-C****	Circulation Loop Loads **PS-D****	Energy End-Use, by Utility Type **PS-E ②****	Energy End-Use, by Utility Meter **PS-F ③****	Building Energy Performance **BEPS****	Building Utility Performance **BEPU****	Loads & Energy Use, by Plant Component **PS-H ①****
THERMAL LOAD	**by Total Plant**	Cooling & Heating	*T*								
		Waste Heat Recovery	*T*								
	by Plant Equipment ①	Circulation Loop Loads				*P/T*					*P/T*
		Boilers, Chillers, Pumps, Towers, etc. Loads			*P/T*						*P/T*
		Equipment Capacity									*P*
		Equipment Part Load Ratio			■	■					■
		Loads Not Satisfied (Loops only)				*P/T*					*P/T*
		Thermal Losses (Loops & Pumps only)				*P/T*					*P/T*
UTILITY ENERGY	**by Total Plant, Site**	Annual	*T*						*T*	*T*	
		Monthly	*T*								
		Energy Use Intensity (EUI)							*T*	*T*	
		Total Electric & Total Fuel Use	*T*				*T*				
		Electric Generation Fuel Use	*T*								
	by Total Plant, Source	Annual	*T*						*T*		
		Monthly									
	by Utility Type ②	Annual		*P/T*			*P/p/T*				
		Monthly		*P/T*			*P/p/T*				
	by Utility Meter ③	Annual		*P/T*				*P/p/T*	*T*	*T*	
		Monthly		*P/T*				*P/p/T*			
	by End Use	Annual, by utility type					*P/p/T*				
		Monthly, by utility type					*P/p/T*				
		Annual, by utility meter						*P/p/T*	*T*	*T*	
		Monthly, by utility meter						*P/p/T*			
		Cooling & Heating (only) Input	*T*								
	by Plant Equipment ①	Boilers, Chillers, Pumps, Towers, etc.			*P/T*						*P/T*
HOURS		Hour & Date of Peak		■	■	■	■	■			■
		Equipment Operations Hours			■	■					■
		% Hours Outside Throttling Range							■	■	
		% Hours Loads Not Met							■	■	

NOTES:

T Total energy or Total load reported for these items
P (upper case) Peak load or Peak demand (COINCIDENT) reported for these items
p (lower case) NON-COINCIDENT Peak demand reported for these items
① One copy of the PS-H report is produced for each plant component, i.e., for each circulation loop, chiller, etc.
② One copy of the PS-E report is produced for each utility type, i.e., for all electric use and for all fuel use.
③ One copy of the PS-F report is produced for each utility meter, i.e., one report for each electric or fuel meter.

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ECONOMICS Summary Reports

left-to-right order of columns indicates top-down order of reports printed in ".SIM" output files,*
*** indicates most important reports*

ECONOMICS SUMMARY REPORTS

			Annual Operations Costs & Savings	Life-Cycle Non-Energy Costs	Energy Savings & Life-Cycle Costs	Energy Cost Summary	Utility Rate Summary	Block Charges & Ratchets, by Utility Rate	Summary of Pollutants	Pollutant Production, by Block Charge
			ES-A	ES-B	ES-C	**ES-D****	**ES-E ①****	**ES-F ②****	ES-G	ES-H
ANNUAL Results	**by Utility Rate** ①	Energy Use				*T*				
		Total Utility Costs ($)				*T*	*T*			
		Total Utility Costs ($/sqft)				*T*				
		Total Utility Costs (ave $/billing unit)				*T*				
		Component Charges					*P/T*			
		Metered & Billing Use					*P/T*			
	by Block or TOU Charge ②	Total Utility Costs ($)						*T*		
		Component Charges						*P/T*		
		Pollutant Production							*T*	*T*
MONTHLY Results	**by Utility Rate** ①	Total Utility Costs ($)					*T*			
		Component Charges					*P/T*			
	by Block or TOU Charge ②	Total Utility Costs ($)						*T*		
		Component Charges						*P/T*		
		Pollutant Production							*T*	*T*
LIFE-CYCLE Results	**Costs**	Installation, Repair, Replacement		*T*	*T*					
		Energy	*T*		*T*					
		Operations	*T*		*T*					
	Savings	Energy	*T*		*T*					
		Operations	*T*		*T*					
		Energy + Operations	*T*		*T*					
	Investment Statistics	Discounted Payback			*T*					
		S-I-R, cost			*T*					
		S-I-R, energy			*T*					

NOTES:

T *Total energy or Total costs reported for these items*
P *Peak demand or Peak demand costs reported for these items*
① *One copy of the ES-E report is produced for each utility rate.*
② *One copy of the ES-F report is produced for each utility rate that includes at least one BLOCK-CHARGE.*

The following is an example listing of simulation output reports from the Three Story Example Office Building (see the file "3-Story Office Bldg.SIM") Note that the sample listing that follows has been edited to remove duplicate reports to conserve space. The actual output report file, "3-Story Office Bldg.SIM", contains a full listing.

DOE-2 UNITS TABLE

	ENGLISH	MULTIPLIED BY	GIVES METRIC	MULTIPLIED BY	GIVES ENGLISH
1		1.000000		1.000000	
2		1.000000		1.000000	
3	BTU	0.293000	WH	3.412969	BTU
4	BTU/HR	0.293000	WATT	3.412969	BTU/HR
5	BTU/LB-F	4183.830078	J/KG-K	0.000239	BTU/LB-F
6	BTU/HR-SQFT-F	5.674460	W/M2-K	0.176228	BTU/HR-SQFT-F
7	DEGREES	1.000000	DEGREES	1.000000	DEGREES
9	SQFT	0.092903	M2	10.763915	SQFT
10	CUFT	0.028317	M3	35.314724	CUFT
11	LB/HR	0.453592	KG/HR	2.204624	LB/HR
12	LB/CUFT	16.018459	KG/M3	0.062428	LB/CUFT
13	MPH	0.447040	M/S	2.236936	MPH
14	BTU/HR-F	0.527178	W/K	1.896893	BTU/HR-F
15	FT	0.304800	M	3.280840	FT
16	BTU/HR-FT-F	1.729600	W/M-K	0.578168	BTU/HR-FT-F
17	BTU/HR- SQFT	3.152480	WATT /M2	0.317211	BTU/HR- SQFT
18	IN	2.540000	CM	0.393701	IN
19	UNITS/IN	0.393700	UNITS/CM	2.540005	UNITS/IN
20	UNITS	1.000000	UNITS	1.000000	UNITS
21	LB	0.453592	KG	2.204624	LB
22	FRAC.OR MULT.	1.000000	FRAC.OR MULT.	1.000000	FRAC.OR MULT.
23	HOURS	1.000000	HRS	1.000000	HOURS
24	PERCENT-RH	1.000000	PERCENT-RH	1.000000	PERCENT-RH
25	CFM	1.699010	M3/H	0.588578	CFM
26	IN-WATER	25.400000	MM-WATER	0.039370	IN-WATER
27	LB/SQFT	4.882400	KG/M2	0.204817	LB/SQFT
28	KW	1.000000	KW	1.000000	KW
29	W/SQFT	10.763920	W/M2	0.092903	W/SQFT
30	THERMS	25.000000	THERMIES	0.040000	THERMS
31	KNOTS	0.514440	M/SEC	1.943861	KNOTS
32	HR-SQFT-F /BTU	0.176228	M2-K /W	5.674467	HR-SQFT-F /BTU
33	$DOLLARS	1.000000	$DOLLARS	1.000000	$DOLLARS
34	MBTU/HR	0.293000	MWATT	3.412969	MBTU/HR
35	YEARS	1.000000	YEARS	1.000000	YEARS
36	$/HR	1.000000	$/HR	1.000000	$/HR
37	HRS/YEARS	1.000000	HRS/YEARS	1.000000	HRS/YEARS
38	PERCENT	1.000000	PERCENT	1.000000	PERCENT
39	$/MONTH	1.000000	$/MONTH	1.000000	$/MONTH
40	GALLONS/MIN/TON	1.078000	LITERS/MIN/KW	0.927644	GALLONS/MIN/TON
41	BTU/LB	0.645683	WH/KG	1.548748	BTU/LB
42	LBS/SQIN-GAGE	68.947571	MBAR-GAGE	0.014504	LBS/SQIN-GAGE
43	$/UNIT	1.000000	$/UNIT	1.000000	$/UNIT
44	BTU/HR/PERSON	0.293000	W/PERSON	3.412969	BTU/HR/PERSON
45	LBS/LB	1.000000	KGS/KG	1.000000	LBS/LB
46	BTU/BTU	1.000000	KWH/KWH	1.000000	BTU/BTU
47	LBS/KW	0.453590	KG/KW	2.204634	LBS/KW
48	REV/MIN	1.000000	REV/MIN	1.000000	REV/MIN
49	KW/TON	1.000000	KW/TON	1.000000	KW/TON
50	MBTU	0.293000	MWH	3.412969	MBTU
51	GAL	3.785410	LITER	0.264172	GAL
52	GAL/MIN	3.785410	LITERS/MIN	0.264172	GAL/MIN
53	BTU/F	1897.800049	J/K	0.000527	BTU/F
54	KWH	1.000000	KWH	1.000000	KWH
55	$/UNIT-HR	1.000000	$/UNIT-HR	1.000000	$/UNIT-HR
56	KW/CFM	0.588500	KW/M3/HR	1.699235	KW/CFM

57	BTU/SQFT-F	20428.400391	J/M2-K	0.000049	BTU/SQFT-F
58	HR/HR	1.000000	HR/HR	1.000000	HR/HR
59	BTU/FT-F	6226.479980	J/M-K	0.000161	BTU/FT-F
60	R	0.555556	K	1.799999	R
61	INCH MER	33.863800	MBAR	0.029530	INCH MER
62	UNITS/GAL/MIN	0.264170	UNITS/LITER/MIN	3.785441	UNITS/GAL/MIN
63	(HR-SQFT-F/BTU)2	0.031056	(M2-K /W)2	32.199585	(HR-SQFT-F/BTU)2
64	KBTU/HR	0.293000	KW	3.412969	KBTU/HR
65	KBTU	0.293000	KWH	3.412969	KBTU
66	CFM	0.471900	L/S	2.119093	CFM
67	CFM/SQFT	18.288000	M3/H-M2	0.054681	CFM/SQFT
68	1/R	1.799900	1/K	0.555586	1/R
69	1/KNOT	1.943860	SEC/M	0.514440	1/KNOT
70	FOOTCANDLES	10.763910	LUX	0.092903	FOOTCANDLES
71	FOOTLAMBERT	3.426259	CANDELA/M2	0.291864	FOOTLAMBERT
72	LUMEN / WATT	1.000000	LUMEN / WATT	1.000000	LUMEN / WATT
73	KBTU/SQFT-YR	3.152480	KWH/M2-YR	0.317211	KBTU/SQFT-YR

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REPORT- LV-N  DETAILS OF GEOMETRY DATA IN BUILDING COORDINATES
SPACE................... (SPACE ORIGIN)
    WALL................ (VERTEX1) (VERTEX2) (...)
        WINDOW.......... (VERTEX1) (VERTEX2) (...)
------------------------------------------------------------------------------------------------------------------------------

South Perim Spac........ (   0.0     0.0     0.0)
    South Wall (G.S1.... (   0.0     0.0     9.0) (   0.0     0.0     0.0) ( 130.0     0.0     0.0) ( 130.0     0.0     9.0)
        South Window (G. (  20.3     0.0     8.1) (  20.3     0.0     3.1) (  60.2     0.0     3.1) (  60.2     0.0     8.1)
        South Window (G. (  69.8     0.0     8.1) (  69.8     0.0     3.1) ( 109.7     0.0     3.1) ( 109.7     0.0     8.1)
        South Door (G.S1 (  62.3     0.0     6.8) (  62.3     0.0     0.3) (  67.8     0.0     0.3) (  67.8     0.0     6.8)
    NE Wall (G.S1.I1.... ( 130.0     0.0     9.0) ( 130.0     0.0     0.0) ( 115.0    15.0     0.0) ( 115.0    15.0     9.0)
    North Wall (G.S1.... ( 115.0    15.0     9.0) ( 115.0    15.0     0.0) (  15.0    15.0     0.0) (  15.0    15.0     9.0)
    NW Wall (G.S1.I3.... (  15.0    15.0     9.0) (  15.0    15.0     0.0) (   0.0     0.0     0.0) (   0.0     0.0     9.0)
    Ceiling (G.S1.I4.... (   0.0     0.0     9.0) ( 130.0     0.0     9.0) ( 115.0    15.0     9.0) (  15.0    15.0     9.0)
East Perim Space........ ( 130.0     0.0     0.0)
    East Wall (G.E2..... ( 130.0     0.0     9.0) ( 130.0     0.0     0.0) ( 130.0   100.0     0.0) ( 130.0   100.0     9.0)
        East Window (G.E ( 130.0    15.6     8.1) ( 130.0    15.6     3.1) ( 130.0    84.4     3.1) ( 130.0    84.4     8.1)
    NE Wall (G.S1.I1.... ( 130.0     0.0     9.0) ( 130.0     0.0     0.0) ( 115.0    15.0     0.0) ( 115.0    15.0     9.0)
    NW Wall (G.E2.I5.... ( 130.0   100.0     9.0) ( 130.0   100.0     0.0) ( 115.0    85.0     0.0) ( 115.0    85.0     9.0)
    West Wall (G.E2..... ( 115.0    85.0     9.0) ( 115.0    85.0     0.0) ( 115.0    15.0     0.0) ( 115.0    15.0     9.0)
    Ceiling (G.E2.I7.... ( 130.0     0.0     9.0) ( 130.0   100.0     9.0) ( 115.0    85.0     9.0) ( 115.0    15.0     9.0)
North Perim Spac........ ( 130.0   100.0     0.0)
    North Wall (G.N3.... ( 130.0   100.0     9.0) ( 130.0   100.0     0.0) (   0.0   100.0     0.0) (   0.0   100.0     9.0)
        North Window (G. ( 109.7   100.0     8.1) ( 109.7   100.0     3.1) (  69.8   100.0     3.1) (  69.8   100.0     8.1)
        North Window (G. (  60.2   100.0     8.1) (  60.2   100.0     3.1) (  20.3   100.0     3.1) (  20.3   100.0     8.1)
        North Door (G.N3 (  67.8   100.0     6.8) (  67.8   100.0     0.3) (  62.3   100.0     0.3) (  62.3   100.0     6.8)
    NW Wall (G.E2.I5.... ( 130.0   100.0     9.0) ( 130.0   100.0     0.0) ( 115.0    85.0     0.0) ( 115.0    85.0     9.0)
    SW Wall (G.N3.I8.... (   0.0   100.0     9.0) (   0.0   100.0     0.0) (  15.0    85.0     0.0) (  15.0    85.0     9.0)
    South Wall (G.N3.... (  15.0    85.0     9.0) (  15.0    85.0     0.0) ( 115.0    85.0     0.0) ( 115.0    85.0     9.0)
    Ceiling (G.N3.I1.... ( 130.0   100.0     9.0) (   0.0   100.0     9.0) (  15.0    85.0     9.0) ( 115.0    85.0     9.0)
West Perim Space........ (   0.0   100.0     0.0)
    West Wall (G.W4..... (   0.0   100.0     9.0) (   0.0   100.0     0.0) (   0.0     0.0     0.0) (   0.0     0.0     9.0)
        West Window (G.W (   0.0    84.4     8.1) (   0.0    84.4     3.1) (   0.0    15.6     3.1) (   0.0    15.6     8.1)
    NW Wall (G.S1.I3.... (  15.0    15.0     9.0) (  15.0    15.0     0.0) (   0.0     0.0     0.0) (   0.0     0.0     9.0)
    SW Wall (G.N3.I8.... (   0.0   100.0     9.0) (   0.0   100.0     0.0) (  15.0    85.0     0.0) (  15.0    85.0     9.0)
    East Wall (G.W4..... (  15.0    15.0     9.0) (  15.0    15.0     0.0) (  15.0    85.0     0.0) (  15.0    85.0     9.0)
    Ceiling (G.W4.I1.... (   0.0   100.0     9.0) (   0.0     0.0     9.0) (  15.0    15.0     9.0) (  15.0    85.0     9.0)
Core Space (G.C5........ (  15.0    15.0     0.0)
    North Wall (G.S1.... ( 115.0    15.0     9.0) ( 115.0    15.0     0.0) (  15.0    15.0     0.0) (  15.0    15.0     9.0)
    West Wall (G.E2..... ( 115.0    85.0     9.0) ( 115.0    85.0     0.0) ( 115.0    15.0     0.0) ( 115.0    15.0     9.0)
    South Wall (G.N3.... (  15.0    85.0     9.0) (  15.0    85.0     0.0) ( 115.0    85.0     0.0) ( 115.0    85.0     9.0)
    East Wall (G.W4..... (  15.0    15.0     9.0) (  15.0    15.0     0.0) (  15.0    85.0     0.0) (  15.0    85.0     9.0)
    Ceiling (G.C5.I1.... (  15.0    15.0     9.0) ( 115.0    15.0     9.0) ( 115.0    85.0     9.0) (  15.0    85.0     9.0)
Plenum (G.6)............ (   0.0     0.0     9.0)
    South Wall (G.6..... (   0.0     0.0    13.0) (   0.0     0.0     9.0) ( 130.0     0.0     9.0) ( 130.0     0.0    13.0)
    East Wall (G.6.E.... ( 130.0     0.0    13.0) ( 130.0     0.0     9.0) ( 130.0   100.0     9.0) ( 130.0   100.0    13.0)
    North Wall (G.6..... ( 130.0   100.0    13.0) ( 130.0   100.0     9.0) (   0.0   100.0     9.0) (   0.0   100.0    13.0)
    West Wall (G.6.E.... (   0.0   100.0    13.0) (   0.0   100.0     9.0) (   0.0     0.0     9.0) (   0.0     0.0    13.0)
    Ceiling (G.S1.I4.... (   0.0     0.0     9.0) ( 130.0     0.0     9.0) ( 115.0    15.0     9.0) (  15.0    15.0     9.0)
    Ceiling (G.E2.I7.... ( 130.0     0.0     9.0) ( 130.0   100.0     9.0) ( 115.0    85.0     9.0) ( 115.0    15.0     9.0)
    Ceiling (G.N3.I1.... ( 130.0   100.0     9.0) (   0.0   100.0     9.0) (  15.0    85.0     9.0) ( 115.0    85.0     9.0)
    Ceiling (G.W4.I1.... (   0.0   100.0     9.0) (   0.0     0.0     9.0) (  15.0    15.0     9.0) (  15.0    85.0     9.0)
    Ceiling (G.C5.I1.... (  15.0    15.0     9.0) ( 115.0    15.0     9.0) ( 115.0    85.0     9.0) (  15.0    85.0     9.0)
    Floor (M.S7.I14).... (   0.0     0.0    13.0) (  15.0    15.0    13.0) ( 115.0    15.0    13.0) ( 130.0     0.0    13.0)
    Floor (M.E8.I19).... ( 130.0     0.0    13.0) ( 115.0    15.0    13.0) ( 115.0    85.0    13.0) ( 130.0   100.0    13.0)
    Floor (M.N9.I23).... ( 130.0   100.0    13.0) ( 115.0    85.0    13.0) (  15.0    85.0    13.0) (   0.0   100.0    13.0)
    Floor (M.W10.I27.... (   0.0   100.0    13.0) (  15.0    85.0    13.0) (  15.0    15.0    13.0) (   0.0     0.0    13.0)
    Floor (M.C11.I30.... (  15.0    15.0    13.0) (  15.0    85.0    13.0) ( 115.0    85.0    13.0) ( 115.0    15.0    13.0)
South Perim Spac........ (   0.0     0.0     0.0)
    South Wall (M.S7.... (   0.0     0.0    22.0) (   0.0     0.0    13.0) ( 130.0     0.0    13.0) ( 130.0     0.0    22.0)
        South Window (M. (  20.3     0.0    21.1) (  20.3     0.0    16.1) ( 109.7     0.0    16.1) ( 109.7     0.0    21.1)
    Floor (M.S7.I14).... (   0.0     0.0    13.0) (  15.0    15.0    13.0) ( 115.0    15.0    13.0) ( 130.0     0.0    13.0)
    NE Wall (M.S7.I1.... ( 130.0     0.0    22.0) ( 130.0     0.0    13.0) ( 115.0    15.0    13.0) ( 115.0    15.0    22.0)
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    North Wall (M.S7.... (  115.0    15.0     22.0) (  115.0    15.0     13.0) (   15.0    15.0     13.0) (   15.0    15.0     22.0)
    NW Wall (M.S7.I1.... (   15.0    15.0     22.0) (   15.0    15.0     13.0) (    0.0     0.0     13.0) (    0.0     0.0     22.0)
    Ceiling (M.S7.I1.... (    0.0     0.0     22.0) (  130.0     0.0     22.0) (  115.0    15.0     22.0) (   15.0    15.0     22.0)
East Perim Space........ (  130.0     0.0      0.0)
    East Wall (M.E8..... (  130.0     0.0     22.0) (  130.0     0.0     13.0) (  130.0   100.0     13.0) (  130.0   100.0     22.0)
        East Window (M.E (  130.0    15.6     21.1) (  130.0    15.6     16.1) (  130.0    84.4     16.1) (  130.0    84.4     21.1)
    NE Wall (M.S7.I1.... (  130.0     0.0     22.0) (  130.0     0.0     13.0) (  115.0    15.0     13.0) (  115.0    15.0     22.0)
    Floor (M.E8.I19).... (  130.0     0.0     13.0) (  115.0    15.0     13.0) (  115.0    85.0     13.0) (  130.0   100.0     13.0)
    NW Wall (M.E8.I2.... (  130.0   100.0     22.0) (  130.0   100.0     13.0) (  115.0    85.0     13.0) (  115.0    85.0     22.0)
    West Wall (M.E8..... (  115.0    85.0     22.0) (  115.0    85.0     13.0) (  115.0    15.0     13.0) (  115.0    15.0     22.0)
    Ceiling (M.E8.I2.... (  130.0     0.0     22.0) (  130.0   100.0     22.0) (  115.0    85.0     22.0) (  115.0    15.0     22.0)
North Perim Spac........ (  130.0   100.0      0.0)
    North Wall (M.N9.... (  130.0   100.0     22.0) (  130.0   100.0     13.0) (    0.0   100.0     13.0) (    0.0   100.0     22.0)
        North Window (M. (  109.7   100.0     21.1) (  109.7   100.0     16.1) (   20.3   100.0     16.1) (   20.3   100.0     21.1)
    NW Wall (M.E8.I2.... (  130.0   100.0     22.0) (  130.0   100.0     13.0) (  115.0    85.0     13.0) (  115.0    85.0     22.0)
    Floor (M.N9.I23).... (  130.0   100.0     13.0) (  115.0    85.0     13.0) (   15.0    85.0     13.0) (    0.0   100.0     13.0)
    SW Wall (M.N9.I2.... (    0.0   100.0     22.0) (    0.0   100.0     13.0) (   15.0    85.0     13.0) (   15.0    85.0     22.0)
    South Wall (M.N9.... (   15.0    85.0     22.0) (   15.0    85.0     13.0) (  115.0    85.0     13.0) (  115.0    85.0     22.0)
    Ceiling (M.N9.I2.... (  130.0   100.0     22.0) (    0.0   100.0     22.0) (   15.0    85.0     22.0) (  115.0    85.0     22.0)
West Perim Space........ (    0.0   100.0      0.0)
    West Wall (M.W10.... (    0.0   100.0     22.0) (    0.0   100.0     13.0) (    0.0     0.0     13.0) (    0.0     0.0     22.0)
        West Window (M.W (    0.0    84.4     21.1) (    0.0    84.4     16.1) (    0.0    15.6     16.1) (    0.0    15.6     21.1)
    NW Wall (M.S7.I1.... (   15.0    15.0     22.0) (   15.0    15.0     13.0) (    0.0     0.0     13.0) (    0.0     0.0     22.0)
    SW Wall (M.N9.I2.... (    0.0   100.0     22.0) (    0.0   100.0     13.0) (   15.0    85.0     13.0) (   15.0    85.0     22.0)
    Floor (M.W10.I27.... (    0.0   100.0     13.0) (   15.0    85.0     13.0) (   15.0    15.0     13.0) (    0.0     0.0     13.0)
    East Wall (M.W10.... (   15.0    15.0     22.0) (   15.0    15.0     13.0) (   15.0    85.0     13.0) (   15.0    85.0     22.0)
    Ceiling (M.W10.I.... (    0.0   100.0     22.0) (    0.0     0.0     22.0) (   15.0    15.0     22.0) (   15.0    85.0     22.0)
Core Space (M.C1........ (   15.0    15.0      0.0)
    North Wall (M.S7.... (  115.0    15.0     22.0) (  115.0    15.0     13.0) (   15.0    15.0     13.0) (   15.0    15.0     22.0)
    West Wall (M.E8..... (  115.0    85.0     22.0) (  115.0    85.0     13.0) (  115.0    15.0     13.0) (  115.0    15.0     22.0)
    South Wall (M.N9.... (   15.0    85.0     22.0) (   15.0    85.0     13.0) (  115.0    85.0     13.0) (  115.0    85.0     22.0)
    East Wall (M.W10.... (   15.0    15.0     22.0) (   15.0    15.0     13.0) (   15.0    85.0     13.0) (   15.0    85.0     22.0)
    Floor (M.C11.I30.... (   15.0    15.0     13.0) (   15.0    85.0     13.0) (  115.0    85.0     13.0) (  115.0    15.0     13.0)
    Ceiling (M.C11.I.... (   15.0    15.0     22.0) (  115.0    15.0     22.0) (  115.0    85.0     22.0) (   15.0    85.0     22.0)
Plenum (M.12)   ........ (    0.0     0.0      9.0)
    South Wall (M.12.... (    0.0     0.0     26.0) (    0.0     0.0     22.0) (  130.0     0.0     22.0) (  130.0     0.0     26.0)
    East Wall (M.12..... (  130.0     0.0     26.0) (  130.0     0.0     22.0) (  130.0   100.0     22.0) (  130.0   100.0     26.0)
    North Wall (M.12.... (  130.0   100.0     26.0) (  130.0   100.0     22.0) (    0.0   100.0     22.0) (    0.0   100.0     26.0)
    West Wall (M.12..... (    0.0   100.0     26.0) (    0.0   100.0     22.0) (    0.0     0.0     22.0) (    0.0     0.0     26.0)
    Ceiling (M.S7.I1.... (    0.0     0.0     22.0) (  130.0     0.0     22.0) (  115.0    15.0     22.0) (   15.0    15.0     22.0)
    Ceiling (M.E8.I2.... (  130.0     0.0     22.0) (  130.0   100.0     22.0) (  115.0    85.0     22.0) (  115.0    15.0     22.0)
    Ceiling (M.N9.I2.... (  130.0   100.0     22.0) (    0.0   100.0     22.0) (   15.0    85.0     22.0) (  115.0    85.0     22.0)
    Ceiling (M.W10.I.... (    0.0   100.0     22.0) (    0.0     0.0     22.0) (   15.0    15.0     22.0) (   15.0    85.0     22.0)
    Ceiling (M.C11.I.... (   15.0    15.0     22.0) (  115.0    15.0     22.0) (  115.0    85.0     22.0) (   15.0    85.0     22.0)
    Floor (T.S13.I32.... (    0.0     0.0     26.0) (   15.0    15.0     26.0) (  115.0    15.0     26.0) (  130.0     0.0     26.0)
    Floor (T.E14.I37.... (  130.0     0.0     26.0) (  115.0    15.0     26.0) (  115.0    85.0     26.0) (  130.0   100.0     26.0)
    Floor (T.N15.I41.... (  130.0   100.0     26.0) (  115.0    85.0     26.0) (   15.0    85.0     26.0) (    0.0   100.0     26.0)
    Floor (T.W16.I45.... (    0.0   100.0     26.0) (   15.0    85.0     26.0) (   15.0    15.0     26.0) (    0.0     0.0     26.0)
    Floor (T.C17.I48.... (   15.0    15.0     26.0) (   15.0    85.0     26.0) (  115.0    85.0     26.0) (  115.0    15.0     26.0)
South Perim Spac........ (    0.0     0.0      0.0)
    South Wall (T.S1.... (    0.0     0.0     35.0) (    0.0     0.0     26.0) (  130.0     0.0     26.0) (  130.0     0.0     35.0)
        South Window (T. (   20.3     0.0     34.1) (   20.3     0.0     29.1) (  109.7     0.0     29.1) (  109.7     0.0     34.1)
    Floor (T.S13.I32.... (    0.0     0.0     26.0) (   15.0    15.0     26.0) (  115.0    15.0     26.0) (  130.0     0.0     26.0)
    NE Wall (T.S13.I.... (  130.0     0.0     35.0) (  130.0     0.0     26.0) (  115.0    15.0     26.0) (  115.0    15.0     35.0)
    North Wall (T.S1.... (  115.0    15.0     35.0) (  115.0    15.0     26.0) (   15.0    15.0     26.0) (   15.0    15.0     35.0)
    NW Wall (T.S13.I.... (   15.0    15.0     35.0) (   15.0    15.0     26.0) (    0.0     0.0     26.0) (    0.0     0.0     35.0)
    Ceiling (T.S13.I.... (    0.0     0.0     35.0) (  130.0     0.0     35.0) (  115.0    15.0     35.0) (   15.0    15.0     35.0)
East Perim Space........ (  130.0     0.0      0.0)
    East Wall (T.E14.... (  130.0     0.0     35.0) (  130.0     0.0     26.0) (  130.0   100.0     26.0) (  130.0   100.0     35.0)
        East Window (T.E (  130.0    15.6     34.1) (  130.0    15.6     29.1) (  130.0    84.4     29.1) (  130.0    84.4     34.1)
    NE Wall (T.S13.I.... (  130.0     0.0     35.0) (  130.0     0.0     26.0) (  115.0    15.0     26.0) (  115.0    15.0     35.0)
    Floor (T.E14.I37.... (  130.0     0.0     26.0) (  115.0    15.0     26.0) (  115.0    85.0     26.0) (  130.0   100.0     26.0)
    NW Wall (T.E14.I.... (  130.0   100.0     35.0) (  130.0   100.0     26.0) (  115.0    85.0     26.0) (  115.0    85.0     35.0)
    West Wall (T.E14.... (  115.0    85.0     35.0) (  115.0    85.0     26.0) (  115.0    15.0     26.0) (  115.0    15.0     35.0)
    Ceiling (T.E14.I.... (  130.0     0.0     35.0) (  130.0   100.0     35.0) (  115.0    85.0     35.0) (  115.0    15.0     35.0)
North Perim Spac........ (  130.0   100.0      0.0)
```

North Wall (T.N1....	130.0	100.0	35.0	130.0	100.0	26.0	0.0	100.0	26.0	0.0	100.0	35.0
North Window (T.	109.7	100.0	34.1	109.7	100.0	29.1	20.3	100.0	29.1	20.3	100.0	34.1
NW Wall (T.E14.I....	130.0	100.0	35.0	130.0	100.0	26.0	115.0	85.0	26.0	115.0	85.0	35.0
Floor (T.N15.I41....	130.0	100.0	26.0	115.0	85.0	26.0	15.0	85.0	26.0	0.0	100.0	26.0
SW Wall (T.N15.I....	0.0	100.0	35.0	0.0	100.0	26.0	15.0	85.0	26.0	15.0	85.0	35.0
South Wall (T.N1....	15.0	85.0	35.0	15.0	85.0	26.0	115.0	85.0	26.0	115.0	85.0	35.0
Ceiling (T.N15.I....	130.0	100.0	35.0	0.0	100.0	35.0	15.0	85.0	35.0	115.0	85.0	35.0
West Perim Space........	0.0	100.0	0.0									
West Wall (T.W16....	0.0	100.0	35.0	0.0	100.0	26.0	0.0	0.0	26.0	0.0	0.0	35.0
West Window (T.W	0.0	84.4	34.1	0.0	84.4	29.1	0.0	15.6	29.1	0.0	15.6	34.1
NW Wall (T.S13.I....	15.0	15.0	35.0	15.0	15.0	26.0	0.0	0.0	26.0	0.0	0.0	35.0
SW Wall (T.N15.I....	0.0	100.0	35.0	0.0	100.0	26.0	15.0	85.0	26.0	15.0	85.0	35.0
Floor (T.W16.I45....	0.0	100.0	26.0	15.0	85.0	26.0	15.0	15.0	26.0	0.0	0.0	26.0
East Wall (T.W16....	15.0	15.0	35.0	15.0	15.0	26.0	15.0	85.0	26.0	15.0	85.0	35.0
Ceiling (T.W16.I....	0.0	100.0	35.0	0.0	0.0	35.0	15.0	15.0	35.0	15.0	85.0	35.0
Core Space (T.C1........	15.0	15.0	0.0									
Skylt Roof (T.C1....	15.0	15.0	39.1	115.0	15.0	39.1	115.0	85.0	39.1	15.0	85.0	39.1
Skylight (T.C17.	73.4	62.4	39.1	73.4	58.4	39.1	77.4	58.4	39.1	77.4	62.4	39.1
Skylight (T.C17.	94.2	62.4	39.1	94.2	58.4	39.1	98.2	58.4	39.1	98.2	62.4	39.1
Skylight (T.C17.	52.6	62.4	39.1	52.6	58.4	39.1	56.6	58.4	39.1	56.6	62.4	39.1
Skylight (T.C17.	73.4	83.2	39.1	73.4	79.2	39.1	77.4	79.2	39.1	77.4	83.2	39.1
Skylight (T.C17.	73.4	41.6	39.1	73.4	37.6	39.1	77.4	37.6	39.1	77.4	41.6	39.1
Skylight (T.C17.	52.6	83.2	39.1	52.6	79.2	39.1	56.6	79.2	39.1	56.6	83.2	39.1
Skylight (T.C17.	94.2	83.2	39.1	94.2	79.2	39.1	98.2	79.2	39.1	98.2	83.2	39.1
Skylight (T.C17.	52.6	41.6	39.1	52.6	37.6	39.1	56.6	37.6	39.1	56.6	41.6	39.1
Skylight (T.C17.	94.2	41.6	39.1	94.2	37.6	39.1	98.2	37.6	39.1	98.2	41.6	39.1
Skylight (T.C17.	31.8	62.4	39.1	31.8	58.4	39.1	35.8	58.4	39.1	35.8	62.4	39.1
Skylight (T.C17.	73.4	20.8	39.1	73.4	16.8	39.1	77.4	16.8	39.1	77.4	20.8	39.1
Skylight (T.C17.	31.8	41.6	39.1	31.8	37.6	39.1	35.8	37.6	39.1	35.8	41.6	39.1
Skylight (T.C17.	31.8	83.2	39.1	31.8	79.2	39.1	35.8	79.2	39.1	35.8	83.2	39.1
Skylight (T.C17.	52.6	20.8	39.1	52.6	16.8	39.1	56.6	16.8	39.1	56.6	20.8	39.1
Skylight (T.C17.	94.2	20.8	39.1	94.2	16.8	39.1	98.2	16.8	39.1	98.2	20.8	39.1
Skylight (T.C17.	31.8	20.8	39.1	31.8	16.8	39.1	35.8	16.8	39.1	35.8	20.8	39.1
North Wall (T.S1....	115.0	15.0	35.0	115.0	15.0	26.0	15.0	15.0	26.0	15.0	15.0	35.0
West Wall (T.E14....	115.0	85.0	35.0	115.0	85.0	26.0	115.0	15.0	26.0	115.0	15.0	35.0
South Wall (T.N1....	15.0	85.0	35.0	15.0	85.0	26.0	115.0	85.0	26.0	115.0	85.0	35.0
East Wall (T.W16....	15.0	15.0	35.0	15.0	15.0	26.0	15.0	85.0	26.0	15.0	85.0	35.0
Floor (T.C17.I48....	15.0	15.0	26.0	15.0	85.0	26.0	115.0	85.0	26.0	115.0	15.0	26.0
Ceiling (T.C17.I....	15.0	15.0	35.0	115.0	15.0	35.0	115.0	85.0	35.0	15.0	85.0	35.0
South Perim Plen........	0.0	0.0	9.0									
South Wall (T.S1....	0.0	0.0	39.0	0.0	0.0	35.0	130.0	0.0	35.0	130.0	0.0	39.0
Roof (T.S18.E23)....	0.0	0.0	39.0	130.0	0.0	39.0	115.0	15.0	39.0	15.0	15.0	39.0
Ceiling (T.S13.I....	0.0	0.0	35.0	130.0	0.0	35.0	115.0	15.0	35.0	15.0	15.0	35.0
NE Wall (T.S18.I....	130.0	0.0	39.0	130.0	0.0	35.0	115.0	15.0	35.0	115.0	15.0	39.0
North Wall (T.S1....	115.0	15.0	39.0	115.0	15.0	35.0	15.0	15.0	35.0	15.0	15.0	39.0
NW Wall (T.S18.I....	15.0	15.0	39.0	15.0	15.0	35.0	0.0	0.0	35.0	0.0	0.0	39.0
East Perim Plenu........	130.0	0.0	9.0									
East Wall (T.E19....	130.0	0.0	39.0	130.0	0.0	35.0	130.0	100.0	35.0	130.0	100.0	39.0
Roof (T.E19.E25)....	130.0	0.0	39.0	130.0	100.0	39.0	115.0	85.0	39.0	115.0	15.0	39.0
Ceiling (T.E14.I....	130.0	0.0	35.0	130.0	100.0	35.0	115.0	85.0	35.0	115.0	15.0	35.0
NE Wall (T.S18.I....	130.0	0.0	39.0	130.0	0.0	35.0	115.0	15.0	35.0	115.0	15.0	39.0
NW Wall (T.E19.I....	130.0	100.0	39.0	130.0	100.0	35.0	115.0	85.0	35.0	115.0	85.0	39.0
West Wall (T.E19....	115.0	85.0	39.0	115.0	85.0	35.0	115.0	15.0	35.0	115.0	15.0	39.0
North Perim Plen........	130.0	100.0	9.0									
North Wall (T.N2....	130.0	100.0	39.0	130.0	100.0	35.0	0.0	100.0	35.0	0.0	100.0	39.0
Roof (T.N20.E27)....	130.0	100.0	39.0	0.0	100.0	39.0	15.0	85.0	39.0	115.0	85.0	39.0
Ceiling (T.N15.I....	130.0	100.0	35.0	0.0	100.0	35.0	15.0	85.0	35.0	115.0	85.0	35.0
NW Wall (T.E19.I....	130.0	100.0	39.0	130.0	100.0	35.0	115.0	85.0	35.0	115.0	85.0	39.0
SW Wall (T.N20.I....	0.0	100.0	39.0	0.0	100.0	35.0	15.0	85.0	35.0	15.0	85.0	39.0
South Wall (T.N2....	15.0	85.0	39.0	15.0	85.0	35.0	115.0	85.0	35.0	115.0	85.0	39.0
West Perim Plenu........	0.0	100.0	9.0									
West Wall (T.W21....	0.0	100.0	39.0	0.0	100.0	35.0	0.0	0.0	35.0	0.0	0.0	39.0
Roof (T.W21.E29)....	0.0	100.0	39.0	0.0	0.0	39.0	15.0	15.0	39.0	15.0	85.0	39.0
Ceiling (T.W16.I....	0.0	100.0	35.0	0.0	0.0	35.0	15.0	15.0	35.0	15.0	85.0	35.0
NW Wall (T.S18.I....	15.0	15.0	39.0	15.0	15.0	35.0	0.0	0.0	35.0	0.0	0.0	39.0
SW Wall (T.N20.I....	0.0	100.0	39.0	0.0	100.0	35.0	15.0	85.0	35.0	15.0	85.0	39.0

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    East Wall (T.W21.... (   15.0    15.0    39.0) (   15.0    15.0    35.0) (   15.0    85.0    35.0) (   15.0    85.0    39.0)
Core Plenum (T.C........ (   15.0    15.0     9.0)
    Roof (T.C22.E30).... (   15.0    15.0    39.0) (  115.0    15.0    39.0) (  115.0    85.0    39.0) (   15.0    85.0    39.0)
    Ceiling (T.C17.I.... (   15.0    15.0    35.0) (  115.0    15.0    35.0) (  115.0    85.0    35.0) (   15.0    85.0    35.0)
    North Wall (T.S1.... (  115.0    15.0    39.0) (  115.0    15.0    35.0) (   15.0    15.0    35.0) (   15.0    15.0    39.0)
    West Wall (T.E19.... (  115.0    85.0    39.0) (  115.0    85.0    35.0) (  115.0    15.0    35.0) (  115.0    15.0    39.0)
    South Wall (T.N2.... (   15.0    85.0    39.0) (   15.0    85.0    35.0) (  115.0    85.0    35.0) (  115.0    85.0    39.0)
    East Wall (T.W21.... (   15.0    15.0    39.0) (   15.0    15.0    35.0) (   15.0    85.0    35.0) (   15.0    85.0    39.0)
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One LV-L report for each combination of window and reference point in each daylit space

3-Story Office Bldg 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LV-L** DAYLIGHT FACTOR SUMMARY FOR South Perim Spac

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SPACE--South Perim Spac
AREA(SQFT) 1725.0
AV REFL 0.44
MAX-GLARE 20.0
VW-AZ(DEG) 270.0

WINDOW--South Window (G.
SC 1.00 GTC 2 VIS-TRANS 0.47
H(FT) 5.0 W(FT) 39.9
AZIM(DEG) 180.0 TILT(DEG) 90.0
DAY-X-DIV 21 DAY-Y-DIV 8
X(FT) 69.8 Y(FT) 0.0 Z(FT) 3.1
WIN-SHADE-TYPE NO-SHADE

REF PT NO.--1
X(FT) 89.8 Y(FT) 7.5 Z(FT) 2.5
ZONE-FRACTION 1.00
LTG-SET-POINT(FC) 50.0
LTG-CTRL-TYPE CONTINUOUS

SUN POS NO.	DAY TYP	WIN SHD IND	SUN ALT (DEG)	SUN AZIM (DEG)	EXT ILL -SKY (FC)	EXT ILL -SUN (FC)	DIR ILL -SKY (FC)	REFL ILL -SKY (FC)	DIR ILL -SUN (FC)	REFL ILL -SUN (FC)	DAY ILL FAC -SKY	DAY ILL FAC -SUN	WIN LUM FAC -SKY	WIN LUM FAC -SUN	BACKG LUM FAC -SKY	BACKG LUM FAC -SUN	GLARE INDEX
1	1	1	10.	290.	1093.6	301.1	73.3	10.6	0.0	1.0	0.0768	0.0033	0.9767	0.0000	0.0043	0.0015	17.7
1	1	2	10.	290.	1093.6	301.1	0.0	14.1	0.0	0.7	0.0129	0.0024	0.0000	0.0000	0.0057	0.0011	0.0
1	2	1	10.	290.	366.9	0.0	15.4	2.6	0.0	0.0	0.0491	0.0000	0.3815	0.0000	0.0032	0.0000	8.4
1	2	2	10.	290.	366.9	0.0	0.0	3.2	0.0	0.0	0.0086	0.0000	0.0000	0.0000	0.0038	0.0000	0.0
2	1	1	10.	235.	1093.6	301.1	169.6	19.1	240.2	13.8	0.1726	0.8435	2.5406	99.0000	0.0078	0.0204	27.7
2	1	2	10.	235.	1093.6	301.1	0.0	27.8	0.0	21.5	0.0254	0.0715	0.0000	0.0000	0.0113	0.0318	0.0
3	1	1	10.	180.	1093.6	301.1	268.9	29.5	301.1	31.1	0.2728	1.1031	1.8285	0.0000	0.0120	0.0459	19.7
3	1	2	10.	180.	1093.6	301.1	0.0	44.7	0.0	49.6	0.0408	0.1649	0.0000	0.0000	0.0182	0.0733	0.0
4	1	1	10.	125.	1093.6	301.1	169.6	19.1	240.2	13.8	0.1726	0.8435	2.5406	0.0000	0.0078	0.0204	20.8
4	1	2	10.	125.	1093.6	301.1	0.0	27.8	0.0	21.5	0.0254	0.0715	0.0000	0.0000	0.0113	0.0318	0.0
5	1	1	10.	70.	1093.6	301.1	73.3	10.6	0.0	1.0	0.0768	0.0033	0.9767	0.0000	0.0043	0.0015	17.7
5	1	2	10.	70.	1093.6	301.1	0.0	14.1	0.0	0.7	0.0129	0.0024	0.0000	0.0000	0.0057	0.0011	0.0
6	1	1	33.	290.	1606.4	3226.7	88.1	13.7	0.0	10.6	0.0634	0.0033	0.7617	0.0000	0.0038	0.0015	18.2
6	1	2	33.	290.	1606.4	3226.7	0.0	17.6	0.0	7.6	0.0109	0.0024	0.0000	0.0000	0.0049	0.0011	0.0
7	1	1	33.	235.	1606.4	3226.7	176.8	21.6	0.0	26.6	0.1235	0.0082	1.3821	0.0000	0.0060	0.0037	20.1
7	1	2	33.	235.	1606.4	3226.7	0.0	30.3	0.0	33.6	0.0189	0.0104	0.0000	0.0000	0.0084	0.0046	0.0
8	1	1	33.	180.	1606.4	3226.7	297.0	32.0	0.0	71.0	0.2048	0.0220	1.3481	0.0000	0.0089	0.0098	19.5
8	1	2	33.	180.	1606.4	3226.7	0.0	47.3	0.0	105.8	0.0295	0.0328	0.0000	0.0000	0.0131	0.0146	0.0
9	1	1	33.	125.	1606.4	3226.7	176.8	21.6	0.0	26.6	0.1235	0.0082	1.3821	0.0000	0.0060	0.0037	20.1
9	1	2	33.	125.	1606.4	3226.7	0.0	30.3	0.0	33.6	0.0189	0.0104	0.0000	0.0000	0.0084	0.0046	0.0
10	1	1	33.	70.	1606.4	3226.7	88.1	13.7	0.0	10.6	0.0634	0.0033	0.7617	0.0000	0.0038	0.0015	18.2
10	1	2	33.	70.	1606.4	3226.7	0.0	17.6	0.0	7.6	0.0109	0.0024	0.0000	0.0000	0.0049	0.0011	0.0
11	1	1	56.	290.	1910.6	5999.5	92.0	15.1	0.0	19.7	0.0560	0.0033	0.6046	0.0000	0.0035	0.0015	18.0
11	1	2	56.	290.	1910.6	5999.5	0.0	18.9	0.0	14.2	0.0099	0.0024	0.0000	0.0000	0.0044	0.0011	0.0
12	1	1	56.	235.	1910.6	5999.5	136.5	19.2	0.0	20.4	0.0815	0.0034	0.7899	0.0000	0.0045	0.0015	18.9
12	1	2	56.	235.	1910.6	5999.5	0.0	25.6	0.0	15.4	0.0134	0.0026	0.0000	0.0000	0.0060	0.0011	0.0
13	1	1	56.	180.	1910.6	5999.5	178.5	23.4	0.0	30.6	0.1057	0.0051	0.8384	0.0000	0.0055	0.0023	19.0
13	1	2	56.	180.	1910.6	5999.5	0.0	32.4	0.0	32.0	0.0170	0.0053	0.0000	0.0000	0.0075	0.0024	0.0
14	1	1	56.	125.	1910.6	5999.5	136.5	19.2	0.0	20.4	0.0815	0.0034	0.7899	0.0000	0.0045	0.0015	18.9
14	1	2	56.	125.	1910.6	5999.5	0.0	25.6	0.0	15.4	0.0134	0.0026	0.0000	0.0000	0.0060	0.0011	0.0
15	1	1	56.	70.	1910.6	5999.5	92.0	15.1	0.0	19.7	0.0560	0.0033	0.6046	0.0000	0.0035	0.0015	18.0
15	1	2	56.	70.	1910.6	5999.5	0.0	18.9	0.0	14.2	0.0099	0.0024	0.0000	0.0000	0.0044	0.0011	0.0
16	1	1	80.	290.	2556.7	7346.2	118.6	19.8	0.0	24.1	0.0541	0.0033	0.5310	0.0000	0.0034	0.0015	18.5
16	1	2	80.	290.	2556.7	7346.2	0.0	24.6	0.0	17.4	0.0096	0.0024	0.0000	0.0000	0.0043	0.0011	0.0
17	1	1	80.	235.	2556.7	7346.2	133.1	21.2	0.0	24.1	0.0603	0.0033	0.5705	0.0000	0.0037	0.0015	18.8
17	1	2	80.	235.	2556.7	7346.2	0.0	26.8	0.0	17.4	0.0105	0.0024	0.0000	0.0000	0.0047	0.0011	0.0
18	1	1	80.	180.	2556.7	7346.2	141.7	22.0	0.0	24.1	0.0640	0.0033	0.5882	0.0000	0.0038	0.0015	18.9
18	1	2	80.	180.	2556.7	7346.2	0.0	28.2	0.0	17.4	0.0110	0.0024	0.0000	0.0000	0.0049	0.0011	0.0
19	1	1	80.	125.	2556.7	7346.2	133.1	21.2	0.0	24.1	0.0603	0.0033	0.5705	0.0000	0.0037	0.0015	18.8
19	1	2	80.	125.	2556.7	7346.2	0.0	26.8	0.0	17.4	0.0105	0.0024	0.0000	0.0000	0.0047	0.0011	0.0
20	1	1	80.	70.	2556.7	7346.2	118.6	19.8	0.0	24.1	0.0541	0.0033	0.5310	0.0000	0.0034	0.0015	18.5
20	1	2	80.	70.	2556.7	7346.2	0.0	24.6	0.0	17.4	0.0096	0.0024	0.0000	0.0000	0.0043	0.0011	0.0

NOTE -- Above values assume VISIBLE TRANSMITTANCE = 1.0
for WINDOW glass and SHADING DEVICE.
Actual transmittances are used in the hourly calculation.

One LV-L report for each combination of window and reference point in each daylit space

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3-Story Office Bldg                                                                                    4/07/2001    10:36:50  BDL  RUN 2

REPORT- LV-L  DAYLIGHT FACTOR SUMMARY FOR          East Perim Space
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SPACE--East Perim Space      WINDOW--East Window (G.E                         REF PT NO.--1
AREA(SQFT)     1275.0        SC 1.00    GTC      2  VIS-TRANS  0.47           X(FT)  122.5  Y(FT)    50.0  Z(FT)     2.5
AV REFL          0.44        H(FT)            5.0  W(FT)       68.7           ZONE-FRACTION         1.00
MAX-GLARE        20.0        AZIM(DEG)       90.0  TILT(DEG)  90.0            LTG-SET-POINT(FC)      50.0
VW-AZ(DEG)      180.0        DAY-X-DIV         36  DAY-Y-DIV    8             LTG-CTRL-TYPE       CONTINUOUS
                             X(FT)   15.6  Y(FT)     0.0  Z(FT)     3.1
                             WIN-SHADE-TYPE       NO-SHADE
```

SUN POS NO.	DAY TYP	WIN SHD IND	SUN ALT (DEG)	SUN AZIM (DEG)	EXT ILL -SKY (FC)	EXT ILL -SUN (FC)	DIR ILL -SKY (FC)	REFL ILL -SKY (FC)	DIR ILL -SUN (FC)	REFL ILL -SUN (FC)	DAY ILL FAC -SKY	DAY ILL FAC -SUN	WIN LUM FAC -SKY	WIN LUM FAC -SUN	BACKG LUM FAC -SKY	BACKG LUM FAC -SUN	GLARE INDEX
1	1	1	10.	290.	1093.6	301.1	75.1	24.7	0.0	2.2	0.0913	0.0074	0.6429	0.0000	0.0100	0.0033	17.1
1	1	2	10.	290.	1093.6	301.1	0.0	32.5	0.0	1.6	0.0297	0.0054	0.0000	0.0000	0.0132	0.0024	0.0
1	2	1	10.	290.	366.9	0.0	15.4	6.0	0.0	0.0	0.0584	0.0000	0.2879	0.0000	0.0073	0.0000	7.8
1	2	2	10.	290.	366.9	0.0	0.0	7.2	0.0	0.0	0.0197	0.0000	0.0000	0.0000	0.0087	0.0000	0.0
2	1	1	10.	235.	1093.6	301.1	73.5	24.3	0.0	2.2	0.0895	0.0074	0.6825	0.0000	0.0099	0.0033	17.3
2	1	2	10.	235.	1093.6	301.1	0.0	31.9	0.0	1.6	0.0292	0.0054	0.0000	0.0000	0.0130	0.0024	0.0
3	1	1	10.	180.	1093.6	301.1	87.7	27.1	0.0	2.2	0.1050	0.0074	1.4036	0.0000	0.0110	0.0033	19.9
3	1	2	10.	180.	1093.6	301.1	0.0	36.4	0.0	1.6	0.0333	0.0054	0.0000	0.0000	0.0148	0.0024	0.0
4	1	1	10.	125.	1093.6	301.1	227.3	56.5	290.7	55.8	0.2595	1.1508	1.5853	99.0000	0.0230	0.0824	28.5
4	1	2	10.	125.	1093.6	301.1	0.0	83.7	0.0	87.7	0.0765	0.2913	0.0000	0.0000	0.0340	0.1295	0.0
5	1	1	10.	70.	1093.6	301.1	255.6	64.3	299.8	66.7	0.2925	1.2169	1.3735	0.0000	0.0261	0.0984	18.8
5	1	2	10.	70.	1093.6	301.1	0.0	96.1	0.0	105.2	0.0879	0.3494	0.0000	0.0000	0.0390	0.1552	0.0
6	1	1	33.	290.	1606.4	3226.7	83.4	30.5	0.0	24.0	0.0709	0.0074	0.5097	0.0000	0.0084	0.0033	17.6
6	1	2	33.	290.	1606.4	3226.7	0.0	38.4	0.0	17.4	0.0239	0.0054	0.0000	0.0000	0.0106	0.0024	0.0
7	1	1	33.	235.	1606.4	3226.7	83.1	30.3	0.0	24.0	0.0706	0.0074	0.5388	0.0000	0.0084	0.0033	17.8
7	1	2	33.	235.	1606.4	3226.7	0.0	38.2	0.0	17.4	0.0238	0.0054	0.0000	0.0000	0.0106	0.0024	0.0
8	1	1	33.	180.	1606.4	3226.7	105.1	34.7	0.0	24.0	0.0870	0.0074	0.8811	0.0000	0.0096	0.0033	19.5
8	1	2	33.	180.	1606.4	3226.7	0.0	45.2	0.0	17.4	0.0281	0.0054	0.0000	0.0000	0.0125	0.0024	0.0
9	1	1	33.	125.	1606.4	3226.7	238.8	62.0	0.0	116.2	0.1872	0.0360	1.0477	0.0000	0.0172	0.0160	18.8
9	1	2	33.	125.	1606.4	3226.7	0.0	89.2	0.0	165.6	0.0555	0.0513	0.0000	0.0000	0.0247	0.0228	0.0
10	1	1	33.	70.	1606.4	3226.7	276.6	69.8	0.0	147.6	0.2156	0.0457	0.9903	0.0000	0.0193	0.0203	18.1
10	1	2	33.	70.	1606.4	3226.7	0.0	101.7	0.0	216.1	0.0633	0.0670	0.0000	0.0000	0.0281	0.0298	0.0
11	1	1	56.	290.	1910.6	5999.5	83.3	32.7	0.0	44.6	0.0607	0.0074	0.4387	0.0000	0.0076	0.0033	17.2
11	1	2	56.	290.	1910.6	5999.5	0.0	40.0	0.0	32.4	0.0209	0.0054	0.0000	0.0000	0.0093	0.0024	0.0
12	1	1	56.	235.	1910.6	5999.5	84.4	32.9	0.0	44.6	0.0614	0.0074	0.4544	0.0000	0.0076	0.0033	17.3
12	1	2	56.	235.	1910.6	5999.5	0.0	40.3	0.0	32.4	0.0211	0.0054	0.0000	0.0000	0.0094	0.0024	0.0
13	1	1	56.	180.	1910.6	5999.5	104.1	36.9	0.0	44.6	0.0738	0.0074	0.5754	0.0000	0.0086	0.0033	18.2
13	1	2	56.	180.	1910.6	5999.5	0.0	46.8	0.0	32.4	0.0245	0.0054	0.0000	0.0000	0.0109	0.0024	0.0
14	1	1	56.	125.	1910.6	5999.5	159.4	49.1	0.0	44.6	0.1091	0.0074	0.6438	0.0000	0.0114	0.0033	18.5
14	1	2	56.	125.	1910.6	5999.5	0.0	66.4	0.0	32.4	0.0347	0.0054	0.0000	0.0000	0.0154	0.0024	0.0
15	1	1	56.	70.	1910.6	5999.5	172.3	52.1	0.0	60.6	0.1174	0.0101	0.6402	0.0000	0.0121	0.0045	18.2
15	1	2	56.	70.	1910.6	5999.5	0.0	71.2	0.0	58.1	0.0373	0.0097	0.0000	0.0000	0.0166	0.0043	0.0
16	1	1	80.	290.	2556.7	7346.2	112.5	43.8	0.0	54.6	0.0611	0.0074	0.4232	0.0000	0.0076	0.0033	17.9
16	1	2	80.	290.	2556.7	7346.2	0.0	53.7	0.0	39.6	0.0210	0.0054	0.0000	0.0000	0.0093	0.0024	0.0
17	1	1	80.	235.	2556.7	7346.2	113.8	44.1	0.0	54.6	0.0617	0.0074	0.4271	0.0000	0.0077	0.0033	17.9
17	1	2	80.	235.	2556.7	7346.2	0.0	54.1	0.0	39.6	0.0212	0.0054	0.0000	0.0000	0.0094	0.0024	0.0
18	1	1	80.	180.	2556.7	7346.2	124.4	46.4	0.0	54.6	0.0668	0.0074	0.4518	0.0000	0.0081	0.0033	18.1
18	1	2	80.	180.	2556.7	7346.2	0.0	57.8	0.0	39.6	0.0226	0.0054	0.0000	0.0000	0.0100	0.0024	0.0
19	1	1	80.	125.	2556.7	7346.2	138.8	49.5	0.0	54.6	0.0737	0.0074	0.4719	0.0000	0.0086	0.0033	18.2
19	1	2	80.	125.	2556.7	7346.2	0.0	62.9	0.0	39.6	0.0246	0.0054	0.0000	0.0000	0.0109	0.0024	0.0
20	1	1	80.	70.	2556.7	7346.2	141.3	50.1	0.0	54.6	0.0749	0.0074	0.4743	0.0000	0.0087	0.0033	18.2
20	1	2	80.	70.	2556.7	7346.2	0.0	63.7	0.0	39.6	0.0249	0.0054	0.0000	0.0000	0.0111	0.0024	0.0

NOTE -- Above values assume VISIBLE TRANSMITTANCE = 1.0
for WINDOW glass and SHADING DEVICE.
Actual transmittances are used in the hourly calculation.

One LV-A report only

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3-Story Office Bldg                                                                       DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LV-A  General Project and Building Input                                           WEATHER FILE- CZ06RV2 WYEC2
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PERIOD OF STUDY

    STARTING DATE    ENDING DATE    NUMBER OF DAYS

     21 DEC 2001     21 DEC 2001                 1
     21 JUN 2001     21 JUN 2001                 1
      1 JAN 2001     31 DEC 2001               365

SITE CHARACTERISTIC DATA

                                                                         BUILDING
    STATION              LATITUDE  LONGITUDE   ALTITUDE       TIME        AZIMUTH
    NAME                    (DEG)      (DEG)       (FT)       ZONE          (DEG)

CZ06RV2 WYEC2                33.9      118.2        97.     8  PST          360.0
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For California Climate Zone weather files, eQUEST uses design days by default (properties are based on Title24 data).

Weather file name shown here on most DOE-2 reports.

Building North vs True North (+/- 360 deg, positive for clockwise rotation).

One LV-B report only

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3-Story Office Bldg                                                              DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2
REPORT- LV-B  Summary of Spaces Occurring in the Project                                  WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

NUMBER OF SPACES    22          EXTERIOR   20     INTERIOR    2

                                                          LIGHTS            EQUIP
                                SPACE*FLOOR SPACE        (WATT /           (WATT / INFILTRATION             AREA        VOLUME
SPACE             FLOOR          MULTIPLIER  TYPE   AZIM  SQFT ) PEOPLE  SQFT )      METHOD   ACH         (SQFT )      (CUFT )

South Perim Spac Ground Floor          1.0   EXT     0.0   1.31   10.7   1.17   AIR-CHANGE  0.17       1725.0       15525.0
East Perim Space Ground Floor          1.0   EXT   -90.0   1.31    7.9   1.17   AIR-CHANGE  0.18       1275.0       11475.0
North Perim Spac Ground Floor          1.0   EXT   180.0   1.31   10.7   1.17   AIR-CHANGE  0.17       1725.0       15525.0
West Perim Space Ground Floor          1.0   EXT    90.0   1.31    7.9   1.17   AIR-CHANGE  0.18       1275.0       11475.0
Core Space (G.C5 Ground Floor          1.0   INT     0.0   1.21   58.5   0.93   AIR-CHANGE  0.01       7000.0       63000.0
Plenum (G.6)     Ground Floor          1.0   EXT     0.0   0.00    0.0   0.00   AIR-CHANGE  0.08      13000.0       52000.0
South Perim Spac Mid Floor             1.0   EXT     0.0   1.41   10.3   1.49   AIR-CHANGE  0.17       1725.0       15525.0
East Perim Space Mid Floor             1.0   EXT   -90.0   1.41    7.6   1.49   AIR-CHANGE  0.18       1275.0       11475.0
North Perim Spac Mid Floor             1.0   EXT   180.0   1.41   10.3   1.49   AIR-CHANGE  0.17       1725.0       15525.0
West Perim Space Mid Floor             1.0   EXT    90.0   1.41    7.6   1.49   AIR-CHANGE  0.18       1275.0       11475.0
Core Space (M.C1 Mid Floor             1.0   INT     0.0   1.35   70.8   1.14   AIR-CHANGE  0.01       7000.0       63000.0
Plenum (M.12)    Mid Floor             1.0   EXT     0.0   0.00    0.0   0.00   AIR-CHANGE  0.08      13000.0       52000.0
South Perim Spac Top Floor             1.0   EXT     0.0   1.41   10.3   1.49   AIR-CHANGE  0.17       1725.0       15525.0
East Perim Space Top Floor             1.0   EXT   -90.0   1.41    7.6   1.49   AIR-CHANGE  0.18       1275.0       11475.0
North Perim Spac Top Floor             1.0   EXT   180.0   1.41   10.3   1.49   AIR-CHANGE  0.17       1725.0       15525.0
West Perim Space Top Floor             1.0   EXT    90.0   1.41    7.6   1.49   AIR-CHANGE  0.18       1275.0       11475.0
Core Space (T.C1 Top Floor             1.0   EXT     0.0   1.35   70.8   1.14   AIR-CHANGE  0.01       7000.0       63000.0
South Perim Plen Top Floor             1.0   EXT     0.0   0.00    0.0   0.00   AIR-CHANGE  0.17       1725.0        6900.0
East Perim Plenu Top Floor             1.0   EXT   -90.0   0.00    0.0   0.00   AIR-CHANGE  0.18       1275.0        5100.0
North Perim Plen Top Floor             1.0   EXT   180.0   0.00    0.0   0.00   AIR-CHANGE  0.17       1725.0        6900.0
West Perim Plenu Top Floor             1.0   EXT    90.0   0.00    0.0   0.00   AIR-CHANGE  0.18       1275.0        5100.0
Core Plenum (T.C Top Floor             1.0   EXT     0.0   0.00    0.0   0.00   AIR-CHANGE  0.02       7000.0       28000.0
                                                                -------                              ---------    ----------
BUILDING TOTALS                                                  309.1                                78000.0      507000.0
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Reports only the first 16 characters of the Space name

Includes task lighting

Does not include space process electric

One LV-C report per space in the project (3 pages fpr each LV-B report, only one LV-C report included here for example)

REPORT- LV-C Details of Space South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

DATA FOR SPACE South Perim Space (G.S1) IN FLOOR Ground Floor

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE*FLOOR MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	1725.00	15525.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
6	1	4	1	YES	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
3	3	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
0.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
Infil Sched	AIR-CHANGE	0.03	0.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
ask Sched	10.7	161.3	450.0	249.4	212.1

LV-C report page 2 of 3 (only one LV-C report included here for example)

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
s Sched	SUS-FLUOR	1.24	2.14	1.00

TASK LIGHTING

SCHEDULE	LOAD (WATTS/ SQFT)	LOAD (KW)
ask Sched	0.07	0.

ELECTRICAL EQUIPMENT

SCHEDULE	ELEC LOAD (WATTS/ SQFT)	ELEC LOAD (KW)	FRACTION OF LOAD TO SPACE SENSIBLE	FRACTION OF LOAD TO SPACE LATENT
Sched	1.17	2.01	1.00	0.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE	
NE Wall (G.S1.I1	190.92	Int Wall Constru	2.000	East Perim Space	QUICK	AIR
North Wall (G.S1	900.00	Int Wall Constru	2.000	Core Space (G.C5	QUICK	AIR
NW Wall (G.S1.I3	190.92	Int Wall Constru	2.000	West Perim Space	QUICK	AIR
Ceiling (G.S1.I4	1725.00	Ceiling Construc	0.361	Plenum (G.6)	QUICK	STANDARD

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
South Wall (G.S1	1.0	1170.00	130.00	9.00	Ext Wall Constru	0.080	DELAYED

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
South Wall (G.S1	-180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- LV-C Details of Space South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)---

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
Floor (G.S1.U1)	1.0	1725.00	UFCons (G.S1.U1)	0.06

EXTERIOR WINDOWS (U-VALUE INCLUDES OUTSIDE AIR FILM)

WINDOW	MULTIPLIER	GLASS AREA (SQFT)	GLASS SHADING COEFF	NUMBER OF PANES	GLASS TYPE CODE	SET-BACK (FT)	GLASS WIDTH (FT)	GLASS HEIGHT (FT)	CENTER-OF-GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS VISIBLE TRANS
South Window (G.	1.0	199.49	0.57	2	2	0.00	39.87	5.00	0.536	0.473
South Window (G.	1.0	199.49	0.57	2	2	0.00	39.87	5.00	0.536	0.473
South Door (G.S1	1.0	35.75	0.95	1	1	0.00	5.50	6.50	0.983	0.881

WINDOW	LOCATED IN SURFACE	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT)	Y (FT)
South Window (G.	South Wall (G.S1	20.28	0.00	3.11	20.28	3.11
South Window (G.	South Wall (G.S1	69.85	0.00	3.11	69.85	3.11
South Door (G.S1	South Wall (G.S1	62.25	0.00	0.25	62.25	0.25

one LV-D report per project — always at least 2 pages long, first page(s) list each exterior surface, last page is summary

REPORT- **LV-D** Details of Exterior Surfaces in the Project WEATHER FILE- CZ06RV2 WYEC2

NUMBER OF EXTERIOR SURFACES 30 RECTANGULAR 0 OTHER 30
(U-VALUE INCLUDES OUTSIDE AIR FILM; WINDOW INCLUDES FRAME, IF DEFINED)

SURFACE	SPACE	- - - W I N D O W S - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	-W A L L + W I N D O W S- U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
North Wall (G.N3	North Perim Spac	0.530	460.51	0.077	709.49	0.256	1170.00	NORTH
North Wall (G.6.	Plenum (G.6)	0.000	0.00	0.077	520.00	0.077	520.00	NORTH
North Wall (M.N9	North Perim Spac	0.502	468.00	0.077	702.00	0.247	1170.00	NORTH
North Wall (M.12	Plenum (M.12)	0.000	0.00	0.077	520.00	0.077	520.00	NORTH
North Wall (T.N1	North Perim Spac	0.502	468.00	0.077	702.00	0.247	1170.00	NORTH
North Wall (T.N2	North Perim Plen	0.000	0.00	0.077	520.00	0.077	520.00	NORTH
East Wall (M.12.	Plenum (M.12)	0.000	0.00	0.077	400.00	0.077	400.00	EAST
East Wall (G.E2.	East Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	EAST
East Wall (T.E14	East Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	EAST
East Wall (M.E8.	East Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	EAST
East Wall (T.E19	East Perim Plenu	0.000	0.00	0.077	400.00	0.077	400.00	EAST
East Wall (G.6.E	Plenum (G.6)	0.000	0.00	0.077	400.00	0.077	400.00	EAST
South Wall (T.S1	South Perim Spac	0.502	468.00	0.077	702.00	0.247	1170.00	SOUTH
South Wall (G.6.	Plenum (G.6)	0.000	0.00	0.077	520.00	0.077	520.00	SOUTH
South Wall (M.12	Plenum (M.12)	0.000	0.00	0.077	520.00	0.077	520.00	SOUTH
South Wall (T.S1	South Perim Plen	0.000	0.00	0.077	520.00	0.077	520.00	SOUTH
South Wall (M.S7	South Perim Spac	0.502	468.00	0.077	702.00	0.247	1170.00	SOUTH
South Wall (G.S1	South Perim Spac	0.530	460.51	0.077	709.49	0.256	1170.00	SOUTH
West Wall (M.W10	West Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	WEST
West Wall (T.W16	West Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	WEST
West Wall (M.12.	Plenum (M.12)	0.000	0.00	0.077	400.00	0.077	400.00	WEST
West Wall (G.6.E	Plenum (G.6)	0.000	0.00	0.077	400.00	0.077	400.00	WEST
West Wall (G.W4.	West Perim Space	0.502	360.00	0.077	540.00	0.247	900.00	WEST
West Wall (T.W21	West Perim Plenu	0.000	0.00	0.077	400.00	0.077	400.00	WEST

LV-D (continued) — one LV-D report per project — page 2 of 3 in this example

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3-Story Office Bldg                                                    DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LV-D  Details of Exterior Surfaces in the Project                        WEATHER FILE- CZ06RV2 WYEC2
--------------------------------------------------------------------------------------------------------------(CONTINUED)--------

Roof (T.E19.E25)  East Perim Plenu        0.000         0.00         0.042       1275.00      0.042          1275.00  ROOF
Roof (T.S18.E23)  South Perim Plen        0.000         0.00         0.042       1725.00      0.042          1725.00  ROOF
Roof (T.N20.E27)  North Perim Plen        0.000         0.00         0.042       1725.00      0.042          1725.00  ROOF
Skylt Roof (T.C1  Core Space (T.C1        0.842       256.00         0.001       6744.00      0.032          7000.00  ROOF
Roof (T.W21.E29)  West Perim Plenu        0.000         0.00         0.042       1275.00      0.042          1275.00  ROOF
Roof (T.C22.E30)  Core Plenum (T.C        0.000         0.00         0.042       7000.00      0.042          7000.00  ROOF
Floor (G.S1.U1)   South Perim Spac        0.000         0.00         0.058       1725.00      0.058          1725.00  UNDERGRND
Floor (G.E2.U2)   East Perim Space        0.000         0.00         0.061       1275.00      0.061          1275.00  UNDERGRND
Floor (G.N3.U3)   North Perim Spac        0.000         0.00         0.058       1725.00      0.058          1725.00  UNDERGRND
Floor (G.W4.U4)   West Perim Space        0.000         0.00         0.061       1275.00      0.061          1275.00  UNDERGRND
Floor (G.C5.U5)   Core Space (G.C5        0.000         0.00         0.010       7000.00      0.010          7000.00  UNDERGRND
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LV-D (continued) — one LV-D report per project (page 3 of 3 in this example) — this last page is a whole-building summary

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3-Story Office Bldg                                          DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LV-D  Details of Exterior Surfaces in the Project                      WEATHER FILE- CZ06RV2 WYEC2
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	AVERAGE U-VALUE/WINDOWS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+WINDOWS (BTU/HR-SQFT-F)	WINDOW AREA (SQFT)	WALL AREA (SQFT)	WINDOW+WALL AREA (SQFT)
NORTH	0.511	0.077	0.197	1396.51	3673.49	5070.00
EAST	0.502	0.077	0.195	1080.00	2820.00	3900.00
SOUTH	0.511	0.077	0.197	1396.51	3673.49	5070.00
WEST	0.502	0.077	0.195	1080.00	2820.00	3900.00
ROOF	0.842	0.028	0.038	256.00	19744.00	20000.00
ALL WALLS	0.507	0.077	0.196	4953.02	12986.98	17940.00
WALLS+ROOFS	0.524	0.048	0.113	5209.02	32730.98	37940.00
UNDERGRND	0.000	0.033	0.033	0.00	13000.00	13000.00
BUILDING	0.524	0.043	0.092	5209.02	45730.98	50940.00

Frame effects can make these differ

Overall wall (only) u-value

Overall wall+win u-value

Will report up to 8 orientations (relative to true north, after any bldg rotation)

U-Values reported here include exterior film resistance effect (assumes 7.5 mph wind)

Includes window frame area (if any)

Areas are reported after the effect of multipliers, if any.

***** Important Report *****

One LV-E report only

REPORT- **LV-E** Details of Underground Surfaces in the Project WEATHER FILE- CZ06RV2 WYEC2

NUMBER OF UNDERGROUND SURFACES 5

SURFACE NAME	MULTIPLIER	AREA (SQFT)	CONSTRUCTION NAME	U-VALUE (BTU/HR-SQFT-F)
Floor (G.S1.U1)	1.0	1725.00	UFCons (G.S1.U1)	0.058
Floor (G.E2.U2)	1.0	1275.00	UFCons (G.E2.U2)	0.061
Floor (G.N3.U3)	1.0	1725.00	UFCons (G.N3.U3)	0.058
Floor (G.W4.U4)	1.0	1275.00	UFCons (G.W4.U4)	0.061
Floor (G.C5.U5)	1.0	7000.00	UFCons (G.C5.U5)	0.010

One LV-F report only (may require more than one page to list all interior surfaces)

REPORT- **LV-F** Details of Interior Surfaces in the Project WEATHER FILE- CZ06RV2 WYEC2

NUMBER OF INTERIOR SURFACES 57
(U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE NAME	AREA (SQFT)	CONSTRUCTION NAME	SURFACE TYPE		U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACES SPACE-1	SPACE-2
NE Wall (G.S1.I1	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	East Perim Space
North Wall (G.S1	900.00	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	Core Space (G.C5
NW Wall (G.S1.I3	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	West Perim Space
Ceiling (G.S1.I4	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	South Perim Spac	Plenum (G.6)
NW Wall (G.E2.I5	190.92	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	North Perim Spac
West Wall (G.E2.	630.00	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	Core Space (G.C5
Ceiling (G.E2.I7	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	East Perim Space	Plenum (G.6)
SW Wall (G.N3.I8	190.92	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	West Perim Space
South Wall (G.N3	900.00	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	Core Space (G.C5
Ceiling (G.N3.I1	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	North Perim Spac	Plenum (G.6)
East Wall (G.W4.	630.00	Int Wall Constru	QUICK	AIR	2.000	West Perim Space	Core Space (G.C5
Ceiling (G.W4.I1	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	West Perim Space	Plenum (G.6)
Ceiling (G.C5.I1	7000.00	Ceiling Construc	QUICK	STANDARD	0.361	Core Space (G.C5	Plenum (G.6)
Floor (M.S7.I14)	1725.00	Int Flr Construc	DELAYED	STANDARD	0.567	South Perim Spac	Plenum (G.6)
NE Wall (M.S7.I1	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	East Perim Space
North Wall (M.S7	900.00	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	Core Space (M.C1
NW Wall (M.S7.I1	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	West Perim Space
Ceiling (M.S7.I1	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	South Perim Spac	Plenum (M.12)
Floor (M.E8.I19)	1275.00	Int Flr Construc	DELAYED	STANDARD	0.567	East Perim Space	Plenum (G.6)
NW Wall (M.E8.I2	190.92	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	North Perim Spac
West Wall (M.E8.	630.00	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	Core Space (M.C1
Ceiling (M.E8.I2	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	East Perim Space	Plenum (M.12)
Floor (M.N9.I23)	1725.00	Int Flr Construc	DELAYED	STANDARD	0.567	North Perim Spac	Plenum (G.6)
SW Wall (M.N9.I2	190.92	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	West Perim Space
South Wall (M.N9	900.00	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	Core Space (M.C1
Ceiling (M.N9.I2	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	North Perim Spac	Plenum (M.12)
Floor (M.W10.I27	1275.00	Int Flr Construc	DELAYED	STANDARD	0.567	West Perim Space	Plenum (G.6)
East Wall (M.W10	630.00	Int Wall Constru	QUICK	AIR	2.000	West Perim Space	Core Space (M.C1
Ceiling (M.W10.I	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	West Perim Space	Plenum (M.12)
Floor (M.C11.I30	7000.00	Int Flr Construc	DELAYED	STANDARD	0.567	Core Space (M.C1	Plenum (G.6)
Ceiling (M.C11.I	7000.00	Ceiling Construc	QUICK	STANDARD	0.361	Core Space (M.C1	Plenum (M.12)
Floor (T.S13.I32	1725.00	Int Flr Construc	DELAYED	STANDARD	0.567	South Perim Spac	Plenum (M.12)
NE Wall (T.S13.I	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	East Perim Space
North Wall (T.S1	900.00	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	Core Space (T.C1
NW Wall (T.S13.I	190.92	Int Wall Constru	QUICK	AIR	2.000	South Perim Spac	West Perim Space
Ceiling (T.S13.I	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	South Perim Spac	South Perim Plen
Floor (T.E14.I37	1275.00	Int Flr Construc	DELAYED	STANDARD	0.567	East Perim Space	Plenum (M.12)
NW Wall (T.E14.I	190.92	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	North Perim Spac
West Wall (T.E14	630.00	Int Wall Constru	QUICK	AIR	2.000	East Perim Space	Core Space (T.C1
Ceiling (T.E14.I	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	East Perim Space	East Perim Plenu
Floor (T.N15.I41	1725.00	Int Flr Construc	DELAYED	STANDARD	0.567	North Perim Spac	Plenum (M.12)
SW Wall (T.N15.I	190.92	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	West Perim Space
South Wall (T.N1	900.00	Int Wall Constru	QUICK	AIR	2.000	North Perim Spac	Core Space (T.C1
Ceiling (T.N15.I	1725.00	Ceiling Construc	QUICK	STANDARD	0.361	North Perim Spac	North Perim Plen
Floor (T.W16.I45	1275.00	Int Flr Construc	DELAYED	STANDARD	0.567	West Perim Space	Plenum (M.12)
East Wall (T.W16	630.00	Int Wall Constru	QUICK	AIR	2.000	West Perim Space	Core Space (T.C1
Ceiling (T.W16.I	1275.00	Ceiling Construc	QUICK	STANDARD	0.361	West Perim Space	West Perim Plenu
Floor (T.C17.I48	7000.00	Int Flr Construc	DELAYED	STANDARD	0.567	Core Space (T.C1	Plenum (M.12)
Ceiling (T.C17.I	7000.00	Ceiling Construc	QUICK	STANDARD	0.361	Core Space (T.C1	Core Plenum (T.C

One LV-F report — continued (page 2 of 2 — larger projects, i.e., more interior surfaces will require more pages)

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3-Story Office Bldg                                                             DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LV-F  Details of Interior Surfaces in the Project                                  WEATHER FILE- CZ06RV2 WYEC2
--------------------------------------------------------------------------------------------------------------(CONTINUED)--------

                                                                                                   ADJACENT SPACES
SURFACE                   AREA      CONSTRUCTION     SURFACE TYPE                  U-VALUE
NAME                    (SQFT )     NAME                                      (BTU/HR-SQFT-F)      SPACE-1          SPACE-2

NE Wall (T.S18.I         84.85      Int Wall Constru QUICK   AIR                        2.000      South Perim Plen East Perim Plenu
North Wall (T.S1        400.00      Int Wall Constru QUICK   AIR                        2.000      South Perim Plen Core Plenum (T.C
NW Wall (T.S18.I         84.85      Int Wall Constru QUICK   AIR                        2.000      South Perim Plen West Perim Plenu
NW Wall (T.E19.I         84.85      Int Wall Constru QUICK   AIR                        2.000      East Perim Plenu North Perim Plen
West Wall (T.E19        280.00      Int Wall Constru QUICK   AIR                        2.000      East Perim Plenu Core Plenum (T.C
SW Wall (T.N20.I         84.85      Int Wall Constru QUICK   AIR                        2.000      North Perim Plen West Perim Plenu
South Wall (T.N2        400.00      Int Wall Constru QUICK   AIR                        2.000      North Perim Plen Core Plenum (T.C
East Wall (T.W21        280.00      Int Wall Constru QUICK   AIR                        2.000      West Perim Plenu Core Plenum (T.C
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One LV-G report only (will likely require more than one page to list all schedules, only one page shown here for example)

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3-Story Office Bldg                                                             DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LV-G  Details of Schedules Occurring in the Project                                WEATHER FILE- CZ06RV2 WYEC2
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NUMBER OF SCHEDULES  36              ( NON DIMENSIONLESS SCHEDULES ARE GIVEN IN ENGLISH UNITS )


    SCHEDULE  Typ Core Occ/Tas

        THROUGH 31 12

            FOR DAYS  SUN HOL

        HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
           0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

            FOR DAYS  MON TUE WED THU FRI HDD CDD

        HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
           0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.00 0.00 0.00 0.00 0.00 0.00 0.00

            FOR DAYS  SAT

        HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
           0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.25 0.25 0.25 0.25 0.25 0.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00


    SCHEDULE  Typ Core Lights

        THROUGH 31 12

            FOR DAYS  SUN HOL

        HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
           0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

            FOR DAYS  MON TUE WED THU FRI HDD CDD

        HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
           0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.47 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.47 0.03 0.03 0.03 0.03 0.03 0.03
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3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LV-H** Details of Windows Occurring in the Project WEATHER FILE- CZ06RV2 WYEC2

NUMBER OF WINDOWS 32 RECTANGULAR 0 OTHER 32

RECTANGULAR WINDOWS (U-VALUES INCLUDE OUTSIDE AIR FILM)

WINDOW NAME	MULTIPLIER	GLASS AREA (SQFT)	GLASS HEIGHT (FT)	GLASS WIDTH (FT)	LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT)	Y (FT)	FRAME AREA (SQFT)	FRAME U-VALUE (BTU/HR-SQFT-F)
South Window (G.	1.0	199.49	5.00	39.87	20.28	3.11	9.77	0.384
South Window (G.	1.0	199.49	5.00	39.87	69.85	3.11	9.77	0.384
South Door (G.S1	1.0	35.75	6.50	5.50	62.25	0.25	6.25	0.384
East Window (G.E	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
North Window (G.	1.0	199.49	5.00	39.87	20.28	3.11	9.77	0.384
North Window (G.	1.0	199.49	5.00	39.87	69.85	3.11	9.77	0.384
North Door (G.N3	1.0	35.75	6.50	5.50	62.25	0.25	6.25	0.384
West Window (G.W	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
South Window (M.	1.0	447.49	5.00	89.44	20.28	3.11	20.51	0.384
East Window (M.E	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
North Window (M.	1.0	447.49	5.00	89.44	20.28	3.11	20.51	0.384
West Window (M.W	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
South Window (T.	1.0	447.49	5.00	89.44	20.28	3.11	20.51	0.384
East Window (T.E	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
North Window (T.	1.0	447.49	5.00	89.44	20.28	3.11	20.51	0.384
West Window (T.W	1.0	343.97	5.00	68.75	15.63	3.11	16.03	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	58.40	43.40	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	79.19	43.40	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	37.61	43.40	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	58.40	64.19	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	58.40	22.61	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	37.61	64.19	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	79.19	64.19	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	37.61	22.61	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	79.19	22.61	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	16.82	43.40	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	58.40	1.82	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	16.82	22.61	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	16.82	64.19	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	37.61	1.82	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	79.19	1.82	0.00	0.384
Skylight (T.C17.	1.0	16.00	4.00	4.00	16.82	1.82	0.00	0.384

WINDOW NAME	SETBACK (FT)	X-DIVISIONS	GLASS SHADING COEFF	NUMBER OF PANES	GLASS TYPE CODE	INFILTRATION FLOW COEFF	CENTER-OF-GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS VISIBLE TRANS
South Window (G.	0.00	10	0.57	2	2	0.0	0.536	0.473
South Window (G.	0.00	10	0.57	2	2	0.0	0.536	0.473
South Door (G.S1	0.00	10	0.95	1	1	0.0	0.983	0.881
East Window (G.E	0.00	10	0.57	2	2	0.0	0.536	0.473
North Window (G.	0.00	10	0.57	2	2	0.0	0.536	0.473
North Window (G.	0.00	10	0.57	2	2	0.0	0.536	0.473
North Door (G.N3	0.00	10	0.95	1	1	0.0	0.983	0.881
West Window (G.W	0.00	10	0.57	2	2	0.0	0.536	0.473
South Window (M.	0.00	10	0.57	2	2	0.0	0.536	0.473
East Window (M.E	0.00	10	0.57	2	2	0.0	0.536	0.473

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LV-H** Details of Windows Occurring in the Project WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)---

WINDOW NAME	SETBACK (FT)	X-DIVISIONS	GLASS SHADING COEFF	NUMBER OF PANES	GLASS TYPE CODE	INFILTRATION FLOW COEFF	CENTER-OF-GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS VISIBLE TRANS
North Window (M.	0.00	10	0.57	2	2	0.0	0.536	0.473
West Window (M.W	0.00	10	0.57	2	2	0.0	0.536	0.473
South Window (T.	0.00	10	0.57	2	2	0.0	0.536	0.473
East Window (T.E	0.00	10	0.57	2	2	0.0	0.536	0.473
North Window (T.	0.00	10	0.57	2	2	0.0	0.536	0.473
West Window (T.W	0.00	10	0.57	2	2	0.0	0.536	0.473
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495
Skylight (T.C17.	0.00	10	0.54	-99	-1	0.0	0.921	0.495

One LV-I report only (may require more than one page to list all construcitons in the project)

```
3-Story Office Bldg                                                       DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LV-I  Details of Constructions Occurring in the Project                     WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

NUMBER OF CONSTRUCTIONS  11          DELAYED   8     QUICK   3
```

CONSTRUCTION NAME	U-VALUE (BTU/HR-SQFT-F)	SURFACE ABSORPTANCE	SURFACE ROUGHNESS INDEX	SURFACE TYPE	NUMBER OF RESPONSE FACTORS
Ext Wall Constru	0.080	0.60	3	DELAYED	9
Roof Constructio	0.043	0.60	3	DELAYED	7
Ceiling Construc	0.361	0.70	3	QUICK	0
Int Wall Constru	2.000	0.70	3	QUICK	0
Int Flr Construc	0.567	0.70	3	DELAYED	4
UFCons (G.S1.U1)	0.058	0.70	3	DELAYED	49
UFCons (G.E2.U2)	0.061	0.70	3	DELAYED	48
UFCons (G.N3.U3)	0.058	0.70	3	DELAYED	49
UFCons (G.W4.U4)	0.061	0.70	3	DELAYED	48
UFCons (G.C5.U5)	0.010	0.70	3	DELAYED	52
Skylt Roof Const	0.001	0.00	1	QUICK	0

One LV-I report only (may require more than one page to list all Building-Shades in large projects)

```
3-Story Office Bldg                                                                  DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LV-J  Details of Building Shades in the Project                                         WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

NUMBER OF BUILDING SHADES   0          RECTANGULAR   0     OTHER   0
```

Up to two LS-A reports per project — one reports the Design Day run (if any), the other reports the weather file run

```
3-Story Office Bldg                                                               DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-A Space Peak Loads Summary                                              DESIGN DAY   WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

                                 MULTIPLIER   COOLING LOAD        TIME OF    DRY-   WET-    HEATING LOAD       TIME OF    DRY-   WET-
SPACE NAME                      SPACE  FLOOR   (KBTU/HR)           PEAK     BULB   BULB     (KBTU/HR)          PEAK     BULB   BULB

South Perim Space (G.S1)          1.     1.       19.514   JUN 21  3 PM    91.F   67.F        -10.104   DEC 21  7 AM    37.F   31.F
East Perim Space (G.E2)           1.     1.       27.845   JUN 21  9 AM    81.F   64.F         -7.639   DEC 21  7 AM    37.F   31.F
North Perim Space (G.N3)          1.     1.       19.176   JUN 21  5 PM    91.F   67.F        -10.511   DEC 21  7 AM    37.F   31.F
West Perim Space (G.W4)           1.     1.       26.713   JUN 21  6 PM    90.F   67.F         -7.894   DEC 21  7 AM    37.F   31.F
Core Space (G.C5)                 1.     1.       52.562   JUN 21  5 PM    91.F   67.F          0.000                    0.F    0.F
Plenum (G.6)                      1.     1.        5.920   JUN 21  7 PM    89.F   66.F         -7.259   DEC 21  7 AM    37.F   31.F
South Perim Space (M.S7)          1.     1.       23.488   JUN 21  5 PM    91.F   67.F         -9.293   DEC 21  7 AM    37.F   31.F
East Perim Space (M.E8)           1.     1.       31.165   JUN 21  9 AM    81.F   64.F         -7.193   DEC 21  7 AM    37.F   31.F
North Perim Space (M.N9)          1.     1.       23.273   JUN 21  5 PM    91.F   67.F         -9.630   DEC 21  7 AM    37.F   31.F
West Perim Space (M.W10)          1.     1.       30.948   JUN 21  7 PM    89.F   66.F         -7.449   DEC 21  7 AM    37.F   31.F
Core Space (M.C11)                1.     1.       62.429   JUN 21  5 PM    91.F   67.F          0.000                    0.F    0.F
Plenum (M.12)                     1.     1.        5.920   JUN 21  7 PM    89.F   66.F         -7.259   DEC 21  7 AM    37.F   31.F
South Perim Space (T.S13)         1.     1.       23.488   JUN 21  5 PM    91.F   67.F         -9.293   DEC 21  7 AM    37.F   31.F
East Perim Space (T.E14)          1.     1.       31.165   JUN 21  9 AM    81.F   64.F         -7.193   DEC 21  7 AM    37.F   31.F
North Perim Space (T.N15)         1.     1.       23.273   JUN 21  5 PM    91.F   67.F         -9.630   DEC 21  7 AM    37.F   31.F
West Perim Space (T.W16)          1.     1.       30.948   JUN 21  7 PM    89.F   66.F         -7.449   DEC 21  7 AM    37.F   31.F
Core Space (T.C17)                1.     1.       71.379   JUN 21  5 PM    91.F   67.F         -1.143   DEC 21  7 AM    37.F   31.F
South Perim Plenum (T.S18)        1.     1.        6.718   JUN 21  3 PM    91.F   67.F         -4.555   DEC 21  6 AM    37.F   31.F
East Perim Plenum (T.E19)         1.     1.        4.993   JUN 21  2 PM    90.F   66.F         -3.427   DEC 21  6 AM    37.F   31.F
North Perim Plenum (T.N20)        1.     1.        6.279   JUN 21  3 PM    91.F   67.F         -4.552   DEC 21  6 AM    37.F   31.F
West Perim Plenum (T.W21)         1.     1.        5.257   JUN 21  5 PM    91.F   67.F         -3.424   DEC 21  6 AM    37.F   31.F
Core Plenum (T.C22)               1.     1.       17.881   JUN 21  4 PM    91.F   67.F        -10.749   DEC 21  7 AM    37.F   31.F
                                                 ---------                                   ---------
SUM                                              550.335                                     -145.645

BUILDING PEAK                                    455.220   JUN 21  5 PM    91.F   67.F       -104.421   DEC 21  7 AM    37.F   31.F
```

This tag indicates this report documents only Design Day results (not weather file results).

The weather file is reported, even though this is a Design Day report (may cause confusion)

Sensible only

Reported BEFORE the application of Space or Floor Multipliers

Reported AFTER the application of Space or Floor Multipliers

Sum of Space Loads (non-coincident peak load)

Coincident whole-building peak Space Load ("block "load)

Important Notes:

Reports LS-B through LS-L for the Design Day simulation results have been excluded from this listing to save space. The LS-B through LS-L reports that follow document weather file simulation results.

A "load" reported in the LOADS ("LS-") reports is defined as the amount of heat that must be added or removed from the space air per hour to maintain a constant air temperature equal to the TEMPERATURE keyword value in SPACE. These loads are modified in the SYSTEMS program ("SS-" reports) to account for time-varying air temperatures. This EXCLUDES outside air ventilation load, duct loss/gain, fan motor heat, and light heat from the top of trouffers, all of which are accounted for in the SYSTEMS part of the calculation (see the "SS-" reports).

***** Important Report *****

Up to two LS-A reports per project — one reports the Design Day run (if any), the other reports the weather file run

```
3-Story Office Bldg                                                   DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-A Space Peak Loads Summary                                                          WEATHER FILE- CZ06RV2 WYEC2
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No "Design Day" tag indicates this report documents weather file results.

SPACE NAME	MULTIPLIER SPACE	FLOOR	COOLING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB	HEATING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB
South Perim Space (G.S1)	1.	1.	44.220	DEC 19 1 PM	79.F	53.F	-8.118	JAN 1 7 AM	39.F	31.F
East Perim Space (G.E2)	1.	1.	27.192	APR 5 9 AM	65.F	49.F	-7.370	JAN 1 7 AM	39.F	31.F
North Perim Space (G.N3)	1.	1.	17.045	AUG 31 3 PM	87.F	63.F	-10.318	JAN 1 7 AM	39.F	31.F
West Perim Space (G.W4)	1.	1.	25.759	APR 4 5 PM	81.F	52.F	-7.303	JAN 1 7 AM	39.F	31.F
Core Space (G.C5)	1.	1.	52.674	AUG 31 5 PM	83.F	63.F	-0.985	JAN 1 7 AM	39.F	31.F
Plenum (G.6)	1.	1.	3.819	AUG 31 5 PM	83.F	63.F	-6.732	DEC 29 7 AM	39.F	31.F
South Perim Space (M.S7)	1.	1.	51.943	DEC 19 2 PM	79.F	53.F	-9.663	JAN 1 7 AM	39.F	31.F
East Perim Space (M.E8)	1.	1.	31.809	APR 5 10 AM	74.F	53.F	-7.617	JAN 1 7 AM	39.F	31.F
North Perim Space (M.N9)	1.	1.	21.042	AUG 31 3 PM	87.F	63.F	-9.913	JAN 1 7 AM	39.F	31.F
West Perim Space (M.W10)	1.	1.	30.697	MAR 15 5 PM	65.F	58.F	-7.515	JAN 1 7 AM	39.F	31.F
Core Space (M.C11)	1.	1.	62.357	AUG 31 5 PM	83.F	63.F	-0.230	JAN 1 7 AM	39.F	31.F
Plenum (M.12)	1.	1.	3.819	AUG 31 5 PM	83.F	63.F	-6.732	DEC 29 7 AM	39.F	31.F
South Perim Space (T.S13)	1.	1.	51.943	DEC 19 2 PM	79.F	53.F	-9.663	JAN 1 7 AM	39.F	31.F
East Perim Space (T.E14)	1.	1.	31.809	APR 5 10 AM	74.F	53.F	-7.617	JAN 1 7 AM	39.F	31.F
North Perim Space (T.N15)	1.	1.	21.042	AUG 31 3 PM	87.F	63.F	-9.913	JAN 1 7 AM	39.F	31.F
West Perim Space (T.W16)	1.	1.	30.697	MAR 15 5 PM	65.F	58.F	-7.515	JAN 1 7 AM	39.F	31.F
Core Space (T.C17)	1.	1.	71.398	JUL 10 5 PM	85.F	67.F	-6.882	JAN 1 7 AM	39.F	31.F
South Perim Plenum (T.S18)	1.	1.	6.487	MAR 6 2 PM	75.F	53.F	-5.478	DEC 29 6 AM	39.F	31.F
East Perim Plenum (T.E19)	1.	1.	4.618	JUL 29 12 NOON	83.F	71.F	-4.112	DEC 29 6 AM	39.F	31.F
North Perim Plenum (T.N20)	1.	1.	5.224	SEP 8 3 PM	84.F	72.F	-5.481	DEC 29 6 AM	39.F	31.F
West Perim Plenum (T.W21)	1.	1.	4.085	SEP 8 3 PM	84.F	72.F	-4.110	DEC 29 6 AM	39.F	31.F
Core Plenum (T.C22)	1.	1.	13.991	JUN 20 3 PM	82.F	72.F	-13.250	DEC 29 6 AM	39.F	31.F
			---------				---------			
SUM			613.670				-156.514			
BUILDING PEAK			447.772	DEC 19 3 PM	77.F	53.F	-110.620	JAN 1 7 AM	39.F	31.F

Important Note:
Compare the peak space cooling loads reported on this report (results from the weather file) with the previous LS-A report (for Design Day results). Note that the south spaces peak at times other than during the summer. In this example, this is due to lower solar angles (increased solar heat gain) in non-summer months. If Design Days are specified and DOE-2 is "asked" to size HVAC equipment, it will rely on the Design Day weather data to do so, hence, in this case, the air flow for the south spaces will be undersized.

***** Important Report *****

One LS-B report per space — only six are shown here (one each for the ground floor zones (others have been omitted for brevity)

```
3-Story Office Bldg                                                    DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-B Space Peak Load Components     South Perim Space (G.S1)                    WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

SPACE  South Perim Space (G.S1)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER        1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA      1725  SQFT       160    M2
                    VOLUME          15525  CUFT       440    M3

                                              COOLING  LOAD                            HEATING  LOAD
                                         ==========================              ==========================
    TIME                                        DEC 19  1PM                             JAN  1  7AM

    DRY-BULB TEMP                          79 F              26 C                 39 F              4 C
    WET-BULB TEMP                          53 F              12 C                 31 F             -1 C
    TOT HORIZONTAL SOLAR RAD              162 BTU/H.SQFT    510 W/M2               0 BTU/H.SQFT     0 W/M2
    WINDSPEED AT SPACE                    0.0 KTS           0.0 M/S              2.6 KTS          1.3 M/S
    CLOUD AMOUNT 0(CLEAR)-10                0                                      1


                                      SENSIBLE          LATENT                              SENSIBLE
                                 (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                  (KBTU/H)  ( KW )
                                 --------    ------  --------  ------                  --------  --------

     WALL CONDUCTION                2.677     0.785     0.000   0.000                    -1.555    -0.455
     ROOF CONDUCTION                0.000     0.000     0.000   0.000                     0.000     0.000
     WINDOW GLASS+FRM COND         13.948     4.087     0.000   0.000                    -6.240    -1.828
     WINDOW GLASS SOLAR            20.571     6.027     0.000   0.000                     2.176     0.638
     DOOR CONDUCTION                0.000     0.000     0.000   0.000                     0.000     0.000
     INTERNAL SURFACE COND          0.000     0.000     0.000   0.000                     0.000     0.000
     UNDERGROUND SURF COND         -0.877    -0.257     0.000   0.000                    -1.036    -0.303
     OCCUPANTS TO SPACE             1.880     0.551     2.042   0.598                     0.000     0.000
     LIGHT     TO SPACE             0.862     0.253     0.000   0.000                     0.000     0.000
     EQUIPMENT TO SPACE             4.946     1.449     0.000   0.000                     0.000     0.000
     PROCESS   TO SPACE             0.000     0.000     0.000   0.000                     0.000     0.000
     INFILTRATION                   0.212     0.062     0.000   0.000                    -1.464    -0.429
                                 --------   -------   -------  ------                  --------  --------
     TOTAL                         44.220    12.956     2.042   0.598                    -8.117    -2.378
     TOTAL / AREA                   0.026     0.081     0.001   0.004                    -0.005    -0.015

     TOTAL LOAD                    46.262 KBTU/H       13.555  KW               -8.117 KBTU/H       -2.378  KW
     TOTAL LOAD / AREA             26.82  BTU/H.SQFT   84.581  W/M2              4.706 BTU/H.SQFT   14.841  W/M2


                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
```

Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

Outside ventilation air is accounted for in the SYSTEMS part of the program, i.e., in "SS-" reports)

```
3-Story Office Bldg                                                        DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-B Space Peak Load Components     East Perim Space (G.E2)                   WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

SPACE  East Perim Space (G.E2)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER        1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA      1275  SQFT       118    M2
                    VOLUME          11475  CUFT       325    M3

                                                  COOLING  LOAD                           HEATING  LOAD
                                             ==========================           ==========================
    TIME                                            APR  5  9AM                           JAN  1  7AM

    DRY-BULB TEMP                              65 F              18 C               39 F              4 C
    WET-BULB TEMP                              49 F               9 C               31 F             -1 C
    TOT HORIZONTAL SOLAR RAD                  108 BTU/H.SQFT    340 W/M2             0 BTU/H.SQFT     0 W/M2
    WINDSPEED AT SPACE                        2.0 KTS           1.0 M/S            2.6 KTS          1.3 M/S
    CLOUD AMOUNT 0(CLEAR)-10                   0                                    1


                                      SENSIBLE          LATENT                              SENSIBLE
                                 (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                  (KBTU/H)  ( KW )
                                 --------    ------  --------  ------                  --------  --------

     WALL CONDUCTION               0.364      0.107     0.000   0.000                    -1.229    -0.360
     ROOF CONDUCTION               0.000      0.000     0.000   0.000                     0.000     0.000
     WINDOW GLASS+FRM COND         8.547      2.504     0.000   0.000                    -4.819    -1.412
     WINDOW GLASS SOLAR           14.097      4.130     0.000   0.000                     0.599     0.176
     DOOR CONDUCTION               0.000      0.000     0.000   0.000                     0.000     0.000
     INTERNAL SURFACE COND         0.000      0.000     0.000   0.000                     0.000     0.000
     UNDERGROUND SURF COND        -0.841     -0.246     0.000   0.000                    -0.796    -0.233
     OCCUPANTS TO SPACE            1.271      0.372     1.509   0.442                     0.000     0.000
     LIGHT     TO SPACE            0.583      0.171     0.000   0.000                     0.000     0.000
     EQUIPMENT TO SPACE            3.397      0.995     0.000   0.000                     0.000     0.000
     PROCESS   TO SPACE            0.000      0.000     0.000   0.000                     0.000     0.000
     INFILTRATION                 -0.226     -0.066     0.000   0.000                    -1.126    -0.330
                                 --------   -------   -------  ------                  --------  --------
     TOTAL                        27.192      7.967     1.509   0.442                    -7.370    -2.159
     TOTAL / AREA                  0.021      0.067     0.001   0.004                    -0.006    -0.018

     TOTAL LOAD                   28.702 KBTU/H       8.410  KW               -7.370 KBTU/H       -2.159  KW
     TOTAL LOAD / AREA            22.51  BTU/H.SQFT  70.996  W/M2              5.781 BTU/H.SQFT   18.231  W/M2

                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
```

Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

```
3-Story Office Bldg                                                           DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-B Space Peak Load Components     North Perim Space (G.N3)                        WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

SPACE  North Perim Space (G.N3)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER        1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA      1725  SQFT       160   M2
                    VOLUME          15525  CUFT       440   M3

                                           COOLING  LOAD                              HEATING  LOAD
                                     ==========================               ==========================
    TIME                                     AUG 31  3PM                                JAN  1  7AM

    DRY-BULB TEMP                      87 F              31 C                39 F              4 C
    WET-BULB TEMP                      63 F              17 C                31 F             -1 C
    TOT HORIZONTAL SOLAR RAD          257 BTU/H.SQFT    810 W/M2              0 BTU/H.SQFT     0 W/M2
    WINDSPEED AT SPACE                8.5 KTS           4.4 M/S             2.6 KTS          1.3 M/S
    CLOUD AMOUNT 0(CLEAR)-10            1                                     1


                               SENSIBLE            LATENT                               SENSIBLE
                           (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                     (KBTU/H)  ( KW )
                           --------    ------  --------  ------                     --------  --------

     WALL CONDUCTION          0.888     0.260     0.000   0.000                       -1.646    -0.482
     ROOF CONDUCTION          0.000     0.000     0.000   0.000                        0.000     0.000
     WINDOW GLASS+FRM COND    4.674     1.370     0.000   0.000                       -6.517    -1.909
     WINDOW GLASS SOLAR       3.782     1.108     0.000   0.000                        0.344     0.101
     DOOR CONDUCTION          0.000     0.000     0.000   0.000                        0.000     0.000
     INTERNAL SURFACE COND    0.000     0.000     0.000   0.000                        0.000     0.000
     UNDERGROUND SURF COND   -0.480    -0.141     0.000   0.000                       -1.036    -0.303
     OCCUPANTS TO SPACE       1.915     0.561     2.042   0.598                        0.000     0.000
     LIGHT     TO SPACE       0.841     0.246     0.000   0.000                        0.000     0.000
     EQUIPMENT TO SPACE       5.028     1.473     0.000   0.000                        0.000     0.000
     PROCESS   TO SPACE       0.000     0.000     0.000   0.000                        0.000     0.000
     INFILTRATION             0.396     0.116     0.000   0.000                       -1.464    -0.429
                           --------   -------   -------  ------                     --------  --------
     TOTAL                   17.045     4.994     2.042   0.598                      -10.318    -3.023
     TOTAL / AREA             0.010     0.031     0.001   0.004                       -0.006    -0.019

     TOTAL LOAD              19.087 KBTU/H        5.593  KW                -10.318 KBTU/H       -3.023  KW
     TOTAL LOAD / AREA       11.07  BTU/H.SQFT   34.898  W/M2                5.981 BTU/H.SQFT   18.864  W/M2


                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
```

Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

```
3-Story Office Bldg                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-B Space Peak Load Components     West Perim Space (G.W4)                  WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

SPACE  West Perim Space (G.W4)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER        1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA      1275  SQFT       118    M2
                    VOLUME          11475  CUFT       325    M3

                                              COOLING  LOAD                               HEATING  LOAD
                                         ==========================                ==========================
    TIME                                          APR  4  5PM                              JAN  1  7AM

    DRY-BULB TEMP                          81 F             27 C                   39 F             4 C
    WET-BULB TEMP                          52 F             11 C                   31 F            -1 C
    TOT HORIZONTAL SOLAR RAD              168 BTU/H.SQFT   529 W/M2                 0 BTU/H.SQFT    0 W/M2
    WINDSPEED AT SPACE                   13.1 KTS          6.7 M/S                2.6 KTS          1.3 M/S
    CLOUD AMOUNT 0(CLEAR)-10                1                                       1


                                  SENSIBLE             LATENT                                  SENSIBLE
                               (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                        (KBTU/H)  ( KW )
                               --------    ------  --------  ------                        --------  --------

     WALL CONDUCTION              1.192     0.349     0.000   0.000                          -1.224    -0.359
     ROOF CONDUCTION              0.000     0.000     0.000   0.000                           0.000     0.000
     WINDOW GLASS+FRM COND        7.115     2.085     0.000   0.000                          -4.782    -1.401
     WINDOW GLASS SOLAR          11.966     3.506     0.000   0.000                           0.624     0.183
     DOOR CONDUCTION              0.000     0.000     0.000   0.000                           0.000     0.000
     INTERNAL SURFACE COND        0.000     0.000     0.000   0.000                           0.000     0.000
     UNDERGROUND SURF COND       -0.841    -0.246     0.000   0.000                          -0.796    -0.233
     OCCUPANTS TO SPACE           1.433     0.420     1.509   0.442                           0.000     0.000
     LIGHT     TO SPACE           0.647     0.190     0.000   0.000                           0.000     0.000
     EQUIPMENT TO SPACE           3.751     1.099     0.000   0.000                           0.000     0.000
     PROCESS   TO SPACE           0.000     0.000     0.000   0.000                           0.000     0.000
     INFILTRATION                 0.496     0.145     0.000   0.000                          -1.126    -0.330
                               --------   -------   -------  ------                        --------  --------
     TOTAL                       25.759     7.547     1.509   0.442                          -7.303    -2.140
     TOTAL / AREA                 0.020     0.064     0.001   0.004                          -0.006    -0.018

     TOTAL LOAD                  27.269 KBTU/H        7.990  KW                  -7.303 KBTU/H       -2.140  KW
     TOTAL LOAD / AREA           21.39  BTU/H.SQFT   67.451  W/M2                 5.728 BTU/H.SQFT   18.066  W/M2

                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
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Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

```
3-Story Office Bldg                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-B Space Peak Load Components     Core Space (G.C5)                         WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

SPACE  Core Space (G.C5)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER        1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA      7000  SQFT       650   M2
                    VOLUME          63000  CUFT      1784   M3

                                          COOLING  LOAD                           HEATING  LOAD
                                     ==========================           ==========================
    TIME                                   AUG 31  5PM                             JAN  1  7AM

    DRY-BULB TEMP                        83 F            28 C              39 F             4 C
    WET-BULB TEMP                        63 F            17 C              31 F            -1 C
    TOT HORIZONTAL SOLAR RAD            162 BTU/H.SQFT  510 W/M2            0 BTU/H.SQFT    0 W/M2
    WINDSPEED AT SPACE                  7.2 KTS         3.7 M/S           2.6 KTS         1.3 M/S
    CLOUD AMOUNT 0(CLEAR)-10              2                                 1


                                  SENSIBLE           LATENT                                 SENSIBLE
                              (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                    (KBTU/H)  ( KW )
                              --------    ------  --------  ------                    --------  --------

     WALL CONDUCTION            0.000      0.000     0.000  0.000                        0.000     0.000
     ROOF CONDUCTION            0.000      0.000     0.000  0.000                        0.000     0.000
     WINDOW GLASS+FRM COND      0.000      0.000     0.000  0.000                        0.000     0.000
     WINDOW GLASS SOLAR         0.000      0.000     0.000  0.000                        0.000     0.000
     DOOR CONDUCTION            0.000      0.000     0.000  0.000                        0.000     0.000
     INTERNAL SURFACE COND      0.000      0.000     0.000  0.000                        0.000     0.000
     UNDERGROUND SURF COND     -0.349     -0.102     0.000  0.000                       -0.754    -0.221
     OCCUPANTS TO SPACE        11.854      3.473    10.949  3.208                        0.000     0.000
     LIGHT     TO SPACE        22.657      6.638     0.000  0.000                        0.000     0.000
     EQUIPMENT TO SPACE        18.394      5.390     0.000  0.000                        0.000     0.000
     PROCESS   TO SPACE         0.000      0.000     0.000  0.000                        0.000     0.000
     INFILTRATION               0.119      0.035     0.000  0.000                       -0.230    -0.068
                              --------   -------   -------  ------                    --------  --------
     TOTAL                     52.674     15.433    10.949  3.208                       -0.985    -0.289
     TOTAL / AREA               0.008      0.024     0.002  0.005                        0.000     0.000

     TOTAL LOAD                63.623 KBTU/H      18.641  KW               -0.985 KBTU/H       -0.289  KW
     TOTAL LOAD / AREA          9.09  BTU/H.SQFT  28.665  W/M2              0.141 BTU/H.SQFT    0.444  W/M2

                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
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Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

```
3-Story Office Bldg                                                       DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-B Space Peak Load Components     Plenum (G.6)                               WEATHER FILE- CZ06RV2 WYEC2
----------------------------------------------------------------------------------------------------------------------------------

SPACE  Plenum (G.6)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS   70 F /  21 C

                    MULTIPLIER       1.0          FLOOR MULTIPLIER        1.0

                    FLOOR  AREA     13000  SQFT      1208    M2
                    VOLUME          52000  CUFT      1473    M3

                                             COOLING  LOAD                           HEATING  LOAD
                                        ==========================           ==========================
    TIME                                       AUG 31  5PM                          DEC 29  7AM

    DRY-BULB TEMP                         83 F              28 C              39 F              4 C
    WET-BULB TEMP                         63 F              17 C              31 F             -1 C
    TOT HORIZONTAL SOLAR RAD             162 BTU/H.SQFT    510 W/M2            0 BTU/H.SQFT     0 W/M2
    WINDSPEED AT SPACE                   7.8 KTS           4.0 M/S           3.5 KTS          1.8 M/S
    CLOUD AMOUNT 0(CLEAR)-10               2                                   1


                                     SENSIBLE            LATENT                                  SENSIBLE
                               (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                         (KBTU/H)  ( KW )
                               --------    ------  --------  ------                         --------  --------

     WALL CONDUCTION              3.344     0.980     0.000   0.000                           -4.431    -1.298
     ROOF CONDUCTION              0.000     0.000     0.000   0.000                            0.000     0.000
     WINDOW GLASS+FRM COND        0.000     0.000     0.000   0.000                            0.000     0.000
     WINDOW GLASS SOLAR           0.000     0.000     0.000   0.000                            0.000     0.000
     DOOR CONDUCTION              0.000     0.000     0.000   0.000                            0.000     0.000
     INTERNAL SURFACE COND        0.000     0.000     0.000   0.000                            0.000     0.000
     UNDERGROUND SURF COND        0.000     0.000     0.000   0.000                            0.000     0.000
     OCCUPANTS TO SPACE           0.000     0.000     0.000   0.000                            0.000     0.000
     LIGHT     TO SPACE           0.000     0.000     0.000   0.000                            0.000     0.000
     EQUIPMENT TO SPACE           0.000     0.000     0.000   0.000                            0.000     0.000
     PROCESS   TO SPACE           0.000     0.000     0.000   0.000                            0.000     0.000
     INFILTRATION                 0.475     0.139     0.000   0.000                           -2.302    -0.674
                               --------   -------   -------  ------                         --------  --------
     TOTAL                        3.819     1.119     0.000   0.000                           -6.732    -1.973
     TOTAL / AREA                 0.000     0.001     0.000   0.000                           -0.001    -0.002

     TOTAL LOAD                   3.819 KBTU/H        1.119  KW                  -6.732 KBTU/H       -1.973  KW
     TOTAL LOAD / AREA            0.29  BTU/H.SQFT    0.926  W/M2                 0.518 BTU/H.SQFT    1.633  W/M2

                                ****************************************************************
                                *                                                              *
                                *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                *  ----    LOADS                                               *
                                *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                *          IN CONSIDERATION                                    *
                                *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                *                                                              *
                                ****************************************************************
```

Important Note:
Loads reported here, i.e., at the space level, are reported BEFORE the application of Space and Floor Multipliers, if any.

One LS-C report only (this is a building level report)

```
3-Story Office Bldg                                                                 DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-C BuiLding Peak Load Components                                                     WEATHER FILE- CZ06RV2 WYEC2
-----------------------------------------------------------------------------------------------------------------------------------

*** BUILDING ***

                  FLOOR  AREA      39000  SQFT      3623    M2
                  VOLUME          507000  CUFT     14358    M3

                                                COOLING  LOAD                                HEATING  LOAD
                                           ==========================                 ==========================
    TIME                                          DEC 19  3PM                                  JAN  1  7AM

    DRY-BULB TEMP                           77 F              25 C                    39 F              4 C
    WET-BULB TEMP                           53 F              12 C                    31 F             -1 C
    TOT HORIZONTAL SOLAR RAD               101 BTU/H.SQFT    318 W/M2                  0 BTU/H.SQFT     0 W/M2
    WINDSPEED AT SPACE                     2.1 KTS           1.1 M/S                 2.8 KTS          1.5 M/S
    CLOUD AMOUNT 0(CLEAR)-10                 0                                         1

                                          SENSIBLE               LATENT                            SENSIBLE
                                     (KBTU/H)     ( KW )   (KBTU/H)  ( KW )                   (KBTU/H)  ( KW )
                                     --------     ------   --------  ------                   --------  --------

     WALL CONDUCTION                   16.158      4.734      0.000   0.000                    -17.857    -5.232
     ROOF CONDUCTION                   -0.078     -0.023      0.000   0.000                     -0.273    -0.080
     WINDOW GLASS+FRM COND             63.958     18.740      0.000   0.000                    -77.499   -22.707
     WINDOW GLASS SOLAR               101.405     29.712      0.000   0.000                      5.656     1.657
     DOOR CONDUCTION                    0.000      0.000      0.000   0.000                      0.000     0.000
     INTERNAL SURFACE COND              0.000      0.000      0.000   0.000                      0.000     0.000
     UNDERGROUND SURF COND             -3.740     -1.096      0.000   0.000                     -4.419    -1.295
     OCCUPANTS TO SPACE                60.187     17.635     56.600  16.584                      0.000     0.000
     LIGHT     TO SPACE                79.619     23.328      0.000   0.000                      0.000     0.000
     EQUIPMENT TO SPACE               128.437     37.632      0.000   0.000                      0.000     0.000
     PROCESS   TO SPACE                 0.000      0.000      0.000   0.000                      0.000     0.000
     INFILTRATION                       1.826      0.535      0.000   0.000                    -16.228    -4.755
                                     --------    -------    -------  ------                   --------  --------
     TOTAL                            447.772    131.197     56.600  16.584                   -110.620   -32.412
     TOTAL / AREA                       0.011      0.036      0.001   0.005                     -0.003    -0.009

     TOTAL LOAD                       504.372 KBTU/H      147.781   KW             -110.620 KBTU/H      -32.412   KW
     TOTAL LOAD / AREA                 12.93  BTU/H.SQFT   40.787   W/M2              2.836 BTU/H.SQFT    8.946   W/M2


                                 ****************************************************************
                                 *                                                              *
                                 *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                                 *  ----    LOADS                                               *
                                 *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                                 *          IN CONSIDERATION                                    *
                                 *        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A           *
                                 *          CONSTANT INDOOR SPACE TEMPERATURE                   *
                                 *                                                              *
                                 ****************************************************************
```

This is the only place total conditioned area is reported.

Important Note:
Loads reported here, i.e., at the Bldg. level, are reported AFTER the application of Space and Floor Multipliers, if any.

This outdoor air condition is used as the ventilation air temperature for coil sizing.

Outside ventilation air is accounted for in the SYSTEMS part of the program, i.e., in "SS-" reports)

***** Important Report *****

One LS-D report only (this is a building level report)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-D** Building Monthly Loads Summary WEATHER FILE- CZ06RV2 WYEC2

Sensible only

"MBTU" = Btu x 1,000,000

	- - - - - - - C O O L I N G - - - - - - -						- - - - - - - - H E A T I N G - - - - - - - -						- - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	90.14034	10	15	70.F	52.F	412.483	-16.043	1	7	39.F	31.F	-110.620	19061.	85.960
FEB	80.68713	13	16	70.F	55.F	425.604	-13.641	11	4	42.F	42.F	-84.761	16189.	79.843
MAR	91.65997	6	16	72.F	52.F	408.699	-14.975	11	6	47.F	46.F	-77.978	18505.	70.593
APR	87.09530	4	16	81.F	52.F	420.446	-11.356	1	6	49.F	42.F	-63.547	17110.	69.208
MAY	94.55062	29	16	71.F	63.F	380.400	-8.053	20	4	48.F	44.F	-69.090	17696.	66.893
JUN	98.43995	14	16	80.F	70.F	411.169	-4.127	3	24	55.F	53.F	-42.942	17347.	66.539
JUL	102.93888	10	16	85.F	67.F	428.373	-2.786	1	24	56.F	54.F	-36.997	16949.	66.694
AUG	109.76257	31	16	83.F	63.F	422.272	-1.479	26	5	57.F	55.F	-38.954	18517.	67.593
SEP	93.07864	7	16	79.F	71.F	414.604	-2.375	30	5	56.F	56.F	-38.000	16134.	69.430
OCT	95.27404	3	15	78.F	70.F	407.345	-5.605	28	24	54.F	46.F	-54.647	18248.	76.255
NOV	85.40744	29	15	80.F	59.F	428.962	-11.688	12	6	44.F	40.F	-88.206	17313.	87.964
DEC	84.24862	19	15	77.F	53.F	447.772	-18.967	30	5	40.F	32.F	-94.844	18037.	88.828
	---------					----------	---------					----------	--------	-------
TOTAL	1113.284						-111.095						211107.	
MAX						447.772						-110.620		88.828

For components, see LS-F

For components, see LS-C

Includes only items know about by the LOADS program, i.e., lights & plugs… Fans, DX compressors, reheat, etc., are included on "SS-" reports.

Important Note:
Loads reported here are based on maintaining an assumed constant indoor temperature, i.e., this implies 24x7 loads (fan hours only coil loads, see "SS-D").

***** Important Report *****

One LS-E report per space — only six are shown here (one each for the ground floor zones (others have been omitted for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-E** Space Monthly Load Components South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
JAN	HEATNG	-0.289	0.000	0.000	-0.377	-0.312	-1.299	0.871	0.041	0.101	0.332	0.000	-0.931
	SEN CL	0.197	0.000	0.000	-0.394	-0.168	0.864	4.192	0.401	0.308	1.183	0.000	6.583
	LAT CL					0.019			0.418		0.000	0.000	0.437
FEB	HEATNG	-0.262	0.000	0.000	-0.409	-0.296	-1.207	0.737	0.043	0.096	0.337	0.000	-0.961
	SEN CL	0.201	0.000	0.000	-0.350	-0.116	0.804	3.101	0.343	0.219	1.001	0.000	5.203
	LAT CL					0.031			0.363		0.000	0.000	0.394
MAR	HEATNG	-0.319	0.000	0.000	-0.478	-0.351	-1.495	0.699	0.054	0.106	0.421	0.000	-1.362
	SEN CL	0.160	0.000	0.000	-0.369	-0.110	0.453	2.522	0.396	0.211	1.145	0.000	4.407
	LAT CL					0.026			0.421		0.000	0.000	0.447
APR	HEATNG	-0.279	0.000	0.000	-0.443	-0.295	-1.289	0.450	0.048	0.102	0.383	0.000	-1.324
	SEN CL	0.093	0.000	0.000	-0.344	-0.069	0.069	1.462	0.377	0.184	1.080	0.000	2.851
	LAT CL					0.013			0.400		0.000	0.000	0.412
MAY	HEATNG	-0.238	0.000	0.000	-0.357	-0.240	-1.054	0.395	0.046	0.095	0.370	0.000	-0.984
	SEN CL	0.046	0.000	0.000	-0.322	-0.067	0.122	1.462	0.398	0.198	1.154	0.000	2.991
	LAT CL					0.055			0.418		0.000	0.000	0.473
JUN	HEATNG	-0.157	0.000	0.000	-0.237	-0.160	-0.682	0.299	0.037	0.075	0.309	0.000	-0.515
	SEN CL	0.076	0.000	0.000	-0.291	-0.039	0.308	1.430	0.393	0.208	1.194	0.000	3.279
	LAT CL					0.195			0.403		0.000	0.000	0.598
JUL	HEATNG	-0.119	0.000	0.000	-0.169	-0.116	-0.512	0.252	0.029	0.060	0.247	0.000	-0.328
	SEN CL	0.121	0.000	0.000	-0.262	-0.010	0.478	1.503	0.395	0.214	1.214	0.000	3.653
	LAT CL					0.219			0.400		0.000	0.000	0.619
AUG	HEATNG	-0.069	0.000	0.000	-0.084	-0.062	-0.274	0.150	0.017	0.037	0.149	0.000	-0.136
	SEN CL	0.167	0.000	0.000	-0.274	-0.016	0.514	1.686	0.447	0.275	1.439	0.000	4.239
	LAT CL					0.304			0.436		0.000	0.000	0.740
SEP	HEATNG	-0.074	0.000	0.000	-0.093	-0.078	-0.327	0.186	0.017	0.040	0.151	0.000	-0.179
	SEN CL	0.242	0.000	0.000	-0.247	-0.018	0.515	1.768	0.375	0.247	1.233	0.000	4.115
	LAT CL					0.282			0.366		0.000	0.000	0.648
OCT	HEATNG	-0.134	0.000	0.000	-0.140	-0.141	-0.579	0.343	0.025	0.057	0.217	0.000	-0.352
	SEN CL	0.252	0.000	0.000	-0.270	-0.069	0.650	2.548	0.417	0.291	1.300	0.000	5.119
	LAT CL					0.166			0.418		0.000	0.000	0.584
NOV	HEATNG	-0.220	0.000	0.000	-0.223	-0.234	-0.990	0.568	0.032	0.082	0.270	0.000	-0.714
	SEN CL	0.230	0.000	0.000	-0.283	-0.106	0.781	3.296	0.373	0.313	1.131	0.000	5.734
	LAT CL					0.039			0.381		0.000	0.000	0.420
DEC	HEATNG	-0.339	0.000	0.000	-0.342	-0.366	-1.485	0.857	0.043	0.109	0.350	0.000	-1.172
	SEN CL	0.230	0.000	0.000	-0.309	-0.152	0.988	3.817	0.367	0.316	1.090	0.000	6.345
	LAT CL					0.004			0.385		0.000	0.000	0.388
TOT	HEATNG	-2.499	0.000	0.000	-3.351	-2.650	-11.192	5.805	0.432	0.961	3.536	0.000	-8.957
	SEN CL	2.014	0.000	0.000	-3.715	-0.942	6.547	28.787	4.681	2.984	14.163	0.000	54.520
	LAT CL					1.351			4.808		0.000	0.000	6.160

One LS-E report per space — only six are shown here (page 2 of 6)

3-Story Office Bldg　　DOE-B2.2NT38　4/07/2001　10:36:50　BDL RUN 2

REPORT- **LS-E** Space Monthly Load Components　East Perim Space (G.E2)　　WEATHER FILE- CZ06RV2 WYEC2

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	-0.275	0.000	0.000	-0.354	-0.275	-1.192	0.284	0.039	0.118	0.307	0.000	-1.347
JAN	SEN CL	-0.009	0.000	0.000	-0.239	-0.094	0.051	1.012	0.287	0.251	0.813	0.000	2.071
	LAT CL					0.011			0.309		0.000	0.000	0.320
	HEATNG	-0.229	0.000	0.000	-0.337	-0.238	-0.996	0.293	0.034	0.083	0.267	0.000	-1.123
FEB	SEN CL	0.040	0.000	0.000	-0.247	-0.079	0.245	1.159	0.251	0.179	0.722	0.000	2.270
	LAT CL					0.021			0.268		0.000	0.000	0.289
	HEATNG	-0.251	0.000	0.000	-0.362	-0.261	-1.092	0.374	0.039	0.085	0.305	0.000	-1.164
MAR	SEN CL	0.048	0.000	0.000	-0.289	-0.093	0.255	1.438	0.293	0.190	0.852	0.000	2.694
	LAT CL					0.020			0.311		0.000	0.000	0.331
	HEATNG	-0.192	0.000	0.000	-0.311	-0.207	-0.844	0.371	0.033	0.069	0.260	0.000	-0.820
APR	SEN CL	0.092	0.000	0.000	-0.294	-0.074	0.433	1.612	0.281	0.146	0.820	0.000	3.016
	LAT CL					0.010			0.295		0.000	0.000	0.305
	HEATNG	-0.160	0.000	0.000	-0.252	-0.170	-0.696	0.303	0.031	0.062	0.251	0.000	-0.630
MAY	SEN CL	0.099	0.000	0.000	-0.271	-0.067	0.412	1.466	0.297	0.153	0.874	0.000	2.962
	LAT CL					0.046			0.309		0.000	0.000	0.354
	HEATNG	-0.099	0.000	0.000	-0.156	-0.108	-0.428	0.233	0.023	0.047	0.194	0.000	-0.295
JUN	SEN CL	0.139	0.000	0.000	-0.251	-0.045	0.552	1.502	0.295	0.161	0.917	0.000	3.269
	LAT CL					0.165			0.298		0.000	0.000	0.463
	HEATNG	-0.064	0.000	0.000	-0.093	-0.068	-0.276	0.176	0.013	0.029	0.121	0.000	-0.162
JUL	SEN CL	0.202	0.000	0.000	-0.239	-0.028	0.751	1.747	0.299	0.172	0.958	0.000	3.863
	LAT CL					0.192			0.295		0.000	0.000	0.488
	HEATNG	-0.039	0.000	0.000	-0.046	-0.037	-0.149	0.097	0.009	0.020	0.080	0.000	-0.065
AUG	SEN CL	0.211	0.000	0.000	-0.229	-0.023	0.824	1.797	0.333	0.210	1.093	0.000	4.217
	LAT CL					0.254			0.323		0.000	0.000	0.577
	HEATNG	-0.061	0.000	0.000	-0.074	-0.062	-0.244	0.136	0.013	0.031	0.118	0.000	-0.142
SEP	SEN CL	0.151	0.000	0.000	-0.187	-0.012	0.607	1.261	0.277	0.183	0.904	0.000	3.183
	LAT CL					0.214			0.271		0.000	0.000	0.484
	HEATNG	-0.128	0.000	0.000	-0.138	-0.128	-0.525	0.194	0.026	0.065	0.216	0.000	-0.419
OCT	SEN CL	0.095	0.000	0.000	-0.177	-0.034	0.436	1.095	0.300	0.214	0.905	0.000	2.834
	LAT CL					0.107			0.309		0.000	0.000	0.416
	HEATNG	-0.204	0.000	0.000	-0.213	-0.204	-0.882	0.239	0.033	0.086	0.258	0.000	-0.888
NOV	SEN CL	0.032	0.000	0.000	-0.175	-0.058	0.187	0.918	0.267	0.248	0.777	0.000	2.195
	LAT CL					0.019			0.282		0.000	0.000	0.301
	HEATNG	-0.320	0.000	0.000	-0.308	-0.315	-1.330	0.258	0.039	0.120	0.304	0.000	-1.553
DEC	SEN CL	-0.012	0.000	0.000	-0.193	-0.084	0.026	0.836	0.264	0.244	0.759	0.000	1.840
	LAT CL					0.002			0.284		0.000	0.000	0.286
	HEATNG	-2.022	0.000	0.000	-2.645	-2.073	-8.654	2.958	0.334	0.814	2.680	0.000	-8.608
TOT	SEN CL	1.087	0.000	0.000	-2.790	-0.690	4.777	15.841	3.443	2.353	10.393	0.000	34.414
	LAT CL					1.059			3.554		0.000	0.000	4.613

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-E** Space Monthly Load Components North Perim Space (G.N3) WEATHER FILE- CZ06RV2 WYEC2

	(UNITS=MBTU)	WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
JAN	HEATNG	-0.432	0.000	0.000	-0.520	-0.405	-1.836	0.249	0.059	0.222	0.457	0.000	-2.205
	SEN CL	-0.108	0.000	0.000	-0.251	-0.075	-0.333	0.468	0.382	0.350	1.058	0.000	1.491
	LAT CL					0.013			0.418		0.000	0.000	0.431
FEB	HEATNG	-0.356	0.000	0.000	-0.486	-0.342	-1.511	0.240	0.050	0.145	0.395	0.000	-1.864
	SEN CL	-0.076	0.000	0.000	-0.273	-0.070	-0.209	0.587	0.336	0.240	0.943	0.000	1.477
	LAT CL					0.025			0.363		0.000	0.000	0.388
MAR	HEATNG	-0.396	0.000	0.000	-0.532	-0.384	-1.700	0.340	0.060	0.134	0.463	0.000	-2.014
	SEN CL	-0.070	0.000	0.000	-0.314	-0.077	-0.183	0.817	0.390	0.218	1.103	0.000	1.884
	LAT CL					0.024			0.421		0.000	0.000	0.445
APR	HEATNG	-0.298	0.000	0.000	-0.451	-0.298	-1.294	0.347	0.049	0.106	0.389	0.000	-1.450
	SEN CL	-0.034	0.000	0.000	-0.336	-0.067	-0.019	1.014	0.376	0.184	1.074	0.000	2.192
	LAT CL					0.012			0.400		0.000	0.000	0.412
MAY	HEATNG	-0.227	0.000	0.000	-0.344	-0.233	-1.001	0.352	0.044	0.091	0.355	0.000	-0.963
	SEN CL	0.013	0.000	0.000	-0.336	-0.074	0.135	1.328	0.400	0.202	1.169	0.000	2.837
	LAT CL					0.058			0.418		0.000	0.000	0.475
JUN	HEATNG	-0.138	0.000	0.000	-0.217	-0.148	-0.617	0.274	0.034	0.068	0.282	0.000	-0.460
	SEN CL	0.083	0.000	0.000	-0.312	-0.051	0.383	1.493	0.397	0.214	1.221	0.000	3.427
	LAT CL					0.206			0.403		0.000	0.000	0.609
JUL	HEATNG	-0.108	0.000	0.000	-0.159	-0.110	-0.479	0.236	0.027	0.057	0.234	0.000	-0.303
	SEN CL	0.112	0.000	0.000	-0.271	-0.015	0.533	1.481	0.396	0.217	1.227	0.000	3.680
	LAT CL					0.226			0.400		0.000	0.000	0.625
AUG	HEATNG	-0.078	0.000	0.000	-0.094	-0.069	-0.302	0.136	0.020	0.043	0.173	0.000	-0.171
	SEN CL	0.094	0.000	0.000	-0.264	-0.010	0.490	1.345	0.444	0.269	1.415	0.000	3.783
	LAT CL					0.292			0.436		0.000	0.000	0.728
SEP	HEATNG	-0.099	0.000	0.000	-0.120	-0.093	-0.399	0.156	0.023	0.053	0.201	0.000	-0.278
	SEN CL	0.068	0.000	0.000	-0.220	-0.003	0.397	1.062	0.369	0.236	1.183	0.000	3.093
	LAT CL					0.250			0.366		0.000	0.000	0.616
OCT	HEATNG	-0.201	0.000	0.000	-0.204	-0.186	-0.820	0.198	0.042	0.109	0.339	0.000	-0.724
	SEN CL	0.018	0.000	0.000	-0.205	-0.025	0.188	0.837	0.400	0.276	1.178	0.000	2.667
	LAT CL					0.125			0.418		0.000	0.000	0.543
NOV	HEATNG	-0.323	0.000	0.000	-0.316	-0.299	-1.374	0.221	0.051	0.145	0.398	0.000	-1.498
	SEN CL	-0.049	0.000	0.000	-0.190	-0.042	-0.085	0.554	0.355	0.329	1.003	0.000	1.876
	LAT CL					0.019			0.381		0.000	0.000	0.401
DEC	HEATNG	-0.488	0.000	0.000	-0.445	-0.449	-1.993	0.238	0.058	0.216	0.452	0.000	-2.410
	SEN CL	-0.099	0.000	0.000	-0.207	-0.069	-0.291	0.444	0.352	0.351	0.988	0.000	1.469
	LAT CL					0.002			0.384		0.000	0.000	0.386
TOT	HEATNG	-3.143	0.000	0.000	-3.888	-3.014	-13.326	2.989	0.517	1.389	4.137	0.000	-14.340
	SEN CL	-0.049	0.000	0.000	-3.178	-0.578	1.007	11.431	4.596	3.085	13.563	0.000	29.877
	LAT CL					1.251			4.808		0.000	0.000	6.059

One LS-E report per space — only six are shown here (page 4 of 6)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-E** Space Monthly Load Components West Perim Space (G.W4) WEATHER FILE- CZ06RV2 WYEC2

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	-0.281	0.000	0.000	-0.366	-0.291	-1.235	0.353	0.039	0.124	0.311	0.000	-1.347
JAN	SEN CL	-0.028	0.000	0.000	-0.226	-0.078	0.029	0.991	0.287	0.230	0.808	0.000	2.013
	LAT CL					0.012			0.309		0.000	0.000	0.321
	HEATNG	-0.230	0.000	0.000	-0.344	-0.248	-1.017	0.339	0.034	0.093	0.270	0.000	-1.104
FEB	SEN CL	0.006	0.000	0.000	-0.240	-0.069	0.131	1.079	0.251	0.168	0.718	0.000	2.045
	LAT CL					0.022			0.268		0.000	0.000	0.290
	HEATNG	-0.247	0.000	0.000	-0.366	-0.271	-1.107	0.490	0.038	0.084	0.304	0.000	-1.076
MAR	SEN CL	0.041	0.000	0.000	-0.285	-0.084	0.257	1.688	0.295	0.159	0.853	0.000	2.923
	LAT CL					0.021			0.311		0.000	0.000	0.332
	HEATNG	-0.187	0.000	0.000	-0.298	-0.205	-0.822	0.445	0.028	0.072	0.242	0.000	-0.724
APR	SEN CL	0.062	0.000	0.000	-0.307	-0.076	0.323	1.840	0.285	0.153	0.839	0.000	3.120
	LAT CL					0.011			0.295		0.000	0.000	0.306
	HEATNG	-0.141	0.000	0.000	-0.222	-0.157	-0.622	0.396	0.025	0.056	0.214	0.000	-0.452
MAY	SEN CL	0.118	0.000	0.000	-0.301	-0.079	0.467	2.099	0.303	0.161	0.912	0.000	3.680
	LAT CL					0.053			0.309		0.000	0.000	0.362
	HEATNG	-0.078	0.000	0.000	-0.116	-0.085	-0.330	0.251	0.016	0.034	0.139	0.000	-0.168
JUN	SEN CL	0.155	0.000	0.000	-0.291	-0.068	0.595	2.223	0.302	0.174	0.971	0.000	4.063
	LAT CL					0.185			0.298		0.000	0.000	0.483
	HEATNG	-0.040	0.000	0.000	-0.056	-0.045	-0.173	0.154	0.007	0.015	0.064	0.000	-0.074
JUL	SEN CL	0.174	0.000	0.000	-0.275	-0.052	0.676	2.339	0.306	0.187	1.015	0.000	4.371
	LAT CL					0.213			0.295		0.000	0.000	0.509
	HEATNG	-0.020	0.000	0.000	-0.023	-0.021	-0.080	0.066	0.004	0.008	0.033	0.000	-0.033
AUG	SEN CL	0.188	0.000	0.000	-0.252	-0.039	0.717	2.206	0.339	0.225	1.140	0.000	4.524
	LAT CL					0.278			0.323		0.000	0.000	0.600
	HEATNG	-0.041	0.000	0.000	-0.046	-0.043	-0.165	0.119	0.008	0.017	0.069	0.000	-0.082
SEP	SEN CL	0.152	0.000	0.000	-0.215	-0.031	0.608	1.881	0.282	0.198	0.953	0.000	3.828
	LAT CL					0.242			0.271		0.000	0.000	0.513
	HEATNG	-0.117	0.000	0.000	-0.118	-0.119	-0.475	0.227	0.021	0.056	0.179	0.000	-0.346
OCT	SEN CL	0.089	0.000	0.000	-0.197	-0.043	0.398	1.422	0.306	0.213	0.942	0.000	3.130
	LAT CL					0.123			0.309		0.000	0.000	0.432
	HEATNG	-0.217	0.000	0.000	-0.221	-0.219	-0.926	0.291	0.033	0.090	0.265	0.000	-0.904
NOV	SEN CL	0.027	0.000	0.000	-0.167	-0.043	0.195	0.973	0.267	0.212	0.770	0.000	2.233
	LAT CL					0.020			0.282		0.000	0.000	0.302
	HEATNG	-0.319	0.000	0.000	-0.314	-0.325	-1.349	0.304	0.038	0.124	0.308	0.000	-1.533
DEC	SEN CL	-0.017	0.000	0.000	-0.187	-0.074	0.069	0.859	0.264	0.228	0.756	0.000	1.899
	LAT CL					0.002			0.284		0.000	0.000	0.286
	HEATNG	-1.919	0.000	0.000	-2.492	-2.028	-8.301	3.436	0.290	0.773	2.398	0.000	-7.843
TOT	SEN CL	0.966	0.000	0.000	-2.942	-0.735	4.466	19.602	3.487	2.309	10.675	0.000	37.829
	LAT CL					1.183			3.554		0.000	0.000	4.737

One LS-E report per space — only six are shown here (page 5 of 6)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- LS-E Space Monthly Load Components Core Space (G.C5) WEATHER FILE- CZ06RV2 WYEC2

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	0.000	0.000	0.000	-0.055	-0.008	0.000	0.000	0.001	0.010	0.008	0.000	-0.044
JAN	SEN CL	0.000	0.000	0.000	-0.506	-0.068	0.000	0.000	2.671	6.325	5.536	0.000	13.958
	LAT CL					0.005			2.241		0.000	0.000	2.246
	HEATNG	0.000	0.000	0.000	-0.062	-0.006	0.000	0.000	0.001	0.011	0.009	0.000	-0.046
FEB	SEN CL	0.000	0.000	0.000	-0.491	-0.059	0.000	0.000	2.326	5.561	4.871	0.000	12.207
	LAT CL					0.007			1.945		0.000	0.000	1.952
	HEATNG	0.000	0.000	0.000	-0.042	-0.004	0.000	0.000	0.001	0.011	0.009	0.000	-0.026
MAR	SEN CL	0.000	0.000	0.000	-0.574	-0.068	0.000	0.000	2.709	6.507	5.699	0.000	14.273
	LAT CL					0.005			2.259		0.000	0.000	2.264
	HEATNG	0.000	0.000	0.000	-0.051	-0.004	0.000	0.000	0.001	0.012	0.010	0.000	-0.031
APR	SEN CL	0.000	0.000	0.000	-0.522	-0.053	0.000	0.000	2.556	6.078	5.320	0.000	13.378
	LAT CL					0.003			2.142		0.000	0.000	2.146
	HEATNG	0.000	0.000	0.000	-0.047	-0.003	0.000	0.000	0.001	0.008	0.007	0.000	-0.034
MAY	SEN CL	0.000	0.000	0.000	-0.448	-0.045	0.000	0.000	2.680	6.356	5.555	0.000	14.098
	LAT CL					0.014			2.241		0.000	0.000	2.255
	HEATNG	0.000	0.000	0.000	-0.021	-0.002	0.000	0.000	0.001	0.006	0.005	0.000	-0.012
JUN	SEN CL	0.000	0.000	0.000	-0.364	-0.029	0.000	0.000	2.591	6.245	5.474	0.000	13.917
	LAT CL					0.044			2.161		0.000	0.000	2.205
	HEATNG	0.000	0.000	0.000	-0.019	-0.002	0.000	0.000	0.001	0.006	0.005	0.000	-0.009
JUL	SEN CL	0.000	0.000	0.000	-0.295	-0.018	0.000	0.000	2.556	6.081	5.324	0.000	13.649
	LAT CL					0.046			2.142		0.000	0.000	2.189
	HEATNG	0.000	0.000	0.000	-0.010	-0.001	0.000	0.000	0.000	0.003	0.003	0.000	-0.004
AUG	SEN CL	0.000	0.000	0.000	-0.250	-0.012	0.000	0.000	2.799	6.627	5.788	0.000	14.952
	LAT CL					0.058			2.339		0.000	0.000	2.398
	HEATNG	0.000	0.000	0.000	-0.021	-0.002	0.000	0.000	0.001	0.005	0.004	0.000	-0.013
SEP	SEN CL	0.000	0.000	0.000	-0.227	-0.013	0.000	0.000	2.356	5.731	5.031	0.000	12.878
	LAT CL					0.053			1.963		0.000	0.000	2.016
	HEATNG	0.000	0.000	0.000	-0.023	-0.003	0.000	0.000	0.001	0.005	0.004	0.000	-0.016
OCT	SEN CL	0.000	0.000	0.000	-0.276	-0.030	0.000	0.000	2.672	6.330	5.540	0.000	14.236
	LAT CL					0.030			2.241		0.000	0.000	2.271
	HEATNG	0.000	0.000	0.000	-0.035	-0.006	0.000	0.000	0.001	0.008	0.006	0.000	-0.026
NOV	SEN CL	0.000	0.000	0.000	-0.334	-0.048	0.000	0.000	2.444	5.829	5.101	0.000	12.993
	LAT CL					0.008			2.044		0.000	0.000	2.052
	HEATNG	0.000	0.000	0.000	-0.040	-0.007	0.000	0.000	0.002	0.012	0.009	0.000	-0.024
DEC	SEN CL	0.000	0.000	0.000	-0.435	-0.075	0.000	0.000	2.466	5.963	5.237	0.000	13.155
	LAT CL					0.001			2.062		0.000	0.000	2.063
	HEATNG	0.000	0.000	0.000	-0.425	-0.047	0.000	0.000	0.012	0.096	0.079	0.000	-0.286
TOT	SEN CL	0.000	0.000	0.000	-4.722	-0.518	0.000	0.000	30.825	73.632	64.477	0.000	163.693
	LAT CL					0.275			25.780		0.000	0.000	26.055

One LS-E report per space — only six are shown here (page 6 of 6)

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3-Story Office Bldg                                                          DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-E Space Monthly Load Components  Plenum (G.6)                              WEATHER FILE- CZ06RV2 WYEC2
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(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	-1.069	0.000	0.000	0.000	-0.651	0.000	0.000	0.000	0.000	0.000	0.000	-1.720
JAN	SEN CL	0.111	0.000	0.000	0.000	-0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.086
	LAT CL					0.006			0.000		0.000	0.000	0.006
	HEATNG	-0.847	0.000	0.000	0.000	-0.554	0.000	0.000	0.000	0.000	0.000	0.000	-1.401
FEB	SEN CL	0.143	0.000	0.000	0.000	-0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.111
	LAT CL					0.022			0.000		0.000	0.000	0.022
	HEATNG	-0.940	0.000	0.000	0.000	-0.625	0.000	0.000	0.000	0.000	0.000	0.000	-1.566
MAR	SEN CL	0.133	0.000	0.000	0.000	-0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.104
	LAT CL					0.019			0.000		0.000	0.000	0.019
	HEATNG	-0.738	0.000	0.000	0.000	-0.507	0.000	0.000	0.000	0.000	0.000	0.000	-1.245
APR	SEN CL	0.165	0.000	0.000	0.000	-0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.152
	LAT CL					0.007			0.000		0.000	0.000	0.007
	HEATNG	-0.571	0.000	0.000	0.000	-0.411	0.000	0.000	0.000	0.000	0.000	0.000	-0.982
MAY	SEN CL	0.218	0.000	0.000	0.000	-0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.189
	LAT CL					0.051			0.000		0.000	0.000	0.051
	HEATNG	-0.353	0.000	0.000	0.000	-0.275	0.000	0.000	0.000	0.000	0.000	0.000	-0.628
JUN	SEN CL	0.364	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.347
	LAT CL					0.203			0.000		0.000	0.000	0.203
	HEATNG	-0.260	0.000	0.000	0.000	-0.207	0.000	0.000	0.000	0.000	0.000	0.000	-0.466
JUL	SEN CL	0.507	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.523
	LAT CL					0.232			0.000		0.000	0.000	0.232
	HEATNG	-0.208	0.000	0.000	0.000	-0.147	0.000	0.000	0.000	0.000	0.000	0.000	-0.355
AUG	SEN CL	0.609	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.634
	LAT CL					0.240			0.000		0.000	0.000	0.240
	HEATNG	-0.235	0.000	0.000	0.000	-0.174	0.000	0.000	0.000	0.000	0.000	0.000	-0.409
SEP	SEN CL	0.534	0.000	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.562
	LAT CL					0.241			0.000		0.000	0.000	0.241
	HEATNG	-0.465	0.000	0.000	0.000	-0.306	0.000	0.000	0.000	0.000	0.000	0.000	-0.771
OCT	SEN CL	0.374	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.378
	LAT CL					0.119			0.000		0.000	0.000	0.119
	HEATNG	-0.782	0.000	0.000	0.000	-0.482	0.000	0.000	0.000	0.000	0.000	0.000	-1.263
NOV	SEN CL	0.218	0.000	0.000	0.000	-0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.208
	LAT CL					0.014			0.000		0.000	0.000	0.014
	HEATNG	-1.192	0.000	0.000	0.000	-0.719	0.000	0.000	0.000	0.000	0.000	0.000	-1.911
DEC	SEN CL	0.124	0.000	0.000	0.000	-0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.102
	LAT CL					0.001			0.000		0.000	0.000	0.001
	HEATNG	-7.660	0.000	0.000	0.000	-5.057	0.000	0.000	0.000	0.000	0.000	0.000	-12.717
TOT	SEN CL	3.501	0.000	0.000	0.000	-0.104	0.000	0.000	0.000	0.000	0.000	0.000	3.397
	LAT CL					1.155			0.000		0.000	0.000	1.155

One LS-F report only (this is a building level report)

Directly transmitted portion only

Conduction + "inward flowing fraction"

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3-Story Office Bldg                                          DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-F Building Monthly Load Components in    MBTU                      WEATHER FILE- CZ06RV2 WYEC2
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See note below

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
JAN	HEATNG	-3.816	-0.013	0.000	-1.672	-3.673	-16.769	3.210	0.317	1.072	5.300	0.000	-16.043
	SEN CL	0.114	-0.084	0.000	-1.616	-1.651	-0.775	24.418	13.414	22.245	34.076	0.000	90.140
	LAT CL					0.206			11.584		0.000	0.000	11.791
FEB	HEATNG	-3.267	-0.007	0.000	-1.638	-3.203	-14.236	2.947	0.282	0.738	4.743	0.000	-13.641
	SEN CL	0.530	-0.075	0.000	-1.601	-1.365	0.697	22.847	11.675	18.075	29.904	0.000	80.687
	LAT CL					0.355			10.056		0.000	0.000	10.411
MAR	HEATNG	-3.687	-0.004	0.000	-1.781	-3.602	-16.029	3.583	0.332	0.664	5.550	0.000	-14.975
	SEN CL	0.562	-0.089	0.000	-1.831	-1.507	-0.478	26.435	13.587	20.011	34.970	0.000	91.660
	LAT CL					0.302			11.679		0.000	0.000	11.981
APR	HEATNG	-2.916	-0.002	0.000	-1.555	-2.855	-12.669	3.074	0.261	0.593	4.712	0.000	-11.356
	SEN CL	0.674	-0.075	0.000	-1.803	-1.187	0.037	25.427	12.883	17.996	33.143	0.000	87.095
	LAT CL					0.155			11.075		0.000	0.000	11.230
MAY	HEATNG	-2.316	-0.001	0.000	-1.222	-2.222	-9.878	2.684	0.222	0.455	4.226	0.000	-8.053
	SEN CL	0.843	-0.066	0.000	-1.678	-1.183	1.303	28.050	13.548	18.476	35.257	0.000	94.551
	LAT CL					0.715			11.584		0.000	0.000	12.299
JUN	HEATNG	-1.446	0.000	0.000	-0.747	-1.391	-6.109	1.852	0.156	0.305	3.253	0.000	-4.127
	SEN CL	1.394	-0.046	0.000	-1.509	-0.813	4.216	28.260	13.153	18.137	35.648	0.000	98.440
	LAT CL					2.482			11.169		0.000	0.000	13.652
JUL	HEATNG	-1.088	0.000	0.000	-0.496	-0.991	-4.549	1.481	0.106	0.226	2.525	0.000	-2.786
	SEN CL	1.935	-0.040	0.000	-1.342	-0.402	6.529	30.083	13.035	17.821	35.320	0.000	102.939
	LAT CL					2.710			11.075		0.000	0.000	13.785
AUG	HEATNG	-0.734	0.000	0.000	-0.256	-0.597	-2.790	0.801	0.073	0.154	1.871	0.000	-1.479
	SEN CL	2.110	-0.034	0.000	-1.268	-0.270	7.081	28.727	14.306	19.876	39.234	0.000	109.763
	LAT CL					3.476			12.094		0.000	0.000	15.569
SEP	HEATNG	-0.918	0.000	0.000	-0.354	-0.830	-3.704	1.035	0.085	0.207	2.105	0.000	-2.375
	SEN CL	1.941	-0.034	0.000	-1.094	-0.233	5.609	23.735	12.021	17.501	33.633	0.000	93.079
	LAT CL					3.119			10.150		0.000	0.000	13.269
OCT	HEATNG	-1.798	-0.004	0.000	-0.624	-1.641	-7.361	1.705	0.172	0.449	3.497	0.000	-5.605
	SEN CL	1.419	-0.051	0.000	-1.125	-0.690	3.599	22.469	13.560	20.207	35.887	0.000	95.274
	LAT CL					1.717			11.584		0.000	0.000	13.301
NOV	HEATNG	-2.927	-0.012	0.000	-1.008	-2.765	-12.820	2.468	0.240	0.718	4.419	0.000	-11.688
	SEN CL	0.745	-0.067	0.000	-1.149	-1.009	1.331	21.240	12.323	20.151	31.843	0.000	85.407
	LAT CL					0.358			10.565		0.000	0.000	10.923
DEC	HEATNG	-4.461	-0.020	0.000	-1.450	-4.213	-18.990	3.230	0.332	1.132	5.473	0.000	-18.967
	SEN CL	0.313	-0.094	0.000	-1.330	-1.532	-0.140	21.754	12.347	21.143	31.790	0.000	84.249
	LAT CL					0.038			10.659		0.000	0.000	10.697
TOT	HEATNG	-29.704	-0.064	0.000	-12.870	-28.273	-127.396	28.126	2.655	6.888	48.102	0.000	-112.535
	SEN CL	12.737	-0.759	0.000	-17.443	-11.769	29.516	304.707	156.980	233.372	413.511	0.000	1120.852
	LAT CL					15.636			134.219		0.000	0.000	149.855

Internal Surfaces: These loads will be zero in this report if you choose the same LOADS calculation temperature for all spaces (as was the case in this example).

***** Important Report *****

One LS-G report per glazed space — only five are shown here (one each for the ground floor glazed perimeter zones plus the top floor skylit core zone (others have been omitted for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-G** Space Daylighting Summary South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

SPACE South Perim Space (G.S1)

	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (ALL HOURS)			PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (REPORT SCHEDULE HOURS)			REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE DAYLIGHT ILLUMINANCE (FOOTCANDLES)		PERCENT HOURS DAYLIGHT ILLUMINANCE ABOVE SETPOINT		AVERAGE GLARE INDEX		PERCENT HOURS GLARE TOO HIGH	
MONTH	TOTAL ZONE	REF PT 1	REF PT 2	TOTAL ZONE	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2
JAN	77.4	77.4	0.0	77.4	77.4	0.0	236.5	0.0	79.3	0.0	17.3	0.0	29.0	0.0
FEB	80.8	80.8	0.0	80.8	80.8	0.0	175.2	0.0	79.2	0.0	17.0	0.0	24.1	0.0
MAR	84.1	84.1	0.0	84.1	84.1	0.0	142.3	0.0	78.3	0.0	18.0	0.0	33.9	0.0
APR	84.8	84.8	0.0	84.8	84.8	0.0	100.7	0.0	80.5	0.0	16.8	0.0	35.5	0.0
MAY	85.2	85.2	0.0	85.2	85.2	0.0	90.6	0.0	76.9	0.0	17.4	0.0	43.4	0.0
JUN	85.4	85.4	0.0	85.4	85.4	0.0	80.8	0.0	72.5	0.0	16.7	0.0	35.6	0.0
JUL	85.6	85.6	0.0	85.6	85.6	0.0	80.2	0.0	76.2	0.0	16.9	0.0	31.3	0.0
AUG	84.7	84.7	0.0	84.7	84.7	0.0	97.1	0.0	80.9	0.0	17.4	0.0	40.1	0.0
SEP	83.5	83.5	0.0	83.5	83.5	0.0	119.0	0.0	75.3	0.0	17.8	0.0	47.9	0.0
OCT	81.5	81.5	0.0	81.5	81.5	0.0	156.8	0.0	77.6	0.0	17.6	0.0	37.6	0.0
NOV	76.1	76.1	0.0	76.1	76.1	0.0	205.8	0.0	78.8	0.0	18.2	0.0	30.6	0.0
DEC	74.8	74.8	0.0	74.8	74.8	0.0	244.4	0.0	77.4	0.0	17.8	0.0	34.3	0.0
ANNUAL	82.1	82.1	0.0	82.1	82.1	0.0	137.1	0.0	77.6	0.0	17.4	0.0	35.7	0.0

Based on ALL hours, including nighttime operations (if any) when the lighting energy reduction due to daylighting is zero

Based on hours defined using the daylight reporting schedule (used to constrain reporting hours).

Important Note: task lighting is never controlled by daylighting in DOE-2.

Based on all SUN UP hours defined using the daylight reporting schedule (if defined).

***** Important Report (Daylighting) *****

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-G** Space Daylighting Summary East Perim Space (G.E2) WEATHER FILE- CZ06RV2 WYEC2

SPACE East Perim Space (G.E2)

	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (ALL HOURS)			PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (REPORT SCHEDULE HOURS)			REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE DAYLIGHT ILLUMINANCE (FOOTCANDLES)		PERCENT HOURS DAYLIGHTa ILLUMINANCE ABOVE SETPOINT		AVERAGE GLARE INDEX		PERCENT HOURS GLARE TOO HIGH	
MONTH	TOTAL ZONE	REF PT 1	REF PT 2	TOTAL ZONE	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2
JAN	71.5	71.5	0.0	71.5	71.5	0.0	114.5	0.0	55.4	0.0	15.3	0.0	29.0	0.0
FEB	77.9	77.9	0.0	77.9	77.9	0.0	117.7	0.0	63.7	0.0	14.2	0.0	20.5	0.0
MAR	80.6	80.6	0.0	80.6	80.6	0.0	108.8	0.0	65.6	0.0	14.0	0.0	12.2	0.0
APR	84.4	84.4	0.0	84.4	84.4	0.0	104.5	0.0	68.3	0.0	13.2	0.0	8.1	0.0
MAY	85.3	85.3	0.0	85.3	85.3	0.0	98.1	0.0	69.4	0.0	13.0	0.0	5.3	0.0
JUN	85.5	85.5	0.0	85.5	85.5	0.0	95.2	0.0	66.7	0.0	12.4	0.0	4.7	0.0
JUL	85.7	85.7	0.0	85.7	85.7	0.0	101.0	0.0	71.1	0.0	12.8	0.0	7.9	0.0
AUG	84.7	84.7	0.0	84.7	84.7	0.0	107.4	0.0	71.7	0.0	13.3	0.0	8.5	0.0
SEP	83.3	83.3	0.0	83.3	83.3	0.0	92.0	0.0	68.8	0.0	13.0	0.0	7.7	0.0
OCT	79.4	79.4	0.0	79.4	79.4	0.0	98.1	0.0	66.8	0.0	13.9	0.0	12.4	0.0
NOV	72.1	72.1	0.0	72.1	72.1	0.0	111.2	0.0	62.1	0.0	15.4	0.0	22.7	0.0
DEC	70.1	70.1	0.0	70.1	70.1	0.0	104.9	0.0	54.5	0.0	15.4	0.0	31.0	0.0
ANNUAL	80.1	80.1	0.0	80.1	80.1	0.0	103.8	0.0	65.9	0.0	13.7	0.0	13.1	0.0

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-G** Space Daylighting Summary North Perim Space (G.N3) WEATHER FILE- CZ06RV2 WYEC2

SPACE North Perim Space (G.N3)

	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (ALL HOURS)			PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (REPORT SCHEDULE HOURS)			REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE DAYLIGHT ILLUMINANCE (FOOTCANDLES)		PERCENT HOURS DAYLIGHT ILLUMINANCE ABOVE SETPOINT		AVERAGE GLARE INDEX		PERCENT HOURS GLARE TOO HIGH	
MONTH	TOTAL ZONE	REF PT 1	REF PT 2	TOTAL ZONE	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2
JAN	66.7	66.7	0.0	66.7	66.7	0.0	37.3	0.0	25.4	0.0	13.7	0.0	0.6	0.0
FEB	75.7	75.7	0.0	75.7	75.7	0.0	46.5	0.0	46.1	0.0	14.2	0.0	5.1	0.0
MAR	81.9	81.9	0.0	81.9	81.9	0.0	55.9	0.0	57.1	0.0	15.8	0.0	12.2	0.0
APR	84.5	84.5	0.0	84.5	84.5	0.0	64.2	0.0	72.4	0.0	16.0	0.0	18.8	0.0
MAY	85.2	85.2	0.0	85.2	85.2	0.0	76.5	0.0	76.4	0.0	16.9	0.0	31.9	0.0
JUN	85.5	85.5	0.0	85.5	85.5	0.0	75.7	0.0	72.5	0.0	16.5	0.0	30.0	0.0
JUL	85.6	85.6	0.0	85.6	85.6	0.0	70.7	0.0	75.8	0.0	16.9	0.0	24.8	0.0
AUG	84.7	84.7	0.0	84.7	84.7	0.0	66.9	0.0	79.0	0.0	16.9	0.0	24.0	0.0
SEP	83.3	83.3	0.0	83.3	83.3	0.0	60.8	0.0	71.8	0.0	16.1	0.0	19.5	0.0
OCT	79.0	79.0	0.0	79.0	79.0	0.0	55.5	0.0	63.2	0.0	15.4	0.0	11.8	0.0
NOV	70.5	70.5	0.0	70.5	70.5	0.0	45.0	0.0	40.3	0.0	14.8	0.0	0.9	0.0
DEC	65.0	65.0	0.0	65.0	65.0	0.0	38.0	0.0	26.5	0.0	13.6	0.0	1.5	0.0
ANNUAL	79.1	79.1	0.0	79.1	79.1	0.0	59.4	0.0	61.1	0.0	15.7	0.0	16.5	0.0

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- LS-G Space Daylighting Summary West Perim Space (G.W4) WEATHER FILE- CZ06RV2 WYEC2

SPACE West Perim Space (G.W4)

MONTH	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (ALL HOURS)			PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (REPORT SCHEDULE HOURS)			REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE DAYLIGHT ILLUMINANCE (FOOTCANDLES)		PERCENT HOURS DAYLIGHT ILLUMINANCE ABOVE SETPOINT		AVERAGE GLARE INDEX		PERCENT HOURS GLARE TOO HIGH	
	TOTAL ZONE	REF PT 1	REF PT 2	TOTAL ZONE	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2
JAN	72.9	72.9	0.0	72.9	72.9	0.0	118.8	0.0	55.1	0.0	11.8	0.0	0.9	0.0
FEB	78.0	78.0	0.0	78.0	78.0	0.0	113.7	0.0	61.6	0.0	12.6	0.0	6.8	0.0
MAR	83.4	83.4	0.0	83.4	83.4	0.0	134.3	0.0	70.2	0.0	14.4	0.0	18.1	0.0
APR	83.5	83.5	0.0	83.5	83.5	0.0	119.4	0.0	71.7	0.0	13.6	0.0	11.9	0.0
MAY	85.1	85.1	0.0	85.1	85.1	0.0	134.0	0.0	75.3	0.0	14.8	0.0	14.1	0.0
JUN	85.5	85.5	0.0	85.5	85.5	0.0	130.4	0.0	76.2	0.0	14.6	0.0	15.7	0.0
JUL	85.6	85.6	0.0	85.6	85.6	0.0	127.7	0.0	77.5	0.0	14.4	0.0	15.8	0.0
AUG	84.5	84.5	0.0	84.5	84.5	0.0	127.4	0.0	75.6	0.0	14.1	0.0	13.4	0.0
SEP	83.1	83.1	0.0	83.1	83.1	0.0	130.1	0.0	76.1	0.0	14.5	0.0	16.7	0.0
OCT	80.4	80.4	0.0	80.4	80.4	0.0	129.7	0.0	72.6	0.0	13.7	0.0	13.4	0.0
NOV	75.1	75.1	0.0	75.1	75.1	0.0	119.9	0.0	64.8	0.0	12.9	0.0	1.8	0.0
DEC	71.3	71.3	0.0	71.3	71.3	0.0	116.8	0.0	53.3	0.0	11.8	0.0	0.0	0.0
ANNUAL	80.8	80.8	0.0	80.8	80.8	0.0	125.8	0.0	70.1	0.0	13.7	0.0	11.4	0.0

One LS-G report per space — only five are shown here (page 5 of 5)

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3-Story Office Bldg                                                        DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-G Space Daylighting Summary      Core Space (T.C17)                              WEATHER FILE- CZ06RV2 WYEC2
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SPACE Core Space (T.C17)

MONTH	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (ALL HOURS)			PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHTING (REPORT SCHEDULE HOURS)			REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE DAYLIGHT ILLUMINANCE (FOOTCANDLES)		REPORT SCHEDULE HOURS WITH SUN UP: PERCENT HOURS DAYLIGHT ILLUMINANCE ABOVE SETPOINT		REPORT SCHEDULE HOURS WITH SUN UP: AVERAGE GLARE INDEX		REPORT SCHEDULE HOURS WITH SUN UP: PERCENT HOURS GLARE TOO HIGH	
	TOTAL ZONE	REF PT 1	REF PT 2	TOTAL ZONE	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2	REF PT 1	REF PT 2
JAN	37.8	37.8	0.0	37.8	37.8	0.0	18.5	0.0	0.0	0.0	8.9	0.0	0.0	0.0
FEB	51.9	51.9	0.0	51.9	51.9	0.0	23.7	0.0	6.5	0.0	9.7	0.0	0.0	0.0
MAR	61.6	61.6	0.0	61.6	61.6	0.0	28.4	0.0	13.0	0.0	10.8	0.0	0.0	0.0
APR	70.7	70.7	0.0	70.7	70.7	0.0	31.7	0.0	18.6	0.0	11.1	0.0	0.2	0.0
MAY	77.0	77.0	0.0	77.0	77.0	0.0	36.4	0.0	28.9	0.0	12.2	0.0	0.4	0.0
JUN	78.4	78.4	0.0	78.4	78.4	0.0	35.7	0.0	29.2	0.0	11.9	0.0	0.6	0.0
JUL	77.0	77.0	0.0	77.0	77.0	0.0	33.3	0.0	15.0	0.0	11.5	0.0	0.2	0.0
AUG	73.4	73.4	0.0	73.4	73.4	0.0	32.3	0.0	12.4	0.0	11.3	0.0	0.0	0.0
SEP	68.9	68.9	0.0	68.9	68.9	0.0	29.9	0.0	11.0	0.0	11.5	0.0	0.0	0.0
OCT	59.6	59.6	0.0	59.6	59.6	0.0	27.6	0.0	11.8	0.0	11.2	0.0	0.0	0.0
NOV	44.7	44.7	0.0	44.7	44.7	0.0	22.2	0.0	3.6	0.0	10.2	0.0	0.0	0.0
DEC	37.7	37.7	0.0	37.7	37.7	0.0	18.3	0.0	0.0	0.0	9.1	0.0	0.0	0.0
ANNUAL	61.8	61.8	0.0	61.8	61.8	0.0	28.9	0.0	13.5	0.0	10.9	0.0	0.1	0.0

One LS-H report per glazed space — only five are shown here (one each for the ground floor glazed perimeter zones plus the top floor skylit core zone (others have been omitted for brevity)

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3-Story Office Bldg                                                      DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-H Energy Reduction By Daylight   South Perim Space (G.S1)                      WEATHER FILE- CZ06RV2 WYEC2
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SPACE  South Perim Space (G.S1)
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HOUR OF DAY is given in standard time, even if DAYLIGHT-SAVINGS = YES.

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	65	85	88	90	90	90	90	89	86	72	0	0	0	0	0	0	0	77
FEB	0	0	0	0	0	0	0	82	90	90	90	90	90	90	90	90	86	8	0	0	0	0	0	0	81
MAR	0	0	0	0	0	0	33	88	90	90	90	90	90	90	90	90	90	64	0	0	0	0	0	0	84
APR	0	0	0	0	0	5	71	90	90	90	90	90	90	90	90	90	90	77	0	0	0	0	0	0	85
MAY	0	0	0	0	0	19	77	90	90	90	90	90	90	90	90	90	90	87	8	0	0	0	0	0	85
JUN	0	0	0	0	0	29	81	90	90	90	90	90	90	90	90	90	90	86	27	0	0	0	0	0	85
JUL	0	0	0	0	0	18	85	90	90	90	90	90	90	90	90	90	89	88	25	0	0	0	0	0	86
AUG	0	0	0	0	0	8	70	90	90	90	90	90	90	90	90	90	90	85	2	0	0	0	0	0	85
SEP	0	0	0	0	0	1	50	89	90	90	90	90	90	90	90	90	88	51	0	0	0	0	0	0	84
OCT	0	0	0	0	0	0	35	82	90	90	90	90	90	90	90	90	82	0	0	0	0	0	0	0	81
NOV	0	0	0	0	0	0	10	81	86	89	90	90	90	90	90	88	42	0	0	0	0	0	0	0	76
DEC	0	0	0	0	0	0	0	76	87	89	90	90	90	89	88	87	30	0	0	0	0	0	0	0	75
ANNUAL	0	0	0	0	0	7	64	86	89	90	90	90	90	90	90	89	75	21	5	0	0	0	0	0	82

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

For this example case, 90% lighting reduction indicates daylight saturation since the daylight controller used in this example has a 10% minimum power input at minimum light output.

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NOTE- THE ENTRIES IN THIS REPORT ARE NOT
      SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE
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For each daylit space this report gives the monthly lighting energy reduction due to daylighting for each hour of the day, and for all hours of the day combined (including nighttime operations hours, if any).

***** Important Report (Daylighting) *****

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-H** Energy Reduction By Daylight East Perim Space (G.E2) WEATHER FILE- CZ06RV2 WYEC2

SPACE East Perim Space (G.E2)

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	66	85	88	90	90	90	89	87	68	25	0	0	0	0	0	0	0	71
FEB	0	0	0	0	0	0	0	82	90	90	90	90	90	90	89	84	61	3	0	0	0	0	0	0	78
MAR	0	0	0	0	0	0	42	89	90	90	90	90	90	90	90	84	74	25	0	0	0	0	0	0	81
APR	0	0	0	0	0	14	71	90	90	90	90	90	90	90	90	89	85	49	0	0	0	0	0	0	84
MAY	0	0	0	0	0	35	80	90	90	90	90	90	90	90	90	90	90	77	8	0	0	0	0	0	85
JUN	0	0	0	0	0	48	84	90	90	90	90	90	90	90	90	90	90	70	26	0	0	0	0	0	86
JUL	0	0	0	0	0	43	87	90	90	90	90	90	90	90	90	90	89	84	25	0	0	0	0	0	86
AUG	0	0	0	0	0	22	70	90	90	90	90	90	90	90	90	90	90	69	2	0	0	0	0	0	85
SEP	0	0	0	0	0	1	50	89	90	90	90	90	90	90	90	90	86	28	0	0	0	0	0	0	83
OCT	0	0	0	0	0	0	40	81	90	90	90	90	90	90	90	86	46	0	0	0	0	0	0	0	79
NOV	0	0	0	0	0	0	16	81	86	89	90	90	90	90	88	73	14	0	0	0	0	0	0	0	72
DEC	0	0	0	0	0	0	0	77	87	89	90	90	90	86	79	68	9	0	0	0	0	0	0	0	70
ANNUAL	0	0	0	0	0	14	66	86	89	90	90	90	90	90	89	83	56	11	5	0	0	0	0	0	80

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

NOTE- THE ENTRIES IN THIS REPORT ARE NOT
SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-H** Energy Reduction By Daylight North Perim Space (G.N3) WEATHER FILE- CZ06RV2 WYEC2

SPACE North Perim Space (G.N3)

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	21	63	84	87	90	90	89	86	68	27	0	0	0	0	0	0	0	67
FEB	0	0	0	0	0	0	0	48	79	89	90	90	90	90	89	85	65	4	0	0	0	0	0	0	76
MAR	0	0	0	0	0	0	21	84	88	89	90	90	90	90	90	88	88	32	0	0	0	0	0	0	82
APR	0	0	0	0	0	5	66	90	90	90	90	90	90	90	90	90	90	67	0	0	0	0	0	0	84
MAY	0	0	0	0	0	25	76	90	90	90	90	90	90	90	90	90	90	86	13	0	0	0	0	0	85
JUN	0	0	0	0	0	39	81	90	90	90	90	90	90	90	90	90	90	86	41	0	0	0	0	0	85
JUL	0	0	0	0	0	27	84	90	90	90	90	90	90	90	90	90	89	88	38	0	0	0	0	0	86
AUG	0	0	0	0	0	10	70	90	90	90	90	90	90	90	90	90	90	83	2	0	0	0	0	0	85
SEP	0	0	0	0	0	1	47	89	90	90	90	90	90	90	90	90	88	39	0	0	0	0	0	0	83
OCT	0	0	0	0	0	0	22	79	90	90	90	90	90	90	90	88	53	0	0	0	0	0	0	0	79
NOV	0	0	0	0	0	0	4	56	79	89	90	90	90	90	87	75	15	0	0	0	0	0	0	0	71
DEC	0	0	0	0	0	0	0	25	69	85	87	89	89	85	78	68	10	0	0	0	0	0	0	0	65
ANNUAL	0	0	0	0	0	9	61	78	84	89	90	90	90	89	88	84	60	14	8	0	0	0	0	0	79

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

NOTE- THE ENTRIES IN THIS REPORT ARE NOT
SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-H** Energy Reduction By Daylight West Perim Space (G.W4) WEATHER FILE- CZ06RV2 WYEC2

SPACE West Perim Space (G.W4)

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	20	63	85	88	90	90	90	88	86	73	0	0	0	0	0	0	0	73
FEB	0	0	0	0	0	0	0	42	76	89	90	90	90	90	90	90	86	13	0	0	0	0	0	0	78
MAR	0	0	0	0	0	0	17	73	85	89	90	90	90	90	90	90	90	76	0	0	0	0	0	0	83
APR	0	0	0	0	0	4	56	85	89	90	90	90	90	90	90	90	90	80	0	0	0	0	0	0	83
MAY	0	0	0	0	0	18	74	90	90	90	90	90	90	90	90	90	90	89	30	0	0	0	0	0	85
JUN	0	0	0	0	0	29	80	90	90	90	90	90	90	90	90	90	90	89	76	0	0	0	0	0	86
JUL	0	0	0	0	0	18	81	90	90	90	90	90	90	90	90	90	89	88	72	0	0	0	0	0	86
AUG	0	0	0	0	0	7	64	90	90	90	90	90	90	90	90	90	90	87	5	0	0	0	0	0	84
SEP	0	0	0	0	0	1	40	89	90	90	90	90	90	90	90	90	88	67	0	0	0	0	0	0	83
OCT	0	0	0	0	0	0	19	75	90	90	90	90	90	90	90	90	84	1	0	0	0	0	0	0	80
NOV	0	0	0	0	0	0	4	54	80	89	90	90	90	90	90	88	52	0	0	0	0	0	0	0	75
DEC	0	0	0	0	0	0	0	24	69	86	88	90	90	89	88	87	41	0	0	0	0	0	0	0	71
ANNUAL	0	0	0	0	0	6	57	76	84	89	90	90	90	90	90	89	78	24	15	0	0	0	0	0	81

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

NOTE- THE ENTRIES IN THIS REPORT ARE NOT
SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-H** Energy Reduction By Daylight Core Space (T.C17) WEATHER FILE- CZ06RV2 WYEC2

SPACE Core Space (T.C17)

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	8	27	43	54	61	62	55	44	29	10	0	0	0	0	0	0	0	38
FEB	0	0	0	0	0	0	0	18	38	58	71	76	75	72	64	45	26	1	0	0	0	0	0	0	52
MAR	0	0	0	0	0	0	8	34	59	74	81	83	83	77	69	55	34	10	0	0	0	0	0	0	62
APR	0	0	0	0	0	2	25	50	74	82	87	89	88	84	77	68	45	20	0	0	0	0	0	0	71
MAY	0	0	0	0	0	8	38	70	86	89	90	90	90	87	81	72	55	33	3	0	0	0	0	0	77
JUN	0	0	0	0	0	13	42	72	87	90	90	90	90	89	83	75	58	32	10	0	0	0	0	0	78
JUL	0	0	0	0	0	7	41	67	81	88	90	90	90	89	84	75	59	40	10	0	0	0	0	0	77
AUG	0	0	0	0	0	3	29	55	81	85	89	90	90	85	79	71	52	29	1	0	0	0	0	0	73
SEP	0	0	0	0	0	0	18	50	78	84	88	88	88	81	71	58	38	10	0	0	0	0	0	0	69
OCT	0	0	0	0	0	0	8	36	64	79	83	83	81	74	63	43	18	0	0	0	0	0	0	0	60
NOV	0	0	0	0	0	0	1	21	39	57	67	69	69	64	48	30	5	0	0	0	0	0	0	0	45
DEC	0	0	0	0	0	0	0	10	30	46	58	64	62	53	37	26	3	0	0	0	0	0	0	0	38
ANNUAL	0	0	0	0	0	3	28	48	63	73	79	81	81	76	66	54	29	5	2	0	0	0	0	0	62

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

NOTE- THE ENTRIES IN THIS REPORT ARE NOT
SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE

One LS-I report only (this is a building level report)

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3-Story Office Bldg                                                            DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- LS-I Energy Reduction By Daylight   Building                                      WEATHER FILE- CZ06RV2 WYEC2
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*** BUILDING ***

HOUR OF DAY

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	ALL HOURS
JAN	0	0	0	0	0	0	0	23	42	51	54	56	56	54	52	44	27	0	0	0	0	0	0	0	44
FEB	0	0	0	0	0	0	0	37	49	55	57	58	58	58	56	52	43	4	0	0	0	0	0	0	49
MAR	0	0	0	0	0	0	12	48	55	58	59	59	59	58	57	54	49	28	0	0	0	0	0	0	53
APR	0	0	0	0	0	3	38	53	58	59	60	60	60	60	58	57	52	28	0	0	0	0	0	0	55
MAY	0	0	0	0	0	10	45	57	60	61	61	61	61	60	59	58	54	37	6	0	0	0	0	0	57
JUN	0	0	0	0	0	15	48	58	60	61	61	61	61	61	60	58	55	36	17	0	0	0	0	0	57
JUL	0	0	0	0	0	11	50	57	59	60	61	61	61	60	60	58	55	39	16	0	0	0	0	0	57
AUG	0	0	0	0	0	4	39	55	59	60	61	61	61	60	59	57	54	35	1	0	0	0	0	0	56
SEP	0	0	0	0	0	0	27	54	59	60	60	60	60	59	57	55	50	18	0	0	0	0	0	0	55
OCT	0	0	0	0	0	0	16	46	56	59	59	60	59	58	56	52	38	0	0	0	0	0	0	0	52
NOV	0	0	0	0	0	0	3	38	49	54	57	57	57	56	53	47	17	0	0	0	0	0	0	0	46
DEC	0	0	0	0	0	0	0	27	45	52	55	56	56	53	49	44	12	0	0	0	0	0	0	0	43
ANNUAL	0	0	0	0	0	4	37	49	54	57	59	59	59	58	56	53	39	8	3	0	0	0	0	0	52

PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT

NOTE- THE ENTRIES IN THIS REPORT ARE NOT
SUBJECT TO THE DAYLIGHTING REPORT SCHEDULE

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-J** Daylight Illuminance Frequency South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

SPACE South Perim Space (G.S1)

		PERCENT OF HOURS IN ILLUMINANCE RANGE									PERCENT OF HOURS ILLUMINANCE LEVEL EXCEEDED								
		ILLUMINANCE RANGE (FOOTCANDLES)									ILLUMINANCE LEVEL (FOOTCANDLES)								
MONTH	REF PT	0 -- 10	-- 20	-- 30	-- 40	-- 50	-- 60	-- 70	-- 80	-ABOVE	0	10	20	30	40	50	60	70	80
JAN	-1-	10	2	1	2	5	3	6	4	67	100	90	88	87	84	79	76	71	67
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEB	-1-	14	3	1	1	2	1	2	2	74	100	86	82	82	81	79	78	76	74
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAR	-1-	7	5	2	3	5	2	2	2	73	100	93	87	86	83	78	77	75	73
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APR	-1-	14	1	3	1	0	3	2	5	71	100	86	85	81	81	80	78	76	71
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	-1-	14	3	1	4	1	1	4	10	62	100	86	83	82	78	77	76	72	62
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	-1-	14	7	2	4	0	3	6	9	55	100	86	79	77	73	73	70	64	55
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	-1-	13	7	0	2	1	0	3	8	65	100	87	79	79	77	76	76	73	65
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	-1-	13	1	3	0	1	1	1	2	77	100	87	85	82	82	81	79	79	77
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	-1-	12	5	2	2	3	1	2	2	69	100	88	83	81	79	75	74	72	69
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	-1-	14	1	2	3	2	1	3	1	72	100	86	85	83	80	78	77	74	72
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	-1-	7	4	8	2	1	3	1	3	72	100	93	89	82	80	79	76	75	72
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEC	-1-	9	4	5	3	2	2	3	5	67	100	91	87	83	79	77	75	72	67
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANNUAL	-1-	12	4	2	2	2	2	3	5	68	100	88	84	82	79	78	76	73	68
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE- THE HOURS CONSIDERED IN THIS REPORT ARE THOSE
WITH SUN UP AND DAYLIGHTING REPORT SCHEDULE ON

***** Important Report (Daylighting) *****

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-J** Daylight Illuminance Frequency East Perim Space (G.E2) WEATHER FILE- CZ06RV2 WYEC2

SPACE East Perim Space (G.E2)

MONTH	REF PT	PERCENT OF HOURS IN ILLUMINANCE RANGE — ILLUMINANCE RANGE (FOOTCANDLES) 0 -- 10	10 -- 20	20 -- 30	30 -- 40	40 -- 50	50 -- 60	60 -- 70	70 -- 80	80 -ABOVE	PERCENT OF HOURS ILLUMINANCE LEVEL EXCEEDED — ILLUMINANCE LEVEL (FOOTCANDLES) 0	10	20	30	40	50	60	70	80
JAN	-1-	13	6	2	9	15	9	6	7	34	100	87	81	79	70	55	46	40	34
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEB	-1-	17	2	3	5	9	8	8	3	45	100	83	81	78	73	64	56	48	45
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAR	-1-	8	8	2	7	9	8	8	6	44	100	92	83	81	74	66	58	50	44
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APR	-1-	12	2	7	4	6	9	7	5	48	100	88	85	78	75	68	60	53	48
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	-1-	14	2	1	6	8	7	6	6	51	100	86	85	84	78	69	62	56	51
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	-1-	14	6	0	8	5	7	6	5	49	100	86	80	80	72	67	60	54	49
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	-1-	12	6	1	3	7	9	8	7	48	100	88	82	81	78	71	63	55	48
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	-1-	11	2	4	6	6	9	8	6	49	100	89	88	84	78	72	63	55	49
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	-1-	13	6	3	1	8	14	6	7	41	100	87	80	78	77	69	55	49	41
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	-1-	13	4	3	4	8	9	11	6	41	100	87	82	79	74	67	58	47	41
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	-1-	13	4	3	9	9	11	8	5	38	100	87	83	80	71	62	52	43	38
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEC	-1-	17	1	2	12	13	6	8	6	34	100	83	82	80	67	55	48	40	34
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANNUAL	-1-	13	4	3	6	8	9	7	6	44	100	87	83	80	74	66	57	50	44
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE- THE HOURS CONSIDERED IN THIS REPORT ARE THOSE
WITH SUN UP AND DAYLIGHTING REPORT SCHEDULE ON

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-J** Daylight Illuminance Frequency North Perim Space (G.N3) WEATHER FILE- CZ06RV2 WYEC2

SPACE North Perim Space (G.N3)

		PERCENT OF HOURS IN ILLUMINANCE RANGE — ILLUMINANCE RANGE (FOOTCANDLES)									PERCENT OF HOURS ILLUMINANCE LEVEL EXCEEDED — ILLUMINANCE LEVEL (FOOTCANDLES)								
MONTH	REF PT	0 -- 10	-- 20	-- 30	-- 40	-- 50	-- 60	-- 70	-- 80	-ABOVE	0	10	20	30	40	50	60	70	80
JAN	-1-	15	11	4	17	28	18	2	2	4	100	85	74	70	53	25	8	5	4
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEB	-1-	16	4	7	9	18	20	10	3	13	100	84	80	73	64	46	26	17	13
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAR	-1-	9	9	2	4	19	19	14	4	20	100	91	82	80	76	57	38	24	20
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APR	-1-	14	2	5	4	4	13	18	12	29	100	86	85	80	76	72	59	41	29
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	-1-	13	3	1	5	1	2	10	20	43	100	87	84	83	78	76	74	64	43
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	-1-	13	3	4	5	2	1	13	14	44	100	87	83	80	74	73	72	58	44
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	-1-	12	3	5	3	1	1	7	25	43	100	88	85	79	77	76	75	68	43
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	-1-	12	3	3	1	2	5	17	30	27	100	88	85	82	81	79	74	57	27
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	-1-	12	6	2	3	4	7	23	18	23	100	88	82	79	76	72	65	41	23
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	-1-	15	5	3	5	8	19	16	6	23	100	85	80	77	72	63	44	29	23
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	-1-	15	4	6	12	23	19	7	5	10	100	85	81	75	63	40	22	15	10
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEC	-1-	17	8	5	23	21	12	5	4	5	100	83	75	70	47	27	14	9	5
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANNUAL	-1-	13	5	4	7	10	10	12	13	25	100	87	82	78	71	61	51	38	25
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE- THE HOURS CONSIDERED IN THIS REPORT ARE THOSE
WITH SUN UP AND DAYLIGHTING REPORT SCHEDULE ON

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-J** Daylight Illuminance Frequency West Perim Space (G.W4) WEATHER FILE- CZ06RV2 WYEC2

SPACE West Perim Space (G.W4)

		PERCENT OF HOURS IN ILLUMINANCE RANGE									PERCENT OF HOURS ILLUMINANCE LEVEL EXCEEDED								
		ILLUMINANCE RANGE (FOOTCANDLES)									ILLUMINANCE LEVEL (FOOTCANDLES)								
MONTH	REF PT	0 -- 10	-- 20	-- 30	-- 40	-- 50	-- 60	-- 70	-- 80	-ABOVE	0	10	20	30	40	50	60	70	80
JAN	-1-	14	5	3	7	16	8	7	7	32	100	86	81	78	71	55	47	40	32
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEB	-1-	12	8	4	7	8	8	8	7	38	100	88	80	76	69	62	54	46	38
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAR	-1-	10	2	3	5	9	5	7	7	51	100	90	87	84	79	70	65	58	51
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APR	-1-	14	1	5	3	5	8	5	4	55	100	86	84	80	77	72	64	60	55
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	-1-	11	3	2	5	3	3	5	4	63	100	89	86	84	79	75	72	67	63
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	-1-	14	2	2	4	3	6	5	4	62	100	86	85	83	79	76	70	66	62
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	-1-	12	3	0	3	3	8	7	7	56	100	88	85	84	81	78	70	63	56
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	-1-	13	1	3	2	5	7	5	6	57	100	87	86	82	80	76	69	64	57
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	-1-	11	5	3	2	3	5	5	9	56	100	89	84	81	79	76	71	66	56
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	-1-	15	3	1	4	4	7	6	4	56	100	85	81	81	77	73	66	60	56
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	-1-	10	2	7	9	7	12	8	7	38	100	90	88	82	72	65	53	45	38
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEC	-1-	11	7	7	9	13	6	7	3	37	100	89	82	75	66	53	47	40	37
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANNUAL	-1-	12	3	3	5	6	7	6	6	51	100	88	84	81	76	70	63	57	51
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE- THE HOURS CONSIDERED IN THIS REPORT ARE THOSE
WITH SUN UP AND DAYLIGHTING REPORT SCHEDULE ON

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-J** Daylight Illuminance Frequency Core Space (T.C17) WEATHER FILE- CZ06RV2 WYEC2

SPACE Core Space (T.C17)

MONTH	REF PT	PERCENT OF HOURS IN ILLUMINANCE RANGE — ILLUMINANCE RANGE (FOOTCANDLES) 0 -- 10	10 -- 20	20 -- 30	30 -- 40	40 -- 50	50 -- 60	60 -- 70	70 -- 80	80 -ABOVE	PERCENT OF HOURS ILLUMINANCE LEVEL EXCEEDED — ILLUMINANCE LEVEL (FOOTCANDLES) 0	10	20	30	40	50	60	70	80
JAN	-1-	27	23	37	10	4	0	0	0	0	100	73	50	13	4	0	0	0	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEB	-1-	24	18	18	24	9	6	1	0	0	100	76	58	40	15	7	1	0	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAR	-1-	21	15	15	26	10	7	5	1	0	100	79	65	50	23	13	6	1	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APR	-1-	20	12	11	18	20	8	8	2	0	100	80	68	56	38	19	11	2	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	-1-	18	11	9	16	17	12	8	6	2	100	82	70	62	46	29	17	8	2
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	-1-	23	8	10	14	16	10	10	8	1	100	77	69	59	45	29	20	9	1
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	-1-	21	6	12	19	27	6	5	4	0	100	79	73	61	42	15	9	4	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	-1-	15	14	11	20	28	6	4	2	0	100	85	72	61	41	12	6	2	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEP	-1-	23	7	15	22	22	7	3	1	0	100	77	70	55	33	11	4	1	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	-1-	24	12	13	26	13	9	3	0	0	100	76	63	51	24	12	3	0	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOV	-1-	22	22	28	17	7	4	0	0	0	100	78	56	28	11	4	0	0	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEC	-1-	26	29	30	9	5	0	0	0	0	100	74	45	15	5	0	0	0	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANNUAL	-1-	22	14	17	19	16	7	4	2	0	100	78	64	48	29	14	7	3	0
	-2-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE- THE HOURS CONSIDERED IN THIS REPORT ARE THOSE
WITH SUN UP AND DAYLIGHTING REPORT SCHEDULE ON

One LS-K report per space & one whole-building — only two are shown here (one example space plus the building, others have been omitted for brevity)

REPORT- **LS-K** Space Input Fuels Summary South Perim Space (G.S1) WEATHER FILE- CZ06RV2 WYEC2

SPACE South Perim Space (G.S1)

MONTH	- - - - L I G H T I N G - - - -		E Q U I P M E N T	- - - - - - - - - - P R O C E S S - - - - - - - - - -		
	TASK LIGHTING (KWH)	TOTAL LIGHTING (KWH)	GENERAL EQUIPMENT (KWH)	PROCESS ELECTRIC (KWH)	PROCESS GAS (MBTU)	PROCESS HOT WATER (MBTU)
JAN	21.14	132.95	494.14	0.00	0.0000	0.0000
FEB	18.35	101.40	433.31	0.00	0.0000	0.0000
MAR	21.31	101.79	506.15	0.00	0.0000	0.0000
APR	20.21	92.39	473.86	0.00	0.0000	0.0000
MAY	21.14	94.47	494.14	0.00	0.0000	0.0000
JUN	20.38	91.26	485.88	0.00	0.0000	0.0000
JUL	20.21	88.63	473.86	0.00	0.0000	0.0000
AUG	22.07	100.62	514.41	0.00	0.0000	0.0000
SEP	18.52	91.88	445.32	0.00	0.0000	0.0000
OCT	21.14	112.68	494.14	0.00	0.0000	0.0000
NOV	19.28	127.64	453.59	0.00	0.0000	0.0000
DEC	19.45	136.87	465.60	0.00	0.0000	0.0000
ANNUAL	243.20	1272.52	5734.22	0.00	0.0000	0.0000

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-K** Building Input Fuels Summary WEATHER FILE- CZ06RV2 WYEC2

BUILDING

	- - - - L I G H T I N G - - - -		E Q U I P M E N T	- - - - - - - - - - P R O C E S S - - - - - - - - - -		
MONTH	TASK LIGHTING (KWH)	TOTAL LIGHTING (KWH)	GENERAL EQUIPMENT (KWH)	PROCESS ELECTRIC (KWH)	PROCESS GAS (MBTU)	PROCESS HOT WATER (MBTU)
JAN	1149.42	6983.26	12077.56	0.00	0.0000	0.0000
FEB	997.78	5593.17	10595.82	0.00	0.0000	0.0000
MAR	1158.78	6123.60	12380.71	0.00	0.0000	0.0000
APR	1098.87	5525.90	11583.66	0.00	0.0000	0.0000
MAY	1149.42	5618.44	12077.56	0.00	0.0000	0.0000
JUN	1108.23	5460.12	11886.80	0.00	0.0000	0.0000
JUL	1098.87	5365.45	11583.65	0.00	0.0000	0.0000
AUG	1199.96	5945.46	12571.47	0.00	0.0000	0.0000
SEP	1007.14	5235.13	10898.98	0.00	0.0000	0.0000
OCT	1149.42	6170.06	12077.57	0.00	0.0000	0.0000
NOV	1048.33	6222.85	11089.73	0.00	0.0000	0.0000
DEC	1057.69	6643.78	11392.89	0.00	0.0000	0.0000
ANNUAL	13222.35	70878.40	140156.28	0.00	0.0000	0.0000

One LS-L report per glazed space — only five are shown here (one each for the ground floor glazed perimeter zones plus the top floor skylit core zone (others have been omitted for brevity)

```
3-Story Office Bldg                                                    DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-L Management and Solar Summary   South Perim Space (G.S1)                        WEATHER FILE- CZ06RV2 WYEC2
-----------------------------------------------------------------------------------------------------------------------------------


DATA FOR SPACE    South Perim Space (G.S1)
```

MONTH	NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED	AVERAGE DAILY SOLAR RADIATION INTO SPACE (BTU/DAY)	MAXIMUM HOURLY SOLAR RADIATION INTO SPACE (BTU/HR)
JAN	0.	191827.188	34269.672
FEB	0.	162006.984	30081.234
MAR	0.	121466.828	21808.434
APR	0.	74322.094	11992.355
MAY	0.	70842.148	11158.893
JUN	0.	68242.445	10038.264
JUL	0.	66951.555	9924.578
AUG	0.	70287.398	11265.102
SEP	0.	77344.703	12352.869
OCT	0.	112011.953	20251.238
NOV	0.	154505.641	28799.945
DEC	0.	178426.281	33551.418
	--------	------------	--------------
ANNUAL	0.	112150.094	34269.672

Column 1 is the number of hours that window shade management would be employed in the space for each month.

Management is employed under any of the following conditions:
- The shading schedule for an exterior window specifies management.
- If the transmitted direct solar gain through an exterior window exceeds a pre-specified value, MAX-SOLAR-SCH, then shades will be in effect with a probability of SUN-CTRL-PROB.
- If daylighting is requested (DAYLIGHTING=YES) and the daylight glare exceeds a pre-specified value MAX-GLARE, then the shades will be in effect.

Column 2 is the average solar radiation into the space through all glazing areas (Btu per day).

Column 3 is the maximum solar radiation into the space through all glazing areas for all hours in the month (Btu per hour).

Important Note:
Note that the entries in this report are solar heat gains, not solar loads; i.e., weighting factors to convert heat gains into delayed loads have not been applied.

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-L** Management and Solar Summary East Perim Space (G.E2) WEATHER FILE- CZ06RV2 WYEC2

DATA FOR SPACE East Perim Space (G.E2)

MONTH	NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED	AVERAGE DAILY SOLAR RADIATION INTO SPACE (BTU/DAY)	MAXIMUM HOURLY SOLAR RADIATION INTO SPACE (BTU/HR)
JAN	0.	49364.359	19418.023
FEB	0.	61899.156	21574.289
MAR	0.	69797.172	26478.418
APR	0.	78551.242	26213.355
MAY	0.	68332.320	23423.201
JUN	0.	68212.039	21861.305
JUL	0.	73871.156	20706.711
AUG	0.	72656.492	21772.592
SEP	0.	54749.164	21720.738
OCT	0.	49189.316	18439.598
NOV	0.	45619.676	15566.069
DEC	0.	41749.738	15470.636
	--------	------------	--------------
ANNUAL	0.	61153.141	26478.418

```
3-Story Office Bldg                                                             DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- LS-L Management and Solar Summary   North Perim Space (G.N3)                        WEATHER FILE- CZ06RV2 WYEC2
------------------------------------------------------------------------------------------------------------------------------

DATA FOR SPACE    North Perim Space (G.N3)

       NUMBER OF HOURS   AVERAGE DAILY     MAXIMUM HOURLY
         MANAGEMENT      SOLAR RADIATION  SOLAR RADIATION
          WOULD BE         INTO SPACE       INTO SPACE
MONTH      EMPLOYED          (BTU/DAY )       (BTU/HR  )


JAN             0.        27270.828          4794.873

FEB             0.        35337.883          6116.467

MAR             0.        44553.234          6941.558

APR             0.        53994.086          7420.953

MAY             0.        64496.246          7863.993

JUN             0.        69821.906          8145.917

JUL             0.        65241.918          7783.005

AUG             0.        56243.996          7432.146

SEP             0.        47768.637          7060.106

OCT             0.        39237.230          6445.047

NOV             0.        30317.670          5558.333

DEC             0.        26040.002          4811.150

           --------     ------------     --------------

ANNUAL          0.        46745.566          8145.917
```

REPORT- **LS-L** Management and Solar Summary West Perim Space (G.W4) WEATHER FILE- CZ06RV2 WYEC2

DATA FOR SPACE West Perim Space (G.W4)

MONTH	NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED	AVERAGE DAILY SOLAR RADIATION INTO SPACE (BTU/DAY)	MAXIMUM HOURLY SOLAR RADIATION INTO SPACE (BTU/HR)
JAN	0.	51197.207	19226.805
FEB	0.	60415.246	22138.861
MAR	0.	84436.063	26171.527
APR	0.	90258.844	26580.305
MAY	0.	96811.977	25046.668
JUN	0.	97682.891	23487.025
JUL	0.	95068.258	22946.318
AUG	0.	87109.094	23828.025
SEP	0.	78431.836	22780.684
OCT	0.	63081.375	20586.527
NOV	0.	49646.301	18019.021
DEC	0.	44595.676	15526.598
	--------	------------	--------------
ANNUAL	0.	74968.594	26580.305

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **LS-L** Management and Solar Summary Core Space (T.C17) WEATHER FILE- CZ06RV2 WYEC2

DATA FOR SPACE Core Space (T.C17)

MONTH	NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED	AVERAGE DAILY SOLAR RADIATION INTO SPACE (BTU/DAY)	MAXIMUM HOURLY SOLAR RADIATION INTO SPACE (BTU/HR)
JAN	0.	99468.164	21911.686
FEB	0.	134776.766	27946.164
MAR	0.	183912.125	32458.596
APR	0.	216042.609	35825.160
MAY	0.	243158.828	37453.309
JUN	0.	242045.781	37479.281
JUL	0.	263041.750	37093.527
AUG	0.	242694.156	36150.129
SEP	0.	200010.172	33679.777
OCT	0.	144938.453	28569.092
NOV	0.	107217.727	23836.154
DEC	0.	89093.953	18806.303
	--------	------------	--------------
ANNUAL	0.	180791.172	37479.281

```
                                          MESSAGE LIST FROM SYSTEMS     PROGRAM

 **WARNING**********************************************************************
            Pump: CW Loop Pump                     has a user-specified head
            of        50. feet, but the loop head is        62. feet.
```

Always search the SIM file for WARNING messages. In the event of a crash (run-time error), always check the SIM file for ERROR messages… it's usually the last thing written to the SIM file.

One SV-A report per SYSTEM (seven for this example building, system 1 of 7) — Ground Floor VAV system

```
3-Story Office Bldg                                                              DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- SV-A System Design Parameters for   System 1 (VAVS) (G)                                WEATHER FILE- CZ06RV2 WYEC2
------------------------------------------------------------------------------------------------------------------------------------
                                FLOOR                 OUTSIDE   COOLING                HEATING    COOLING     HEATING    HEAT PUMP
 SYSTEM    ALTITUDE             AREA        MAX        AIR      CAPACITY   SENSIBLE    CAPACITY     EIR         EIR      SUPP-HEAT
  TYPE      FACTOR             (SQFT )     PEOPLE     RATIO     (KBTU/HR)    (SHR)     (KBTU/HR)  (BTU/BTU)  (BTU/BTU)  (KBTU/HR)

VAVS         1.000            13000.0       96.       0.214     271.497      0.702       0.000      0.000      0.000      0.000
```

For DX equipment only

Based on Altitude (in eQUEST detailed Interface, see Project & Site: Site Data)

Total for ALL zone types served by this system with non-zero occupancy

Ignores occupancy schedule values

Total (sensible+latent) capacity, adjusted to ARI conditions

Central heating coil only, does not include zone-level heating coils (reheat)

```
                      DIVERSITY    POWER        FAN      STATIC    TOTAL      MECH                             MAX FAN     MIN FAN
  FAN     CAPACITY      FACTOR     DEMAND     DELTA-T   PRESSURE     EFF       EFF         FAN        FAN       RATIO       RATIO
  TYPE     (CFM )       (FRAC)      (KW)        (F)    (IN-WATER)  (FRAC)    (FRAC)     PLACEMENT   CONTROL    (FRAC)      (FRAC)

  SUPPLY    7562.         1.00      4.931       2.02        3.5      0.63      0.72      DRAW-THRU   BY USER      1.10        0.30
  RETURN    7562.         1.00      1.644       0.67        1.2      0.63      0.70         RETURN   BY USER      1.10        0.30
```

Total supply flow is always the sum of zone design supply flows (no diversity for VAV systems)

Fan kW = (CFM * fan static / fan eff) / 8520

Total Eff = Mechanical Eff * fan motor eff (not shown)

eQUEST uses fan power curves based on CEC data (not DOE-2 defaults)

↑ Items reported above are system-level

↓ Items reported below are zone-level

```
                                SUPPLY    EXHAUST              MINIMUM    OUTSIDE    COOLING               EXTRACTION   HEATING   ADDITION
        ZONE                      FLOW       FLOW        FAN       FLOW   AIR FLOW   CAPACITY   SENSIBLE        RATE   CAPACITY       RATE   ZONE
        NAME                     (CFM )     (CFM )      (KW)     (FRAC)     (CFM )  (KBTU/HR)     (FRAC)   (KBTU/HR)  (KBTU/HR)  (KBTU/HR)   MULT

South Perim Zone (G.S1)           863.         0.     0.000      0.250       179.       0.00       0.00       18.63     -27.95     -12.11     1.
East Perim Zone (G.E2)           1195.         0.     0.000      0.250       132.       0.00       0.00       25.81     -38.72     -16.78     1.
North Perim Zone (G.N3)           863.         0.     0.000      0.250       179.       0.00       0.00       18.63     -27.95     -12.11     1.
West Perim Zone (G.W4)           1142.         0.     0.000      0.250       132.       0.00       0.00       24.68     -37.02     -16.04     1.
Core Zone (G.C5)                 3500.         0.     0.000      0.400       994.       0.00       0.00       75.60    -113.40     -49.14     1.

Plenum Zone (G.6)                   0.         0.     0.000      0.000         0.       0.00       0.00        0.00       0.00       0.00     1.
```

Space MULT * Floor MULT

eQUEST Wizard does not provide any exhaust

No zonal fans in this example

1.08 * CFM * (Min-Supply-T - Design-Cool-T)

***** Important Report *****

One SV-A report per SYSTEM (system 2 of 7) — Second (Middle) Floor VAV system

```
3-Story Office Bldg                                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- SV-A System Design Parameters for   System 1 (VAVS) (M)                             WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------
                          FLOOR              OUTSIDE  COOLING             HEATING   COOLING    HEATING  HEAT PUMP
  SYSTEM   ALTITUDE        AREA        MAX       AIR  CAPACITY  SENSIBLE  CAPACITY       EIR        EIR  SUPP-HEAT
   TYPE      FACTOR    (SQFT )     PEOPLE      RATIO  (KBTU/HR)     (SHR) (KBTU/HR) (BTU/BTU)  (BTU/BTU)  (KBTU/HR)

VAVS          1.000    13000.0       107.      0.211   291.173     0.702     0.000     0.000      0.000      0.000


                     DIVERSITY    POWER       FAN     STATIC   TOTAL    MECH                            MAX FAN    MIN FAN
    FAN   CAPACITY      FACTOR   DEMAND   DELTA-T   PRESSURE     EFF     EFF        FAN         FAN      RATIO      RATIO
   TYPE     (CFM )      (FRAC)     (KW)       (F) (IN-WATER)  (FRAC)  (FRAC)  PLACEMENT     CONTROL     (FRAC)     (FRAC)

  SUPPLY      8109.       1.00    5.288      2.02        3.5    0.63    0.72  DRAW-THRU     BY USER       1.10       0.30
  RETURN      8109.       1.00    1.763      0.67        1.2    0.63    0.70     RETURN     BY USER       1.10       0.30

                              SUPPLY    EXHAUST              MINIMUM  OUTSIDE   COOLING            EXTRACTION   HEATING   ADDITION
     ZONE                       FLOW       FLOW        FAN      FLOW AIR FLOW  CAPACITY  SENSIBLE       RATE  CAPACITY       RATE ZONE
     NAME                     (CFM )     (CFM )       (KW)    (FRAC)   (CFM ) (KBTU/HR)    (FRAC) (KBTU/HR) (KBTU/HR)  (KBTU/HR) MULT

South Perim Zone (M.S7)         965.         0.      0.000     0.250     182.      0.00      0.00      20.84    -31.26     -13.55   1.
East Perim Zone (M.E8)         1349.         0.      0.000     0.250     135.      0.00      0.00      29.13    -43.70     -18.93   1.
North Perim Zone (M.N9)         955.         0.      0.000     0.250     182.      0.00      0.00      20.63    -30.94     -13.41   1.
West Perim Zone (M.W10)        1341.         0.      0.000     0.250     135.      0.00      0.00      28.96    -43.44     -18.82   1.
Core Zone (M.C11)              3500.         0.      0.000     0.400    1079.      0.00      0.00      75.60   -113.40     -49.14   1.

Plenum Zone (M.12)                0.         0.      0.000     0.000       0.      0.00      0.00       0.00      0.00       0.00   1.
```

One SV-A report per SYSTEM (system 3 of 7) — Third (Top) Floor, South Zone Package Single Zone (PSZ) system

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SV-A** System Design Parameters for System 2 (PSZ) (T.S13) WEATHER FILE- CZ06RV2 WYEC2

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.000	1725.0	10.	0.189	33.557	0.660	-40.504	0.416	0.345	-44.802

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	965.	1.00	0.267	0.86	1.3	0.53	0.62	DRAW-THRU	CONSTANT	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
South Perim Zone (T.S13)	965.	0.	0.000	1.000	182.	0.00	0.00	20.84	0.00	17.72	1.
South Perim Plenum Zone (1	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	0.00	1.

One SV-A report per SYSTEM (system 4 of 7) — Third (Top) Floor, East Zone Package Single Zone (PSZ) system

REPORT- **SV-A** System Design Parameters for System 2 (PSZ) (T.E14) WEATHER FILE- CZ06RV2 WYEC2

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.000	1275.0	8.	0.100	41.034	0.703	-49.529	0.416	0.345	-55.311

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	1349.	1.00	0.373	0.86	1.3	0.53	0.62	DRAW-THRU	CONSTANT	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
East Perim Zone (T.E14)	1349.	0.	0.000	1.000	135.	0.00	0.00	29.13	0.00	24.76	1.
East Perim Plenum Zone (T9	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	0.00	1.

One SV-A report per SYSTEM (system 5 of 7) — Third (Top) Floor, North Zone Package Single Zone (PSZ) system

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SV-A** System Design Parameters for System 2 (PSZ) (T.N15) WEATHER FILE- CZ06RV2 WYEC2

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.000	1725.0	10.	0.191	32.977	0.662	-39.805	0.416	0.345	-44.448

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	955.	1.00	0.264	0.86	1.3	0.53	0.62	DRAW-THRU	CONSTANT	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
North Perim Zone (T.N15)	955.	0.	0.000	1.000	182.	0.00	0.00	20.63	0.00	17.53	1.
North Perim Plenum Zone (2	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	0.00	1.

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SV-A** System Design Parameters for System 2 (PSZ) (T.W16) WEATHER FILE- CZ06RV2 WYEC2

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.000	1275.0	8.	0.101	40.041	0.709	-48.331	0.416	0.345	-55.035

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	1341.	1.00	0.371	0.86	1.3	0.53	0.62	DRAW-THRU	CONSTANT	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
West Perim Zone (T.W16)	1341.	0.	0.000	1.000	135.	0.00	0.00	28.96	0.00	24.62	1.
West Perim Plenum Zone (T1	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	0.00	1.

One SV-A report per SYSTEM (system 7 of 7) — Third (Top) Floor, Core Zone Package Single Zone (PSZ) system

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SV-A** System Design Parameters for System 2 (PSZ) (T.C17) WEATHER FILE- CZ06RV2 WYEC2

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.000	7000.0	71.	0.308	126.770	0.651	-153.016	0.416	0.345	-172.877

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	3500.	1.00	0.969	0.86	1.3	0.53	0.62	DRAW-THRU	CONSTANT	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
Core Zone (T.C17)	3500.	0.	0.000	1.000	1079.	0.00	0.00	75.60	0.00	64.26	1.
Core Plenum Zone (T.C22)	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	0.00	1.

One SS-D report only (this is a building level report)

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3-Story Office Bldg                                                  DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- SS-D Building HVAC Load Summary                                         WEATHER FILE- CZ06RV2 WYEC2
```

Sensible+Latent

"MBTU" = Btu x 1,000,000

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	21.72392	11	13	78.F	54.F	354.041	-1.736	2	9	51.F	46.F	-497.692	22116.	98.679
FEB	24.85833	13	16	70.F	55.F	361.034	-0.233	5	9	54.F	51.F	-20.692	18924.	93.166
MAR	28.42772	16	13	75.F	61.F	390.949	-0.234	24	10	57.F	54.F	-9.862	21737.	91.375
APR	31.33976	4	17	81.F	52.F	430.741	-0.146	30	11	61.F	53.F	-7.640	20420.	95.302
MAY	58.57369	31	14	72.F	66.F	517.425	-0.121	26	10	62.F	57.F	-9.391	22201.	94.822
JUN	90.54893	20	14	84.F	74.F	684.319	-0.065	2	10	59.F	55.F	-6.253	23003.	102.334
JUL	103.67539	11	10	82.F	70.F	612.783	-0.039	3	8	58.F	56.F	-2.196	23236.	103.320
AUG	116.64235	7	10	80.F	67.F	599.605	-0.037	22	8	59.F	57.F	-2.042	25519.	101.127
SEP	94.19563	7	17	79.F	71.F	683.036	-0.043	27	8	55.F	53.F	-2.620	21828.	104.272
OCT	76.96026	1	14	85.F	73.F	657.055	-0.105	29	11	65.F	50.F	-6.885	23366.	101.493
NOV	43.97081	2	16	69.F	62.F	435.737	-0.220	13	9	56.F	51.F	-12.469	20947.	109.714
DEC	21.03675	19	15	77.F	53.F	396.410	-0.751	31	9	54.F	45.F	-92.008	20965.	106.311
TOTAL	711.955						-3.730						264267.	
MAX						684.319						-497.692		109.714

```
MAXIMUM DAILY INTEGRATED COOLING LOAD (DES DAY )          0.000 (KBTU)
MAXIMUM DAILY INTEGRATED COOLING LOAD (WTH FILE)       3951.138 (KBTU)
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These whole-building totals (peak and annual) are also reported on the PS-D for CHW/HW coil loads.

Useful for TES sizing. See SS-J for system-level 24-hour profiles of this same information.

Includes only items know about by the LOADS and SYSTEMS programs, i.e., lights, plugs, fans, DX compressors, reheat, etc., for the whole building Central plant electric is included on "PS-" reports.

Important Note:
Loads reported here are coil loads, i.e., these loads include outside ventilation air, duct loss/gain, fan heat, and economizer effects (if any). SS-D reports building total coil loads, i.e., unitary + built-up equipment.

***** Important Report *****

One SS-E report only (this is a building level report)

```
3-Story Office Bldg                                                    DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2
REPORT- SS-E Building HVAC Load Hours                                             WEATHER FILE- CZ06RV2 WYEC2
```

	- - - - - - - - - - - - - - - - N U M B E R O F H O U R S - - - - - - - - - - - - - - - - -										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	183	125	51	487	744	744	274	0	0	17	0.000	88.369
FEB	173	76	31	454	672	672	241	0	0	23	0.000	93.131
MAR	202	75	26	493	744	744	282	0	0	31	0.000	88.639
APR	202	56	20	482	720	720	263	0	0	25	0.000	95.302
MAY	234	49	20	481	744	744	274	0	0	11	0.000	93.774
JUN	251	34	16	451	720	720	271	0	0	2	0.000	102.334
JUL	249	25	11	481	744	744	263	0	0	0	0.000	100.422
AUG	280	27	22	459	744	744	285	0	0	0	0.000	100.548
SEP	239	26	16	471	720	720	249	0	0	0	0.000	104.272
OCT	244	44	24	480	744	744	274	0	0	10	0.000	101.115
NOV	203	63	31	485	720	720	252	0	0	17	0.000	95.022
DEC	180	117	53	500	744	744	260	0	0	16	0.000	95.902
ANNUAL	2640	717	321	5724	8760	8760	3188	0	0	152		

Large number of Coincident Cooling/Heating hours may indicate overcooling and excessive reheat

hours floating when fans are "off" + "HOURS FLOATING WHEN FANS ON"

Controlled by Heating/Cooling Availability Schedule (defaults to always available) in eQUEST's Detailed Interface, see "Air-Side HVAC System Parameters": "Heating/Cooling" tab: "Coil Capacity/Control" sub-tab

Controlled by user input in eQUEST's Wizard at HVAC System Fan Schedules screen
HOURS FANS ON =
HOUR COOLING LOAD +
HOURS HEATING LOAD -
HOURS COINCIDENT COOL-HEAT LOAD +
HOURS FLOATING WHEN FANS ON

provides an assessment of oversizing for simultaneous heating/cooling systems (e.g., reheat systems)

IMPORTANT NOTE:
If a fan system runs for only part of an hour, one hour is still logged for this report, i.e., these are not equivalent full-load hours. For a system-level report of operations hours, see SS-C.

***** Important Report *****

One SS-M report only (this is a building level report)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- SS-M Building HVAC Fan Elec Energy WEATHER FILE- CZ06RV2 WYEC2

MONTH	FAN ELECTRIC ENERGY DURING HEATING (KWH)	FAN ELECTRIC ENERGY DURING COOLING (KWH)	FAN ELECTRIC ENERGY DURING HEATING-COOLING (KWH)	FAN ELECTRIC ENERGY DURING FLOATING (KWH)
JAN	229.201	1173.765	17.252	762.620
FEB	95.088	1183.188	0.000	662.109
MAR	97.090	1388.123	0.000	778.840
APR	79.295	1480.203	0.000	640.020
MAY	68.862	1922.848	0.000	394.867
JUN	48.672	2197.378	0.000	231.575
JUL	38.033	2300.778	0.000	152.256
AUG	38.062	2608.159	0.000	110.090
SEP	39.124	2157.940	0.000	122.475
OCT	63.713	2105.447	0.000	273.620
NOV	97.575	1561.080	0.000	440.077
DEC	191.019	1163.693	0.000	687.847
ANNUAL	1085.742	21242.639	17.252	5256.291

Total Fan Electric =
Heating Fan Electric +
Cooling Fan Electric +
Floating Fan Electric -
Heat & Cool Fan Electric

Important Notes:
Total fan electric for the building is NOT reported here.
Total fan electric for the building is reported on PS-E.

For a system-level report similar to this building-level report, see SS-L.

The fan energy reported here includes only supply & return fans. Exhaust fans are excluded. (Exhaust fans are included under the VENT FANS end use category on Plant reports.)

One SS-A report for each SYSTEM (only one included here for brevity)

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3-Story Office Bldg                                            DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- SS-A System Loads Summary for       System 1 (VAVS) (G)                        WEATHER FILE- CZ06RV2 WYEC2
```

Sensible+Latent

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	6.99828	11	13	78.F	54.F	106.237	-0.335	2	9	51.F	46.F	-127.921	6476.	28.587
FEB	7.95906	16	13	66.F	61.F	106.263	-0.009	5	9	54.F	51.F	-7.526	5603.	27.116
MAR	8.68998	16	13	75.F	61.F	110.816	0.000	31	24	52.F	51.F	0.000	6462.	24.540
APR	8.84468	4	17	81.F	52.F	123.646	0.000	30	1	55.F	55.F	0.000	6074.	24.658
MAY	16.40177	31	14	72.F	66.F	147.515	0.000	31	1	54.F	49.F	0.000	6365.	24.394
JUN	26.80062	20	14	84.F	74.F	204.080	0.000	30	1	61.F	58.F	0.000	6297.	24.748
JUL	30.59795	11	10	82.F	70.F	184.888	0.000	31	1	63.F	58.F	0.000	6174.	24.907
AUG	34.87575	9	9	74.F	67.F	178.021	0.000	31	1	64.F	56.F	0.000	6744.	25.088
SEP	28.61793	7	17	79.F	71.F	201.941	0.000	30	1	63.F	61.F	0.000	5820.	25.000
OCT	23.54031	1	14	85.F	73.F	200.059	0.000	31	24	55.F	47.F	0.000	6470.	26.057
NOV	13.54112	2	15	70.F	62.F	125.971	-0.005	13	9	56.F	51.F	-3.619	5975.	29.202
DEC	6.80566	19	15	77.F	53.F	116.220	-0.095	26	9	50.F	42.F	-16.469	6134.	29.417
TOTAL	213.673						-0.444						74595.	
MAX						204.080						-127.921		29.417

"MBTU" = Btu x 1,000,000

For sens/latent components, see SS-I

For 24-hr profile, see SS-J

Important Note:
Loads reported here are coil loads, i.e., these loads include outside ventilation air, duct loss/gain, fan heat, and economizer effects (if any). SS-A reports coil loads only for one system.

For more detailed reporting similar to this report, see SS-Q (for Heat Pumps ONLY).

Includes only items know about by the LOADS and SYSTEMS programs, i.e., lights, plugs, fans, DX compressors, reheat, etc., for this system. Central plant electric is included on "PS-" reports.

***** Important Report *****

One SS-B report for each SYSTEM (only one included here for brevity)

```
3-Story Office Bldg                                                       DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- SS-B System Loads Summary for       System 1 (VAVS) (G)                     WEATHER FILE- CZ06RV2 WYEC2
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MONTH	- - Z O N E C O O L I N G - - COOLING BY ZONE COILS OR NAT VENTIL (MBTU)	MAXIMUM COOLING BY ZONE COILS OR NAT VENTIL (KBTU/HR)	- - Z O N E H E A T I N G - - HEATING BY ZONE COILS OR FURNACE (MBTU)	MAXIMUM HEATING BY ZONE COILS OR FURNACE (KBTU/HR)	- - B A S E B O A R D S - - BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING ENERGY (KBTU/HR)	- -PREHEAT OR FURN FAN ELEC- - PREHEAT COIL ENERGY OR ELEC FOR FURN FAN (MBTU)	MAXIMUM PREHEAT COIL ENERGY OR ELEC FOR FURN FAN (KBTU/HR)
JAN	0.00000	0.000	-0.25887	-114.660	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	-0.01095	-6.519	0.00000	0.000	0.00000	0.000
	----------	----------	----------	----------	----------	----------	----------	----------
TOTAL	0.000		-0.270		0.000		0.000	
MAX		0.000		-114.660		0.000		0.000

This is the only place natural ventilative cooling is reported. NOTE: this is a system-level report, i.e., for building total natural ventilation, you must sum the SS-B reports. Natural ventilation (if used) acts like a non-integrated economizer (i.e., reports only for hours it can fully meet the cooling load).

This is the only place reheat energy is reported separately. NOTE: this is a system-level report, i.e., for building total reheat, you must sum the SS-B reports. See SS-F for Zone-level reporting.

This is the only place baseboard energy is reported separately. NOTE: this is a system-level report, i.e., for building total baseboards, you must sum the SS-B reports. See SS-F for Zone-level reporting.

This is the only place preheat energy is reported separately. NOTE: this is a system-level report, i.e., for building total preheat, you must sum the SS-B reports.

One SS-C report for each SYSTEM (only one included here for brevity)

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3-Story Office Bldg                                               DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2

REPORT- SS-C System Load Hours for          System 1 (VAVS) (G)                        WEATHER FILE- CZ06RV2 WYEC2
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	N U M B E R O F H O U R S											--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	165	17	4	566	744	744	274	0	0	96	0.000	24.177
FEB	166	2	0	504	672	672	241	0	0	73	0.000	23.926
MAR	190	0	0	554	744	744	282	0	0	92	0.000	24.068
APR	187	0	0	533	720	720	263	0	0	76	0.000	24.658
MAY	225	0	0	519	744	744	274	0	0	49	0.000	24.311
JUN	248	0	0	472	720	720	271	0	0	23	0.000	24.606
JUL	249	0	0	495	744	744	263	0	0	14	0.000	24.729
AUG	280	0	0	464	744	744	285	0	0	5	0.000	24.977
SEP	239	0	0	481	720	720	249	0	0	10	0.000	25.000
OCT	242	0	0	502	744	744	274	0	0	32	0.000	24.691
NOV	197	2	0	521	720	720	252	0	0	53	0.000	24.338
DEC	161	8	0	575	744	744	260	0	0	91	0.000	25.233
	-------	-------	--------	--------	-------	-------	-------	--------	-------	--------		
ANNUAL	2549	29	4	6186	8760	8760	3188	0	0	614		

hours floating when fans are "off" + "HOURS FLOATING WHEN FANS ON"

Controlled by Heating/Cooling Availability Schedule (defaults to always available) in eQUEST's Detailed Interface, see "Air-Side HVAC System Parameters": "Heating/Cooling" tab: "Coil Capacity/Control" sub-tab

Controlled by user input in eQUEST's Wizard at HVAC System Fan Schedules screen (screens 19 & 20).
HOURS FANS ON =
HOUR COOLING LOAD +
HOURS HEATING LOAD -
HOURS COINCIDENT COOL-HEAT LOAD +
HOURS FLOATING WHEN FANS ON

provides an assessment of oversizing for simultaneous heating/cooling systems (e.g., reheat systems).

IMPORTANT NOTE:
If a fan system runs for only part of an hour, one hour is still logged for this report, i.e., these are not equivalent full-load hours. For a building-level report of operations hours, see SS-E.

One SS-H report for each SYSTEM (only one included here for brevity)

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3-Story Office Bldg                                              DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- SS-H System Utility Energy Use for  System 1 (VAVS) (G)                    WEATHER FILE- CZ06RV2 WYEC2
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	- -F A N E L E C- -		- -F U E L H E A T- -		- -F U E L C O O L- -		- -E L E C H E A T- -		- -E L E C C O O L- -	
MONTH	FAN ENERGY (KWH)	MAXIMUM FAN LOAD (KW)	GAS OIL ENERGY (MBTU)	MAXIMUM GAS OIL LOAD (KBTU/HR)	GAS OIL ENERGY (MBTU)	MAXIMUM GAS OIL LOAD (KBTU/HR)	ELECTRIC ENERGY (KWH)	MAXIMUM ELECTRIC LOAD (KW)	ELECTRIC ENERGY (KWH)	MAXIMUM ELECTRIC LOAD (KW)
JAN	709.	3.588	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
FEB	640.	3.604	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
MAR	745.	3.265	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
APR	746.	3.753	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
MAY	823.	3.591	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
JUN	860.	3.945	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
JUL	867.	4.104	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
AUG	964.	4.285	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
SEP	806.	4.197	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
OCT	840.	4.096	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
NOV	705.	3.803	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
DEC	678.	3.716	0.000	0.000	0.000	0.000	0.	0.000	0.	0.000
TOTAL	9382.		0.000		0.000		0.		0.	
MAX		4.285		0.000		0.000		0.000		0.000

For a breakdown of heating vrs cooling fan hours, see SS-L. For unitary DX systems, also see SS-P.

NOTE:
For a more detailed breakdown of heating, cooling, and fan energy use, also see SS-P (for unitary DX systems. Only)

Heat Pump compressor + condenser electric or electric reheat

Unitary equipment compressor + condenser electric

***** Important Report *****

One SS-I report for each SYSTEM (only one included here for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-I** Sensible/Latent Summary for System 1 (VAVS) (G) WEATHER FILE- CZ06RV2 WYEC2

MONTH	SENSIBLE COOLING ENERGY (MBTU)	LATENT COOLING ENERGY (MBTU)	MAX TOTAL COOLING ENERGY (KBTU/HR)	SENSIBLE HEAT RATIO AT MAX	TIME OF MAX DY	TIME OF MAX HR	SENSIBLE HEATING ENERGY (MBTU)	LATENT HEATING ENERGY (MBTU)	MAX TOTAL HEATING ENERGY (KBTU/HR)
JAN	6.45050	0.54778	106.237	1.000	11	13	-0.33485	0.00000	-127.921
FEB	6.39564	1.56342	106.263	0.734	16	13	-0.00855	0.00000	-7.526
MAR	7.35717	1.33280	110.816	0.881	16	13	0.00000	0.00000	0.000
APR	8.06314	0.78154	123.646	1.000	4	17	0.00000	0.00000	0.000
MAY	12.91002	3.49175	147.515	0.695	31	14	0.00000	0.00000	0.000
JUN	18.74260	8.05803	204.080	0.650	20	14	0.00000	0.00000	0.000
JUL	22.03828	8.55967	184.888	0.725	11	10	0.00000	0.00000	0.000
AUG	26.09985	8.77590	178.021	0.729	9	9	0.00000	0.00000	0.000
SEP	21.13661	7.48132	201.941	0.680	7	17	0.00000	0.00000	0.000
OCT	18.41732	5.12299	200.059	0.683	1	14	0.00000	0.00000	0.000
NOV	12.20625	1.33487	125.971	0.784	2	15	-0.00495	0.00000	-3.619
DEC	6.73569	0.06997	116.220	1.000	19	15	-0.09519	0.00000	-16.469
TOTAL	166.553	47.120					-0.444	0.000	
MAX			204.080	0.650					-127.921

Provides a sensible - latent breakdown of total monthly cooling reported on SS-A

Provides a sensible - latent breakdown of total monthly heating reported on SS-A

Up to Two SS-J reports for each System — the first for Design Day results, the second for weather file results (page 1 of 2) (only one system included here for brevity)

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3-Story Office Bldg                                                         DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- SS-J Peak Heating and Cooling for   System 1 (VAVS) (G)              DESIGN DAY    WEATHER FILE- CZ06RV2 WYEC2
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This tag indicates this report documents only Design Day results (not weather file results).

The weather file is reported, even though this is a Design Day report (may cause confusion)

Reports 24-hr profile for day with peak cooling HOUR.

Reports 24-hr profile for the day with the maximum Day-Long cooling load (largest 24-hr sum). (May not be same day as peak hour day for annual weather file results.) Useful for TES sizing. Compare building total on SS-D report.

	- - - C O O L I N G - - - JUN 21				- - - H E A T I N G - - - DEC 21			D A Y C O O L I N G P E A K JUN 21			
HOUR	HOURLY COOLING LOAD (KBTU)	SENSIBLE HEAT RATIO	DRY-BULB TEMP	WET-BULB TEMP	HOURLY HEATING LOAD (KBTU)	DRY-BULB TEMP	WET-BULB TEMP	HOURLY COOLING LOAD (KBTU)	SENSIBLE HEAT RATIO	DRY-BULB TEMP	WET-BULB TEMP
1	0.000	0.000	78.F	62.F	0.000	37.F	31.F	0.000	0.000	78.F	62.F
2	0.000	0.000	77.F	62.F	0.000	37.F	31.F	0.000	0.000	77.F	62.F
3	0.000	0.000	77.F	62.F	0.000	37.F	31.F	0.000	0.000	77.F	62.F
4	0.000	0.000	77.F	62.F	0.000	37.F	31.F	0.000	0.000	77.F	62.F
5	0.000	0.000	77.F	62.F	0.000	37.F	31.F	0.000	0.000	77.F	62.F
6	0.000	0.000	78.F	62.F	0.000	37.F	31.F	0.000	0.000	78.F	62.F
7	51.662	0.915	79.F	63.F	0.000	37.F	31.F	51.662	0.915	79.F	63.F
8	223.857	0.920	81.F	63.F	-14.511	37.F	31.F	223.857	0.920	81.F	63.F
9	203.781	0.905	83.F	64.F	-136.408	37.F	31.F	203.781	0.905	83.F	64.F
10	193.384	0.897	85.F	64.F	-69.997	37.F	31.F	193.384	0.897	85.F	64.F
11	193.060	0.898	87.F	65.F	-53.072	37.F	31.F	193.060	0.898	87.F	65.F
12	194.928	0.899	88.F	66.F	-45.162	37.F	31.F	194.928	0.899	88.F	66.F
13	196.798	0.900	89.F	66.F	-41.946	37.F	31.F	196.798	0.900	89.F	66.F
14	197.782	0.900	90.F	66.F	-38.574	37.F	31.F	197.782	0.900	90.F	66.F
15	200.104	0.901	91.F	66.F	-34.481	37.F	31.F	200.104	0.901	91.F	66.F
16	205.685	0.902	90.F	66.F	-29.969	37.F	31.F	205.685	0.902	90.F	66.F
17	64.732	0.919	90.F	66.F	-28.312	37.F	31.F	64.732	0.919	90.F	66.F
18	0.000	0.000	89.F	66.F	0.000	37.F	31.F	0.000	0.000	89.F	66.F
19	0.000	0.000	88.F	65.F	0.000	37.F	31.F	0.000	0.000	88.F	65.F
20	0.000	0.000	86.F	65.F	0.000	37.F	31.F	0.000	0.000	86.F	65.F
21	0.000	0.000	84.F	64.F	0.000	37.F	31.F	0.000	0.000	84.F	64.F
22	0.000	0.000	83.F	64.F	0.000	37.F	31.F	0.000	0.000	83.F	64.F
23	0.000	0.000	81.F	63.F	0.000	37.F	31.F	0.000	0.000	81.F	63.F
24	0.000	0.000	80.F	63.F	0.000	37.F	31.F	0.000	0.000	80.F	63.F
SUM								1925.773			
MAX	223.857				-136.408						

```
SYSTEM-TYPE          VAVS                     SQFT/TON             696.9
COOLING PEAK           17.22 (BTU/HR- SQFT)   HEATING PEAK        -10.49 (BTU/HR- SQFT)
SUPPLY AIR PEAK FLOW    0.58 (CFM/SQFT)       MIN-OA/PERSON        16.90 (CFM )
OA FRAC AT CLG PEAK    0.228                  OA FRAC AT HTG PEAK  0.470

* ASTERISKS INDICATE HOURS LOADS NOT MET
```

Review these values as a "sanity check" for each system.

IMPORTANT NOTE:
The 24-hour profiles on this report will include "pick-up" or "pull-down" loads (resulting from floating space temperatures during fan OFF hours).

***** Important Report *****

Up to Two SS-J reports for each System — the first for Design Day results, the second for weather file results (page 1 of 2)
(only one system included here for brevity)

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3-Story Office Bldg                                                         DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- SS-J Peak Heating and Cooling for   System 1 (VAVS) (G)                        WEATHER FILE- CZ06RV2 WYEC2
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No "Design Day" tag indicates this report documents weather

HOUR	- - - - - C O O L I N G - - - - - JUN 20 HOURLY COOLING LOAD (KBTU)	SENSIBLE HEAT RATIO	DRY-BULB TEMP	WET-BULB TEMP	- - - H E A T I N G - - - JAN 2 HOURLY HEATING LOAD (KBTU)	DRY-BULB TEMP	WET-BULB TEMP	D A Y C O O L I N G P E A K SEP 7 HOURLY COOLING LOAD (KBTU)	SENSIBLE HEAT RATIO	DRY-BULB TEMP	WET-BULB TEMP
1	0.000	0.000	59.F	58.F	0.000	48.F	46.F	0.000	0.000	68.F	66.F
2	0.000	0.000	59.F	57.F	0.000	47.F	45.F	0.000	0.000	68.F	64.F
3	0.000	0.000	58.F	57.F	0.000	44.F	42.F	0.000	0.000	68.F	64.F
4	0.000	0.000	58.F	56.F	0.000	43.F	41.F	0.000	0.000	68.F	65.F
5	0.000	0.000	60.F	58.F	0.000	44.F	42.F	0.000	0.000	67.F	64.F
6	0.000	0.000	63.F	60.F	0.000	43.F	41.F	0.000	0.000	67.F	65.F
7	26.097	0.594	65.F	62.F	0.000	42.F	40.F	43.922	0.531	69.F	66.F
8	148.827	0.671	70.F	66.F	-25.727	44.F	41.F	172.644	0.687	71.F	67.F
9	166.892	0.662	75.F	69.F	-127.921	51.F	46.F	185.862	0.671	76.F	70.F
10	183.615	0.646	80.F	72.F	-55.636	53.F	48.F	185.491	0.686	78.F	70.F
11	187.272	0.669	82.F	72.F	-24.443	60.F	52.F	187.705	0.689	78.F	70.F
12	194.910	0.650	82.F	73.F	-16.313	64.F	53.F	195.188	0.708	82.F	71.F
13	204.080	0.650	84.F	74.F	-8.914	66.F	56.F	194.650	0.707	82.F	71.F
14	191.313	0.674	82.F	72.F	-2.590	64.F	53.F	193.539	0.679	79.F	71.F
15	187.021	0.678	80.F	71.F	-0.894	57.F	52.F	192.316	0.730	82.F	70.F
16	186.201	0.678	78.F	70.F	-0.932	57.F	51.F	201.941	0.680	79.F	71.F
17	59.891	0.594	76.F	68.F	-1.559	55.F	50.F	69.845	0.563	78.F	70.F
18	0.000	0.000	73.F	66.F	0.000	52.F	49.F	0.000	0.000	74.F	69.F
19	0.000	0.000	70.F	64.F	0.000	55.F	52.F	0.000	0.000	73.F	69.F
20	0.000	0.000	67.F	63.F	0.000	55.F	50.F	0.000	0.000	71.F	69.F
21	0.000	0.000	65.F	61.F	0.000	52.F	48.F	0.000	0.000	70.F	68.F
22	0.000	0.000	63.F	60.F	0.000	52.F	46.F	0.000	0.000	70.F	68.F
23	0.000	0.000	61.F	59.F	0.000	52.F	46.F	0.000	0.000	70.F	67.F
24	0.000	0.000	60.F	58.F	0.000	51.F	44.F	0.000	0.000	69.F	66.F
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SUM								1823.101			
MAX	204.080				-127.921						

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SYSTEM-TYPE          VAVS                      SQFT/TON               764.4
COOLING PEAK         15.70 (BTU/HR- SQFT)      HEATING PEAK           -9.84 (BTU/HR- SQFT)
SUPPLY AIR PEAK FLOW  0.58 (CFM/SQFT)          MIN-OA/PERSON          16.90 (CFM )
OA FRAC AT CLG PEAK   0.343                    OA FRAC AT HTG PEAK    0.459

* ASTERISKS INDICATE HOURS LOADS NOT MET
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This flow rate is set by: 1) user input in eQUEST or 2) based on a Design Day run (see previous SS-J report), if used, or 3) based on a Weather File run if no Design Day is used.

IMPORTANT NOTE:
The 24-hour profiles on this report will include "pick-up" or "pull-down" loads (resulting from floating space temperatures during fan OFF hours).

***** Important Report *****

One SS-K report for each SYSTEM (only one included here for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-K** Space Temperature Summary for System 1 (VAVS) (G) WEATHER FILE- CZ06RV2 WYEC2

MONTH	A V E R A G E S P A C E T E M P ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)	SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	73.51	74.76	70.97	74.28	73.05	-17.56	-14.01	-19.63	10.85	545.02	-0.00094
FEB	74.33	75.15	72.79	74.85	74.04	-17.71	-13.69	-19.95	1.52	496.58	-0.00071
MAR	74.43	75.21	0.00	74.92	74.13	-17.93	-13.32	-20.74	0.00	556.46	-0.00061
APR	74.99	75.49	0.00	75.26	74.83	-16.02	-11.99	-18.34	0.00	483.78	-0.00100
MAY	75.46	75.67	0.00	75.53	75.42	-14.37	-10.21	-16.79	0.00	446.33	-0.00009
JUN	76.15	75.90	0.00	75.85	76.33	-11.83	-6.73	-14.90	0.00	361.16	0.00086
JUL	76.48	76.03	0.00	76.01	76.74	-9.66	-4.23	-12.63	0.00	311.27	0.00113
AUG	76.64	76.12	0.00	76.11	76.96	-8.34	-3.36	-11.43	0.00	268.59	0.00157
SEP	76.39	75.96	0.00	75.94	76.63	-8.74	-3.50	-11.51	0.00	280.91	0.00143
OCT	75.75	75.74	0.00	75.67	75.80	-11.46	-6.85	-14.15	0.00	371.33	0.00032
NOV	74.68	75.35	72.99	75.12	74.45	-14.70	-9.41	-17.55	1.46	444.22	-0.00091
DEC	73.89	74.89	72.36	74.51	73.55	-18.96	-13.84	-21.70	7.04	588.76	-0.00094
ANNUAL	75.23	75.60	71.62	75.34	75.16	-13.92	-9.24	-16.60	20.87	5154.40	0.00001

IMPORTANT NOTE:
Average temperatures include any unconditioned zone temperatures assigned to the system.

One SS-R report for each SYSTEM (only one included here for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-R** Zone Performance Summary for System 1 (VAVS) (G) WEATHER FILE- CZ06RV2 WYEC2

ZONE	ZONE OF MAXIMUM HTG DMND (HOURS)	ZONE OF MAXIMUM CLG DMND (HOURS)	ZONE UNDER HEATED (HOURS)	ZONE UNDER COOLED (HOURS)	00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
					Number of hours within each PART LOAD range											
South Perim Zone (G.S1)	0	1401	0	46	0	0	840	55	259	685	631	257	162	299	0	3188
East Perim Zone (G.E2)	0	176	0	0	0	0	1542	703	613	174	116	33	7	0	0	3188
North Perim Zone (G.N3)	0	1	0	0	0	0	1432	395	466	647	247	1	0	0	0	3188
West Perim Zone (G.W4)	0	160	0	0	0	0	1525	641	610	205	125	76	6	0	0	3188
Core Zone (G.C5)	0	1450	0	0	0	0	0	0	1269	640	1192	87	0	0	0	3188
TOTAL	0	3188	0	46												

IMPORTANT NOTE:
Check here for hours out of control. Compare to "Hours Outside Throttling Range" on BEPS and BEPU reports.

See the SS-F report of any offending zone to see what month(s) the problem occurred in.

See the SS-G report for any offending zone to get an idea of the time of day the control problem occurs.

***** Important Report *****

One SS-L report for each SYSTEM (only one included here for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- SS-L Fan Electric Energy Use for System 1 (VAVS) (G) WEATHER FILE- CZ06RV2 WYEC2

MONTH	FAN ELEC DURING HEATING (KWH)	FAN ELEC DURING COOLING (KWH)	FAN ELEC DURING HEAT & COOL (KWH)	FAN ELEC DURING FLOATING (KWH)	00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
					--------- Number of hours within each PART LOAD range ---------											
JAN	39.455	455.446	9.460	223.216	0	0	0	154	98	22	0	0	0	0	0	274
FEB	4.480	466.890	0.000	168.577	0	0	0	120	92	29	0	0	0	0	0	241
MAR	0.000	531.361	0.000	213.856	0	0	0	134	123	25	0	0	0	0	0	282
APR	0.000	566.748	0.000	179.406	0	0	0	90	69	103	1	0	0	0	0	263
MAY	0.000	709.446	0.000	113.750	0	0	0	70	38	166	0	0	0	0	0	274
JUN	0.000	806.921	0.000	52.598	0	0	0	56	21	166	28	0	0	0	0	271
JUL	0.000	835.799	0.000	31.361	0	0	0	51	5	131	76	0	0	0	0	263
AUG	0.000	952.859	0.000	11.200	0	0	0	54	5	105	121	0	0	0	0	285
SEP	0.000	783.344	0.000	22.401	0	0	0	49	22	122	56	0	0	0	0	249
OCT	0.000	767.802	0.000	72.498	0	0	0	59	64	124	27	0	0	0	0	274
NOV	4.480	576.682	0.000	123.611	0	0	0	99	77	72	4	0	0	0	0	252
DEC	17.921	444.306	0.000	215.425	0	0	0	144	94	18	4	0	0	0	0	260
ANNUAL	**Total Fan Electric =** 66.336	**+** 7897.629	**-** 9.460	**+** 1427.909	0	0	0	1080	708	1083	317	0	0	0	0	3188

BREAKDOWN OF ANNUAL FAN POWER USAGE

FAN TYPE	ANNUAL FAN ELEC (KWH)
SUPPLY	7037.
RETURN	2346.
TOTAL	9382.

Total Fan Electric = Heating Fan Electric + Cooling Fan Electric + Floating Fan Electric - Heat & Cool Fan Electric

Used to confirm fan sizing and minimum flow settings.
In this example, default non-coincident fan sizing led to maximum part-loads less than 70%.

NOTES:
For a building-level report similar to this system-level report, see SS-M.

The fan energy reported here includes only supply & return fans. Exhaust fans are excluded. (Exhaust fans are included under the VENT FANS end use category on Plant reports.)

***** Important Report *****

One SS-N report for each SYSTEM (only one included here for brevity)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-N** Relative Humidity Summary for System 1 (VAVS) (G) WEATHER FILE- CZ06RV2 WYEC2

These hours report "hour ending" time, i.e., 1AM reports the hour ending at 1am (midnight to 1am).

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70-79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-69	0	0	0	0	0	0	0	2	2	3	2	1	2	1	2	0	0	0	0	0	0	0	0	0	15
50-59	0	0	0	0	0	0	62	67	61	38	24	20	17	16	20	19	53	7	0	0	0	0	0	0	404
40-49	0	0	0	0	0	0	66	131	175	205	226	235	238	250	243	214	156	52	0	0	0	0	0	0	2200
30-39	0	0	0	0	0	0	8	36	33	24	25	26	26	19	25	28	29	24	0	0	0	0	0	0	305
20-29	0	0	0	0	0	0	6	22	23	25	19	16	17	13	8	9	9	14	0	0	0	0	0	0	190
10-19	0	0	0	0	0	0	4	23	7	7	6	4	2	4	6	4	4	6	0	0	0	0	0	0	79
0-09	0	0	0	0	0	0	0	1	3	2	2	2	2	1	0	0	1	3	0	0	0	0	0	0	17

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*****************************************************************
*                                                               *
*  NOTE  1)THE RELATIVE HUMIDITY COUNTS ARE MADE ONLY FOR       *
*          THE HOURS WHEN THE FANS ARE ON                       *
*                                                               *
*****************************************************************
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NOTE:
DOE-2's humidistat is only located in the central return path for the system, therefore, the RH's reported here are the average for all zones served by the system.

***** Important Report *****

One SS-G report for each ZONE (only one included here for brevity)

```
3-Story Office Bldg                                              DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2

REPORT- SS-G Zone Loads Summary for         South Perim Zone (G.S1)                     WEATHER FILE- CZ06RV2 WYEC2
```

MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
	COOLING						HEATING						ELEC	
JAN	0.00000	31	24	50.F	49.F	0.000	-0.006	2	9	51.F	46.F	-6.252	627.	3.560
FEB	0.00000	28	24	51.F	50.F	0.000	0.000	28	24	51.F	50.F	0.000	535.	3.078
MAR	0.00000	31	24	52.F	51.F	0.000	0.000	31	24	52.F	51.F	0.000	608.	2.107
APR	0.00000	30	1	55.F	55.F	0.000	0.000	30	1	55.F	55.F	0.000	566.	2.107
MAY	0.00000	31	1	54.F	49.F	0.000	0.000	31	1	54.F	49.F	0.000	589.	2.107
JUN	0.00000	30	1	61.F	58.F	0.000	0.000	30	1	61.F	58.F	0.000	577.	2.107
JUL	0.00000	31	1	63.F	58.F	0.000	0.000	31	1	63.F	58.F	0.000	562.	2.107
AUG	0.00000	31	1	64.F	56.F	0.000	0.000	31	1	64.F	56.F	0.000	615.	2.107
SEP	0.00000	30	1	63.F	61.F	0.000	0.000	30	1	63.F	61.F	0.000	537.	2.257
OCT	0.00000	31	24	55.F	47.F	0.000	0.000	31	24	55.F	47.F	0.000	607.	2.715
NOV	0.00000	30	24	52.F	43.F	0.000	0.000	30	24	52.F	43.F	0.000	581.	3.718
DEC	0.00000	31	24	48.F	47.F	0.000	0.000	31	24	48.F	47.F	0.000	602.	3.786
TOTAL	0.000						-0.006						7007.	
MAX						0.000						-6.252		3.786

No zone-level cooling in this example. (Cooling via natural ventilation is only reported at the system level on SS-B.)

Zone-level heating in this example is reheat.

Includes only items know about by the LOADS and SYSTEMS programs, i.e., lights, plugs, fans, DX compressors, reheat, etc., for this zone. Central plant electric is included on "PS-" reports.

One SS-F report for each ZONE (only one included here for brevity)

3-Story Office Bldg   DOE-B2.2NT38   4/07/2001   10:36:50 BDL RUN 2

REPORT- **SS-F** Zone Demand Summary for   South Perim Zone (G.S1)   WEATHER FILE- CZ06RV2 WYEC2

	- - - -D E M A N D S- - - - -		- -B A S E B O A R D S- - -		- - T E M P E R A T U R E S- -		- - L O A D S N O T M E T- -	
MONTH	HEAT EXTRACTION ENERGY (MBTU)	HEAT ADDITION ENERGY (MBTU)	BASEBOARD ENERGY (MBTU)	MAXIMUM BASEBOARD LOAD (KBTU/HR)	MAXIMUM ZONE TEMP (F)	MINIMUM ZONE TEMP (F)	HOURS UNDER HEATED	HOURS UNDER COOLED
JAN	3.16646	-0.005	0.00000	0.000	79.3	65.7	0	12
FEB	2.77667	0.000	0.00000	0.000	78.2	70.3	0	3
MAR	2.49827	0.000	0.00000	0.000	77.2	71.1	0	0
APR	1.71558	0.000	0.00000	0.000	76.5	71.1	0	0
MAY	1.90271	0.000	0.00000	0.000	76.0	72.0	0	0
JUN	2.25829	0.000	0.00000	0.000	76.7	73.4	0	0
JUL	2.43026	0.000	0.00000	0.000	77.0	74.1	0	0
AUG	2.91116	0.000	0.00000	0.000	77.3	74.7	0	0
SEP	2.58410	0.000	0.00000	0.000	77.7	74.0	0	0
OCT	3.10833	0.000	0.00000	0.000	78.6	73.2	0	0
NOV	3.06735	0.000	0.00000	0.000	79.0	71.7	0	10
DEC	3.06291	0.000	0.00000	0.000	80.1	69.5	0	21

These zone temperatures are hour-ending temperatures and are only reported for fan run hours, i.e., these temperatures always report conditions after the fans have been running at least one hour.

Reports hours >0.5F outside throttling range by month for this zone (only logs during fan run hours).

The recommended sequence to check adequate control: Check hours outside throttling range on BEPS or BEPU report, then check SS-R report, then check this report and the next report (SS-O).

***** Important Report *****

One SS-O report for each ZONE (only one included here for brevity)

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3-Story Office Bldg                                                             DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2
REPORT- SS-O Space Temperature Summary for  South Perim Zone (G.S1)                                    WEATHER FILE- CZ06RV2 WYEC2
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These hours report "hour ending" time, i.e., 1AM reports the hour ending at 1am (midnight to 1am).

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-85	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
75-80	0	0	0	0	0	0	65	140	245	288	300	301	303	303	303	274	238	58	0	0	0	0	0	0	2818
70-75	0	0	0	0	0	0	81	138	59	16	4	3	0	0	1	0	14	48	0	0	0	0	0	0	364
65-70	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
60-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Unfortunately, these temperature ranges ("bins") cannot be set by the user. Therefore, these pre-set bins may not correspond very conveniently to the throttling range limits in any specific example.

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*****************************************************************
*                                                               *
*  NOTE  1)THE TEMPERATURE COUNTS ARE MADE ONLY FOR             *
*          THE HOURS WHEN THE FANS ARE ON                       *
*                                                               *
*****************************************************************
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In this example, these hours indicate inadequate flow to this south zone, as suggested by hours outside of throttling range (BEPS, BEPU, SS-R, and SS-F). Likely due to inadequate Design Day sizing where low sun angle in winter months sets the south zone peak space load (not captured using Design Day).

NOTE:
Hours are logged on this report ONLY during fan run hours.

Use this report to check the time of day for any hours outside of throttling range (as reported on BEPS, BEPU, SS-R, or SS-F).

***** Important Report *****

One SS-P report for each UNITARY SYSTEM (i.e., PSZ, PVAVS, RESYS, RESVVT, PTAC, or HP — only one included here for brevity)

REPORT- **SS-P** **Heating** Performance Summary of System 2 (PSZ) (T.S13) WEATHER FILE- CZ06RV2 WYEC2

UNIT TYPE is PSZ HEATING-CAPACITY = -40.504 (KBTU/HR) HEATING-EIR = 0.345 (BTU/BTU) SUPPLY-FLOW = 965. (CFM)

MONTH	SUM / PEAK	UNIT LOAD (MBTU) (KBTU/HR)	ENERGY USE (KWH) (KW)	COMPRESSOR (KWH) (KW)	FAN ENERGY (KWH) (KW)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
JAN	SUM	-0.067	35.548	31.002	73.185	CMP	66	0	1	0	1	0	0	0	0	0	0	68
	PEAK	-20.264	2.097	2.097	0.267	FAN	0	0	0	0	0	0	0	0	0	0	68	68
	DAY/HR	2/ 9	2/ 9	2/ 9	31/18													
FEB	SUM	-0.020	21.238	18.845	64.370	CMP	46	0	0	0	0	0	0	0	0	0	0	46
	PEAK	-1.989	0.540	0.540	0.267	FAN	0	0	0	0	0	0	0	0	0	0	46	46
	DAY/HR	5/ 9	5/ 9	5/ 9	28/18													
MAR	SUM	-0.029	26.262	23.489	75.321	CMP	56	0	0	0	0	0	0	0	0	0	0	56
	PEAK	-2.815	0.635	0.635	0.267	FAN	0	0	0	0	0	0	0	0	0	0	56	56
	DAY/HR	17/10	17/10	17/10	31/16													
APR	SUM	-0.020	20.206	19.506	70.247	CMP	47	0	0	0	0	0	0	0	0	0	0	47
	PEAK	-1.631	0.528	0.528	0.267	FAN	0	0	0	0	0	0	0	0	0	0	47	47
	DAY/HR	30/11	30/11	30/11	30/18													
MAY	SUM	-0.018	19.888	19.638	73.185	CMP	47	0	0	0	0	0	0	0	0	0	0	47
	PEAK	-1.367	0.510	0.510	0.267	FAN	0	0	0	0	0	0	0	0	0	0	47	47
	DAY/HR	26/10	26/10	26/10	31/18													
JUN	SUM	-0.010	12.598	12.598	72.383	CMP	30	0	0	0	0	0	0	0	0	0	0	30
	PEAK	-1.461	0.507	0.507	0.267	FAN	0	0	0	0	0	0	0	0	0	0	30	30
	DAY/HR	2/10	2/10	2/10	30/16													
JUL	SUM	-0.006	9.350	9.350	70.247	CMP	22	0	0	0	0	0	0	0	0	0	0	22
	PEAK	-0.334	0.442	0.442	0.267	FAN	0	0	0	0	0	0	0	0	0	0	22	22
	DAY/HR	3/ 8	24/ 8	24/ 8	31/18													
AUG	SUM	-0.005	9.190	9.190	76.123	CMP	21	0	0	0	0	0	0	0	0	0	0	21
	PEAK	-0.313	0.468	0.468	0.267	FAN	0	0	0	0	0	0	0	0	0	0	21	21
	DAY/HR	22/ 8	6/ 8	6/ 8	31/18													
SEP	SUM	-0.006	9.840	9.840	66.507	CMP	23	0	0	0	0	0	0	0	0	0	0	23
	PEAK	-0.346	0.471	0.471	0.267	FAN	0	0	0	0	0	0	0	0	0	0	23	23
	DAY/HR	27/ 8	24/ 9	24/ 9	29/16													
OCT	SUM	-0.012	15.250	15.175	73.185	CMP	36	0	0	0	0	0	0	0	0	0	0	36
	PEAK	-0.650	0.463	0.463	0.267	FAN	0	0	0	0	0	0	0	0	0	0	36	36
	DAY/HR	30/ 9	25/ 9	25/ 9	31/18													
NOV	SUM	-0.022	20.971	19.498	67.309	CMP	46	0	0	0	0	0	0	0	0	0	0	46
	PEAK	-1.759	0.543	0.543	0.267	FAN	0	0	0	0	0	0	0	0	0	0	46	46
	DAY/HR	13/11	13/11	13/11	30/18													
DEC	SUM	-0.046	35.037	29.687	69.445	CMP	68	1	0	0	0	0	0	0	0	0	0	69
	PEAK	-6.149	0.897	0.897	0.267	FAN	0	0	0	0	0	0	0	0	0	0	69	69
	DAY/HR	31/ 9	31/ 9	31/ 9	31/18													
YR	SUM	-0.261	235.376	217.818	851.486	CMP	508	1	1	0	1	0	0	0	0	0	0	511
	PEAK	-20.264	2.097	2.097	0.267	FAN	0	0	0	0	0	0	0	0	0	0	511	511
	MON/DAY	1/ 2	1/ 2	1/ 2	12/31													

***** Important Report *****

One SS-P report for each UNITARY SYSTEM (i.e., PSZ, PVAVS, RESYS, RESVVT, PTAC, or HP — only one included here for brevity)

3-Story Office Bldg **NOTE:** To obtain this report, SS-H must also be selected. DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-P** **Cooling** Performance Summary of System 2 (PSZ) (T.S13) WEATHER FILE- CZ06RV2 WYEC2

UNIT TYPE is PSZ COOLING-CAPACITY = 33.557 (KBTU/HR) COOLING-EIR = 0.416 (BTU/BTU) SUPPLY-FLOW = 965. (CFM)

MONTH	SUM PEAK	UNIT LOAD (MBTU) (KBTU/HR)	ENERGY USE (KWH) (KW)	COMPRESSOR (KWH) (KW)	FAN ENERGY (KWH) (KW)		00-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100 +	TOTAL RUN HOURS
							Number of hours within each PART LOAD range											
JAN	SUM	2.842	287.448	284.349	73.185	CMP	0	0	3	3	13	15	53	43	1	0	0	131
	PEAK	27.395	2.827	2.827	0.267	FAN	0	0	0	0	0	0	0	0	0	0	131	131
	DAY/HR	18/13	11/13	11/13	31/18													
FEB	SUM	2.722	274.443	272.243	64.370	CMP	1	0	3	6	13	7	42	52	1	0	0	125
	PEAK	27.761	2.838	2.838	0.267	FAN	0	0	0	0	0	0	0	0	0	0	124	124
	DAY/HR	16/13	12/13	12/13	28/18													
MAR	SUM	2.211	224.134	221.409	75.321	CMP	1	0	3	8	33	42	23	10	1	0	0	121
	PEAK	27.353	2.868	2.868	0.267	FAN	0	0	0	0	0	0	0	0	0	0	120	120
	DAY/HR	16/13	16/13	16/13	31/16													
APR	SUM	1.329	137.767	137.067	70.247	CMP	3	0	14	28	30	21	3	0	0	0	0	99
	PEAK	20.847	2.275	2.275	0.267	FAN	0	0	0	0	0	0	0	0	0	0	96	96
	DAY/HR	6/14	4/14	4/14	30/18													
MAY	SUM	2.603	261.987	261.737	73.185	CMP	4	0	16	22	66	44	15	1	0	0	0	168
	PEAK	23.977	2.665	2.665	0.267	FAN	0	0	0	0	0	0	0	0	0	0	164	164
	DAY/HR	31/14	29/14	29/14	31/18													
JUN	SUM	3.769	387.657	387.657	72.383	CMP	6	0	5	16	39	57	44	22	7	1	0	197
	PEAK	31.382	3.542	3.542	0.267	FAN	0	0	0	0	0	0	0	0	0	0	191	191
	DAY/HR	20/14	20/14	20/14	30/16													
JUL	SUM	4.297	449.928	449.928	70.247	CMP	17	0	2	12	32	46	56	49	6	0	0	220
	PEAK	27.809	3.262	3.262	0.267	FAN	0	0	0	0	0	0	0	0	0	0	203	203
	DAY/HR	10/16	10/16	10/16	31/18													
AUG	SUM	4.953	519.924	519.924	76.123	CMP	19	0	0	10	28	49	70	67	4	0	0	247
	PEAK	27.499	3.306	3.306	0.267	FAN	0	0	0	0	0	0	0	0	0	0	228	228
	DAY/HR	31/15	31/15	31/15	31/18													
SEP	SUM	4.122	435.378	435.378	66.507	CMP	14	0	8	17	27	31	59	27	25	3	0	211
	PEAK	31.479	3.465	3.465	0.267	FAN	0	0	0	0	0	0	0	0	0	0	197	197
	DAY/HR	7/15	7/14	7/14	29/16													
OCT	SUM	4.095	422.497	422.422	73.185	CMP	11	0	10	16	24	40	39	23	20	19	2	204
	PEAK	34.932	3.687	3.687	0.267	FAN	0	0	0	0	0	0	0	0	0	0	193	193
	DAY/HR	1/14	1/14	1/14	31/18													
NOV	SUM	3.324	338.893	337.468	67.309	CMP	3	0	4	7	15	24	30	44	26	0	0	153
	PEAK	29.063	3.168	3.168	0.267	FAN	0	0	0	0	0	0	0	0	0	0	150	150
	DAY/HR	27/13	29/13	29/13	30/18													
DEC	SUM	2.503	257.208	252.434	69.445	CMP	2	0	4	6	17	19	55	16	5	0	0	124
	PEAK	27.361	2.994	2.994	0.267	FAN	0	0	0	0	0	0	0	0	0	0	122	122
	DAY/HR	19/15	19/14	19/14	31/18													
YR	SUM	38.770	3997.244	3982.015	851.486	CMP	81	0	72	151	337	395	489	354	96	23	2	2000
	PEAK	34.932	3.687	3.687	0.267	FAN	0	0	0	0	0	0	0	0	0	0	1919	1919
	MON/DAY	10/ 1	10/ 1	10/ 1	12/31													

***** Important Report *****

One SS-P report for each HEAT PUMP SYSTEM (i.e., PSZ, PVAVS, RESYS, RESVVT or PTAC — only one included here for brevity)

3-Story Office Bldg **NOTE:** To obtain this report, SS-A must also be selected. DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **SS-Q** Heat Pump **Cooling** Summary for System 2 (PSZ) (T.S13) WEATHER FILE- CZ06RV2 WYEC2

	UNIT RUN TIME (HOURS)	TOTAL LOAD ON UNIT (MBTU)	ENERGY IN TO UNIT (MBTU)	AUXILIARY ENERGY (MBTU)	SUP UNIT LOAD (MBTU)	SUP UNIT ENERGY (MBTU)	WASTE HEAT GENERATED (MBTU)	WASTE HEAT USE (MBTU)		INDOOR FAN ENERGY (MBTU)
JAN	84.	2.842	0.970	0.011	0.000	0.000	0.000	0.000	0.000	0.154
FEB	80.	2.722	0.929	0.008	0.000	0.000	0.000	0.000	0.000	0.145
MAR	65.	2.211	0.756	0.009	0.000	0.000	0.000	0.000	0.000	0.158
APR	40.	1.329	0.468	0.002	0.000	0.000	0.000	0.000	0.000	0.142
MAY	76.	2.603	0.893	0.001	0.000	0.000	0.000	0.000	0.000	0.178
JUN	108.	3.769	1.323	0.000	0.000	0.000	0.000	0.000	0.000	0.197
JUL	124.	4.297	1.536	0.000	0.000	0.000	0.000	0.000	0.000	0.202
AUG	143.	4.953	1.774	0.000	0.000	0.000	0.000	0.000	0.000	0.224
SEP	119.	4.122	1.486	0.000	0.000	0.000	0.000	0.000	0.000	0.193
OCT	120.	4.095	1.442	0.000	0.000	0.000	0.000	0.000	0.000	0.196
NOV	98.	3.324	1.152	0.005	0.000	0.000	0.000	0.000	0.000	0.162
DEC	74.	2.503	0.862	0.016	0.000	0.000	0.000	0.000	0.000	0.143
ANNUAL	1130.	38.770	13.591	0.052	0.000	0.000	0.000	0.000	0.000	2.095

CSPF (WITH PARASITICS) = 2.46 (KBTU/HR)
CSPF (WITHOUT PARASITICS) = 2.85 (BTU/BTU)

"Seasonal Cooling COP" (Btu/Btu)
COP = TOTAL LOAD / ENERGY IN
"parasitics" are fan and pump (if any) energy.

One SS-P report for each HEAT PUMP SYSTEM (i.e., PSZ, PVAVS, RESYS, RESVVT or PTAC — only one included here for brevity)

3-Story Office Bldg   **NOTE:** To obtain this report, SS-A must also be selected.   DOE-B2.2NT38   4/07/2001   10:36:50 BDL RUN 2

REPORT- **SS-Q** Heat Pump **Heating** Summary for System 2 (PSZ) (T.S13)   WEATHER FILE- CZ06RV2 WYEC2

	UNIT RUN TIME (HOURS)	TOTAL LOAD ON UNIT (MBTU)	ENERGY IN TO UNIT (MBTU)	AUXILIARY ENERGY (MBTU)	SUP UNIT LOAD (MBTU)	SUP UNIT ENERGY (MBTU)	WASTE HEAT GENERATED (MBTU)	WASTE HEAT USE (MBTU)	DEFROST LOAD (MBTU)	INDOOR FAN ENERGY (MBTU)
JAN	2.	-0.067	0.109	0.012	0.000	0.000	0.000	0.000	0.000	0.096
FEB	0.	-0.020	0.064	0.008	0.000	0.000	0.000	0.000	0.000	0.074
MAR	1.	-0.029	0.080	0.009	0.000	0.000	0.000	0.000	0.000	0.099
APR	0.	-0.020	0.067	0.002	0.000	0.000	0.000	0.000	0.000	0.098
MAY	0.	-0.018	0.067	0.001	0.000	0.000	0.000	0.000	0.000	0.072
JUN	0.	-0.010	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.050
JUL	0.	-0.006	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.037
AUG	0.	-0.005	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.036
SEP	0.	-0.006	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.034
OCT	0.	-0.012	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.053
NOV	0.	-0.022	0.067	0.005	0.000	0.000	0.000	0.000	0.000	0.067
DEC	1.	-0.046	0.101	0.018	0.000	0.000	0.000	0.000	0.000	0.094
ANNUAL	6.	-0.261	0.747	0.057	0.000	0.000	0.000	0.000	0.000	0.811

HSPF (WITH PARASITICS)   =   0.66 (KBTU/HR)
HSPF (WITHOUT PARASITICS) =   0.35 (BTU/BTU)

"Seasonal Heating COP" (Btu/Btu)
COP = TOTAL LOAD / ENERGY IN
"parasitics" are fan and pump (if any) energy.

One PV-A report only (this is a building level report — may be muliple pages depending on amount of plant equipment)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PV-A** Plant Design Parameters WEATHER FILE- CZ06RV2 WYEC2

*** CIRCULATION LOOPS ***

	HEATING CAPACITY (MBTU/HR)	COOLING CAPACITY (MBTU/HR)	LOOP FLOW (GAL/MIN)	TOTAL HEAD (FT)	SUPPLY UA PRODUCT (BTU/HR-F)	SUPPLY LOSS DT (F)	RETURN UA PRODUCT (BTU/HR-F)	RETURN LOSS DT (F)	LOOP VOLUME (GAL)	FLUID HEAT CAPACITY (BTU/LB-F)
Chilled Water Loop	0.000	0.570	112.4	56.6	0.0	0.00	0.0	0.00	168.7	1.00
Hot Water Loop	-0.507	0.000	25.4	36.6	0.0	0.00	0.0	0.00	38.1	1.00
Condenser Water Loop	0.000	0.727	144.1	61.6	0.0	0.00	0.0	0.00	216.1	1.00
Domestic Hot Water Loop	-0.020	0.000	0.5	0.0	0.0	0.00	0.0	0.00	0.8	1.00

*** PUMPS ***

ATTACHED TO		FLOW (GAL/MIN)	HEAD (FT)	HEAD SETPOINT (FT)	CAPACITY CONTROL	POWER (KW)	MECHANICAL EFFICIENCY (FRAC)	MOTOR EFFICIENCY (FRAC)
CHW Loop Pump Chilled Water Loop PRIMARY LOOP	1 PUMP(s)	112.4	80.0	37.6	VAR-SPEED	2.544	0.770	0.865
HW Loop Pump Hot Water Loop PRIMARY LOOP	1 PUMP(s)	25.4	40.0	0.0	ONE-SPEED	0.355	0.770	0.700
CW Loop Pump Condenser Water Loop PRIMARY LOOP	1 PUMP(s)	144.1	50.0	0.0	ONE-SPEED	2.176	0.770	0.810

*** PRIMARY EQUIPMENT ***

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	EIR (FRAC)	HIR (FRAC)	AUXILIARY (KW)
Boiler 1 (HWNatDraft) HW-BOILER	Hot Water Loop	-0.507	25.4	0.000	1.250	0.000
Chiller 1 (ElecRecipHerm) ELEC-HERM-REC	Chilled Water Loop	0.570	113.9	0.265	0.000	0.000
	Condenser Water Loop	0.721	144.1			

Chiller capacity (in MBTU) compare with PS-C PEAK Load

IMPORTANT NOTE: reports non-coincident heating & cooling capacity. Depending on each loop's SIZING-OPTION, the capacity is either the sum of all coil loads (SECONDARY), or suppliers (PRIMARY).

*** COOLING TOWERS ***

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	NUMBER OF CELLS	FAN POWER PER CELL (KW)	SPRAY PWR PER CELL (KW)	AUXILIARY (KW)
Open Tower OPEN-TWR	Condenser Water Loop	0.727	145.3	1	2.237	0.000	0.000

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3-Story Office Bldg                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PV-A Plant Design Parameters                                        WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------(CONTINUED)--------

*** DW-HEATERS ***
                                                                    CAPACITY      FLOW          EIR       HIR   AUXILIARY    TANK     TANK UA
   EQUIPMENT TYPE              ATTACHED TO                         (MBTU/HR) (GAL/MIN    )  (FRAC)    (FRAC)     (KW)    ( GAL )  (BTU/HR-F)
  ----------------  --------------------------------  ----------  ----------  --------  --------  --------  --------  ----------

  GAS DW-HEATER     Domestic Hot Water Loop                 -0.206        5.3     0.000     1.370     0.000    154.6        6.44
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One PS-A report only (this is a building level report)

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3-Story Office Bldg                                              DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- PS-A Plant Energy Utilization                                      WEATHER FILE- CZ06RV2 WYEC2
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MONTH	2 TOTAL HEAT LOAD (MBTU)	3 TOTAL COOLING LOAD (MBTU)	4 TOTAL ELECTR LOAD (MWH)	5 RCVRED ENERGY (MBTU)	6 WASTED RCVRABL ENERGY (MBTU)	7 FUEL INPUT COOLING (MBTU)	8 ELEC INPUT COOLING (MWH)	9 FUEL INPUT HEATING (MBTU)	10 ELEC INPUT HEATING (MWH)	11 FUEL INPUT ELECT (MBTU)	12 TOTAL FUEL INPUT (MBTU)	13 TOTAL SITE ENERGY (MBTU)	SOURCE 14 TOTAL SOURCE ENERGY (MBTU)
	S I T E	E N E R G Y											
JAN	-4.6	16.5	25.2	0.0	0.0	0.0	2.9	6.9	0.3	0.0	6.9	93.0	265.2
FEB	-3.5	18.9	22.1	0.0	0.0	0.0	3.1	5.0	0.1	0.0	5.0	80.3	230.9
MAR	-4.1	21.1	25.3	0.0	0.0	0.0	3.5	5.8	0.2	0.0	5.8	92.2	264.9
APR	-3.9	22.1	24.0	0.0	0.0	0.0	3.8	5.4	0.1	0.0	5.4	87.2	250.8
MAY	-4.0	39.0	27.3	0.0	0.0	0.0	6.3	5.5	0.1	0.0	5.5	98.6	284.8
JUN	-3.7	60.8	29.9	0.0	0.0	0.0	9.1	5.2	0.1	0.0	5.2	107.1	310.9
JUL	-3.6	68.4	30.6	0.0	0.0	0.0	10.3	5.0	0.1	0.0	5.0	109.6	318.8
AUG	-3.9	77.2	33.8	0.0	0.0	0.0	11.6	5.4	0.1	0.0	5.4	120.8	351.7
SEP	-3.2	63.2	28.7	0.0	0.0	0.0	9.4	4.5	0.1	0.0	4.5	102.6	298.8
OCT	-3.7	52.8	29.6	0.0	0.0	0.0	8.0	5.3	0.1	0.0	5.3	106.2	308.2
NOV	-3.5	31.1	25.2	0.0	0.0	0.0	4.9	4.9	0.1	0.0	4.9	90.9	263.0
DEC	-3.6	15.8	23.9	0.0	0.0	0.0	2.8	5.2	0.3	0.0	5.2	86.9	250.2
TOTAL	-45.3	486.9	325.6	0.0	0.0	0.0	75.6	64.2	1.6	0.0	64.2	1175.5	3398.2

These loads are loads into the plant equipment and include all coil loads + pipe loss/gain (if any) + pump work.

NOTE:
For lack of column space, PS-A groups heat rejection energy with cooling energy, while BEPS, BEPU, PS-E, and PS-F report heat rejection energy as a separate category.

One PS-B report only (this is a building level report)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-B** Utility and Fuel Use Summary WEATHER FILE- CZ06RV2 WYEC2

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
EM1 ELECTRICITY													
KWH	25228.	22069.	25308.	23963.	27275.	29859.	30647.	33820.	28743.	29591.	25205.	23920.	325626.
MAX KW	118.6	119.2	117.3	125.0	127.5	144.6	140.7	138.6	145.9	142.4	137.7	131.7	145.9
DAY/HR	11/16	13/16	15/16	4/17	31/14	20/14	10/17	7/10	7/17	1/14	29/17	19/17	9/ 7
FM1 NATURAL-GAS													
THERM	69.	50.	58.	54.	55.	52.	50.	54.	45.	53.	49.	52.	642.
MAX THERM/HR	3.8	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	1.1	3.8
DAY/HR	2/ 9	2/ 9	1/ 9	11/ 9	7/ 9	5/ 9	2/ 9	22/ 9	26/ 9	15/ 9	16/16	31/ 9	1/ 2

IMPORTANT NOTE:
More detailed annual information similar to this report is available on the PS-E report and the ES-E report (ES-E includes user-controlled monthly meter read dates).

One PS-C report only (this is a building level report — may be muliple pages depending on amount of plant equipment)

3-Story Office Bldg   DOE-B2.2NT38   4/07/2001   10:36:50   BDL RUN 2

REPORT- **PS-C** Equipment Loads and Energy Use   WEATHER FILE- CZ06RV2 WYEC2

MON	SUM PEAK	COOL LOAD (MBTU) (KBTU/HR)	HEAT LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	FUEL USE (MBTU) (KBTU/HR)		-------- Number of hours within each PART LOAD range --------- 00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
Boiler 1 (HWNatDraft)																		
	SUM		-0.5		1.4	LOAD	11	0	1	0	1	0	0	0	0	0	0	13
	PEAK		-252.9		354.9	FUEL	4	6	2	0	0	1	0	0	0	0	0	13
	MON/DAY		1/ 2		1/ 2													
Chiller 1 (ElecRecipHerm)																		
	SUM	486.9		50853.4		LOAD	1001	502	278	361	382	410	219	35	0	0	0	3188
	PEAK	448.9		37.1		ELEC	441	636	415	278	361	402	444	199	12	0	0	3188
	MON/DAY	6/20		6/20														
Open Tower																		
	SUM	714.0		904.5		LOAD	0	0	0	0	3125	57	6	0	0	0	0	3188
	PEAK	581.2		1.5		ELEC	482	392	336	388	172	51	6	0	0	0	0	1827
	MON/DAY	6/20		6/20														
Domestic Water Heater																		
	SUM		-44.8		67.0	LOAD	2580	0	0	0	0	0	0	0	0	0	0	2580
	PEAK		-19.9		28.0	FUEL	8760	0	0	0	0	0	0	0	0	0	0	8760
	MON/DAY		3/ 1		3/ 1													
CHW Loop Pump																		
	SUM			1538.2		FLOW	1040	541	496	454	452	178	27	0	0	0	0	3188
	PEAK			1.1		RPM	0	0	0	0	0	979	2150	59	0	0	0	3188
	MON/DAY			6/20		ELEC	0	1949	990	245	4	0	0	0	0	0	0	3188
HW Loop Pump																		
	SUM			1130.6		FLOW	0	0	0	0	0	0	0	0	0	0	3188	3188
	PEAK			0.4		RPM	0	0	0	0	0	0	0	0	0	0	3188	3188
	MON/DAY			1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	3188	3188
CW Loop Pump																		
	SUM			6937.0		FLOW	0	0	0	0	0	0	0	0	0	0	3188	3188
	PEAK			2.2		RPM	0	0	0	0	0	0	0	0	0	0	3188	3188
	MON/DAY			1/ 2		ELEC	0	0	0	0	0	0	0	0	0	0	3188	3188

SUM = Btu X 1,000,000
PEAK = Btu x 1,000

In the case of one chiller (this example), these loads will match the Circulation Loop loads on PS-D.

USAGE NOTE:
Use PEAK values and PART LOAD hours from this report to check the adequacy of plant equipment sizes. Compare PEAK sizes on this report (reported in KBTU) with equipment CAPACITY (etc.) from the PV-A report (often reported in MBTU).
In this example, the PV-A reports the chiller size = 0.570 MBTU (570 KBTU). PS-C reports chiller PEAK = 448.9 KBTU, hence, the peak load represents 79% (448.9/570.0) of the installed chiller size (agrees with the 70-80% part load range as the highest load range).

NOTE:
For more detailed reporting of this type of information, see the PS-H report (one report per piece of central plant equipment).

***** Important Report *****

One PS-D report only (this is a building level report — may be muliple pages depending on number of circulaiton loops)

```
3-Story Office Bldg                                                        DOE-B2.2NT38    4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-D Circulation Loop Loads                                                         WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------
            COIL LOAD   PIPE GAIN   NET LOAD    OVERLOAD       --------  Number of hours within each PART LOAD range  --------- TOTAL
      SUM    (MBTU)      (MBTU)      (MBTU)      (MBTU)          00    10    20    30    40    50    60    70    80    90   100   RUN
MON  PEAK   (KBTU/HR)   (KBTU/HR)   (KBTU/HR)   (KBTU/HR)        10    20    30    40    50    60    70    80    90   100    +  HOURS
---  ----  ----------  ----------  ----------  ----------      ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----

Chilled Water Loop
      SUM       483.2         0.0       486.9         0.0 COOL1014   497   282   357   376   401   224    37     0     0     0  3188
     PEAK       446.0         0.0       448.9         0.0 FLOW1040   541   496   454   452   178    27     0     0     0     0  3188
  MON/DAY        6/20        0/ 0        6/20        0/ 0

Hot Water Loop
      SUM        -0.6         0.0        -0.5         0.0 HEAT  11     0     1     0     1     0     0     0     0     0     0    13
     PEAK      -256.8         0.0      -252.9         0.0 FLOW   0     0     0     0     0     0     0     0     0     0  3188  3188
  MON/DAY        1/ 2        0/ 0        1/ 2        0/ 0

Condenser Water Loop
      SUM       694.8         0.0       714.0         0.0 COOL 658   664   404   310   410   405   289    48     0     0     0  3188
     PEAK       575.7         0.0       581.2         0.0 FLOW   0     0     0     0     0     0     0     0     0     0  3188  3188
  MON/DAY        6/20        0/ 0        6/20        0/ 0

Domestic Hot Water Loop
      SUM       -44.8         0.0       -44.8         0.0 HEAT   0     0   312     0     0     0     0     0     0  2070   198  2580
     PEAK       -19.9         0.0       -19.9         0.0 FLOW6180     0   312     0     0     0     0     0     0     0  2268  8760
  MON/DAY        3/ 1        0/ 0        3/ 1        0/ 0
```

If all cooling coils in the building were CHW coils, these coil loads would match those reported on SS-D. In this example, CHW coils serve the first two floors, DX coils serve the third (top) floor.

Compare these loads (CHW loop loads) with those reported on PS-C (central plant equipment loads). In this case, since there is only one chiller, these loads agree with those reported on LS-C.

***** Important Report *****

Two PS-E reports (one Electric, one Fuel, this is a building level report — two-page report — page 1 of 2)

3-Story Office Bldg **NOTE:** see comments on page 2 of 2 (next page). DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-E** Energy End-Use Summary **for all Electric Meters** WEATHER FILE- CZ06RV2 WYEC2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
JAN													
KWH	5834.	1149.	12078.	301.	2876.	8.	826.	2148.	0.	7.	0.	0.	25228.
MAX KW	37.8	5.6	42.6	21.6	35.9	0.4	3.1	10.4	0.0	3.4	0.0	0.0	118.6
DAY/HR	24/17	2/ 9	2/ 9	2/ 9	11/13	18/13	11/13	12/16	0/ 0	8/ 8	0/ 0	0/ 0	11/16
PEAK ENDUSE	23.8	5.6	42.6	0.0	33.0	0.3	3.0	10.3	0.0	0.0	0.0	0.0	
PEAK PCT	20.1	4.7	35.9	0.0	27.8	0.2	2.6	8.7	0.0	0.0	0.0	0.0	
FEB													
KWH	4595.	998.	10596.	139.	3062.	13.	725.	1940.	0.	0.	0.	0.	22069.
MAX KW	31.7	5.6	42.6	3.3	35.6	0.5	3.1	10.5	0.0	0.0	0.0	0.0	119.2
DAY/HR	8/17	1/ 9	1/ 9	3/ 9	13/16	16/13	16/13	13/16	0/ 0	8/ 8	0/ 0	0/ 0	13/16
PEAK ENDUSE	21.6	5.6	42.6	0.0	35.6	0.3	3.1	10.5	0.0	0.0	0.0	0.0	
PEAK PCT	18.1	4.7	35.7	0.0	29.9	0.3	2.6	8.8	0.0	0.0	0.0	0.0	
MAR													
KWH	4965.	1159.	12381.	152.	3523.	16.	848.	2264.	0.	0.	0.	0.	25308.
MAX KW	22.4	5.6	42.6	4.1	38.8	0.5	3.1	9.8	0.0	0.0	0.0	0.0	117.3
DAY/HR	14/17	1/ 9	1/ 9	26/11	16/13	16/13	16/13	6/16	0/ 0	8/ 8	0/ 0	0/ 0	15/16
PEAK ENDUSE	19.0	5.6	42.6	0.0	36.9	0.4	3.1	9.7	0.0	0.0	0.0	0.0	
PEAK PCT	16.2	4.8	36.3	0.0	31.5	0.4	2.6	8.3	0.0	0.0	0.0	0.0	
APR													
KWH	4427.	1099.	11584.	121.	3740.	19.	774.	2200.	0.	0.	0.	0.	23963.
MAX KW	21.0	5.6	42.6	3.4	43.3	0.5	3.2	10.8	0.0	0.0	0.0	0.0	125.0
DAY/HR	2/ 9	2/ 9	2/ 9	30/11	4/17	23/12	4/17	4/17	0/ 0	8/ 8	0/ 0	0/ 0	4/17
PEAK ENDUSE	19.2	5.6	42.6	0.0	43.3	0.4	3.2	10.8	0.0	0.0	0.0	0.0	
PEAK PCT	15.3	4.5	34.0	0.0	34.6	0.3	2.5	8.6	0.0	0.0	0.0	0.0	
MAY													
KWH	4469.	1149.	12078.	107.	6203.	62.	819.	2387.	0.	0.	0.	0.	27275.
MAX KW	18.7	5.6	42.6	2.9	48.8	0.8	3.3	10.4	0.0	0.0	0.0	0.0	127.5
DAY/HR	9/ 9	1/ 9	1/ 9	23/ 8	31/14	31/14	31/14	30/17	0/ 0	8/ 8	0/ 0	0/ 0	31/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	48.8	0.8	3.3	10.2	0.0	0.0	0.0	0.0	
PEAK PCT	12.7	4.4	33.4	0.0	38.2	0.7	2.6	8.0	0.0	0.0	0.0	0.0	
JUN													
KWH	4352.	1108.	11887.	77.	8974.	139.	843.	2478.	0.	0.	0.	0.	29859.
MAX KW	18.3	5.6	42.6	3.3	64.2	1.5	3.6	11.1	0.0	0.0	0.0	0.0	144.6
DAY/HR	1/ 9	1/ 9	1/ 9	15/ 8	20/14	20/14	20/14	21/17	0/ 0	8/ 8	0/ 0	0/ 0	20/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	64.2	1.5	3.6	10.8	0.0	0.0	0.0	0.0	
PEAK PCT	11.2	3.9	29.4	0.0	44.4	1.1	2.5	7.5	0.0	0.0	0.0	0.0	
JUL													
KWH	4267.	1099.	11584.	62.	10149.	163.	833.	2491.	0.	0.	0.	0.	30647.
MAX KW	18.5	5.6	42.6	3.0	58.8	1.2	3.5	11.5	0.0	0.0	0.0	0.0	140.7
DAY/HR	17/ 9	2/ 9	2/ 9	26/ 8	10/17	10/11	11/10	10/17	0/ 0	8/ 8	0/ 0	0/ 0	10/17
PEAK ENDUSE	17.8	5.6	42.6	0.0	58.8	1.0	3.4	11.5	0.0	0.0	0.0	0.0	
PEAK PCT	12.7	4.0	30.3	0.0	41.8	0.7	2.4	8.2	0.0	0.0	0.0	0.0	
AUG													
KWH	4745.	1200.	12572.	65.	11397.	181.	905.	2756.	0.	0.	0.	0.	33820.
MAX KW	19.4	5.6	42.6	2.9	56.9	1.0	3.4	12.1	0.0	0.0	0.0	0.0	138.6
DAY/HR	31/ 9	1/ 9	1/ 9	27/ 8	7/10	9/11	7/10	6/ 9	0/ 0	8/ 8	0/ 0	0/ 0	7/10
PEAK ENDUSE	17.5	5.6	42.6	0.0	56.9	1.0	3.4	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	4.1	30.7	0.0	41.1	0.7	2.4	8.3	0.0	0.0	0.0	0.0	

Two PS-E reports (one Electric, one Fuel, this is a building level report — two-page report — page 2 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-E** Energy End-Use Summary **for all Electric Meters** WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)--------

SEP													
KWH	4228.	1007.	10899.	64.	9288.	151.	787.	2320.	0.	0.	0.	0.	28743.
MAX KW	21.2	5.6	42.6	3.3	62.9	1.5	3.6	11.6	0.0	0.0	0.0	0.0	145.9
DAY/HR	26/ 9	4/ 9	4/ 9	26/ 8	7/17	24/12	7/17	7/17	0/ 0	8/ 8	0/ 0	0/ 0	7/17
PEAK ENDUSE	18.3	5.6	42.6	0.0	62.9	1.3	3.6	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	3.8	29.2	0.0	43.1	0.9	2.4	8.0	0.0	0.0	0.0	0.0	
OCT													
KWH	5021.	1149.	12078.	101.	7854.	104.	841.	2443.	0.	0.	0.	0.	29591.
MAX KW	28.1	5.6	42.6	3.4	62.1	1.4	3.6	11.4	0.0	0.0	0.0	0.0	142.4
DAY/HR	31/17	1/ 9	1/ 9	16/ 8	1/14	1/14	1/14	3/16	0/ 0	8/ 8	0/ 0	0/ 0	1/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	62.1	1.4	3.6	10.9	0.0	0.0	0.0	0.0	
PEAK PCT	11.4	3.9	29.9	0.0	43.6	1.0	2.5	7.6	0.0	0.0	0.0	0.0	
NOV													
KWH	5174.	1048.	11090.	145.	4846.	41.	762.	2099.	0.	0.	0.	0.	25205.
MAX KW	39.8	5.6	42.6	4.1	42.9	0.6	3.2	10.8	0.0	0.0	0.0	0.0	137.7
DAY/HR	16/17	1/ 9	1/ 9	13/11	29/15	27/13	27/13	29/15	0/ 0	8/ 8	0/ 0	0/ 0	29/17
PEAK ENDUSE	36.3	5.6	42.6	0.0	39.2	0.4	3.1	10.5	0.0	0.0	0.0	0.0	
PEAK PCT	26.4	4.1	30.9	0.0	28.5	0.3	2.3	7.6	0.0	0.0	0.0	0.0	
DEC													
KWH	5586.	1058.	11393.	260.	2770.	7.	803.	2043.	0.	0.	0.	0.	23920.
MAX KW	40.6	5.6	42.6	8.2	39.4	0.4	3.1	10.7	0.0	0.0	0.0	0.0	131.7
DAY/HR	3/17	3/ 9	3/ 9	31/ 9	19/15	19/15	20/14	20/16	0/ 0	8/ 8	0/ 0	0/ 0	19/17
PEAK ENDUSE	35.9	5.6	42.6	0.0	34.3	0.2	3.1	10.1	0.0	0.0	0.0	0.0	
PEAK PCT	27.3	4.3	32.3	0.0	26.0	0.2	2.3	7.6	0.0	0.0	0.0	0.0	
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	========
KWH	57663.	13224.	140219.	1594.	74682.	905.	9765.	27568.	0.	7.	0.	0.	325626.
MAX KW	40.6	5.6	42.6	21.6	64.2	1.5	3.6	12.1	0.0	3.4	0.0	0.0	145.9
MON/DY	12/ 3	1/ 2	1/ 2	1/ 2	6/20	6/20	6/20	8/ 6	0/ 0	1/ 8	0/ 0	0/ 0	9/ 7
PEAK ENDUSE	18.3	5.6	42.6	0.0	62.9	1.3	3.6	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	3.8	29.2	0.0	43.1	0.9	2.4	8.0	0.0	0.0	0.0	0.0	

PEAK ENDUSE is the kW for each end use that is coincident with the building peak for each month.

DAY/HR is the time of the non-coincident maximum kW for each end use.

MAX KW is non-coincident kW, i.e., what is the maximum kW for each end use (each end use considered independently)?

These are coincident peak kW's for each end use. These sum (across) to the building TOTAL.

PEAK PCT is the percentage coincident contribution each end use makes to the building peak for each month.

IMPORTANT NOTES:
A description of eQUEST/DOE-2.2 end use reporting categories is provided at the end of this sample listing.

There are up to four PS-E reports, one for electricity usage, one for fuel usage, one for steam utility usage (if one or more steam meters is defined), and one for chilled-water utility usage (if one or more chilled-water meters is defined).

GENERATORS:
Fuel consumed by electric generators and consumed on-site is allocated to the building end-uses. However, the portion of fuel used to generate power that is sold to a utility, if any, is not allocated to any of these categories, but is included in the total.

***** Important Report *****

3-Story Office Bldg **NOTE:** see comments on the previous page. DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-E** Energy End-Use Summary **for all Fuel Meters** WEATHER FILE- CZ06RV2 WYEC2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
JAN													
MBTU	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	6.	0.	7.
MAX MBTU/HR	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	17/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	
FEB													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
MAR													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	0.	6.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	1/ 9	0/ 0	1/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
APR													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	11/ 9	0/ 0	11/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
MAY													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	0.	6.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	7/ 9	0/ 0	7/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
JUN													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	5/ 9	0/ 0	5/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
JUL													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
AUG													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	22/ 9	0/ 0	22/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	

3-Story Office Bldg **NOTE:** see comments on page 2 of 2 on the previous report. DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-E** Energy End-Use Summary **for all Fuel Meters** WEATHER FILE- CZ06RV2 WYEC2

--(CONTINUED)--------

SEP													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	26/ 9	0/ 0	26/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
OCT													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	15/ 9	0/ 0	15/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
NOV													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	16/16	0/ 0	16/16
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
DEC													
MBTU	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	5.
MAX MBTU/HR	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
DAY/HR	0/ 0	0/ 0	0/ 0	31/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	24/ 9	0/ 0	31/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	75.4	0.0	0.0	0.0	0.0	0.0	0.0	24.6	0.0	
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	========
MBTU	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	63.	0.	64.
MAX MBTU/HR	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
MON/DY	0/ 0	0/ 0	0/ 0	1/ 2	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	3/ 1	0/ 0	1/ 2
PEAK ENDUSE	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PEAK PCT	0.0	0.0	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	

GENERATORS:

Fuel consumed by electric generators and consumed on-site is allocated to the building end-uses. However, the portion of fuel used to generate power that is sold to a utility, if any, is not allocated to any of these categories, but is included in the total. In this case, the total will not match the sum of the reported end-uses.

***** Important Report *****

One PS-F report per METER (two-page report — page 1 of 2)

3-Story Office Bldg   DOE-B2.2NT38   4/07/2001   10:36:50 BDL RUN 2

REPORT- **PS-F** Energy End-Use Summary **for   EM1 (Elec #1 the default)**   WEATHER FILE- CZ06RV2 WYEC2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
JAN													
KWH	5834.	1149.	12078.	301.	2876.	8.	826.	2148.	0.	7.	0.	0.	25228.
MAX KW	37.8	5.6	42.6	21.6	35.9	0.4	3.1	10.4	0.0	3.4	0.0	0.0	118.6
DAY/HR	24/17	2/ 9	2/ 9	2/ 9	11/13	18/13	11/13	12/16	0/ 0	8/ 8	0/ 0	0/ 0	11/16
PEAK ENDUSE	23.8	5.6	42.6	0.0	33.0	0.3	3.0	10.3	0.0	0.0	0.0	0.0	
PEAK PCT	20.1	4.7	35.9	0.0	27.8	0.2	2.6	8.7	0.0	0.0	0.0	0.0	
FEB													
KWH	4595.	998.	10596.	139.	3062.	13.	725.	1940.	0.	0.	0.	0.	22069.
MAX KW	31.7	5.6	42.6	3.3	35.6	0.5	3.1	10.5	0.0	0.0	0.0	0.0	119.2
DAY/HR	8/17	1/ 9	1/ 9	3/ 9	13/16	16/13	16/13	13/16	0/ 0	0/ 0	0/ 0	0/ 0	13/16
PEAK ENDUSE	21.6	5.6	42.6	0.0	35.6	0.3	3.1	10.5	0.0	0.0	0.0	0.0	
PEAK PCT	18.1	4.7	35.7	0.0	29.9	0.3	2.6	8.8	0.0	0.0	0.0	0.0	
MAR													
KWH	4965.	1159.	12381.	152.	3523.	16.	848.	2264.	0.	0.	0.	0.	25308.
MAX KW	22.4	5.6	42.6	4.1	38.8	0.5	3.1	9.8	0.0	0.0	0.0	0.0	117.3
DAY/HR	14/17	1/ 9	1/ 9	26/11	16/13	16/13	16/13	6/16	0/ 0	0/ 0	0/ 0	0/ 0	15/16
PEAK ENDUSE	19.0	5.6	42.6	0.0	36.9	0.4	3.1	9.7	0.0	0.0	0.0	0.0	
PEAK PCT	16.2	4.8	36.3	0.0	31.5	0.4	2.6	8.3	0.0	0.0	0.0	0.0	
APR													
KWH	4427.	1099.	11584.	121.	3740.	19.	774.	2200.	0.	0.	0.	0.	23963.
MAX KW	21.0	5.6	42.6	3.4	43.3	0.5	3.2	10.8	0.0	0.0	0.0	0.0	125.0
DAY/HR	2/ 9	2/ 9	2/ 9	30/11	4/17	23/12	4/17	4/17	0/ 0	0/ 0	0/ 0	0/ 0	4/17
PEAK ENDUSE	19.2	5.6	42.6	0.0	43.3	0.4	3.2	10.8	0.0	0.0	0.0	0.0	
PEAK PCT	15.3	4.5	34.0	0.0	34.6	0.3	2.5	8.6	0.0	0.0	0.0	0.0	
MAY													
KWH	4469.	1149.	12078.	107.	6203.	62.	819.	2387.	0.	0.	0.	0.	27275.
MAX KW	18.7	5.6	42.6	2.9	48.8	0.8	3.3	10.4	0.0	0.0	0.0	0.0	127.5
DAY/HR	9/ 9	1/ 9	1/ 9	23/ 8	31/14	31/14	31/14	30/17	0/ 0	0/ 0	0/ 0	0/ 0	31/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	48.8	0.8	3.3	10.2	0.0	0.0	0.0	0.0	
PEAK PCT	12.7	4.4	33.4	0.0	38.2	0.7	2.6	8.0	0.0	0.0	0.0	0.0	
JUN													
KWH	4352.	1108.	11887.	77.	8974.	139.	843.	2478.	0.	0.	0.	0.	29859.
MAX KW	18.3	5.6	42.6	3.3	64.2	1.5	3.6	11.1	0.0	0.0	0.0	0.0	144.6
DAY/HR	1/ 9	1/ 9	1/ 9	15/ 8	20/14	20/14	20/14	21/17	0/ 0	0/ 0	0/ 0	0/ 0	20/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	64.2	1.5	3.6	10.8	0.0	0.0	0.0	0.0	
PEAK PCT	11.2	3.9	29.4	0.0	44.4	1.1	2.5	7.5	0.0	0.0	0.0	0.0	
JUL													
KWH	4267.	1099.	11584.	62.	10149.	163.	833.	2491.	0.	0.	0.	0.	30647.
MAX KW	18.5	5.6	42.6	3.0	58.8	1.2	3.5	11.5	0.0	0.0	0.0	0.0	140.7
DAY/HR	17/ 9	2/ 9	2/ 9	26/ 8	10/17	10/11	11/10	10/17	0/ 0	0/ 0	0/ 0	0/ 0	10/17
PEAK ENDUSE	17.8	5.6	42.6	0.0	58.8	1.0	3.4	11.5	0.0	0.0	0.0	0.0	
PEAK PCT	12.7	4.0	30.3	0.0	41.8	0.7	2.4	8.2	0.0	0.0	0.0	0.0	
AUG													
KWH	4745.	1200.	12572.	65.	11397.	181.	905.	2756.	0.	0.	0.	0.	33820.
MAX KW	19.4	5.6	42.6	2.9	56.9	1.0	3.4	12.1	0.0	0.0	0.0	0.0	138.6
DAY/HR	31/ 9	1/ 9	1/ 9	27/ 8	7/10	9/11	7/10	6/ 9	0/ 0	0/ 0	0/ 0	0/ 0	7/10
PEAK ENDUSE	17.5	5.6	42.6	0.0	56.9	1.0	3.4	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	4.1	30.7	0.0	41.1	0.7	2.4	8.3	0.0	0.0	0.0	0.0	

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-F** Energy End-Use Summary **for EM1 (Elec #1 the default)** WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)--------

SEP													
KWH	4228.	1007.	10899.	64.	9288.	151.	787.	2320.	0.	0.	0.	0.	28743.
MAX KW	21.2	5.6	42.6	3.3	62.9	1.5	3.6	11.6	0.0	0.0	0.0	0.0	145.9
DAY/HR	26/ 9	4/ 9	4/ 9	26/ 8	7/17	24/12	7/17	7/17	0/ 0	0/ 0	0/ 0	0/ 0	7/17
PEAK ENDUSE	18.3	5.6	42.6	0.0	62.9	1.3	3.6	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	3.8	29.2	0.0	43.1	0.9	2.4	8.0	0.0	0.0	0.0	0.0	
OCT													
KWH	5021.	1149.	12078.	101.	7854.	104.	841.	2443.	0.	0.	0.	0.	29591.
MAX KW	28.1	5.6	42.6	3.4	62.1	1.4	3.6	11.4	0.0	0.0	0.0	0.0	142.4
DAY/HR	31/17	1/ 9	1/ 9	16/ 8	1/14	1/14	1/14	3/16	0/ 0	0/ 0	0/ 0	0/ 0	1/14
PEAK ENDUSE	16.3	5.6	42.6	0.0	62.1	1.4	3.6	10.9	0.0	0.0	0.0	0.0	
PEAK PCT	11.4	3.9	29.9	0.0	43.6	1.0	2.5	7.6	0.0	0.0	0.0	0.0	
NOV													
KWH	5174.	1048.	11090.	145.	4846.	41.	762.	2099.	0.	0.	0.	0.	25205.
MAX KW	39.8	5.6	42.6	4.1	42.9	0.6	3.2	10.8	0.0	0.0	0.0	0.0	137.7
DAY/HR	16/17	1/ 9	1/ 9	13/11	29/15	27/13	27/13	29/15	0/ 0	0/ 0	0/ 0	0/ 0	29/17
PEAK ENDUSE	36.3	5.6	42.6	0.0	39.2	0.4	3.1	10.5	0.0	0.0	0.0	0.0	
PEAK PCT	26.4	4.1	30.9	0.0	28.5	0.3	2.3	7.6	0.0	0.0	0.0	0.0	
DEC													
KWH	5586.	1058.	11393.	260.	2770.	7.	803.	2043.	0.	0.	0.	0.	23920.
MAX KW	40.6	5.6	42.6	8.2	39.4	0.4	3.1	10.7	0.0	0.0	0.0	0.0	131.7
DAY/HR	3/17	3/ 9	3/ 9	31/ 9	19/15	19/15	20/14	20/16	0/ 0	0/ 0	0/ 0	0/ 0	19/17
PEAK ENDUSE	35.9	5.6	42.6	0.0	34.3	0.2	3.1	10.1	0.0	0.0	0.0	0.0	
PEAK PCT	27.3	4.3	32.3	0.0	26.0	0.2	2.3	7.6	0.0	0.0	0.0	0.0	
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	========
KWH	57663.	13224.	140219.	1594.	74682.	905.	9765.	27568.	0.	7.	0.	0.	325626.
MAX KW	40.6	5.6	42.6	21.6	64.2	1.5	3.6	12.1	0.0	3.4	0.0	0.0	145.9
MON/DY	12/ 3	1/ 2	1/ 2	1/ 2	6/20	6/20	6/20	8/ 6	0/ 0	1/ 8	0/ 0	0/ 0	9/ 7
PEAK ENDUSE	18.3	5.6	42.6	0.0	62.9	1.3	3.6	11.6	0.0	0.0	0.0	0.0	
PEAK PCT	12.6	3.8	29.2	0.0	43.1	0.9	2.4	8.0	0.0	0.0	0.0	0.0	

YEARLY TRANSFORMER LOSSES = 0.0 KWH

IMPORTANT NOTE:
One PS-F report is printed per meter. Since most users allow the meters to default (one master meter per fuel type, e.g., electric and gas), the PS-F reports are normally identical to the PS-E reports (PS-E reports print one report for all electric use, and one for all gas use.)

IMPORTANT NOTE:
A description of eQUEST/DOE-2.2 end use reporting categories is provided at the end of this sample listing.

***** Important Report *****

One PS-F report per METER (two-page report — page 1 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-F** Energy End-Use Summary for FM1 (Fuel Meter #1 the default) WEATHER FILE- CZ06RV2 WYEC2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
JAN													
THERM	0.	0.	0.	12.	0.	0.	0.	0.	0.	0.	56.	0.	69.
MAX THERM/HR	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	3.8
DAY/HR	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	17/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	
FEB													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	50.	0.	50.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
MAR													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	58.	0.	58.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	1/ 9	0/ 0	1/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
APR													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	54.	0.	54.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	11/ 9	0/ 0	11/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
MAY													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	55.	0.	55.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	7/ 9	0/ 0	7/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
JUN													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	52.	0.	52.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	5/ 9	0/ 0	5/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
JUL													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	50.	0.	50.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	2/ 9	0/ 0	2/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
AUG													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	54.	0.	54.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	22/ 9	0/ 0	22/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-F** Energy End-Use Summary **for FM1 (Fuel Meter #1 the default)** WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)--------

SEP													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	45.	0.	45.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	26/ 9	0/ 0	26/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
OCT													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	53.	0.	53.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	15/ 9	0/ 0	15/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
NOV													
THERM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	49.	0.	49.
MAX THERM/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	16/16	0/ 0	16/16
PEAK ENDUSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	
DEC													
THERM	0.	0.	0.	2.	0.	0.	0.	0.	0.	0.	51.	0.	52.
MAX THERM/HR	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.1
DAY/HR	0/ 0	0/ 0	0/ 0	31/ 9	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	24/ 9	0/ 0	31/ 9
PEAK ENDUSE	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	75.4	0.0	0.0	0.0	0.0	0.0	0.0	24.6	0.0	
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	========
THERM	0.	0.	0.	14.	0.	0.	0.	0.	0.	0.	628.	0.	642.
MAX THERM/HR	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	3.8
MON/DY	0/ 0	0/ 0	0/ 0	1/ 2	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	3/ 1	0/ 0	1/ 2
PEAK ENDUSE	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	
PEAK PCT	0.0	0.0	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	

IMPORTANT NOTE:
One PS-F report is printed per meter. Since most users allow the meters to default (one master meter per fuel type, e.g., electric and gas), the PS-F reports are normally identical to the PS-E reports (PS-E reports print one report for all electric use, and one for all gas use.)

IMPORTANT NOTE:
A description of eQUEST/DOE-2.2 end use reporting categories is provided at the end of this sample listing.

***** Important Report *****

One BEPS report only (this is a building level report)

```
3-Story Office Bldg                                                       DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- BEPS Building Energy Performance                                              WEATHER FILE- CZ06RV2 WYEC2
```

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	196.8	45.1	478.6	5.4	254.9	3.1	33.3	94.1	0.0	0.0	0.0	0.0	1111.4
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	62.8	0.0	64.2
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	========
MBTU	196.8	45.1	478.6	6.8	254.9	3.1	33.3	94.1	0.0	0.0	62.8	0.0	1175.5

These results, by end-use, are reported in more detail on the ES-E report.

```
TOTAL SITE ENERGY      1175.54 MBTU     30.1 KBTU/SQFT-YR GROSS-AREA     30.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    3398.25 MBTU     87.1 KBTU/SQFT-YR GROSS-AREA     87.1 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =   4.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =   0.0

NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

To investigate any hours reported here, examine PS-D, PS-C, and PS-H to isolate the circulation loop, plant equipment, time of year, and time of day the control problems occur.

NOTE:
The denominator used for this % calculation is always 8760. To investigate any hours reported here, examine SS-R, then SS-F, and SS-O to isolate the system, zone, time of year, and time of day the control problems occur.

NOTE:
The BEPS report provides that same results found on the BEPU report. The only difference is the reporting units: the BEPS report uses MBTU (Btu x 1,000,000) while BEPU uses conventional utility units (e.g., kWh, therms).

ENERGY END USES:
A description of eQUEST/DOE-2.2 end use reporting categories is provided at the end of this sample listing.

ENERGY TYPES:
The energy types shown are those specified with the ELEC-METER, FUEL-METER, STEAM-METER, and CHW-METER commands in PLANT.

GENERATORS AND PV:
The BEPS report only includes energy drawn or supplied across the building boundary, i.e., energy provided by generators or PV is not included in the BEPS report unless it "flows" through a utility meter (e.g., is supplied back to the utility grid).
Strictly, the BEPS report does not report energy used within the building , rather, it reports energy "imported" into or "exported" from the building.
Compare BEPS results with PS-E, which reports all energy used within the building, including energy provided by on-site generators and PV.

***** Important Report *****

One BEPU report only (this is a building level report)

```
3-Story Office Bldg                                                   DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- BEPU Building Utility Performance                                        WEATHER FILE- CZ06RV2 WYEC2
-----------------------------------------------------------------------------------------------------------------------------

                         TASK      MISC     SPACE     SPACE     HEAT     PUMPS      VENT    REFRIG  HT PUMP   DOMEST      EXT
               LIGHTS    LIGHTS    EQUIP   HEATING   COOLING   REJECT    & AUX      FANS   DISPLAY  SUPPLEM  HOT WTR    USAGE      TOTAL
              -------   -------   -------   -------   -------   -------   -------   -------   -------   -------   -------   -------   --------

EM1  ELECTRICITY
  KWH          57663.    13224.   140219.     1594.    74682.      905.     9765.    27568.        0.        7.        0.        0.   325626.

FM1  NATURAL-GAS
  THERM            0.        0.        0.       14.        0.        0.        0.        0.        0.        0.      628.        0.      642.
```

These results, by end-use, are reported in more detail on the ES-F report.

```
           TOTAL ELECTRICITY    325626. KWH        8.349 KWH     /SQFT-YR GROSS-AREA    8.349 KWH     /SQFT-YR NET-AREA
           TOTAL NATURAL-GAS       642. THERM      0.016 THERM   /SQFT-YR GROSS-AREA    0.016 THERM   /SQFT-YR NET-AREA

           PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =   4.1
           PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =   0.0

           NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

The denominator used for this % calculation is always 8760.

To investigate any hours reported here, examine SS-R, then SS-F, and SS-O to isolate the system, zone, time of year, and time of day the control problems occur.

The denominator used for this % calculation is always 8760. To investigate any hours reported here, examine PS-D, PS-C, and PS-H to isolate the circulation loop, plant equipment, time of year, and time of day the control problems occur.

NOTE:
The BEPU report provides that same results found on the BEPS report. The only difference is the reporting units: BEPU uses conventional utility units (e.g., kWh, therms), while the BEPS report uses MBTU (Btux1,000,000).

ENERGY END USES:
A description of eQUEST/DOE-2.2 end use reporting categories is provided at the end of this sample listing.

ENERGY TYPES:
The energy types shown are those specified using ELEC-METER, FUEL-METER, STEAM-METER, and CHW-METER commands in PLANT, therefore, one energy type is reported for each UTILITY METER specified.

GENERATORS AND PV:
The BEPS report only includes energy drawn or supplied across the building boundary, i.e., energy provided by generators or PV is not included in the BEPS report unless it "flows" through a utility meter (e.g., is supplied back to the utility grid). Strictly, the BEPS report does not report energy used within the building , rather, it reports energy "imported" into or "exported" from the building. Compare BEPS results with PS-E, which reports all energy used within the building, including energy provided by on-site generators and PV.

***** Important Report *****

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Chilled Water Loop** WEATHER FILE- CZ06RV2 WYEC2

HEATING CAPACITY (MBTU/HR)	COOLING CAPACITY (MBTU/HR)	LOOP FLOW (GAL/MIN)	TOTAL HEAD (FT)	SUPPLY UA PRODUCT (BTU/HR-F)	SUPPLY LOSS DT (F)	RETURN UA PRODUCT (BTU/HR-F)	RETURN LOSS DT (F)	LOOP VOLUME (GAL)	FLUID HEAT CAPACITY (BTU/LB-F)
0.000	0.570	112.4	56.6	0.0	0.00	0.0	0.00	168.7	1.00

MON	SUM PEAK	COIL LOAD (MBTU) (KBTU/HR)	PIPE GAIN (MBTU) (KBTU/HR)	NET LOAD (MBTU) (KBTU/HR)	OVERLOAD (MBTU) (KBTU/HR)		-------- Number of hours within each PART LOAD range 00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	--------- TOTAL RUN HOURS
JAN	SUM	16.288	0.000	16.523	0.000	COOL	157	61	34	21	1	0	0	0	0	0	0	274
	PEAK	239.922	0.000	241.213	0.000	FLOW	160	62	47	5	0	0	0	0	0	0	0	274
	DAY/HR	11/13	0/ 0	11/13	0/ 0													
FEB	SUM	18.729	0.000	18.942	0.000	COOL	103	65	43	28	2	0	0	0	0	0	0	241
	PEAK	241.127	0.000	242.548	0.000	FLOW	111	71	50	9	0	0	0	0	0	0	0	241
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
MAR	SUM	20.816	0.000	21.060	0.000	COOL	138	62	40	36	6	0	0	0	0	0	0	282
	PEAK	253.296	0.000	254.649	0.000	FLOW	142	69	54	17	0	0	0	0	0	0	0	282
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
APR	SUM	21.895	0.000	22.133	0.000	COOL	125	54	32	33	19	0	0	0	0	0	0	263
	PEAK	280.477	0.000	281.863	0.000	FLOW	139	57	42	25	0	0	0	0	0	0	0	263
	DAY/HR	4/17	0/ 0	4/17	0/ 0													
MAY	SUM	38.682	0.000	38.972	0.000	COOL	88	28	26	58	51	23	0	0	0	0	0	274
	PEAK	329.823	0.000	331.804	0.000	FLOW	89	41	63	60	21	0	0	0	0	0	0	274
	DAY/HR	31/14	0/ 0	31/14	0/ 0													
JUN	SUM	60.384	0.000	60.779	0.000	COOL	39	31	12	24	64	59	29	13	0	0	0	271
	PEAK	446.007	0.000	448.920	0.000	FLOW	41	34	26	67	67	23	13	0	0	0	0	271
	DAY/HR	20/14	0/ 0	20/14	0/ 0													
JUL	SUM	67.930	0.000	68.356	0.000	COOL	21	30	8	15	33	91	64	1	0	0	0	263
	PEAK	403.450	0.000	406.021	0.000	FLOW	19	34	19	38	98	55	0	0	0	0	0	263
	DAY/HR	11/10	0/ 0	11/10	0/ 0													
AUG	SUM	76.741	0.000	77.209	0.000	COOL	12	44	1	7	34	101	86	0	0	0	0	285
	PEAK	389.758	0.000	393.278	0.000	FLOW	10	46	5	41	135	48	0	0	0	0	0	285
	DAY/HR	7/10	0/ 0	7/10	0/ 0													
SEP	SUM	62.847	0.000	63.244	0.000	COOL	23	21	8	17	51	83	33	13	0	0	0	249
	PEAK	440.722	0.000	443.465	0.000	FLOW	20	24	22	56	83	36	8	0	0	0	0	249
	DAY/HR	7/17	0/ 0	7/17	0/ 0													
OCT	SUM	52.421	0.000	52.792	0.000	COOL	54	29	25	36	65	43	12	10	0	0	0	274
	PEAK	432.761	0.000	435.498	0.000	FLOW	52	36	49	67	48	16	6	0	0	0	0	274
	DAY/HR	1/14	0/ 0	1/14	0/ 0													
NOV	SUM	30.806	0.000	31.065	0.000	COOL	94	28	25	62	42	1	0	0	0	0	0	252
	PEAK	284.898	0.000	286.494	0.000	FLOW	93	28	73	58	0	0	0	0	0	0	0	252
	DAY/HR	2/16	0/ 0	2/16	0/ 0													
DEC	SUM	15.626	0.000	15.845	0.000	COOL	160	44	28	20	8	0	0	0	0	0	0	260
	PEAK	262.630	0.000	263.665	0.000	FLOW	164	39	46	11	0	0	0	0	0	0	0	260
	DAY/HR	19/15	0/ 0	19/15	0/ 0													

One PS-H report for each piece of PLANT EQUIPMENT (1 of 8) — two page report (page 2 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Chilled Water Loop** WEATHER FILE- CZ06RV2 WYEC2

---(CONTINUED)--------

	==========	==========	==========	==========	====	====	====	====	====	====	====	====	====	====	====	====
YR SUM	483.165	0.000	486.920	0.000	COOL1014	497	282	357	376	401	224	37	0	0	0	3188
PEAK	446.007	0.000	448.920	0.000	FLOW1040	541	496	454	452	178	27	0	0	0	0	3188
MON/DAY	6/20	0/ 0	6/20	0/ 0												

***** Important Report *****

One PS-H report for each piece of PLANT EQUIPMENT (2 of 8) — two page report (page 1 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Hot Water Loop** WEATHER FILE- CZ06RV2 WYEC2

HEATING CAPACITY (MBTU/HR)	COOLING CAPACITY (MBTU/HR)	LOOP FLOW (GAL/MIN)	TOTAL HEAD (FT)	SUPPLY UA PRODUCT (BTU/HR-F)	SUPPLY LOSS DT (F)	RETURN UA PRODUCT (BTU/HR-F)	RETURN LOSS DT (F)	LOOP VOLUME (GAL)	FLUID HEAT CAPACITY (BTU/LB-F)
-0.507	0.000	25.4	36.6	0.0	0.00	0.0	0.00	38.1	1.00

MON	SUM PEAK	COIL LOAD (MBTU) (KBTU/HR)	PIPE GAIN (MBTU) (KBTU/HR)	NET LOAD (MBTU) (KBTU/HR)	OVERLOAD (MBTU) (KBTU/HR)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
							Number of hours within each PART LOAD range											
JAN	SUM	-0.551	0.000	-0.532	0.000	HEAT	9	0	1	0	1	0	0	0	0	0	0	11
	PEAK	-256.825	0.000	-252.888	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0													
FEB	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	241	241
	DAY/HR	5/ 9	0/ 0	0/ 0	0/ 0													
MAR	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	282	282
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
APR	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	263	263
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
MAY	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
JUN	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	271	271
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
JUL	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	263	263
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
AUG	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	285	285
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
SEP	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	249	249
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
OCT	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0													
NOV	SUM	0.000	0.000	0.000	0.000	HEAT	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	252	252
	DAY/HR	13/ 9	0/ 0	0/ 0	0/ 0													
DEC	SUM	-0.020	0.000	-0.010	0.000	HEAT	2	0	0	0	0	0	0	0	0	0	0	2
	PEAK	-12.780	0.000	-8.584	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	260	260
	DAY/HR	31/ 9	0/ 0	31/ 9	0/ 0													

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3-Story Office Bldg                                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Hot Water Loop                                  WEATHER FILE- CZ06RV2 WYEC2
-----------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========     ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR    SUM      -0.571       0.000      -0.543       0.000 HEAT  11     0     1     0     1     0     0     0     0     0     0    13
     PEAK    -256.825       0.000    -252.888       0.000 FLOW   0     0     0     0     0     0     0     0     0     0  3188  3188
  MON/DAY        1/ 2        0/ 0        1/ 2        0/ 0
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***** Important Report *****

One PS-H report for each piece of PLANT EQUIPMENT (3 of 8) — two page report (page 1 of 2)

3-Story Office Bldg   DOE-B2.2NT38   4/07/2001   10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Condenser Water Loop**   WEATHER FILE- CZ06RV2 WYEC2

HEATING CAPACITY (MBTU/HR)	COOLING CAPACITY (MBTU/HR)	LOOP FLOW (GAL/MIN)	TOTAL HEAD (FT)	SUPPLY UA PRODUCT (BTU/HR-F)	SUPPLY LOSS DT (F)	RETURN UA PRODUCT (BTU/HR-F)	RETURN LOSS DT (F)	LOOP VOLUME (GAL)	FLUID HEAT CAPACITY (BTU/LB-F)
0.000	0.727	144.1	61.6	0.0	0.00	0.0	0.00	216.1	1.00

MON	SUM PEAK	COIL LOAD (MBTU) (KBTU/HR)	PIPE GAIN (MBTU) (KBTU/HR)	NET LOAD (MBTU) (KBTU/HR)	OVERLOAD (MBTU) (KBTU/HR)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
							Number of hours within each PART LOAD range											
JAN	SUM	28.993	0.000	30.646	0.000	COOL	117	91	39	20	7	0	0	0	0	0	0	274
	PEAK	320.785	0.000	326.461	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	11/13	0/ 0	11/13	0/ 0													
FEB	SUM	30.648	0.000	32.098	0.000	COOL	84	58	60	26	13	0	0	0	0	0	0	241
	PEAK	322.523	0.000	328.168	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	241	241
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
MAR	SUM	34.635	0.000	36.330	0.000	COOL	110	71	53	34	14	0	0	0	0	0	0	282
	PEAK	337.604	0.000	343.465	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	282	282
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
APR	SUM	35.334	0.000	36.916	0.000	COOL	80	84	41	26	31	1	0	0	0	0	0	263
	PEAK	371.258	0.000	377.027	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	263	263
	DAY/HR	4/17	0/ 0	4/17	0/ 0													
MAY	SUM	56.060	0.000	57.706	0.000	COOL	53	52	28	43	75	22	1	0	0	0	0	274
	PEAK	433.012	0.000	438.755	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	31/14	0/ 0	31/14	0/ 0													
JUN	SUM	82.649	0.000	84.278	0.000	COOL	10	45	26	18	56	62	39	15	0	0	0	271
	PEAK	575.665	0.000	581.229	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	271	271
	DAY/HR	20/14	0/ 0	20/14	0/ 0													
JUL	SUM	91.678	0.000	93.259	0.000	COOL	1	32	25	11	28	75	87	4	0	0	0	263
	PEAK	523.585	0.000	527.843	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	263	263
	DAY/HR	11/10	0/ 0	11/10	0/ 0													
AUG	SUM	103.378	0.000	105.092	0.000	COOL	0	25	30	6	22	96	105	1	0	0	0	285
	PEAK	508.031	0.000	512.778	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	285	285
	DAY/HR	7/10	0/ 0	7/10	0/ 0													
SEP	SUM	85.021	0.000	86.518	0.000	COOL	2	30	18	16	40	84	42	17	0	0	0	249
	PEAK	568.896	0.000	574.518	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	249	249
	DAY/HR	7/17	0/ 0	7/17	0/ 0													
OCT	SUM	72.910	0.000	74.561	0.000	COOL	23	46	31	37	54	57	15	11	0	0	0	274
	PEAK	559.400	0.000	564.615	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	274	274
	DAY/HR	1/14	0/ 0	1/14	0/ 0													
NOV	SUM	45.747	0.000	47.263	0.000	COOL	61	50	24	53	56	8	0	0	0	0	0	252
	PEAK	377.122	0.000	383.039	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	252	252
	DAY/HR	2/16	0/ 0	2/16	0/ 0													
DEC	SUM	27.785	0.000	29.350	0.000	COOL	117	80	29	20	14	0	0	0	0	0	0	260
	PEAK	348.714	0.000	354.533	0.000	FLOW	0	0	0	0	0	0	0	0	0	0	260	260
	DAY/HR	19/15	0/ 0	19/15	0/ 0													

One PS-H report for each piece of PLANT EQUIPMENT (3 of 8) — two page report (page 2 of 2)

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3-Story Office Bldg                                                              DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Condenser Water Loop                            WEATHER FILE- CZ06RV2 WYEC2
--------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========     ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR     SUM     694.838       0.000     714.020       0.000 COOL 658   664   404   310   410   405   289    48     0     0     0  3188
      PEAK     575.665       0.000     581.229       0.000 FLOW   0     0     0     0     0     0     0     0     0     0  3188  3188
  MON/DAY        6/20        0/ 0        6/20        0/ 0
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***** Important Report *****

One PS-H report for each piece of PLANT EQUIPMENT (4 of 8) — two page report (page 1 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Domestic Hot Water Loop** WEATHER FILE- CZ06RV2 WYEC2

HEATING CAPACITY (MBTU/HR)	COOLING CAPACITY (MBTU/HR)	LOOP FLOW (GAL/MIN)	TOTAL HEAD (FT)	SUPPLY UA PRODUCT (BTU/HR-F)	SUPPLY LOSS DT (F)	RETURN UA PRODUCT (BTU/HR-F)	RETURN LOSS DT (F)	LOOP VOLUME (GAL)	FLUID HEAT CAPACITY (BTU/LB-F)
-0.020	0.000	0.5	0.0	0.0	0.00	0.0	0.00	0.8	1.00

MON	SUM PEAK	COIL LOAD (MBTU) (KBTU/HR)	PIPE GAIN (MBTU) (KBTU/HR)	NET LOAD (MBTU) (KBTU/HR)	OVERLOAD (MBTU) (KBTU/HR)		Number of hours within each PART LOAD range 00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
JAN	SUM	-4.020	0.000	-4.020	0.000	HEAT	0	0	24	0	0	0	0	0	0	198	0	222
	PEAK	-19.644	0.000	-19.644	0.000	FLOW	522	0	24	0	0	0	0	0	0	0	198	744
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0													
FEB	SUM	-3.537	0.000	-3.537	0.000	HEAT	0	0	24	0	0	0	0	0	0	171	0	195
	PEAK	-19.907	0.000	-19.907	0.000	FLOW	477	0	24	0	0	0	0	0	0	0	171	672
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
MAR	SUM	-4.112	0.000	-4.112	0.000	HEAT	0	0	30	0	0	0	0	0	0	0	198	228
	PEAK	-19.928	0.000	-19.928	0.000	FLOW	516	0	30	0	0	0	0	0	0	0	198	744
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
APR	SUM	-3.875	0.000	-3.875	0.000	HEAT	0	0	24	0	0	0	0	0	0	189	0	213
	PEAK	-19.803	0.000	-19.803	0.000	FLOW	507	0	24	0	0	0	0	0	0	0	189	720
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0													
MAY	SUM	-3.950	0.000	-3.950	0.000	HEAT	0	0	24	0	0	0	0	0	0	198	0	222
	PEAK	-19.301	0.000	-19.301	0.000	FLOW	522	0	24	0	0	0	0	0	0	0	198	744
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
JUN	SUM	-3.710	0.000	-3.710	0.000	HEAT	0	0	30	0	0	0	0	0	0	189	0	219
	PEAK	-18.802	0.000	-18.802	0.000	FLOW	501	0	30	0	0	0	0	0	0	0	189	720
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
JUL	SUM	-3.594	0.000	-3.594	0.000	HEAT	0	0	24	0	0	0	0	0	0	189	0	213
	PEAK	-18.368	0.000	-18.368	0.000	FLOW	531	0	24	0	0	0	0	0	0	0	189	744
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0													
AUG	SUM	-3.866	0.000	-3.866	0.000	HEAT	0	0	24	0	0	0	0	0	0	207	0	231
	PEAK	-18.094	0.000	-18.094	0.000	FLOW	513	0	24	0	0	0	0	0	0	0	207	744
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
SEP	SUM	-3.241	0.000	-3.241	0.000	HEAT	0	0	30	0	0	0	0	0	0	171	0	201
	PEAK	-18.071	0.000	-18.071	0.000	FLOW	519	0	30	0	0	0	0	0	0	0	171	720
	DAY/HR	4/ 9	0/ 0	4/ 9	0/ 0													
OCT	SUM	-3.744	0.000	-3.744	0.000	HEAT	0	0	24	0	0	0	0	0	0	198	0	222
	PEAK	-18.294	0.000	-18.294	0.000	FLOW	522	0	24	0	0	0	0	0	0	0	198	744
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
NOV	SUM	-3.494	0.000	-3.494	0.000	HEAT	0	0	24	0	0	0	0	0	0	180	0	204
	PEAK	-18.716	0.000	-18.716	0.000	FLOW	516	0	24	0	0	0	0	0	0	0	180	720
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0													
DEC	SUM	-3.616	0.000	-3.616	0.000	HEAT	0	0	30	0	0	0	0	0	0	180	0	210
	PEAK	-19.200	0.000	-19.200	0.000	FLOW	534	0	30	0	0	0	0	0	0	0	180	744
	DAY/HR	3/ 9	0/ 0	3/ 9	0/ 0													

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3-Story Office Bldg                                                             DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Domestic Hot Water Loop                         WEATHER FILE- CZ06RV2 WYEC2
-------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ========== ========== ========== ==========     ==== ==== ==== ==== ==== ==== ==== ==== ==== ==== ==== ====

YR     SUM     -44.759      0.000    -44.759      0.000 HEAT   0    0  312    0    0    0    0    0    0 2070  198 2580
      PEAK     -19.928      0.000    -19.928      0.000 FLOW6180    0  312    0    0    0    0    0    0    0 2268 8760
  MON/DAY         3/ 1       0/ 0       3/ 1       0/ 0
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***** Important Report *****

One PS-H report for each piece of PLANT EQUIPMENT (5 of 8) — two page report (page 1 of 2)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Boiler 1 (HWNatDraft)** WEATHER FILE- CZ06RV2 WYEC2

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	EIR (FRAC)	HIR (FRAC)	AUXILIARY (KW)
HW-BOILER	Hot Water Loop	-0.507	25.4	0.000	1.250	0.000

MON	SUM PEAK	HEAT LOAD SUM (MBTU) PEAK (KBTU/HR)	ELEC USE SUM (KWH) PEAK (KW)	FUEL USE SUM (MBTU) PEAK (KBTU/HR)	AUX ENERGY SUM (KWH) PEAK (KW)		00-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100 +	TOTAL RUN HOURS
							-------- Number of hours within each PART LOAD range ---------											
JAN	SUM	-0.532	0.000	1.202	0.000	LOAD	9	0	1	0	1	0	0	0	0	0	0	11
	PEAK	-252.888	0.000	354.909	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0	FUEL	4	4	2	0	0	1	0	0	0	0	0	11
FEB	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
MAR	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
APR	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
MAY	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
JUN	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
JUL	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
AUG	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
SEP	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
OCT	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
NOV	SUM	0.000	0.000	0.000	0.000	LOAD	0	0	0	0	0	0	0	0	0	0	0	0
	PEAK	0.000	0.000	0.000	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	0/ 0	0/ 0	0/ 0	0/ 0	FUEL	0	0	0	0	0	0	0	0	0	0	0	0
DEC	SUM	-0.010	0.000	0.154	0.000	LOAD	2	0	0	0	0	0	0	0	0	0	0	2
	PEAK	-8.584	0.000	82.782	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	31/ 9	0/ 0	31/ 9	0/ 0	FUEL	0	2	0	0	0	0	0	0	0	0	0	2

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3-Story Office Bldg                                                                         DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Boiler 1 (HWNatDraft)                                      WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========     ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR     SUM     -0.543       0.000       1.357       0.000 LOAD  11     0     1     0     1     0     0     0     0     0     0    13
      PEAK   -252.888       0.000       0.355       0.000 ELEC   0     0     0     0     0     0     0     0     0     0     0     0
  MON/DAY        1/ 2        0/ 0        1/ 2        0/ 0 FUEL   4     6     2     0     0     1     0     0     0     0     0    13
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** Important Report **

One PS-H report for each piece of PLANT EQUIPMENT (6 of 8) — two page report (page 1 of 2)

3-Story Office Bldg   DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Chiller 1 (ElecRecipHerm)**   WEATHER FILE- CZ06RV2 WYEC2

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	EIR (FRAC)	AUXILIARY (KW)
ELEC-HERM-REC	Chilled Water Loop	0.570	113.9	0.265	0.000
	Condenser Water Loop	0.721	144.1		

MON	SUM PEAK	COOL LOAD (MBTU) (KBTU/HR)	HEAT LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	AUX ENERGY (KWH) (KW)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
						-------- Number of hours within each PART LOAD range ---------												
JAN	SUM	16.523	0.000	2309.795	0.000	LOAD	152	63	35	23	1	0	0	0	0	0	0	274
	PEAK	241.213	0.000	23.315	0.000	ELEC	82	86	50	32	23	1	0	0	0	0	0	274
	DAY/HR	11/13	0/ 0	11/13	0/ 0													
FEB	SUM	18.942	0.000	2429.475	0.000	LOAD	102	66	41	29	3	0	0	0	0	0	0	241
	PEAK	242.548	0.000	23.433	0.000	ELEC	56	56	56	40	28	5	0	0	0	0	0	241
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
MAR	SUM	21.060	0.000	2735.042	0.000	LOAD	137	62	40	37	6	0	0	0	0	0	0	282
	PEAK	254.649	0.000	24.306	0.000	ELEC	74	72	54	37	38	7	0	0	0	0	0	282
	DAY/HR	16/13	0/ 0	16/13	0/ 0													
APR	SUM	22.133	0.000	2757.533	0.000	LOAD	125	54	32	33	19	0	0	0	0	0	0	263
	PEAK	281.863	0.000	26.193	0.000	ELEC	56	79	44	30	35	19	0	0	0	0	0	263
	DAY/HR	4/17	0/ 0	4/17	0/ 0													
MAY	SUM	38.972	0.000	4193.897	0.000	LOAD	88	28	24	56	55	23	0	0	0	0	0	274
	PEAK	331.804	0.000	29.654	0.000	ELEC	33	60	23	22	56	58	22	0	0	0	0	274
	DAY/HR	31/14	0/ 0	31/14	0/ 0													
JUN	SUM	60.779	0.000	5872.717	0.000	LOAD	38	32	11	25	64	61	27	13	0	0	0	271
	PEAK	448.920	0.000	37.136	0.000	ELEC	6	38	24	13	24	66	66	31	3	0	0	271
	DAY/HR	20/14	0/ 0	20/14	0/ 0													
JUL	SUM	68.356	0.000	6415.625	0.000	LOAD	21	30	8	14	34	93	62	1	0	0	0	263
	PEAK	406.021	0.000	34.446	0.000	ELEC	0	19	31	9	14	36	97	57	0	0	0	263
	DAY/HR	11/10	0/ 0	11/10	0/ 0													
AUG	SUM	77.209	0.000	7215.313	0.000	LOAD	12	43	2	7	34	103	84	0	0	0	0	285
	PEAK	393.278	0.000	33.623	0.000	ELEC	0	12	33	12	7	35	129	57	0	0	0	285
	DAY/HR	7/10	0/ 0	7/10	0/ 0													
SEP	SUM	63.244	0.000	5977.696	0.000	LOAD	22	22	8	17	51	84	33	12	0	0	0	249
	PEAK	443.465	0.000	36.751	0.000	ELEC	1	19	21	10	17	53	85	37	6	0	0	249
	DAY/HR	7/17	0/ 0	7/17	0/ 0													
OCT	SUM	52.792	0.000	5280.709	0.000	LOAD	51	30	26	36	64	45	13	9	0	0	0	274
	PEAK	435.498	0.000	36.303	0.000	ELEC	15	42	24	26	36	67	44	17	3	0	0	274
	DAY/HR	1/14	0/ 0	1/14	0/ 0													
NOV	SUM	31.065	0.000	3469.950	0.000	LOAD	93	28	24	63	43	1	0	0	0	0	0	252
	PEAK	286.494	0.000	26.554	0.000	ELEC	39	60	23	21	62	46	1	0	0	0	0	252
	DAY/HR	2/16	0/ 0	2/16	0/ 0													
DEC	SUM	15.845	0.000	2195.693	0.000	LOAD	160	44	27	21	8	0	0	0	0	0	0	260
	PEAK	263.665	0.000	24.919	0.000	ELEC	79	93	32	26	21	9	0	0	0	0	0	260
	DAY/HR	19/15	0/ 0	19/15	0/ 0													

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3-Story Office Bldg                                                                 DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Chiller 1 (ElecRecipHerm)                          WEATHER FILE- CZ06RV2 WYEC2
--------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========     ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR     SUM     486.920       0.000   50853.445       0.000 LOAD1001   502   278   361   382   410   219    35     0     0     0  3188
      PEAK     448.920       0.000      37.136       0.000 ELEC 441   636   415   278   361   402   444   199    12     0     0  3188
  MON/DAY        6/20        0/ 0        6/20        0/ 0
```

** Important Report **

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **PS-H** Loads and Energy Usage for **Open Tower** WEATHER FILE- CZ06RV2 WYEC2

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	NUMBER OF CELLS	FAN POWER PER CELL (KW)	SPRAY PWR PER CELL (KW)	AUXILIARY (KW)
OPEN-TWR	Condenser Water Loop	0.727	145.3	1	2.237	0.000	0.000

MON	SUM PEAK	HTREJ LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	AUX ENERGY (KWH) (KW)	AUX ENERGY (MBTU) (KBTU/HR)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
							-------- Number of hours within each PART LOAD range ---------											
JAN	SUM	30.646	8.484	0.000	0.000	LOAD	0	0	0	0	274	0	0	0	0	0	0	274
	PEAK	326.461	0.401	0.000	0.000	ELEC	39	18	0	0	0	0	0	0	0	0	0	57
	DAY/HR	11/13	18/13	0/ 0	0/ 0													
FEB	SUM	32.098	13.037	0.000	0.000	LOAD	0	0	0	0	241	0	0	0	0	0	0	241
	PEAK	328.168	0.458	0.000	0.000	ELEC	63	24	1	0	0	0	0	0	0	0	0	88
	DAY/HR	16/13	16/13	0/ 0	0/ 0													
MAR	SUM	36.330	15.978	0.000	0.000	LOAD	0	0	0	0	282	0	0	0	0	0	0	282
	PEAK	343.465	0.490	0.000	0.000	ELEC	55	29	2	0	0	0	0	0	0	0	0	86
	DAY/HR	16/13	16/13	0/ 0	0/ 0													
APR	SUM	36.916	18.566	0.000	0.000	LOAD	0	0	0	0	263	0	0	0	0	0	0	263
	PEAK	377.027	0.514	0.000	0.000	ELEC	50	34	4	0	0	0	0	0	0	0	0	88
	DAY/HR	4/17	23/12	0/ 0	0/ 0													
MAY	SUM	57.706	62.402	0.000	0.000	LOAD	0	0	0	0	274	0	0	0	0	0	0	274
	PEAK	438.755	0.838	0.000	0.000	ELEC	41	70	36	21	0	0	0	0	0	0	0	168
	DAY/HR	31/14	31/14	0/ 0	0/ 0													
JUN	SUM	84.278	139.489	0.000	0.000	LOAD	0	0	0	0	250	18	3	0	0	0	0	271
	PEAK	581.229	1.550	0.000	0.000	ELEC	24	32	58	60	25	16	3	0	0	0	0	218
	DAY/HR	20/14	20/14	0/ 0	0/ 0													
JUL	SUM	93.259	162.900	0.000	0.000	LOAD	0	0	0	0	256	7	0	0	0	0	0	263
	PEAK	527.843	1.233	0.000	0.000	ELEC	33	14	43	89	54	5	0	0	0	0	0	238
	DAY/HR	11/10	10/11	0/ 0	0/ 0													
AUG	SUM	105.092	180.871	0.000	0.000	LOAD	0	0	0	0	285	0	0	0	0	0	0	285
	PEAK	512.778	1.034	0.000	0.000	ELEC	39	12	50	115	56	0	0	0	0	0	0	272
	DAY/HR	7/10	9/11	0/ 0	0/ 0													
SEP	SUM	86.518	150.823	0.000	0.000	LOAD	0	0	0	0	225	22	2	0	0	0	0	249
	PEAK	574.518	1.452	0.000	0.000	ELEC	16	31	58	70	26	20	2	0	0	0	0	223
	DAY/HR	7/17	24/12	0/ 0	0/ 0													
OCT	SUM	74.561	104.070	0.000	0.000	LOAD	0	0	0	0	263	10	1	0	0	0	0	274
	PEAK	564.615	1.449	0.000	0.000	ELEC	43	44	62	33	11	10	1	0	0	0	0	204
	DAY/HR	1/14	1/14	0/ 0	0/ 0													
NOV	SUM	47.263	40.609	0.000	0.000	LOAD	0	0	0	0	252	0	0	0	0	0	0	252
	PEAK	383.039	0.603	0.000	0.000	ELEC	38	72	22	0	0	0	0	0	0	0	0	132
	DAY/HR	2/16	27/13	0/ 0	0/ 0													
DEC	SUM	29.350	7.294	0.000	0.000	LOAD	0	0	0	0	260	0	0	0	0	0	0	260
	PEAK	354.533	0.359	0.000	0.000	ELEC	41	12	0	0	0	0	0	0	0	0	0	53
	DAY/HR	19/15	19/15	0/ 0	0/ 0													

One PS-H report for each piece of PLANT EQUIPMENT (7 of 8) — two page report (page 2 of 2)

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3-Story Office Bldg                                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Open Tower                                        WEATHER FILE- CZ06RV2 WYEC2
-------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========     ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR     SUM    714.020     904.522       0.000       0.000 LOAD   0     0     0     0  3125    57     6     0     0     0     0  3188
      PEAK    581.229       1.550       0.000       0.000 ELEC 482   392   336   388   172    51     6     0     0     0     0  1827
  MON/DAY        6/20        6/20        0/ 0        0/ 0

  MAXIMUM TOWER SUPPLY TEMPERATURE WAS  90.0F ON  7/ 6 AT 17:00
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***** Important Report *****

One PS-H report for each piece of PLANT EQUIPMENT (8 of 8) — two page report (page 1 of 2)

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3-Story Office Bldg                                                DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- PS-H Loads and Energy Usage for     Domestic Water Heater                    WEATHER FILE- CZ06RV2 WYEC2
```

EQUIPMENT TYPE	ATTACHED TO	CAPACITY (MBTU/HR)	FLOW (GAL/MIN)	EIR (FRAC)	HIR (FRAC)	AUXILIARY (KW)	TANK (GAL)	TANK UA (BTU/HR-F)
GAS DW-HEATER	Domestic Hot Water Loop	-0.206	5.3	0.000	1.370	0.000	154.6	6.44

MON	SUM PEAK	HEAT LOAD (MBTU) (KBTU/HR)	ELEC USE (KWH) (KW)	FUEL USE (MBTU) (KBTU/HR)	AUX ENERGY (KWH) (KW)		00 10	10 20	20 30	30 40	40 50	50 60	60 70	70 80	80 90	90 100	100 +	TOTAL RUN HOURS
							-------- Number of hours within each PART LOAD range ---------											
JAN	SUM	-4.020	0.000	6.024	0.000	LOAD	222	0	0	0	0	0	0	0	0	0	0	222
	PEAK	-19.644	0.000	0.028	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	2/ 9	0/ 0	17/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
FEB	SUM	-3.537	0.000	5.308	0.000	LOAD	195	0	0	0	0	0	0	0	0	0	0	195
	PEAK	-19.907	0.000	0.028	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	2/ 9	0/ 0	FUEL	672	0	0	0	0	0	0	0	0	0	0	672
MAR	SUM	-4.112	0.000	6.146	0.000	LOAD	228	0	0	0	0	0	0	0	0	0	0	228
	PEAK	-19.928	0.000	0.028	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	1/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
APR	SUM	-3.875	0.000	5.789	0.000	LOAD	213	0	0	0	0	0	0	0	0	0	0	213
	PEAK	-19.803	0.000	0.028	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	2/ 9	0/ 0	11/ 9	0/ 0	FUEL	720	0	0	0	0	0	0	0	0	0	0	720
MAY	SUM	-3.950	0.000	5.894	0.000	LOAD	222	0	0	0	0	0	0	0	0	0	0	222
	PEAK	-19.301	0.000	0.027	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	7/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
JUN	SUM	-3.710	0.000	5.529	0.000	LOAD	219	0	0	0	0	0	0	0	0	0	0	219
	PEAK	-18.802	0.000	0.026	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	5/ 9	0/ 0	FUEL	720	0	0	0	0	0	0	0	0	0	0	720
JUL	SUM	-3.594	0.000	5.369	0.000	LOAD	213	0	0	0	0	0	0	0	0	0	0	213
	PEAK	-18.368	0.000	0.026	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	2/ 9	0/ 0	2/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
AUG	SUM	-3.866	0.000	5.731	0.000	LOAD	231	0	0	0	0	0	0	0	0	0	0	231
	PEAK	-18.094	0.000	0.025	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	22/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
SEP	SUM	-3.241	0.000	4.865	0.000	LOAD	201	0	0	0	0	0	0	0	0	0	0	201
	PEAK	-18.071	0.000	0.025	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	4/ 9	0/ 0	26/ 9	0/ 0	FUEL	720	0	0	0	0	0	0	0	0	0	0	720
OCT	SUM	-3.744	0.000	5.591	0.000	LOAD	222	0	0	0	0	0	0	0	0	0	0	222
	PEAK	-18.294	0.000	0.026	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	15/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744
NOV	SUM	-3.494	0.000	5.260	0.000	LOAD	204	0	0	0	0	0	0	0	0	0	0	204
	PEAK	-18.716	0.000	0.026	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	1/ 9	0/ 0	16/16	0/ 0	FUEL	720	0	0	0	0	0	0	0	0	0	0	720
DEC	SUM	-3.616	0.000	5.477	0.000	LOAD	210	0	0	0	0	0	0	0	0	0	0	210
	PEAK	-19.200	0.000	0.027	0.000	ELEC	0	0	0	0	0	0	0	0	0	0	0	0
	DAY/HR	3/ 9	0/ 0	24/ 9	0/ 0	FUEL	744	0	0	0	0	0	0	0	0	0	0	744

One PS-H report for each piece of PLANT EQUIPMENT (8 of 8) — two page report (page 2 of 2)

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3-Story Office Bldg                                                                   DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- PS-H Loads and Energy Usage for     Domestic Water Heater                           WEATHER FILE- CZ06RV2 WYEC2
--------------------------------------------------------------------------------------------------------------(CONTINUED)--------
           ==========  ==========  ==========  ==========      ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====  ====

YR     SUM    -44.759       0.000      66.982       0.000 LOAD2580     0     0     0     0     0     0     0     0     0     0  2580
      PEAK    -19.928       0.000       0.028       0.000 ELEC    0     0     0     0     0     0     0     0     0     0     0     0
  MON/DAY        3/ 1        0/ 0        3/ 1        0/ 0 FUEL8760     0     0     0     0     0     0     0     0     0     0  8760
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***** Important Report *****

One EV-A report only (this is a building level report)

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3-Story Office Bldg                                                  DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- EV-A Life-Cycle Costing Parameters                                      WEATHER FILE- CZ06RV2 WYEC2
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                                              LIFE-CYCLE COSTING PARAMETERS
                                              -----------------------------

                                                    LABOR     MATERIALS
                                   DISCOUNT      INFLATION    INFLATION         PROJECT
                                       RATE           RATE         RATE            LIFE
                                  (PERCENT)      (PERCENT)    (PERCENT)         (YEARS)
                                  ---------      ---------    ---------        --------

                                       10.0            0.0          0.0            25.0



                                    BUILDING COMPONENT COST INPUT DATA (CURRENT DOLLARS)
                                    ----------------------------------------------------

                                                                             UNIT       UNIT      UNIT                 UNIT
                                                                   UNIT    INSTALL    ANNUAL     MINOR      MINOR     MAJOR      MAJOR
                                                                  FIRST     -ATION     MAINT  OVERHAUL   OVERHAUL  OVERHAUL   OVERHAUL
                           NUMBER                       LIFE       COST       COST      COST      COST   INTERVAL      COST   INTERVAL
COST NAME                OF UNITS  UNIT NAME          (YEARS)       ($)        ($)       ($)       ($)    (YEARS)       ($)    (YEARS)
---------                --------  ---------           -----      -----    -------    ------  --------   --------  --------   --------

NO BUILDING COMPONENT COSTS SPECIFIED
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One ES-A report only (this is a building level report)

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3-Story Office Bldg                                                         DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- ES-A Annual Costs and Savings                                                    WEATHER FILE- CZ06RV2 WYEC2
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YEAR	ENERGY COST BASELINE	ENERGY COST THIS RUN	ENERGY COST SAVINGS	OPRNS COST BASELINE	OPRNS COST -- THIS RUN PLANT	OPRNS COST -- THIS RUN BUILDING	OPRNS COST -- THIS RUN TOTAL	OPRNS COST SAVINGS	TOTAL SAVINGS- ENERGY PLUS OPRNS
	E N E R G Y ($)			O P E R A T I O N S ($)					
1	0.	39291.	-39291.	0.	0.	0.	0.	0.	-39291.
2	0.	37505.	-37505.	0.	0.	0.	0.	0.	-37505.
3	0.	35800.	-35800.	0.	0.	0.	0.	0.	-35800.
4	0.	34173.	-34173.	0.	0.	0.	0.	0.	-34173.
5	0.	32620.	-32620.	0.	0.	0.	0.	0.	-32620.
6	0.	31137.	-31137.	0.	0.	0.	0.	0.	-31137.
7	0.	29722.	-29722.	0.	0.	0.	0.	0.	-29722.
8	0.	28371.	-28371.	0.	0.	0.	0.	0.	-28371.
9	0.	27081.	-27081.	0.	0.	0.	0.	0.	-27081.
10	0.	25850.	-25850.	0.	0.	0.	0.	0.	-25850.
11	0.	24675.	-24675.	0.	0.	0.	0.	0.	-24675.
12	0.	23554.	-23554.	0.	0.	0.	0.	0.	-23554.
13	0.	22483.	-22483.	0.	0.	0.	0.	0.	-22483.
14	0.	21461.	-21461.	0.	0.	0.	0.	0.	-21461.
15	0.	20485.	-20485.	0.	0.	0.	0.	0.	-20485.
16	0.	19554.	-19554.	0.	0.	0.	0.	0.	-19554.
17	0.	18665.	-18665.	0.	0.	0.	0.	0.	-18665.
18	0.	17817.	-17817.	0.	0.	0.	0.	0.	-17817.
19	0.	17007.	-17007.	0.	0.	0.	0.	0.	-17007.
20	0.	16234.	-16234.	0.	0.	0.	0.	0.	-16234.
21	0.	15496.	-15496.	0.	0.	0.	0.	0.	-15496.
22	0.	14792.	-14792.	0.	0.	0.	0.	0.	-14792.
23	0.	14119.	-14119.	0.	0.	0.	0.	0.	-14119.
24	0.	13478.	-13478.	0.	0.	0.	0.	0.	-13478.
25	0.	12865.	-12865.	0.	0.	0.	0.	0.	-12865.
TOTALS($)	0.	594236.	-594236.	0.	0.	0.	0.	0.	-594236.

One ES-B report only (this is a building level report)

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3-Story Office Bldg                                                   DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- ES-B Life-Cycle Non-Energy Costs                                       WEATHER FILE- CZ06RV2 WYEC2
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                                   LIFE-CYCLE BUILDING AND PLANT NON-ENERGY COSTS ($)
                                   --------------------------------------------------

                                                                                                      INVESTMENT
                                                  FIRST COST                                          (FIRST COST
                                                  (INCLUDING                                                PLUS
           COST NAME                            INSTALLATION)   REPLACEMENTS  OPERATIONS       TOTAL   REPLACEMENTS)
        --------------------------------  -------------  --------------  ----------    ---------   -------------

        NO BUILDING COMPONENT COSTS SPECIFIED
```

One ES-C report only (this is a building level report)

REPORT- **ES-C** Life-Cycle Investment Savings WEATHER FILE- CZ06RV2 WYEC2

ENERGY SAVINGS

	ANNUAL ENERGY USE BASELINE (MBTU)	ANNUAL ENERGY USE THIS RUN (MBTU)	ANNUAL ENERGY SAVINGS (MBTU)	ANNUAL ENERGY SAVINGS (PERCENT)
AT SITE	0.00	1175.54	-1175.54	0.0
AT SOURCE	0.00	3398.25	-3398.25	0.0

INVESTMENT STATISTICS

PROJECT LIFE, 25.0 YEARS

INVESTMENT THIS RUN ($)	BASELINE REPLACEMENT COSTS ($)	INCREMENTAL INVESTMENT ($)	COST SAVINGS ($)	RATIO OF SAVINGS TO INCREMENTAL INVESTMENT (SIR)	DISCOUNTED PAYBACK PERIOD (YEARS)	RATIO OF LIFE CYCLE ENERGY SAVINGS (AT SITE) TO INCREMENTAL INVESTMENT (MBTU/$)	RATIO OF LIFE-CYCLE ENERGY SAVINGS (AT SOURCE) TO INCREMENTAL INVESTMENT (MBTU/$)
0.	0.	0.	-594236.	0.00	999.00	0.00	0.00

OVERALL LIFE-CYCLE COSTS ($)

	FIRST COST	OPRNS COST	REPLACEMENTS	ENERGY COST	T O T A L
BASELINE	0.	0.	0.	0.	0.
THIS RUN	0.	0.	0.	594236.	594236.
SAVINGS($)	0.	0.	0.	-594236.	-594236.
(PERCENT)	0.0	0.0	0.0	0.0	0.0

One ES-D report only (this is a building level report)

```
3-Story Office Bldg                                                                 DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2

REPORT- ES-D Energy Cost Summary                                                               WEATHER FILE- CZ06RV2 WYEC2
-----------------------------------------------------------------------------------------------------------------------------------

                                                                                 METERED           TOTAL        VIRTUAL
                                                                                  ENERGY          CHARGE           RATE    RATE USED
UTILITY-RATE                       RESOURCE           METERS                    UNITS/YR             ($)      ($/UNIT)    ALL YEAR?
--------------------------------   ----------------   -----------   -------------------   ----------   ----------   ---------

SCE GS-2 Elec Rate                 ELECTRICITY        EM1               325626. KWH           38696.       0.1188        YES

SoCalGas GN-10 Gas Rate            NATURAL-GAS        FM1                  642. THERM           595.       0.9276        YES
                                                                                              ==========
                                                                                                39291.

                                                                ENERGY COST/GROSS BLDG AREA:      1.01
                                                                  ENERGY COST/NET BLDG AREA:      1.01
```

This is the only place that total annual utility cost is reported.

Valuable QC check

Valuable QC check

***** Important Report *****

One ES-E report for each UTILITY RATE (two rates in this example)

```
3-Story Office Bldg                                                        DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- ES-E Summary of Utility-Rate:        SCE GS-2 Elec Rate                         WEATHER FILE- CZ06RV2 WYEC2
----------------------------------------------------------------------------------------------------------------------------------

       RESOURCE:  ELECTRICITY         DEMAND-WINDOW:   15                    3413. BTU/KWH
    BILLING-DAY:  31                RATE-LIMITATION:   0.0000
         METERS:  EM1
   POWER-FACTOR:  0.80              EXCESS-KVAR-FRAC:  0.75             EXCESS-KVAR-CHG:   0.0000

 RATE-QUALIFICATIONS          BLOCK-CHARGES                       DEMAND-RATCHETS                   MIN-MON-RATCHETS
--------------------------  ------------------------------  --------------------------------  --------------------------------
   MIN-ENERGY:         0.0  SCE GS-2 Facility Block
   MAX-ENERGY:         0.0  SCE GS-2 Time-Related Block
   MIN-DEMAND:         0.0  SCE GS-2 Energy Charge Block
   MAX-DEMAND:         0.0
 QUALIFY-RATE:    ALL YEAR
 USE-MIN-QUAL:          NO
```

MONTH	METERED ENERGY KWH	BILLING ENERGY KWH	METERED DEMAND KW	BILLING DEMAND KW	ENERGY CHARGE ($)	DEMAND CHARGE ($)	ENERGY CST ADJ ($)	TAXES ($)	SURCHRG ($)	FIXED CHARGE ($)	MINIMUM CHARGE ($)	VIRTUAL RATE ($/UNIT)	TOTAL CHARGE ($)
JAN	25228	25228	118.7	118.7	1941	641	0	0	0	60	0	0.1047	2642
FEB	22069	22069	119.7	119.7	1698	646	0	0	0	60	0	0.1089	2404
MAR	25308	25308	117.7	117.7	1947	636	0	0	0	60	0	0.1044	2643
APR	23963	23963	125.7	125.7	1843	679	0	0	0	60	0	0.1078	2582
MAY	27275	27275	127.6	127.6	2098	689	0	0	0	60	0	0.1044	2848
JUN	29859	29859	145.1	145.1	2297	1796	0	0	0	60	0	0.1391	4153
JUL	30647	30647	141.2	141.2	2357	1857	0	0	0	60	0	0.1395	4274
AUG	33820	33820	139.3	139.3	2601	1831	0	0	0	60	0	0.1329	4493
SEP	28743	28743	145.9	145.9	2211	1919	0	0	0	60	0	0.1458	4190
OCT	29591	29591	143.0	143.0	2276	772	0	0	0	60	0	0.1050	3108
NOV	25205	25205	137.9	137.9	1939	745	0	0	0	60	0	0.1089	2744
DEC	23920	23920	132.2	132.2	1840	714	0	0	0	60	0	0.1093	2614
TOTAL	325626	325626	145.9		25047	12925	0	0	0	724		0.1188	38696

Includes the effect of UTILITY-RATE: DEMAND-INTERVAL (default = 15min), i.e., may exceed peak kW's reported in Plant reports

Includes the effect of demand ratchets, if any, i.e., may exceed "Metered Demand"

IMPORTANT NOTE:
Several other reports include monthly/annual kWh and therms, however, only the ES-E report reflects user-controlled monthly meter read dates, i.e., the monthly read dates do not have to be last day of each month, as is all other DOE-2 reports.

***** Important Report *****

One ES-F report for each UTILITY RATE (two rates in this example — may require more than one page, depending on the number of blocks in a rate)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **ES-F** Block-Charges and Ratchets for **SCE GS-2 Elec Rate** WEATHER FILE- CZ06RV2 WYEC2

RESOURCE: ELECTRICITY
ENERGY-UNITS: KWH
DEMAND-UNITS: KW
DEMAND-WINDOW: 15

BLOCK-CHARGES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
SCE GS-2 Facility Block													
USE: YEARLY													
METERED ENERGY:	25228	22069	25308	23963	27275	29859	30647	33820	28743	29591	25205	23920	
BILLING ENERGY:	0	0	0	0	0	0	0	0	0	0	0	0	325626
METERED DEMAND:	118.7	119.7	117.7	125.7	127.6	145.1	141.2	139.3	145.9	143.0	137.9	132.2	
BILLING DEMAND:	118.7	119.7	117.7	125.7	127.6	145.1	141.2	139.3	145.9	143.0	137.9	132.2	
DEMAND CHGS($):	641	646	636	679	689	784	762	752	788	772	745	714	8608
SCE GS-2 Time-Related Block													
USE: SEASONAL													
METERED ENERGY:	0	0	0	0	0	28057	30647	33820	28743	0	0	0	
BILLING ENERGY:	0	0	0	0	0	0	0	0	0	0	0	0	120083
METERED DEMAND:	0.0	0.0	0.0	0.0	0.0	145.1	141.2	139.3	145.9	0.0	0.0	0.0	
BILLING DEMAND:	0.0	0.0	0.0	0.0	0.0	145.1	141.2	139.3	145.9	0.0	0.0	0.0	
PRORATE FACTOR:	0.0000	0.0000	0.0000	0.0000	0.0000	0.9000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	
DEMAND CHGS($):	0	0	0	0	0	1012	1094	1079	1131	0	0	0	4317
SCE GS-2 Energy Charge Block													
USE: YEARLY													
METERED ENERGY:	25228	22069	25308	23963	27275	29859	30647	33820	28743	29591	25205	23920	
BILLING ENERGY:	25228	22069	25308	23963	27275	29859	30647	33820	28743	29591	25205	23920	325626
METERED DEMAND:	118.7	119.7	117.7	125.7	127.6	145.1	141.2	139.3	145.9	143.0	137.9	132.2	
BILLING DEMAND:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ENERGY CHGS($):	1941	1698	1947	1843	2098	2297	2357	2601	2211	2276	1939	1840	25047
TOTAL ENERGY:	25228	22069	25308	23963	27275	29859	30647	33820	28743	29591	25205	23920	325626
TOTAL CHARGES ($):	2582	2344	2582	2522	2787	4093	4214	4433	4130	3048	2683	2554	37972

RATCHETS	TYPE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SCE GS-2 Ratchet 50	HIGHEST	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0

NOTE:
This report is especially helpful for QC checking time-of-use rates.

***** Important Report *****

One ES-E report for each UTILITY RATE (two rates in this example)

```
3-Story Office Bldg                                                                      DOE-B2.2NT38   4/07/2001    10:36:50  BDL RUN  2
REPORT- ES-E Summary of Utility-Rate:       SoCalGas GN-10 Gas Rate                                WEATHER FILE- CZ06RV2 WYEC2
---------------------------------------------------------------------------------------------------------------------------------

       RESOURCE:  NATURAL-GAS         DEMAND-WINDOW:   60                     100000. BTU/THERM
    BILLING-DAY:  31                RATE-LIMITATION:   0.0000
         METERS:  FM1

 RATE-QUALIFICATIONS         BLOCK-CHARGES                     DEMAND-RATCHETS                   MIN-MON-RATCHETS
--------------------------  -------------------------------  -------------------------------  -------------------------------
   MIN-ENERGY:          0.0  SoCalGas GN-10 Summer Block
   MAX-ENERGY:          0.0  SoCalGas GN-10 Winter Block
   MIN-DEMAND:          0.0
   MAX-DEMAND:          0.0
 QUALIFY-RATE:     ALL YEAR
 USE-MIN-QUAL:           NO
```

MONTH	METERED ENERGY THERM	BILLING ENERGY THERM	METERED DEMAND THERM/HR	BILLING DEMAND THERM/HR	ENERGY CHARGE ($)	DEMAND CHARGE ($)	ENERGY CST ADJ ($)	TAXES ($)	SURCHRG ($)	FIXED CHARGE ($)	MINIMUM CHARGE ($)	VIRTUAL RATE ($/UNIT)	TOTAL CHARGE ($)
JAN	69	69	3.8	3.8	44	0	0	0	0	15	0	0.8703	60
FEB	50	50	0.3	0.3	32	0	0	0	0	14	0	0.9251	46
MAR	58	58	0.3	0.3	37	0	0	0	0	15	0	0.9119	53
APR	54	54	0.3	0.3	35	0	0	0	0	15	0	0.9192	50
MAY	55	55	0.3	0.3	36	0	0	0	0	15	0	0.9230	51
JUN	52	52	0.3	0.3	34	0	0	0	0	15	0	0.9314	48
JUL	50	50	0.3	0.3	33	0	0	0	0	15	0	0.9506	48
AUG	54	54	0.3	0.3	35	0	0	0	0	15	0	0.9293	50
SEP	45	45	0.3	0.3	29	0	0	0	0	15	0	0.9726	44
OCT	53	53	0.3	0.3	34	0	0	0	0	15	0	0.9382	49
NOV	49	49	0.3	0.3	32	0	0	0	0	15	0	0.9487	47
DEC	52	52	1.1	1.1	34	0	0	0	0	15	0	0.9389	49
TOTAL	642	642	3.8		415	0	0	0	0	180		0.9276	595

IMPORTANT NOTE:
Several other reports include monthly/annual kWh and therms, however, only the ES-E report reflects user-controlled monthly meter read dates, i.e., the monthly read dates do not have to be last day of each month, as is all other DOE-2 reports.

***** Important Report *****

One ES-F report for each UTILITY RATE (two rates in this example — may require more than one page, depending on the number of blocks in a rate)

3-Story Office Bldg DOE-B2.2NT38 4/07/2001 10:36:50 BDL RUN 2

REPORT- **ES-F** Block-Charges and Ratchets for **SoCalGas GN-10 Gas Rate** WEATHER FILE- CZ06RV2 WYEC2

RESOURCE: NATURAL-GAS
ENERGY-UNITS: THERM
DEMAND-UNITS: THERM/HR
DEMAND-WINDOW: 60

BLOCK-CHARGES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
SoCalGas GN-10 Summer Block													
USE: SEASONAL													
METERED ENERGY:	0	0	0	54	55	52	50	54	45	53	49	0	
BILLING ENERGY:	0	0	0	54	55	52	50	54	45	53	49	0	414
METERED DEMAND:	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	
BILLING DEMAND:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ENERGY CHGS($):	0	0	0	35	36	34	33	35	29	34	32	0	268
SoCalGas GN-10 Winter Block													
USE: SEASONAL													
METERED ENERGY:	69	50	58	0	0	0	0	0	0	0	0	52	
BILLING ENERGY:	69	50	58	0	0	0	0	0	0	0	0	52	228
METERED DEMAND:	3.8	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	
BILLING DEMAND:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
ENERGY CHGS($):	44	32	37	0	0	0	0	0	0	0	0	34	148
TOTAL ENERGY:	69	50	58	54	55	52	50	54	45	53	49	52	642
TOTAL CHARGES ($):	44	32	37	35	36	34	33	35	29	34	32	34	41

NOTE:
This report is especially helpful for QC checking time-of-use rates.

***** Important Report *****

Description of eQUEST/DOE-2.2 End Use Reporting Categories (used on reports: PS-E, PS-F, BEPS, BEPU)

LIGHTS Indoor overhead (ambient) lighting

BDL: SPACE: LIGHTING-KW and/or LIGHTING-W/AREA
eQ :Internal Loads > Space Properties > Lighting

Usage Notes:
1) Additive if both keywords are used
2) Can be controlled by daylight controls

TASK LIGHTS Indoor Task lighting energy

BDL: SPACE: TASK-LIGHTING-KW
eQ :Internal Loads > Space Properties > Lighting

Usage Notes:
1) Cannot be controlled by daylight controls

MISC EQUIP Indoor equipment energy (see EXT USAGE for outdoor equipment energy)

Elec. Plug Loads: Indoor electric equipment (generally contributes to space loads, but may not)
BDL: SPACE: EQUIPMENT-KW and/or EQUIPMENT-W/AREA
eQ: Internal Loads > Space Properties > Equipment > Equipment

Process Loads: Other indoor energy sources (generally contributes to space loads, but may not)
BDL: SPACE: SOURCE-TYPE and SOURCE-BTU/HR
eQ: Internal Loads > Space Properties > Equipment > Internal Energy Sources

Indoor Direct Loads: Indoor energy sources which do not contribute to space loads (e.g., equipment in exhausted spaces) Consider this a process load sensed only by a utility meter, not sensed by any thermostat.
BDL: ELEC-METER: INTERIOR-POWER, and INTERIOR-SCH
eQ: Utility & Economics > Electric Meter Properties > Direct Loads > Interior Direct Loads

Usage Notes:
1) additive if multiple keywords are used

SPACE HEATING Space heating by boilers, furnaces, heat-pumps etc.

Boilers: BDL: BOILER: TYPE and HEAT-INPUT-RATIO
eQ: Water-Side HVAC > Boiler Properties > Basic Specifications

Furnaces: BDL: SYSTEM: HEAT-SOURCE, FURNACE-HIR, HEATING-EIR, …
eQ: Air-Side HVAC > System Properties > Heating > Coil Capacity/Control | Unitary Power

Heat Pumps: during heating mode only
BDL: SYSTEM: HEAT-SOURCE, HEATING-EIR, …
eQ: Air-Side HVAC > System Properties > Heating > Coil Capacity/Control | Unitary Power

Usage Notes:
1) includes the impact of outdoor ventilation air, air-side economizers, fan heat, and pump heat
2) includes HP condenser fan electric use IF accounted for via SYSTEM: HEATING-EIR
3) boiler draft fan electric use is included under SPACE HEATING, not PUMPS & AUX

SPACE COOLING Space cooling by chillers and package DX systems

Chillers: BDL: CHILLER: TYPE and ELEC-INPUT-RATIO
eQ: Water-Side HVAC > Chiller Properties > Basic Specifications

DX Units: BDL: SYSTEM: COOLING-EIR, …
eQ: Air-Side HVAC > System Properties > Cooling > Coil Capacity/Control | Unitary Power

Heat Pumps: during cooling mode only
BDL: SYSTEM: COOLING-EIR, …
eQ: Air-Side HVAC > System Properties > Cooling > Coil Capacity/Control | Unitary Power

Usage Notes:
1) includes the impact of outdoor ventilation air, air-side economizers, fan heat, and pump heat
2) includes DX condenser fan electric use IF accounted for via SYSTEM: COOLING-EIR
3) includes desiccant cooling, if any

***NOTE**: BDL = Building Description Language, i.e., input found in the project INP file (BDL command: keyword).*
eQ = "path" to inputs within eQUEST's detailed interface dialogs (module > component > dialog tab > sub-tab)

Description of eQUEST/DOE-2.2 End Use Reporting Categories (*continued*)

HEAT REJECT	Cooling towers and other heat rejection devices
WC Condensers:	Heat rejection (tower) fan energy only. BDL: HEAT-REJECTION: TYPE and ELEC-INPUT-RATIO eQ: Water-Side HVAC > Heat Rejection Properties > Basic Specifications
AC DX Condensers:	BDL: SYSTEM: CONDENSER-TYPE, OUTSIDE-FAN-ELEC eQ: Air-Side HVAC > System Properties > Cooling > Condenser
Usage Notes:	1) Condenser water pump energy is reported under PUMPS & AUX 2) AC DX condenser fan electric use will be included under SPACE COOLING IF accounted for using SYSTEM: COOLING-EIR
PUMPS & AUX	Circulation pumps and auxiliary power consumed by various components
Circ Pumps:	All circulation pumping energy, e.g., chilled water, condenser water, space heat hot water, domestic hot water, including all pumps attached directly to loops or primary equipment. BDL: PUMP: HEAD and FLOW eQ: Water-Side HVAC > Pump Properties > Basic Specifications
Auxiliaries:	any of numerous auxiliary power requirements, e.g., control panels, gas pilot lights, solution pumps, crankcase heaters, heat tracing on a pipe. In general, energy use is treated as "auxiliary" if it is incidental to the principal equipment, e.g., draft fans on DHW heaters (note that draft fans on forced draft boilers are treated under space heat), heat-recovery pumps on electric generators, cooling tower filter pump, etc. BDL: (example:) CHILLER: AUX-KW, and AUX-MODE eQ: (example:) Water-Side HVAC > Chiller Properties > Miscellaneous
Usage Notes:	1) Condenser water pump energy is reported under PUMPS & AUX 2) Boiler draft fan electric use is included under SPACE HEATING, not PUMPS & AUX
VENT FANS	All ventilation fans, e.g., supply, return and exhaust fans (does not include condenser fans or draft fans).
Supply Fans:	BDL: SYSTEM: SUPPLY-STATIC and SUPPLY-EFF eQ: Air-Side HVAC > System Properties > Fans > Fan Power and Control
Return Fans:	BDL: SYSTEM: RETURN-STATIC and RETURN-EFF eQ: Air-Side HVAC > System Properties > Fans > Fan Power and Control
Exhaust Fans:	BDL: ZONE: EXHAUST-FLOW, EXHAUST-STATIC and EXHAUST-EFF eQ: Air-Side HVAC > Zone Properties > Outdoor Air > Exhaust Air
Usage Notes:	1) An alternative to SYSTEM: SUPPLY-STATIC and SUPPLY-EFF is SUPPLY-KW/FLOW and SUPPLY-DELTA-T (similar for return fans) 2) Condenser fan energy is reported under HEAT REJECT 3) Boiler draft fan electric use is reported under SPACE HEATING, not PUMPS & AUX 4) Although exhaust fans are included under VENT FANS on Plant reports, they are excluded from SS-M and SS-L (these fan reports include only supply & return).
REFRIG DISPLAY	Refrigerated display cases, and associated refrigeration systems BDL: SYSTEM: REFG-COMP-EER and others… and ZONE: REFG-ZONE-LOAD and others… eQ: Air-Side HVAC > System Properties > Refrigeration > Design Parameters and Air-Side HVAC > Zone Properties > Refrigeration
HT PUMP SUPPLEM	Heat pump supplemental and defrost energy BDL: SYSTEM: HP-SUPP-SOURCE, HP-SUPP-HT-CAP, and others… eQ: Air-Side HVAC > System Properties > Heating > Supp Heat/Defrost

NOTE*: BDL = Building Description Language, i.e., input found in the project INP file (BDL command: keyword).*
eQ = "path" to inputs within eQUEST's detailed interface dialogs (module > component > dialog tab > sub-tab)

Description of eQUEST/DOE-2.2 End Use Reporting Categories (*continued*)

DOMESTIC HOT WTR	Domestic hot water energy BDL: DW-HEATER: TYPE, HEAT-INPUT-RATIO, ELEC-INPUT-RATIO… eQ: Air-Side HVAC > System Properties > Heating > Supp Heat/Defrost
EXT USAGE	Energy usage exterior to building, such as exterior lighting (e.g., parking lots or signage)… think of this as a direct process load on a meter (not sensed by any thermostat) BDL: ELEC-METER: EXTERIOR-POWER, and INTERIOR-SCH eQ: Utility & Economics > Electric Meter Properties > Direct Loads > Exterior Direct Loads

NOTE*:* *BDL = Building Description Language, i.e., input found in the project INP file (BDL command: keyword).*
eQ = "path" to inputs within eQUEST's detailed interface dialogs (module > component > dialog tab > sub-tab)

DOE-2.1E-W74 WEATHER UTILITY PROGRAM

INPUT VERIFICATION

RUN TYPE STAT

LATITUDE = 33.60 LONGITUDE = 117.70 TIME ZONE = 8

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. TEMP. (F) (DRYBULB)		54.7	56.2	57.6	60.6	63.6	67.4	70.9	70.8	70.1	65.4	59.4	55.7	62.7
AVG. TEMP. (F) (WETBULB)		46.5	50.0	51.5	51.8	57.2	62.0	63.6	64.0	59.6	59.9	52.6	46.5	55.5
AVG. DAILY MAX. TEMP.		67.5	69.0	69.1	72.3	74.2	78.4	82.9	84.0	83.2	79.0	73.4	68.4	75.2
AVG. DAILY MIN. TEMP.		45.0	46.5	48.2	50.3	55.0	58.6	61.4	62.0	60.5	55.7	48.9	44.7	53.1
HEATING DEG. DAYS	(BASE 65)	280.5	206.0	199.0	128.5	71.0	10.5	0.0	2.5	0.5	22.0	132.5	263.5	1316.5
	(BASE 60)	151.0	86.0	56.0	36.5	10.5	0.0	0.0	0.0	0.0	2.0	50.5	117.5	510.0
	(BASE 55)	55.0	10.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	11.0	31.5	109.5
	(BASE 50)	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	8.0
COOLING DEG. DAYS	(BASE 80)	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.5	1.5	0.0	0.0	0.0	4.0
	(BASE 75)	0.0	0.0	0.0	0.0	1.0	0.0	24.0	31.5	25.0	1.0	0.0	0.0	82.5
	(BASE 70)	0.0	0.0	0.0	0.0	15.5	23.0	100.5	113.0	82.5	22.5	0.0	0.0	357.0
	(BASE 65)	8.5	3.0	2.0	18.0	58.5	114.5	222.5	251.0	207.0	96.0	16.5	1.0	998.5
HEATING DEG. HRS./24	(BASE 65)	342.0	271.8	251.6	191.2	128.8	51.0	32.1	26.9	37.4	101.9	223.3	314.1	1972.1
	(BASE 60)	215.5	162.4	137.8	96.5	47.0	12.7	4.4	1.5	4.5	36.9	122.0	200.0	1041.0
	(BASE 55)	117.4	75.5	50.0	36.8	9.4	2.4	0.0	0.0	0.0	6.9	52.2	108.9	459.4
	(BASE 50)	54.4	25.7	10.6	8.1	1.1	0.0	0.0	0.0	0.0	0.8	17.9	46.7	165.3
COOLING DEG. HRS./24	(BASE 80)	0.1	0.2	0.1	2.7	6.5	7.5	26.4	29.1	33.9	8.3	2.9	0.0	117.8
	(BASE 75)	1.8	3.3	1.2	10.7	18.9	25.5	63.7	66.0	66.5	23.8	11.0	0.3	292.5
	(BASE 70)	8.2	10.1	5.5	27.3	42.2	62.3	123.9	121.8	116.3	56.0	26.0	5.5	605.2
	(BASE 65)	23.6	24.3	23.2	58.2	86.1	122.8	215.0	206.0	190.4	112.8	53.9	25.4	1141.8
MAXIMUM TEMP.		82	83	82	86	88	91	94	96	98	94	88	78	98
MINIMUM TEMP.		35	38	39	42	47	51	55	55	54	47	39	34	34
NO. DAYS MAX. 90 AND ABOVE		0	0	0	0	0	2	4	6	8	2	0	0	22
NO. DAYS MAX. 32 AND BELOW		0	0	0	0	0	0	0	0	0	0	0	0	0
NO. DAYS MIN. 32 AND BELOW		0	0	0	0	0	0	0	0	0	0	0	0	0
NO. DAYS MIN. 0 AND BELOW		0	0	0	0	0	0	0	0	0	0	0	0	0
AVG. WIND SPEED (MPH)		3.9	6.0	4.9	6.3	5.2	6.1	5.6	5.2	4.4	5.0	5.3	6.3	5.3
AVG. WIND SPEED (DAY)		4.2	6.8	6.4	7.6	6.2	7.2	7.2	6.7	5.6	6.2	6.9	7.0	6.6
AVG. WIND SPEED (NIGHT)		3.6	5.3	3.4	4.8	3.7	4.3	3.3	3.2	3.0	3.8	3.9	5.9	4.0
AVG. TEMP. (DAY)		61.1	62.2	62.5	65.6	67.6	71.2	75.4	75.7	75.5	71.1	66.1	62.2	68.5
AVG. TEMP. (NIGHT)		50.1	51.3	52.9	54.5	58.0	61.5	64.4	64.6	64.0	59.6	53.6	50.8	56.6
AVG. SKY COVER		3.4	3.9	4.0	4.3	5.0	5.1	3.3	3.8	4.0	4.1	3.7	3.3	4.0
AVG. SKY COVER (DAY)		3.6	4.1	4.1	4.3	4.8	4.1	2.9	3.2	3.5	3.9	3.6	3.4	3.8
AVG. REL. HUM. AT	4AM	61.4	75.5	79.0	70.1	87.6	89.9	86.8	89.1	69.2	82.8	80.1	58.0	77.5
	10AM	55.8	62.4	60.4	52.4	59.2	65.4	57.1	60.8	48.8	64.9	57.6	49.3	57.8
	4PM	45.5	57.7	54.7	45.2	51.3	61.5	51.0	53.3	44.5	67.8	59.9	44.6	53.0
	10PM	61.8	74.8	80.2	66.3	83.5	86.6	82.2	84.1	65.3	82.7	75.3	54.5	74.8

CZ08RV2 WYEC2 MONTHLY WEATHER DATA SUMMARY DOE-2.1E-W74

LATITUDE = 33.60 LONGITUDE = 117.70 TIME ZONE = 8

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. DAILY DIRECT NORMAL SOLAR	1663.2	1701.5	1978.3	1916.2	1828.4	2050.0	2337.8	2102.7	1710.9	1593.0	1486.3	1405.6	1815.7
AVG. DAILY TOTAL HORIZNTL SOLAR	993.1	1232.9	1626.4	1922.2	2113.1	2224.8	2369.0	2143.2	1719.6	1375.1	1039.6	872.5	1638.3
MAX. DAILY DIRECT NORMAL SOLAR	2308.0	2495.0	2853.0	3044.0	2999.0	3041.0	2932.0	2646.0	2490.0	2299.0	1995.0	2062.0	3044.0
MAX. DAILY TOTAL HORIZNTL SOLAR	1215.0	1644.0	2082.0	2393.0	2610.0	2661.0	2619.0	2410.0	2087.0	1617.0	1251.0	1024.0	2661.0
MIN. DAILY DIRECT NORMAL SOLAR	70.0	38.0	86.0	59.0	86.0	64.0	387.0	1007.0	47.0	495.0	22.0	2.0	2.0
MIN. DAILY TOTAL HORIZNTL SOLAR	498.0	477.0	601.0	1016.0	1168.0	1014.0	1239.0	1744.0	797.0	936.0	391.0	280.0	280.0
MAX. HRLY DIRECT NORMAL SOLAR	275.0	282.0	288.0	285.0	280.0	278.0	275.0	271.0	268.0	264.0	262.0	264.0	288.0
MAX. HRLY TOTAL HORIZNTL SOLAR	194.0	242.0	275.0	303.0	315.0	316.0	314.0	306.0	287.0	243.0	200.0	172.0	316.0
AVG. MAX. HRLY DIRECT NORML SOLAR	228.0	217.8	243.5	221.8	228.3	245.6	256.5	259.7	223.2	226.7	218.1	202.7	231.1
AVG. MAX. HRLY TOTAL HRZNTL SOLAR	164.2	189.3	234.0	256.1	275.3	288.9	296.2	292.1	246.7	215.8	173.6	148.3	232.0

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. DAILY TOTAL VERTICAL SOLAR													
AZIMUTH													
N	231.9	288.6	382.7	518.8	654.1	721.2	661.7	522.5	438.3	351.9	259.8	218.7	438.2
E	664.5	775.9	1002.4	1116.7	1093.3	1062.6	1186.8	1014.3	920.1	780.3	627.0	574.7	902.3
S	1573.7	1488.2	1406.1	1151.3	922.0	787.6	833.8	1061.4	1268.9	1461.3	1479.8	1440.5	1238.2
W	700.6	826.5	1105.7	1280.4	1360.6	1446.8	1403.2	1315.9	1104.1	907.7	691.4	582.2	1061.6
MAX. DAILY TOTAL VERTICAL SOLAR													
AZIMUTH													
N	340.1	358.2	542.3	659.7	782.6	860.0	764.0	663.6	609.2	468.9	392.6	317.8	860.0
E	828.1	985.2	1311.6	1425.9	1419.5	1428.2	1420.5	1339.2	1185.8	969.5	768.2	691.2	1428.2
S	1886.2	1844.3	1738.6	1394.6	1062.8	887.8	937.1	1202.9	1514.4	1723.9	1746.1	1805.1	1886.2
W	828.9	1035.8	1349.8	1474.9	1546.6	1606.0	1532.2	1407.6	1301.8	1036.7	838.8	684.0	1606.0
MAX. HRLY TOTAL VERTICAL SOLAR													
AZIMUTH													
N	54.9	57.8	81.7	85.1	88.5	93.5	86.5	85.6	79.3	70.9	58.1	51.6	93.5
E	191.9	223.2	246.9	251.9	251.0	247.6	243.2	242.4	233.5	210.3	171.7	165.2	251.9
S	265.3	257.7	242.9	200.3	156.8	133.5	138.2	182.8	223.9	249.7	259.7	263.3	265.3
W	189.6	228.8	252.2	258.2	256.0	253.5	251.6	251.0	243.5	213.9	183.3	164.3	258.2

DESIGN TEMPERATURES -------------------------------- SUMMER ---------- WINTER

PER CENT	T(DRY)	T(WET)	T(DRY)
1.0	92	73	38
2.5	90	72	39
5.0	87	70	

MONTHLY AVERAGE TEMPERATURES AS A FUNCTION OF HOUR OF THE DAY

HOUR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
0	49.3	50.7	52.5	53.4	56.9	60.9	63.2	63.6	63.0	59.3	53.1	49.5	56.3
1	48.9	50.1	51.8	53.2	56.7	60.6	63.0	63.5	62.6	58.6	52.5	48.9	55.9
2	48.5	49.6	51.0	52.6	56.4	60.2	62.6	63.6	62.3	58.1	51.8	48.4	55.4
3	47.9	49.2	50.8	52.2	56.0	60.5	62.4	63.4	62.1	58.2	51.7	47.5	55.2
4	48.0	48.9	50.1	53.6	57.3	60.4	63.4	63.5	62.1	57.8	52.0	47.4	55.4
5	47.2	48.0	50.2	54.7	58.3	62.8	64.5	63.5	61.8	57.9	51.8	47.2	55.7
6	47.6	48.5	51.9	55.9	59.3	64.5	65.8	64.7	64.2	61.3	53.6	47.0	57.1
7	49.8	52.1	55.6	59.7	62.5	66.4	69.8	67.5	67.8	65.1	59.4	51.3	60.6
8	55.3	56.9	59.5	63.2	65.4	69.4	73.8	71.6	71.5	69.3	62.8	55.9	64.6
9	59.3	61.0	62.4	66.8	68.4	72.9	77.7	76.2	76.3	72.7	66.4	60.2	68.4
10	62.3	63.8	64.7	68.6	70.3	75.4	79.3	80.8	79.7	75.3	69.1	62.9	71.1
11	64.9	66.2	65.9	70.3	71.9	76.9	80.9	82.6	81.0	76.9	71.4	65.5	72.9
12	66.1	67.2	67.4	71.9	73.7	77.3	82.4	83.0	82.3	77.2	72.3	68.0	74.1
13	66.3	67.5	67.7	71.2	73.4	77.2	81.6	83.0	82.2	77.0	71.9	67.3	73.9
14	65.9	66.9	66.7	70.3	72.8	76.4	80.8	81.9	81.2	74.9	69.4	66.6	72.9
15	63.5	65.0	65.4	69.6	72.4	74.9	79.9	79.8	79.1	72.0	66.5	65.9	71.2
16	59.4	62.2	63.4	66.3	69.5	72.7	76.9	76.8	76.4	67.6	61.9	62.3	68.0
17	55.9	58.3	59.9	63.1	66.5	69.1	73.9	73.4	71.8	64.5	59.8	59.0	64.6
18	53.5	55.3	57.1	59.6	63.3	66.2	71.1	69.5	69.0	62.8	57.0	55.3	61.7
19	52.0	53.8	55.5	58.1	61.7	64.4	69.0	67.3	67.1	61.7	55.5	54.2	60.1
20	50.9	52.3	54.4	56.6	60.4	63.2	67.1	66.3	66.1	60.6	54.4	53.1	58.8
21	50.6	51.9	53.5	55.0	58.8	62.2	65.2	65.3	65.0	60.2	53.7	52.0	57.8
22	50.3	51.5	53.0	54.0	57.8	61.6	63.9	64.3	64.2	59.8	53.5	51.0	57.1
23	50.0	51.1	52.8	53.8	57.3	61.2	63.4	63.9	63.5	59.4	53.0	50.1	56.7

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUND TEMPERATURES	519.7	518.5	518.4	518.9	521.3	523.6	525.7	527.0	527.1	526.0	524.0	521.8
CLEARNESS NUMBERS	1.05	1.04	1.02	1.00	0.98	0.96	0.95	0.97	0.99	1.01	1.03	1.04

DOE-2.2 and *PowerDOE*®
THE NEW GENERATION IN DOE-2 BUILDING ENERGY ANALYSIS

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INTRODUCTION

DOE-2.2, the much awaited and newest generation of the DOE-2 building energy analysis software program, is ready for public release. At the same time, PowerDOE®, a Windows™-based graphical application that incorporates DOE-2.2, is also now available for commercial distribution. DOE-2.2 adds significant new modeling capabilities to DOE-2.1E and facilitates use in interactive products, while PowerDOE presents the first interactive and graphical environment for DOE-2.2 that is both user-friendly and comprehensive. The DOE-2.2 project is a collaboration between Lawrence Berkeley National Laboratory (LBNL), primarily under funding from the U.S. Department of Energy, and James J. Hirsch and Associates, under funding from the Electric Power Research Institute (EPRI) as well as other gas and electric utility industry organizations. The major support for PowerDOE development has come from EPRI, Southern California Edison, Pacific Gas and Electric, Southern Company, and the Bonneville Power Administration.

PROJECT DEVELOPMENT

DOE-2.2 and PowerDOE development was initiated in 1992 as a collaboration between the U.S. Department of Energy and the Electric Power Research Institute. The project's initial concept was to update and enhance DOE-2 to allow direct and close integration with a comprehensive graphical user interface. The objective was to make DOE-2 easier to learn and less expensive to use, thus extending DOE-2's detailed modeling capabilities to building designers rather than being limited to use by energy analyst specialists. However, as the project proceeded, two issues slowed its completion. First, the benefit and need for significant enhancements to the DOE-2 simulation engine became more and more evident; this has produced a significant new "standard" version of DOE-2, i.e., DOE-2.2. Secondly, the changing nature of the utility and government funding "landscape" resulted in two tools, rather than one tool, i.e., DOE-2.2 (machine independent, batch execution) and PowerDOE (Windows-based, interactive execution). Both tools are open (source and executable licensing through a wide range of vendors), inexpensive (a few hundred dollars), well documented and supported, and share a common "simulation engine" core.

This article provides an overview of the DOE-2.2 simulation enhancements and the PowerDOE version 1 user interface. Additional features for future releases of DOE-2 and PowerDOE version 2 are briefly described. Machine requirements and availability are also described. *PowerDOE is a registered trademark of the Electric Power Research Institute.*

DOE-2.2 ENHANCEMENTS

Space constraints permit only brief description of only the most important DOE-2.2 enhancements over DOE-2.1E.

Circulation loops — DOE-2.2 now uses an integrated air-side/water-side HVAC simulator, thus the DOE2.1E SYSTEM and PLANT programs are replaced with a combined HVAC simulation program. One benefit from this change is improved connectivity between the loads incurred by secondary HVAC system components such as air handler coils and reheat coils and the primary HVAC equipment such as boilers and chillers. Primary equipment, terminal units and coils are now attached to specific circulation loops. Currently, three levels of circulation loops are provided: "dedicated" equipment loops which serve specific pieces of primary equipment, "primary" loops and, "secondary" loops. Each level of loop may have associated constant-flow or variable-flow pumps. Different coils in the same system or zone such as preheat coils, re-heat coils and baseboards, can be supplied flow by different loops. Additionally, valves and pumps are explicitly modeled including flow, pressure drop, and pressure control.

Central plant equipment — Major new equipment selections include:

- ground loop heat exchanges (GLHX) for use with water source heat pumps;
- heat rejection equipment including enhanced cooling tower and fluid cooler models with or without heat exchangers;
- greatly improved control modeling including hot and chilled water reset,
- expanded equipment assignment to meet loop loads and many "load management" modes to control overall plant operation.

Additionally, each chiller, boiler, pump, etc., is now modeled separately, thus each piece of equipment can now have unique size and performance characteristics.

Air handling equipment — A Dual Fan option has been added to the Dual Duct, Multi-Zone, and Packaged Multi-Zone systems. The return fan can be located either in the return or relief air stream. Exhaust fans can be scheduled separately from supply/return fans. All coils can be independently assigned to fluid loops.

Expressions — Expressions are general multi-line equation-like entries used to calculate input values. Expressions can be simple or complex, arithmetic or logical, and can reference one or more other building parameters. Expressions differ from input macro's (still supported) in that they operate on actual keyword values rather than simply manipulate text. Using expressions, building models can be made to be easily "adjustable". See Figures 3 and 4 below.

Shapes and geometry — all opaque heat transfer surfaces, floors and spaces can now be described as arbitrary polygons (up to thirty sides). Using polygon input for floors and spaces can greatly decrease the time required for describing complex geometry of architectural features.

Windows — windows can now be "built up" in a layer-by-layer manner, combining multiple glass layers, gaps and/or blinds.

Lighting systems — lighting systems can now be described on a luminaire-by-luminaire basis or the user can describe a target illuminance and DOE-2.2 will calculate the required number of luminaires.

Multiple lighting and equipment profiles — previously, only one lighting and one equipment description could be input per space (i.e., one power density with one associated schedule). DOE-2.2 now permits up to five lighting and five equipment descriptions per space.

Scheduling and design days — Design days can be specified in a more common format using familiar values from ASHRAE and other sources. Schedules have been enhanced to allow separate specification of profiles to use for heating and cooling design days and enhanced to include many new types with support for metric specifications. Reset schedules can also include day/night alternate values.

Meters — Three levels of electric meters can be defined (site, building, and sub-building) with up to 100 total meters being allowed in an arbitrary tree structure. Any energy consuming equipment can be individually assigned to a meter. All meters have separate and combined summary and hourly report capabilities. All electric meters can include a transformer model that allows the accounting of stand-by losses and performance as a function of load. Also, 15-, 30-, and 60-minute demand intervals (either fixed or floating windows) are supported for the most important HVAC electric equipment; these demand intervals are also accounted for in the utility rate calculation. Multiple fuel, chilled water and steam meters can also be defined (up to 15 each).

Libraries — DOE-2.2 now uses a more general library feature that permits a user to store and retrieve a much broader variety of building components including: windows, walls, lighting fixtures, spaces, schedules, air handlers and central plant equipment. The standard library includes: extensive schedules for common building types as well as space and equipment usage; extensive (with user over-ride capabilities) primary/secondary equipment performance curves.

Documentation — Documentation for DOE-2.2 has been completely revised. The *DOE-2.2 Basics Manual* (an extension of the *DOE2.1E Basics Manual*) is an introduction to DOE-2 for new users. The old *DOE-2.1A Reference Manual*, *DOE-2.1E Supplement* and *DOE-2.1E BDL Summary* have been combined (at last!) into the *DOE-2.2 Command/Keyword Dictionary* which defines all of the commands and keywords in the DOE-2.2 input language. The *DOE-2.2 Topics Manual* provides discussion and example input for "topics" that are broader than a single command or keyword, e.g., daylighting or circulation loops.

POWERDOE USER INTERFACE

PowerDOE's user interface provides important visual feedback that greatly reduces the time required to prepare an accurate building description. For example, the Building View screen (Figure 1) which displays a three-dimensional view of all building and shading surfaces, allows the user to quickly catch gross building and external shading geometry errors. The user may easily shift the position of the viewer and can suppress the display of any selected type of surface. From the 3-D view, the user may also select any building surface to be edited by simply clicking on it.

PowerDOE is organized into four main modules: LOCATE SITE (e.g., select weather location), DESCRIBE BUILDING (architectural, HVAC, building operations and utility services input screens), RUN CALCULATIONS (specify simulation periods and select standard or hourly reporting) and REVIEW RESULTS (graphical reports summarizing simulation results).

LOCATE SITE

PowerDOE provides an extensive library of average year weather data. Users can easily select from over 650 standard weather files for North America including, TMY, TMY2, CTMY, WYEC, WYEC2, CTZ, and TRY. (Figure 2). Other site-related data may be specified, including design day data.

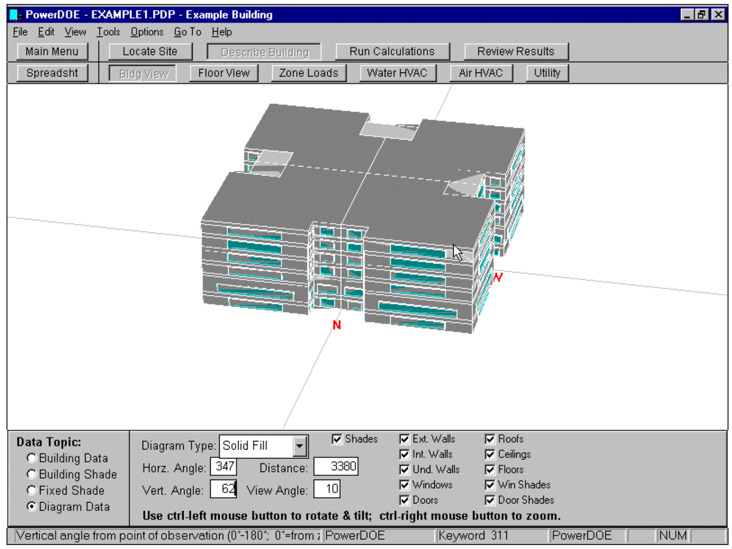


Figure 1: 3-D Building View provides graphical feedback on the overall building envelope. The user may easily tilt or rotate the view, and can suppress the display of any selected type of surface. The user may also select any building element to be edited simply by clicking on it.

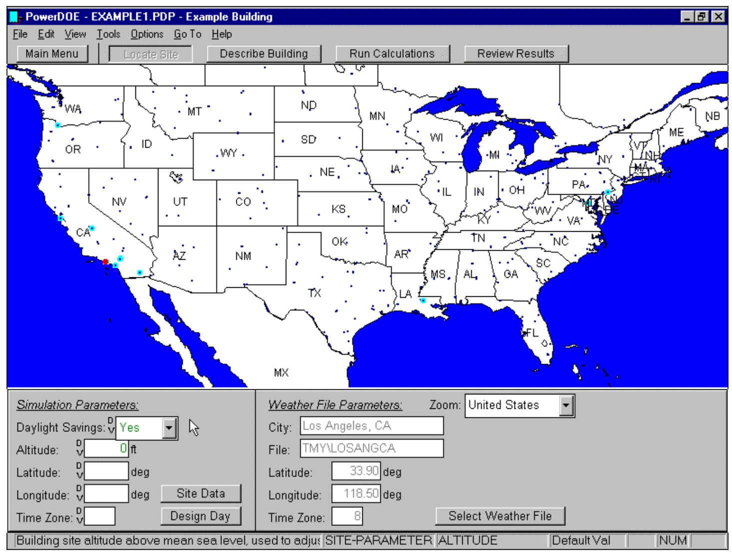


Figure 2: Locate Site
Users may zoom, point and click to select from over 650 average year weather files available for North American locations (e.g., TMY, WYEC, etc.). Actual year weather files (e.g., airport weather data obtained directly from the National Climatic Data Center) may also be used.

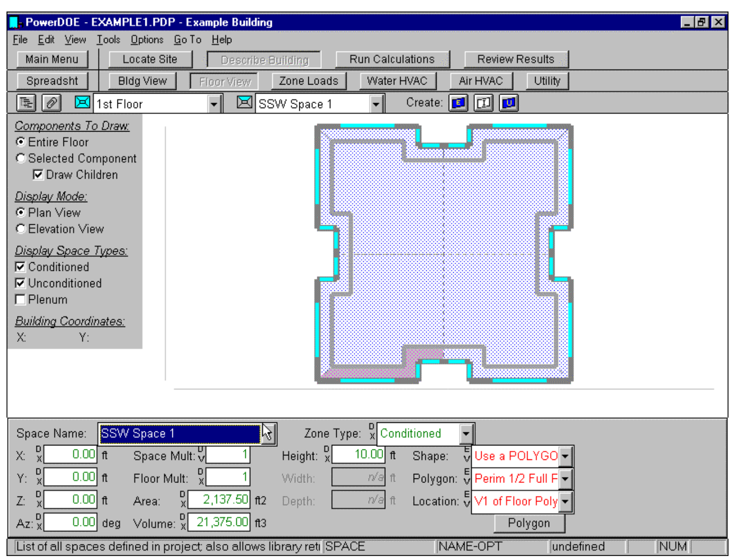


Figure 3: Floor View
The Floor View screen provides building designers with a familiar plan view of each floor within the building. Clicking on any building component (e.g., space, wall, window, etc.) displays data for the selected component at the bottom of the screen (the southwest space is selected at right).

Describe Building

PowerDOE organizes architectural and HVAC building components in a hierarchy that is intuitive and familiar to designers and analysts. Building areas are grouped into floor plans (Figures 3 and 4) while HVAC equipment is grouped by air flow and water flow paths that supply building HVAC requirements (Figures 5 and 6).

Using the new "expressions" capability of DOE-2.2, building models can be created that are more flexible than ever. For example, using expressions to describe the layout of the example floor plan illustrated in Figure 3, the floor footprint and zone depth are easily modified into the floor plan illustrated in Figure 4 by changing only four user-defined input parameters (overall building length, facade "notch" width and depth, and perimeter zone depth).

Air-side and water-side screens (Figures 5 and 6) help the user readily identify the equipment installed on each air-side and water-side circuit. For example, on the air-side equipment screen shown in Figure 7, "installed" system options are illustrated by colored icons. "Uninstalled" system options are shown as dotted gray outlines. Users double click on uninstalled pieces of equipment to install them. On the chilled water loop screen shown in Figure 6, installed suppliers (i.e., chillers) are shown on the top leg of the loop. Demanders (i.e., chilled water coils) are shown on the bottom leg of the loop.

Most of PowerDOE's input screens are organized to visually illustrate the selected building component while simultaneously displaying only the most important data pertaining to the selected building component. For example, in Figure 7, the lower portion of the screen is used to display the most important data describing the system. More detailed inputs and component descriptions are accessible if desired (Figure 8), either by clicking on the "More" button in the lower right hand corner of the screen or by double clicking on any icon for a selected system option (e.g., double clicking on the DX cooling coil). Similarly, by double clicking on primary equipment icons in Figure 6, more detailed information is presented for the selected piece of primary equipment (Figure 9).

"Zoning" a selected building floor into separate spaces can now be done graphically in PowerDOE (Figure 10) by simply pointing and clicking on the floor footprint

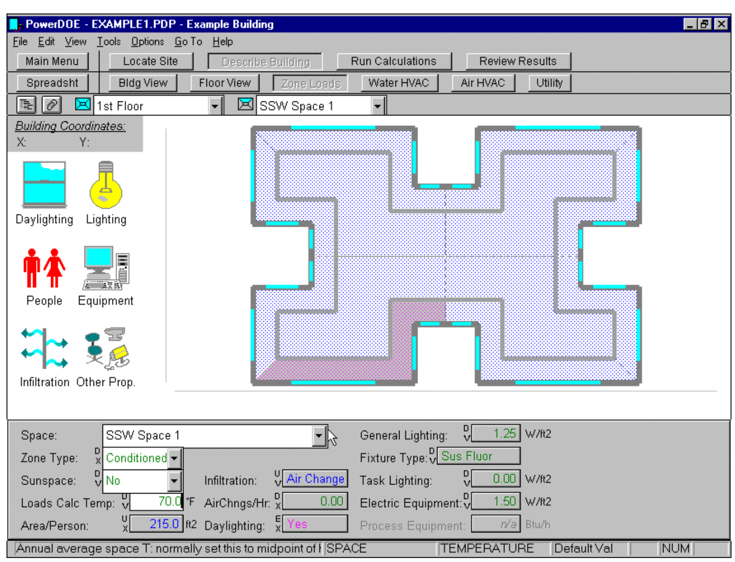


Figure 4: "Flexible" Geometry Using equation-like input "expressions" to describe the layout of the example floor plan in Figure 3, the floor footprint and zone depth are easily modified into the floor plan illustrated at right by changing only four user-defined parameters (building length, facade "notch" width and depth, and perimeter zone depth, compare Fig. 3)

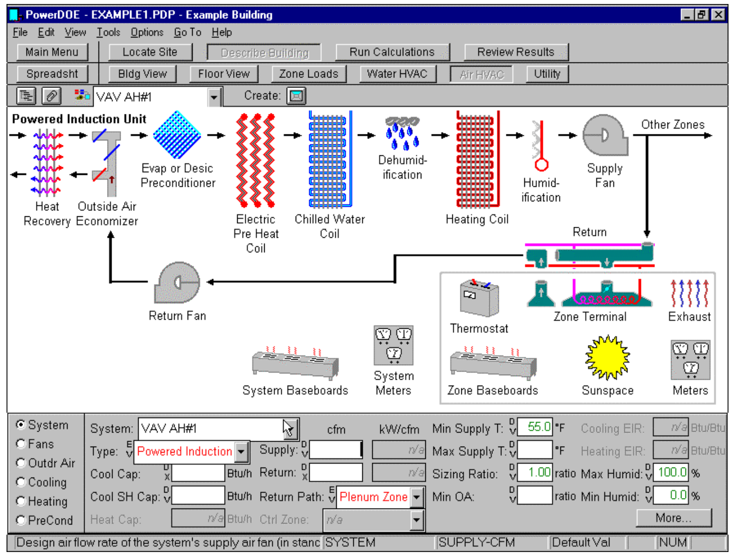


Figure 5: Air-Side HVAC
The Air-Side HVAC System screen provides building designers with a schematic view of each air-side system. Clicking on any system component (e.g., fan, coil, etc.) displays data for the selected component at the bottom of the screen.

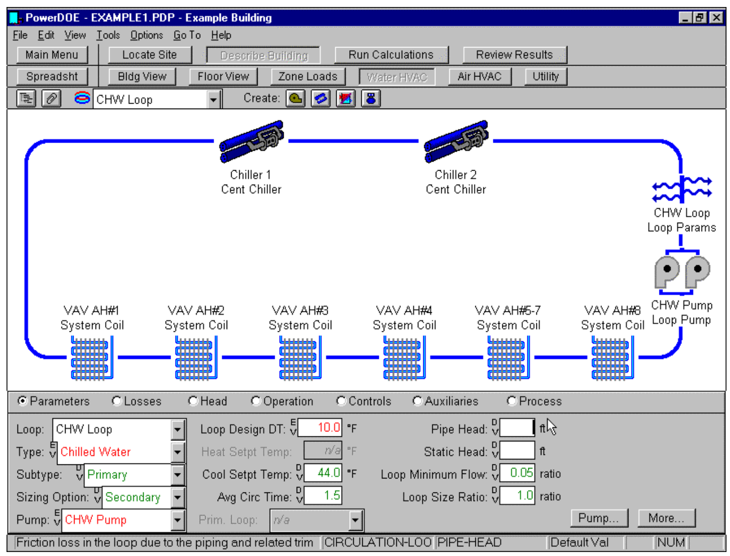


Figure 6: Water-Side HVAC
The Water-Side HVAC Loop screen provides a schematic view of each water-side loop within the building. On the chilled water loop screen shown at right, suppliers (i.e., chillers) are shown on the top leg of the loop. Demanders (i.e., chilled water coils) are shown on the bottom leg of the loop.

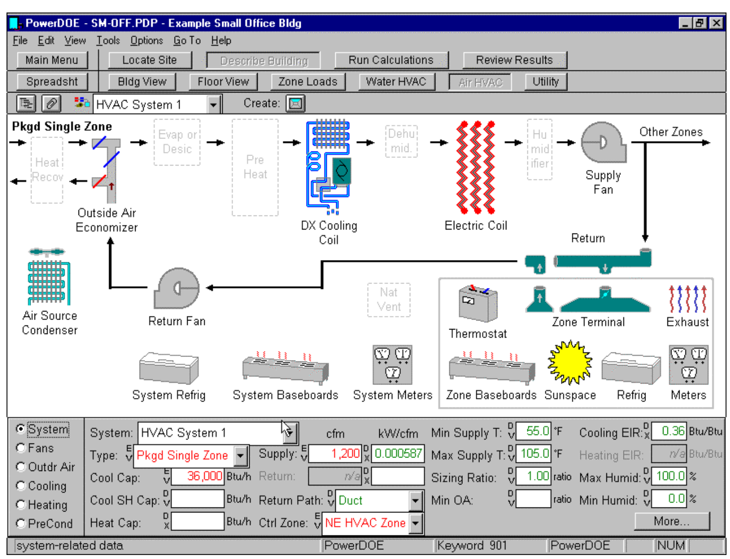


Figure 7: Uninstalled Options
On the Air-Side HVAC System screen at right, “installed” system options are illustrated by colored icons. “Uninstalled” system options are shown as dotted outlines. Double click on these uninstalled components to install them.

Figure 8: Air-Side Details
Detailed air-side component descriptions are displayed on a "pop-up" tabbed dialog (shown at right), by clicking on the "More" button in the lower right hand corner of the screen or by double clicking on any selected system component icon (e.g., double clicking on the DX cooling coil).

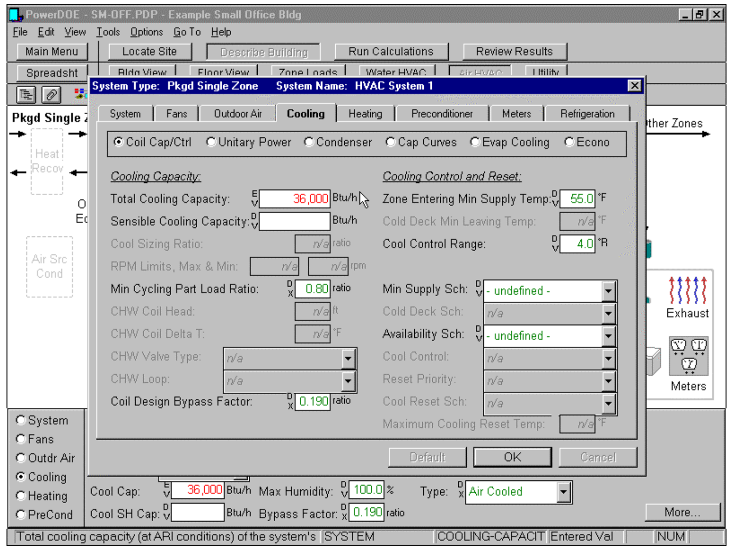


Figure 9: Primary Equipment
Double clicking on primary equipment icons (e.g., in Figure 6) displays the primary equipment screen shown at right. A "pop-up" tabbed dialog (not shown) can be displayed by clicking on the "More" button in the lower right hand corner of the screen.

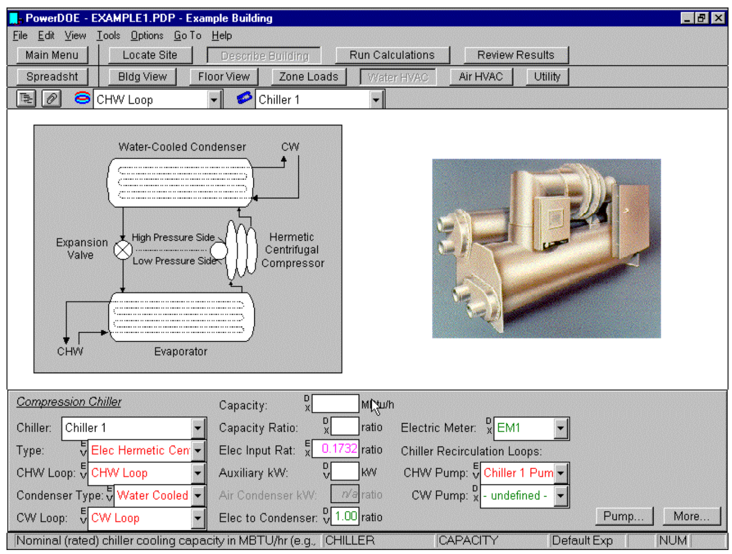
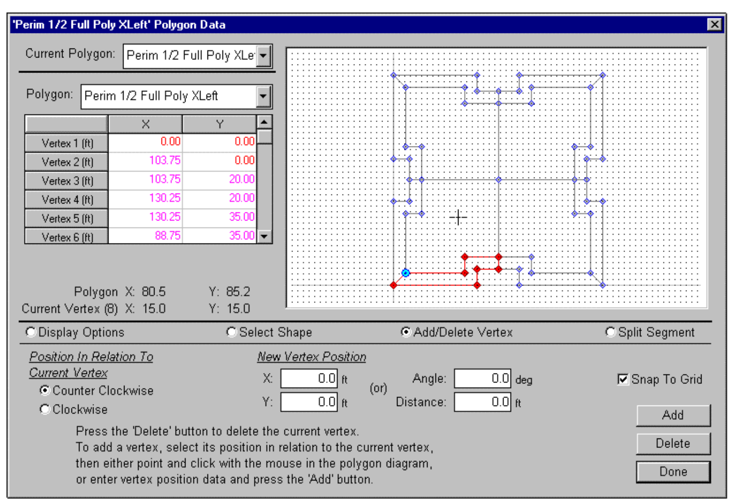


Figure 10: Polygon dialog
"Zoning" a selected building floor into separate spaces can now be done graphically in PowerDOE by simply pointing and clicking on the floor footprint to outline the desired zone (i.e., "space") boundaries.



to outline the desired zone (i.e., "space") boundaries. This method of defining spaces uses polygons to define the space shape, which later greatly speeds the placement of the walls, ceilings and floors that surround spaces.

On all PowerDOE screens, only those controls (i.e., input fields) that are applicable to the current building description or selected component are active. Inactive controls are grayed back and marked "*n/a*" (Figure 8).

Pop-up "tabbed dialog boxes", such as the one shown in Figure 8, allow a user to quickly review all relevant inputs pertaining to a currently selected building component. Alternatively, PowerDOE also provides a global summary worksheet in a spreadsheet-like format containing data for all building elements (Figure 11). This spreadsheet mode of displaying data is especially useful for reviewing a specific input (e.g., window glass type) across all components to which it applies (i.e., across all windows in the building). Using the building data spreadsheet, users can efficiently review or directly edit any building data from this central "database".

Space internal loads (people, lighting, daylighting, equipment and infiltration) are input using the Zone Loads screen (shown in Figure 12 with the zone loads detailed data tabbed dialog displayed).

Schedules may be reviewed or edited from anywhere in the interface via a right mouse click. Schedules allow all building and HVAC schedule profiles to be entered graphically, numerically, or as expressions (Figure 13). For easily comparing various schedules, PowerDOE can display multiple weekly schedules side-by-side, as shown in Figure 14. An extensive schedule library, combined with the ability to easily copy, modify and save user-defined schedules, make using schedules in PowerDOE much less tedious than before.

Review Results

Results are reviewed in a separate application called DOE-2REV that enables preparation and display of customized reports (Figure 15). When running PowerDOE, DOE-2REV is seamlessly integrated, with full navigation functionality between the two applications as if they were one. DOE-2REV can also be executed separately for post-processing DOE-2.2 results.

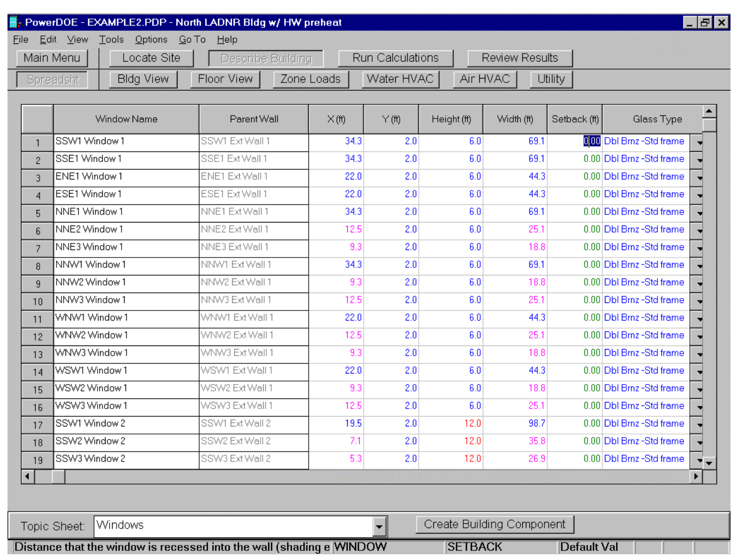


Figure 11: Bldg Spreadsheet PowerDOE provides a global summary worksheet in a spreadsheet-like format containing data for all building elements. Users can efficiently review or directly edit any building data from this central "database".

Figure 12: Zone Loads
Space internal loads are input using the Zone Loads screen (shown at right with the zone loads detailed data tabbed dialog displayed). Only those controls (i.e., input fields) that are applicable to the current building description or selected component are active. Inactive controls are grayed back and marked “*n/a*”.

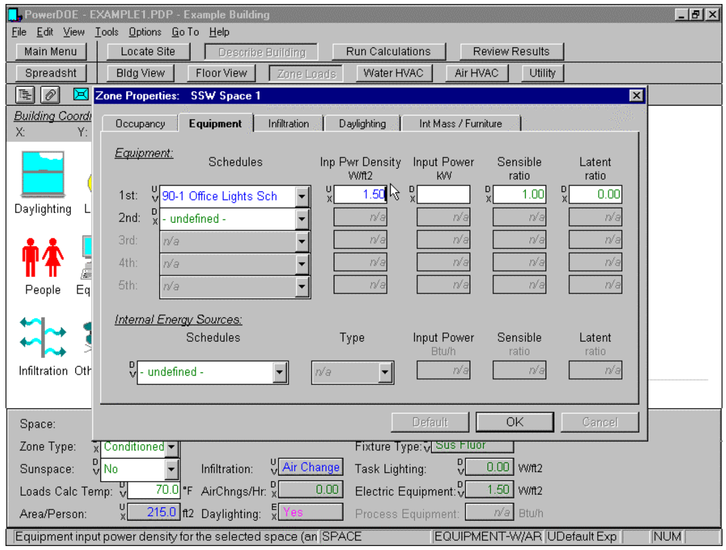


Figure 13: Day Schedule
Schedules may be reviewed or edited from anywhere in the interface via a right mouse click. An extensive schedule library, combined with the ability to easily copy, graphically modify and save user-defined schedules, make using schedules in PowerDOE much less tedious than before.

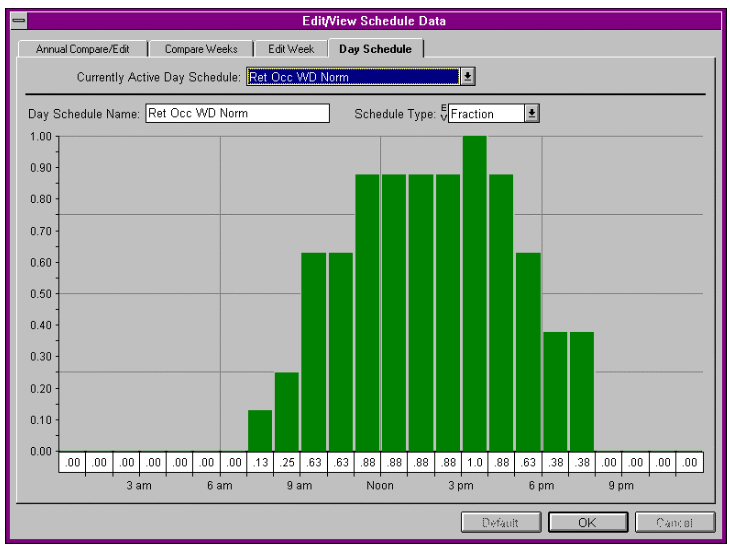
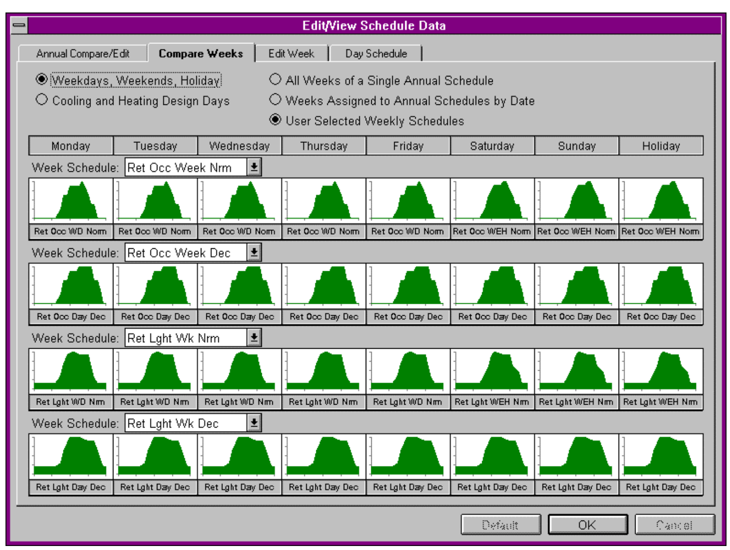


Figure 14: Compare Weeks
For easily comparing various schedules, PowerDOE can display multiple weekly schedules side-by-side.



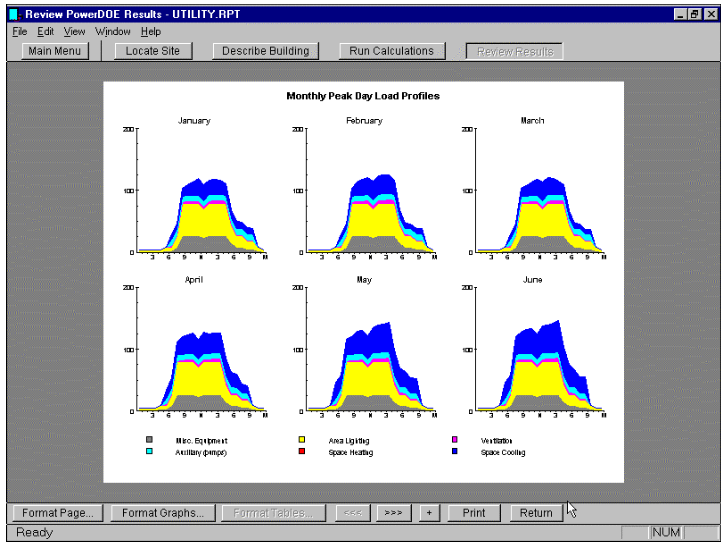


Figure 15: Review Results
The Review Results module provides predefined and user-defined graphical reports. A predefined utility report is shown at right, showing peak day electrical profiles for January through June.

Input Data Sources

PowerDOE inputs can either be user-input values (directly input by the user), DOE-2.2 defaults (program default values used in the absence of user inputs), user defaults (defaults established by the user), DOE-2.2 library data (data retrieved from the DOE-2.2 library), or formula-like "expressions". PowerDOE labels each of these data sources (small labels to the left of the input controls, see Figures 3 through 9) and displays them in different font colors, permitting the user to easily recognize the source of the data.

Online HELP

PowerDOE includes a comprehensive online help system. Context-sensitive help is available for every data entry field, as well as for every program screen. When the user points to a data field and clicks the right mouse button, PowerDOE displays a drop down "Quick Menu" beside that field. The user can then select Field Help for the particular field, or Topic Help for information on the current screen. Help is also available from the main menu bar or by pressing the F1 key, and includes standard Windows Help components such as Contents and a Search Keywords dialog box. In addition, the online help system contains extensive hypertext links that provide quick access to related topics.

POWERDOE STRUCTURE and the DOE-2.2 SIMULATION ENGINE

PowerDOE has a modular structure that allows sections of the program to be externally accessed or to be connected with other analysis tools. The modular structure of PowerDOE also enables third-party developers to use PowerDOE's interface modules and the DOE-2.2 simulation engine in their applications.

Due to reduced file access and improved memory management, the simulation speed of DOE-2.2 is approximately 25% faster than DOE-2.1E. Simulations can also be performed in the background while the user performs other tasks on the computer.

MACHINE REQUREMENTS

DOE-2.2 versions will be available for DOS, Microsoft Windows (EXE and DLL format), Unix, VAX, and other common operating systems; hardware requirements vary, but generally 32 megabytes of RAM memory and 200 megabytes of hard disk space is required. The minimum PowerDOE computer requirements are: Pentium™ PC, color VGA monitor, 32 megabytes of RAM memory, 200 megabytes of free hard drive space. Recommended specifications include: a Super-VGA monitor (800x600 resolution) is suggested for improved display of graphics, 64 megabytes of RAM, and a 200 MHz or faster Pentium (for larger projects). Microsoft Windows™ 3.1 is the minimum operating environment; Windows95™ is recommended and Windows NT™ is also supported. Although no conflicts are anticipated, use of PowerDOE under Windows98 is still being evaluated.

FUTURE ENHANCEMENTS

Subsequent releases of both DOE-2.2 and PowerDOE are planned that will incorporate additional features; details of these features will be the subjects of future articles. Features that are funded and under development include:

- *Process Refrigeration* — A module for modeling commercial (supermarkets, food service) and industrial (warehouses, food processing) facilities with complex refrigeration systems including refrigerant piping networks, compressor racks and chillers with alternative refrigerants, controls, air-units, display cases, condensers, and heat reclaim for HVAC and DHW;
- *Process Equipment* — the ability to model process equipment loads and characteristics with much greater detail, including libraries of specialized equipment specifications. The first use of this enhanced modeling capability is a food service kitchen equipment module designed for a "vertical" range of users from equipment manufactures' representatives and utility professionals to design engineers. Later modules could include industrial and laboratory applications.
- *Rule processor* — a general rule processor used to automate selected modeling processes. The first use of the rules processor will be a module for showing compliance with building energy standards. Using rules from any energy code (e.g., ASHRAE 90.1 or California Title24) a "code compliant" version of an as-designed building model can be automatically generated.
- *Automated Design* — using the rule processor capability described above, design "agents" will be developed to assist in the selection of better energy and cost performing design alternatives – initial agents are being developed for glazing and HVAC system selection;
- Wizards for guiding the user step-by-step through the process of describing a building and creating building components plus a library of prototype building models — the user would customize a prototype by specifying building type (i.e.: office, hospital, etc.), size (i.e.: large, medium, small), vintage (i.e.: pre 1970's, 1970's, 1980's, etc.), and location;
- Building type specific modeling applications designed to allow rapid analysis of specific building types – initial applications for food service, supermarkets, central plants, and refrigerated warehouses.

AVAILABILITY

Both DOE-2.2 and PowerDOE are expected to be available for commercial distribution beginning in July of 1998. Visit http://www.doe2.com to obtain the latest details, list of distributors, costs, licensing information, free evaluation copies, tutorial and training information.

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"User Friendly" Building Life-Cycle Costing

a spreadsheet implementation of BLCC

"User-Friendly" Life-Cycle Costing: The *BLCC* Procedure in an Easy-to-Use Spreadsheet

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SUMMARY

This paper describes an Excel spreadsheet implementation of *BLCC*, called *User-Friendly Life-Cycle Costing*. Although the life-cycle cost formulas used in *BLCC* are widely published and recognized, some *BLCC* users describe *BLCC*'s conventional procedure of first collecting user input, then "going away" to calculate results, as a familiar but uncomfortable "black box" procedure, i.e., does not display intermediate results. Spreadsheet users express greater confidence using the user-friendly "glass box" spreadsheet implementation of *BLCC* reported here. The *User-Friendly Life-Cycle Costing* spreadsheet is available for free download in Excel Office95 and Office 97 formats at http://www.doe2.com.

ABSTRACT

The Life-Cycle Costing (LCC) analysis method is recognized to reliably identify cost optimal building design solutions yet it is not widely used with confidence, even within the federal sector where its use is mandated (10 CFR 436). At the direction of the Federal Energy Management Program (FEMP), and drawing on standards work by the American Society for Testing and Materials (ASTM), the National Institute of Standards and Technology (NIST) has rendered a valuable service to the buildings industry at large by developing a recommended life-cycle costing procedure. NIST's LCC procedures standardize both nomenclature and conventions so that the entire buildings industry can speak one "language" when using LCC analysis. The centerpiece to NIST's LCC contributions is a computer program called *BLCC*, the *Building Life-Cycle Cost Program*, which automatically applies the FEMP/NIST LCC conventions in LCC analyses. Despite *BLCC*'s contribution to the buildings industry's use of LCC methods, many *BLCC* users report feeling uncomfortable with a "black box" procedure that collects user inputs, then reports LCC results.

This paper describes an alternative: a thorough implementation of *BLCC* in an Excel spreadsheet format, *User-Friendly Life-Cycle Costing*. Users already familiar with spreadsheet programs, e.g., *Excel*, *Lotus*, *QuatroPro*, report greater confidence using this "glass box" spreadsheet implementation of *BLCC*. The *User-Friendly Life-Cycle Costing* spreadsheet is available for free download in Excel Office95 and Office 97 formats at http://www.doe2.com.

KEYWORDS

Life-Cycle Costing, BLCC, Simplified Life-Cycle Costing

INTRODUCTION AND BACKGROUND

The Life-Cycle Costing (LCC) analysis method is recognized to reliably identify cost optimal building design solutions. The Federal Energy Management Program (FEMP) of the U.S. Department of Energy (DOE) has codified the rules for performing LCC analysis of investments for energy and water conservation and renewable energy resource projects in the Code of Federal Regulations, 10 CFR 436, Subpart A, "Methodology and Procedures for Life-Cycle Cost Analysis" [1] (http://www.access.gpo.gov/nara/cfr search for "10 CFR 436"). These rules apply to both new and existing buildings owned or leased by the Federal Government. These economic evaluations are required by the Federal Energy Management Improvement Act of 1988 (Public Law 100-6 15) and the National Energy Conservation Policy Act (NECPA) of 1978 (P.L. 95-6 19). More recently, these requirements have been renewed in Executive Order 13123 [2], "Greening the Government through Efficient Energy Management", issued on 3 June 99 (available at: http://www.pub.whitehouse.gov/uri-res/I2R?urn:pdi://oma.eop.gov.us/1999/6/4/6.text.1).

At the direction of FEMP, and drawing on standards work by the American Society for Testing and Materials (ASTM) [3], the National Institute of Standards and Technology (NIST) has developed standardized LCC nomenclature and conventions so that the entire buildings industry can speak one "language" when using LCC analysis. These are documented in NIST Handbook 135, *Life-Cycle Costing Manual for the Federal Energy Management Program* [4] (a PDF version is available from http://www.orau.gov/femp/emw.htm, select "Life-Cycle Costing", then "pre-work"). The centerpiece to NIST's LCC procedures is a computer program called *BLCC* [7], the *Building Life-Cycle Cost Program*, which automatically applies the FEMP/NIST LCC conventions in LCC analyses. Despite *BLCC*'s contribution to the buildings industry's use of LCC methods, many *BLCC* users report feeling uncomfortable with a "black box" procedure that collects user inputs, then reports LCC results.

An Excel spreadsheet implementation of *BLCC*, called *User-Friendly Life-Cycle Costing* [8] is now available for free download to Excel users in Office95 and Office 97 formats (http://www.doe2.com). Spreadsheet users report greater confidence using this user-friendly "glass box" spreadsheet implementation of *BLCC*.

LIFE-CYCLE COST BASIC CONCEPTS

With regard to energy efficiency and energy conservation projects, there seems to be an unwritten rule of nature which holds that whatever project design options cost less to acquire will tend to cost more to operate and conversely. In other words, more efficient project alternatives tend to cost more than less efficient alternatives.

For a hypothetical project, if the first costs for all identified project alternatives were plotted against their respective operating costs, a curve somewhat like the one illustrated in Figure 1 would result. Actual first cost vs operating cost data for glass type options for a large institutional new construction project are plotted in Figure 2, which roughly resembles Figure 1. In Figure 2, glass type #1 would be the preferred choice if least operating cost was the principal concern. Conversely, glass type #5 would be the preferred choice if minimum first cost was the principal concern. Glass types #3, #4, and #5 present other options that weigh the relative importance of first vs operating costs differently. Clearly, the best choice lies on the imaginary line connecting glass types #1 through #5. According to multiple criteria decision methods [5], the other glass types (un-numbered in Figure 2) are said to be *dominated* by glass types #1 through #5. Which of the *non-dominated* options (1 through 5) we favor will depend on how we weigh the relative importance of first vs operating costs. The value of life-cycle costing can be understood as a rational means to weigh the value of first costs versus future (e.g., operating) costs. The principle used to do this is the "time value of money".

The Time Value of Money

Everyone intuitively recognizes that a dollar today does not have the same value as a dollar in the distant future. The time value of money results from two considerations: 1) inflation, which is the "erosion" of future purchasing power and 2) "opportunity cost", which for existing capital is the cost of forgone investment opportunities and for borrowed capital is the cost of borrowing (i.e., the loan rate). Of the two, most of us have a more intuitive feel for the process of inflation, where future increases in the level of prices for goods and services causes an effective loss in the future purchasing power of our dollars. Opportunity costs recognize that a fair comparison of the economic benefit of two or more project options must consider what else we might have done with our money (i.e., in the case of existing capital) had we chosen to invest in something other than the available project options or what it would cost us to borrow the capital if necessary. Life-cycle costing considers both effects in weighing the value of present costs against future costs.

Figure 3 illustrates a process in which all costs, both future and present, are expressed in terms of the same time frame, i.e., the present. Owing to the influences of inflation and opportunity cost, the process is referred to as "discounting" future costs to their "present value". The FEMP/NIST method for life-cycle costing have established recommended procedures, resources, and requirements for federal projects. They are well described in NIST Handbook 135, *Life-Cycle Costing Manual for the Federal Energy Management Program* [4].

FEMP/NIST LIFE-CYCLE COST PROCEDURES

A very brief summary of the principal conventions and requirements of the FEMP/NIST LCC method includes:

- use PRESENT VALUE method, i.e., discount all future values to present value
- use “REAL” discount and escalation rates (explained below)
- use the FEMP discount rate, i.e., 3.1% for 1999 (real rate, revised annually, see [6])
- use DOE energy price escalation rates (real rates, revised annually, see [6])
- since all rates are "real", estimate all costs in TODAY’S dollars, i.e., “constant” dollars
- assume end-of-year cash flows
- use site-metered energy (i.e., not source)
- use local energy tariffs (not average costs)
- 25 years maximum study period
- five principal cost components are broken into two main categories (Figure 3 and Equation 1):
    - investment-related
        - initial investment costs (i.e., acquisition or installed costs)
        - capital replacement costs
        - residual value
    - operations-related
        - energy costs
        - operation, maintenance, and repair (OM&R)

The basic life-cycle cost equation (1) sums the present value of all cost components.

LCC = Initial investment costs (1)
+ PV replacement costs
- PV Residual Value
+ PV energy costs
+ PV OM&R

See NIST Handbook 135 [4] for a complete discussion of these conventions.

"Real" vs "Nominal" discounting rates

Under the influence of inflation, the future value of a present cost can be calculated using equation (2).

$$F_t = P_0 \times (1+i)^t \qquad (2)$$

where:

F_t = future value of a present cost, P_0, in year t
P_0 = present cost of goods or services in year 0

i = the assumed rate of general inflation
t = future year assumed in the calculation

Assuming an expected rate of return, D, on an alternative available investment, a future cost is discounted to its present value using equation (3).

$$PV = F_t \times \frac{1}{(1+D)^t} \qquad (3)$$

where:

- PV = present value of the future cost of goods/services
- F_t = future cost of goods/services in year t
- t = future year assumed in the calculation
- D = the assumed "discount rate", for existing capital, D is the minimum rate-of-return on an alternative investment for borrowed capital, D is the cost of borrwed captial, i.e., the loan rate

Of course, any investor would hope for a minimum rate-of-return that would out pace the influence of general inflation, else, the net value of their investment return is negative, i.e., a loss. Hence, they would hope that their realized rate-of-return is greater than the inflation rate, i.e., $D > i$.

The FEMP LCC procedures require a convention that permits the LCC analysis to "factor out" inflation. This is done by using "real" rather than "nominal" rates. For example, equation (4) can be used to determine a "real" discount rate, d, which is exclusive of inflation.

$$d = \frac{1+D}{1+i} - 1 \qquad (4)$$

where:

- d = the "real" discount rate, exclusive of inflation
- i = the assumed rate of general inflation
- D = the assumed "nominal" discount rate, for exisitng capital, D is the minimum rate-of-return on an alternative investment for borrowed capital, D is the cost of borrwed captial, i.e., the loan rate

Using real discount rates in equation (5), a user need not explicitly adjust future costs, F_t, for inflation.

$$PV = F_t \times \frac{1}{(1+d)^t} \qquad (5)$$

where the terms are the same as in equation (2), except:

- d = the assumed discount rate (real)
- F_t = P_0 if d is "real"

Rather, future costs (e.g., future repair or replacement costs) can be estimated in today's dollars, which is much more convenient! Real rates are alternately referred to as "net", "differential", or "effective" rates (i.e, they are expressed net of inflation and are the difference between the nominal rate and the real rate… the effective rate).

Inflation vs Escalation

One further distinction in the FEMP/NIST LCC method is important to discuss briefly. While goods and services are assumed to inflate at the same rate (i.e., the general inflation rate), the FEMP/NIST LCC procedures require that inflation of energy prices be treated separately. In other words, this assumes that energy prices will not inflate at the same rate as other goods and services. Accordingly, we distinguish general price inflation from energy price inflation by referring to the latter as energy price "escalation". As with the use of the discount rate, the energy price escalation rates are "real" (i.e., net or differential). DOE publishes official projections for future energy prices annually [6] each April for the residential, commercial and industrial sectors, broken down by region of the country, for six energy types (electricity, natural gas, LPG, distillate fuel oil, residual fuel oil, and coal).

***"USER-FRIENDLY" LIFE-CYCLE COSTING* SPREADSHEET**

M. S. Addison and Associates, Tempe, AZ, has implemented the FEMP/NIST LCC procedures used in *BLCC* into an easy-to-use Excel spreadsheet format [8]. Users already familiar with spreadsheet programs will find the User-Friendly LCC spreadsheet intuitive, flexible, and easy to use. The spreadsheet can be downloaded free from http://www.doe2.com. Figures 5 and 6 illustrate main sheets in *"User-Friendly" LCC*.

General data applicable to all alternatives are input on the "General Data" tab sheet. This includes (refer to Figure 5):

- the discount rate to be used for the analysis (for federal projects, this should be the current year FEMP discount rate)
- number of years for the analysis (25 max)
- DOE energy price escalation region (1 - 4, 5=U.S. average, see map in Figure 5)
- analysis sector (Residential, Commercial, or Industrial)
- second fuel type (electric is assumed for all, one additional fuel can be specified: none, N.Gas, LPG, Distillate Oil, Residual Oil, Coal)
- uniform energy price escalation rates are optional, i.e., if omitted (the default), all analyses use the DOE energy price escalation rates for the current year
- reference discount rates for the current year are shown (i.e., FEMP, OMB Short- and Long-term)
- a "nominal" discount rate calculator is provided to convert nominal to real rates.
- comments for each of the input cells are provided
- Inputs cells are shown in blue font. Only the input cells are unprotected. The remainder of the General Data tab sheet is protected, but can easily be unprotected if edits to protected cells are desired. To unprotect any sheet, from the menu select "Tools", "Protection", "Unprotect Sheet…").

Data unique to each alternative are input on each of the "LCC" tab sheets. Sheet "LCC0" is assumed to be the base case. Sheets "LCC1", "LCC2", etc., are for project alternatives. Nine alternative sheets are provided on the example available for download. These "LCC" tabs sheets are illustrated in Figure 6. Inputs include:

- name of the project alternative, e.g., "base case", "alternative 1", etc.
- investment-related costs, e.g., first cost, capital replacement costs, residual values; each estimated in <u>today's</u> dollars, entered in the year in which they are expected to occur.
- operations-related capital costs, e.g., non-annually recurring maintenance such as overhauls; each estimated in <u>today's</u> dollars, entered in the year in which they are expected to occur.
- annual electric costs, estimated in <u>today's</u> dollars (normally first year only, although you can assume any year-to-year variations you wish)
- annual second fuel costs, estimated in <u>today's</u> dollars, e.g., natural gas, LPG, etc. (normally first year only, although you can assume any year-to-year variations you wish)
- annually recurring costs, e.g., ongoing operations, maintenance, and repair (OM&R)

Items of interest that are reported on the "LCC" tab sheets include:

- total life-cycle cost, also reported by year and by cost category (e.g., investment-related, operations-related, utility costs, annually recurring costs)
- general data from the "General Data" tab sheet, e.g., FEMP fiscal year, discount rate, length analysis period, DOE region, and analysis sector
- the year-by-year "real" or differential energy price escalation - normally these are allowed to default to select the DOE energy price escalation rates for the current year, region

and sector, however, user input for uniform energy price escalation rates on the General Data tab sheet can over ride these DOE values. Alternately, if a user obtains local energy price projects (e.g., specific to a particular utility) for any of the analysis years, they may be input.

- annually recurring costs, e.g., ongoing operations, maintenance, and repair (OM&R)

Items of interest that are reported on the "LCC" tab sheets but which are normally in hidden or unprinted columns include:

- annual energy costs, adjusted only for energy price escalation (no discount rate effect)
- annual energy costs, adjusted only for the discount rate (no energy price escalation)
- *(the preceding are provided mostly for instructional purposes)*
- discounted cumulative costs (reported year-by-year)
- discounted cumulative savings (year-by-year only for the alternative cases, relative to "LCC0")
- *(the preceding are provided mostly for graphing purposes)*
- discounted simple payback, shown in the year in which discounted payback occurs (includes ALL costs up the year of payback)

EXAMPLE RESULTS

Figure 7 illustrates example results from *User-Friendly LCC*. The data are from the same example plotted in Figure 2, i.e., glass type options for a large institutional new construction project. In Figure 7, the tabular results are divided into an upper and lower half. The upper half reports life-cycle costs. The lower half reports life-cycle savings. Cells in the cost portion of the table (upper portion) are linked directly to the "LCC" tab sheets for the base case and each alternative. Cells in the savings portion of the table (lower portion) are calculated from the upper portion of the table, by subtracting a row for each project alternative from the base case. Thus, two columns, "Total LCC Savings" and "Net Savings" are identical. Using the results in Figure 7, we can answer the question posed previously regarding the "best" glass type illustrated in Figure 2.

Simple Payback Method vs Life-Cycle Cost Method

The measure-of-merit most commonly used throughout the buildings industry to make project investment decisions is Simple Payback. This is unfortunate because simple payback almost always fails to identify the most economic solution measured over the project life cycle. In part, this is not surprising since simple payback considers only initial costs, i.e., incremental initial investment cost and incremental first year utility savings. Simple payback ignores capital replacement, residual value, life-cycle utility costs, and operations and maintenance costs (OM&R). In summary, decisions made using simple payback are usually inferior because they are short-sighted. Like refusing to invest in preventative maintenance, long-term operating costs are ignored in favor of short-term cost (i.e., investment) savings.

As an example, if we select the glass type based on minimum simple payback, we would select Alt 1, which would yield $417,795 in 25-year life-cycle utility savings and $397,215 in net total 25-year life-cycle cost savings. Alt 1 in Figure 7 corresponds to point #4 in Figure 2. Alternatively, if we select based on minimum life-cycle costs (or maximum net savings), we would select Alt 9, which yields $852,158 in 25-year life-cycle utility savings and $681,798 in net total 25-year life-cycle cost savings. Alt 9 in Figure 7 corresponds to point #2 in Figure 2. In this example, selecting based on minimum life-cycle costs, rather than minimum simple payback adds $170,360 in first costs, but also adds $434,634 in 25-year life-cycle utility savings or $284,584 in net total 25-year life-cycle cost savings. Figure 4 illustrates cumulative life-cycle savings for both alternatives.

Interestingly, for this glass type selection example, no capital replacement costs or residual values were considered appropriate and OM&R costs were assumed to be identical for all glass types and hence were ignored. <u>Even in the case where these additional life-cycle cost components are eliminated, simple payback failed to select the life-cycle minimum cost alternative</u>.

USER-FRIENDLY LCC STRENGTHS AND LIMITATIONS

A list of limitations of the spreadsheet implementation of *BLCC* include:

- only two energy types are possible, electricity plus any one additional fuel type (e.g., none, N.Gas, LPG, Distillate Oil, Residual Oil, Coal)
- Only end-of-year cash flow convention is possible. BLCC permits either end-of-year, or mid-year cash flow convention.
- BLCC permits user input describing the number of years <u>and months</u> for length of analysis and occurrence of costs (e.g., capital replacement costs). The spreadsheet assumes whole year time steps.

Based on user comments, a list of advantages of the spreadsheet implementation of *BLCC* include:

- Life-cycle costing done in the spreadsheet form of BLCC seems like a "glass box" rather than a "black box" since the intermediate calculations and input assumptions are presented year-by-year for recurring as well as non-recurring costs. Each "LCC" tab sheet is formatted to print out on a single page, self-documenting all of the significant analysis assumptions.
- Any number of project alternatives are easily reviewed and compared side-by-side in one spreadsheet "workbook". Additional project alternatives (i.e., LCC sheets) can be added by simply copying existing LCC sheets (drag and drop using the ctrl key + left mouse button).
- Being in a spreadsheet, comparative and summary results are possible in user-controllable tabular and/or graphic formats, e.g., Figures 4 and 7.
- DOE energy price escalation rates can be easily replaced with uniform user rates or with actual utility-projected rates for any portion of the analysis period.
- energy price escalation rates are shown for each analysis are shown year-by-year in real (i.e., differential) form, therefore, for years that the net price of energy decrease (as in periods of deregulation), escalation rates are shown as negative values.
- LCC results can also be dynamically linked to other analysis results (e.g., energy and water conservation estimates). Iterative changes in either the conservation estimates or the general LCC parameters (e.g., discount rate), require no rerunning of the LCC calculations — they are recalculated and updated automatically, thus greatly facilitating "what-if" iterations.

CONCLUSIONS

Today's environmental and regulatory context for building design requires, even mandates, more thorough analysis that considers the whole picture, i.e., the whole project life-cycle. Fortunately, recent development in simulation and economic analysis programs make this extra level of design effort more affordable and reliable. Tools and methods that can better weigh the life-cycle cost of short-term budget expediencies will help project decision makers realize "globally optimal" design.

REFERENCES

[1] Code of Federal Regulations, 10 CFR 436, Subpart A, *Federal Energy Management and Planning Programs; Life Cycle Cost Methodology and Procedures,* effective December 20, 1990.
(for a PDF version, visit http://www.access.gpo.gov/nara/cfr and search for "10 CFR 436")

[2] Executive Order 13123, *Greening the Government through Efficient Energy Management*, 3 June 99 (available at : http://www.pub.whitehouse.gov/uri-res/I2R?urn:pdi://oma.eop.gov.us/1999/6/4/6.text.1).

[3] *ASTM Standards on Building Economics,* American Society for Testing and Materials, Third Edition, Philadelphia, PA, 1994.

[4] Fuller, S.K. and S.R. Petersen, *Life-Cycle Costing Manual for the Federal Energy Management Program,* NIST Handbook 135, National Institute of Standards and Technology, Gaithersburg, February 1996 (replaces the 1987 edition). For a PDF version, visit http://www.orau.gov/femp/emw.htm, select "Life-Cycle Costing", then "pre-work". Order a free printed hard copy by phone from the DOE Help Desk at (1-800-363-3732) or by web at http://www.eren.doe.gov/femp/ordermaterials.html

[5] Fandel, G. and Spronk, J. Eds., *Multiple Criteria Decision Methods and Applications,* Springer-Verlag, Berlin, 1985

[6] Fuller, S.K., Annual Supplement to NIST Handbook 135, *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1999,* NISTIR 85-3273-9, National Institute of Standards and Technology, Gaithersburg, October 1994 (revised annually, available each April). For a PDF version, visit the FEMP technical assistance web site:
http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html

LCC SOFTWARE

[7] *BLCC, The NIST "Building Life-Cycle Cost" Program,* NISTIR *5185-2,* National Institute of Standards and Technology, Gaithersburg, MD, April 1999. To download a free copy and manual, visit the FEMP technical assistance web site:
http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html

[8] *User-Friendly Life-Cycle Costing*, M. S. Addison and Associates, Tempe, AZ, 1999. Available in Excel Office95 and Office 97 formats. To download a free copy, visit: http://www.doe2.com.

***BLCC* SUPPORTING SOFTWARE**

The following programs are often used in support of BLCC. To download a free copy and manual for any of the programs listed below, visit the FEMP technical assistance web site:
http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html

EMISS: A Program for Estimating Local Air Pollution Emission Factors Related to Energy Use in Buildings, User's Guide and Reference Manual, NISTIR *5704,* National Institute of Standards and Technology, Gaithersburg, MD, October 1995.

ERATES: A Computer Program for Calculating Time-of-Use, Block, and Demand Charges for Electricity Usage, User's Guide and Reference Manual, NISTIR *5186-2,* National Institute of Standards and Technology, Gaithersburg, MD, October 1996.

DISCOUNT--A Program for Discounting Computations in Life-Cycle Cost Analyses, User's Guide and Reference Manual, NISTIR 4513, National Institute of Standards and Technology, Gaithersburg, MD, January 1991.

Figure 1: First vs Operating Costs (hypothetical)
What's good for first costs tends to be bad for operating costs (i.e., efficiency usually costs more)

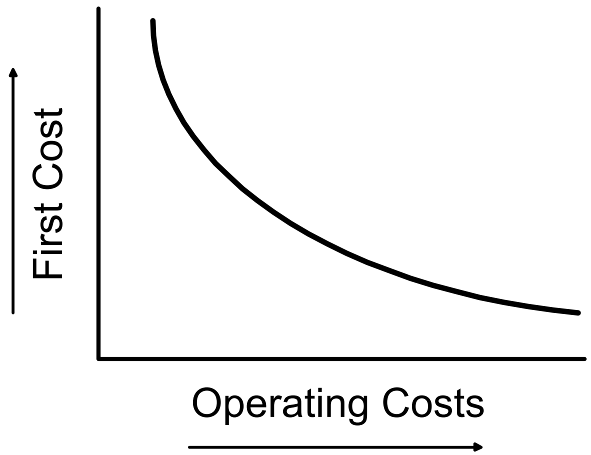


Figure 2: First vs Operating Costs (actual data)
The data below represent glass type alternatives for a building project. Which one is "best"?

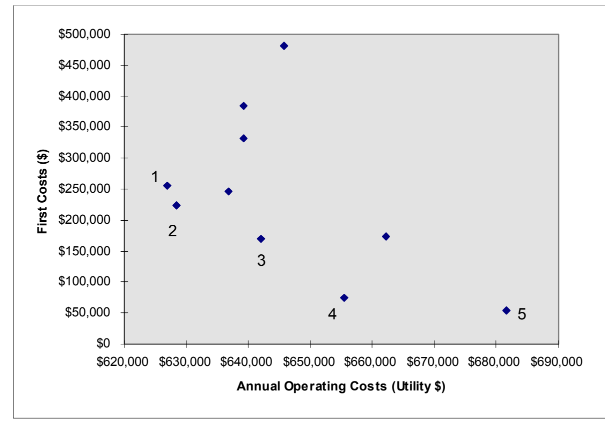


Figure 3: "Discounting" Future Cash Flows
In LCC, future costs are expressed in their equivalent "present value" by being discounted

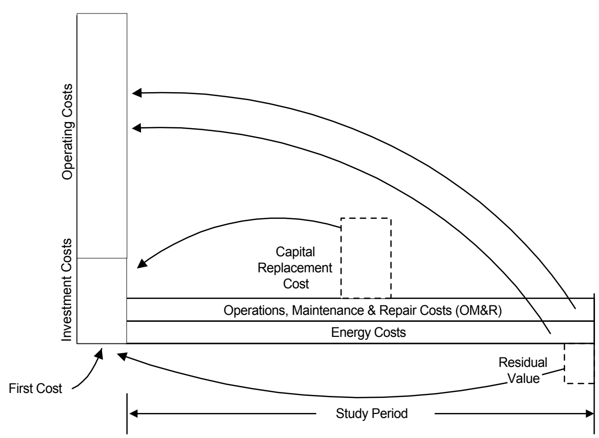


Figure 4: Cummulative Life-Cycle Savings
Cummulative life-cycle savings for glass types selcted via Simple Payback and LCC

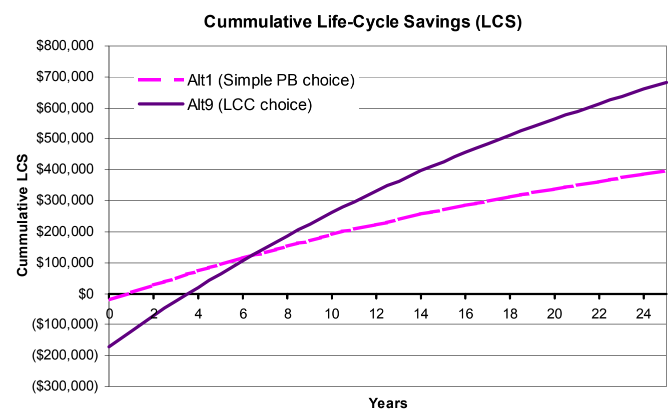


Figure 5: *User-Friendly LCC* "General Data" tab sheet

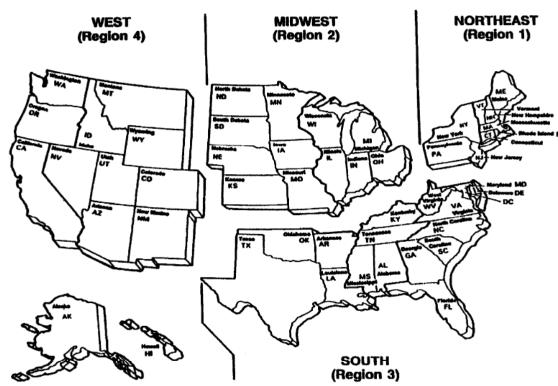
USER-FRIENDLY BUILDING LIFE-CYCLE COST ANALYSIS

by M.S. Addison and Associates, Tempe, AZ   marlin.addison@doe2.com

User input fields are indicated in blue.

IMPORTANT NOTE: This spreadsheet should be updated (replaced) every April, after DOE releases updated energy price escalation factors.
Visit http://www.doe2.com to download the most current copy.

Basic Data, this analysis			***FY 1999 Federal Discount Rates:***		
DOE/FEMP Fiscal Year	**1999**		DOE/FEMP	3.1%	
Discount Rate for this Analysis	**3.1%**		OMB Short Term	2.7%	
Number of Analysis Years	**25**		OMB Long Term	2.9%	***Reference Rates:***
DOE Fuel Price Escalation Region (1 through 4, see map below, 5=U.S. average)	**4**	*(West)*		5.7%	Nominal Discount Rate
				2.5%	General Inflation Rate
Analysis Sector (1=Residential; 2=Commercial; 3=Industrial)	**2**	*(Commercial)*		3.1%	Real Discount Rate
Second Fuel Type (0=None, 1=N.Gas; 2=LPG, 3=Dist Oil; 4=Resid Oil; 5=Coal)	**1**	*(Natural Gas)*			
Uniform Electric Price Escalation Rate	________	*(to use DOE escalation rates, which vary by year, leave this entry empty)*			
Uniform Natural Gas Price Escalation Rate	________	*(to use DOE escalation rates, which vary by year, leave this entry empty)*			



Source: U.S. Bureau of the Census

Figure 6: *User-Friendly LCC* Example "LCC" tab sheet

(user input cells are show shaded below)

Base Case
Rooftop Package HVAC

FEMP Fiscal Year: 1999 | **Disc. Rate: 3.1%** | **DOE Region: West**
Years of Analysis: 25 | **Analysis Sector: Commercial**

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS			NATURAL GAS COSTS			ANNUAL RECURRING COSTS		TOTAL COSTS	
	Investment-Related Costs (e.g., 1st cost, replacement, residual)			Operations-Related Costs (e.g., non-annual maintenance)												
Year	*Descript of Cost*	*Constant $*	Discounted *PV $*	*Descript of Cost*	*Constant $*	Discounted *PV $*	Annual Recurring Electric *Constant $*	Electric Differential Escalation *%*	Discounted Electric w/Fuel Esc. *PV $*	Annual Recurring Nat Gas *Constant $*	Nat Gas Differential Escalation *%*	Discounted Nat Gas w/Fuel Esc. *PV $*	Annual Recurring (e.g., maintenance) *Constant $*	Discounted Recurring *PV $*	Year	Discounted Total Costs *PV $*
0	First Cost	$75,000	$75,000	n/a	n/a	n/a	$62,500			$3,650			$1,000		0	$75,000
1		$0	$0		$0	$0	$62,500	-1.30%	$59,834	$3,650	1.09%	$3,579	$1,000	$970	1	$64,383
2		$0	$0		$0	$0	$62,500	-1.46%	$57,190	$3,650	0.36%	$3,484	$1,000	$941	2	$61,614
3		$0	$0		$0	$0	$62,500	-2.29%	$54,201	$3,650	0.18%	$3,385	$1,000	$912	3	$58,498
4		$0	$0		$0	$0	$62,500	-0.44%	$52,341	$3,650	0.71%	$3,306	$1,000	$885	4	$56,532
5		$0	$0		$0	$0	$62,500	-0.10%	$50,717	$3,650	0.18%	$3,213	$1,000	$858	5	$54,788
6		$0	$0		$0	$0	$62,500	-0.10%	$49,144	$3,650	0.35%	$3,127	$1,000	$833	6	$53,104
7		$0	$0		$0	$0	$62,500	0.34%	$47,830	$3,650	0.53%	$3,049	$1,000	$808	7	$51,687
8		$0	$0		$0	$0	$62,500	-0.59%	$46,119	$3,650	-0.35%	$2,947	$1,000	$783	8	$49,850
9		$0	$0		$0	$0	$62,500	-0.49%	$44,513	$3,650	-0.88%	$2,833	$1,000	$760	9	$48,106
10		$0	$0		$0	$0	$62,500	-0.45%	$42,982	$3,650	-1.06%	$2,719	$1,000	$737	10	$46,438
11		$0	$0		$0	$0	$62,500	-0.65%	$41,420	$3,650	-1.08%	$2,609	$1,000	$715	11	$44,744
12		$0	$0		$0	$0	$62,500	-1.30%	$39,653	$3,650	-1.45%	$2,494	$1,000	$693	12	$42,840
13		$0	$0		$0	$0	$62,500	-0.61%	$38,227	$3,650	-1.29%	$2,388	$1,000	$672	13	$41,287
14		$0	$0		$0	$0	$62,500	-0.36%	$36,945	$3,650	-1.30%	$2,286	$1,000	$652	14	$39,883
15	Replace	$65,000	$41,118		$0	$0	$62,500	0.15%	$35,889	$3,650	-1.13%	$2,192	$1,000	$633	15	$79,832
16		$0	$0		$0	$0	$62,500	-0.36%	$34,686	$3,650	-0.57%	$2,114	$1,000	$614	16	$37,413
17		$0	$0		$0	$0	$62,500	-0.51%	$33,470	$3,650	-0.38%	$2,042	$1,000	$595	17	$36,108
18		$0	$0		$0	$0	$62,500	-0.62%	$32,263	$3,650	0.00%	$1,981	$1,000	$577	18	$34,821
19		$0	$0		$0	$0	$62,500	0.21%	$31,358	$3,650	0.00%	$1,921	$1,000	$560	19	$33,839
20		$0	$0		$0	$0	$62,500	-0.98%	$30,116	$3,650	0.19%	$1,867	$1,000	$543	20	$32,526
21		$0	$0		$0	$0	$62,500	-0.94%	$28,936	$3,650	0.19%	$1,815	$1,000	$527	21	$31,277
22		$0	$0		$0	$0	$62,500	-0.21%	$28,007	$3,650	0.38%	$1,767	$1,000	$511	22	$30,284
23		$0	$0		$0	$0	$62,500	0.00%	$27,164	$3,650	0.38%	$1,720	$1,000	$496	23	$29,380
24		$0	$0		$0	$0	$62,500	0.00%	$26,348	$3,650	0.38%	$1,675	$1,000	$481	24	$28,503
25	Residual	($21,645)	($10,090)		$0	$0	$62,500	0.00%	$25,555	$3,650	0.38%	$1,631	$1,000	$466	25	$17,562
		$118,355	**$106,028**		$0	**$0**	$1,562,500		**$994,907**	$91,250		**$62,142**	$25,000	***$17,221***		***$1,180,298***

Figure 7: *User-Friendly LCC* Example "Results Summary" Sheet

Using minum simple payback or discounted payback, Alt 1 is the best choice. Minimum LCC would select Alt 9.

Case	Description	One-Time Costs 1st year $	One-Time Costs LCC *PV $*	Total Utility Costs 1st year $	Total Utility Costs LCC *PV $*	Maintentance 1st year $	Maintentance LCC *PV $*	Total LCC *PV $*	Net Savings *NS*	Simple Payback *yrs*	Discnt'd Payback *yrs*	Saving-to-Invest Ratio SIR	Adjusted Internal Rate-of-Return AIRR
					Life-Cycle COSTS								
Base	Single Clear	$54,300	$54,300	$681,630	$10,878,556	$0	$0	$10,932,856	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 1	Single Pane Azurlite	$74,880	$74,880	$655,380	$10,460,762	$0	$0	$10,535,642	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 2	Calif Series - Water White Crystal	$482,040	$482,040	$645,720	$10,307,255	$0	$0	$10,789,295	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 3	Calif Series - Sea Foam Low-E Clear	$383,760	$383,760	$639,220	$10,201,814	$0	$0	$10,585,574	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 4	Calif Series - Tahoe Blue	$332,280	$332,280	$639,140	$10,203,131	$0	$0	$10,535,411	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 5	Viracon - VE1-55 - Low-E Clear	$169,650	$169,650	$642,060	$10,243,006	$0	$0	$10,412,656	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 6	Viracon - VE1-85 - Low-E Clear	$174,330	$174,330	$662,150	$10,563,041	$0	$0	$10,737,371	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 7	Viracon - VE7-55 - Low-E Azurlite	$256,470	$256,470	$626,930	$10,002,944	$0	$0	$10,259,414	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 8	Viracon - VE7-85 - Low-E Azurlite	$245,540	$245,540	$636,780	$10,159,188	$0	$0	$10,404,728	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 9	Viracon - SolarBan 2000	$224,660	$224,660	$628,370	$10,026,398	$0	$0	$10,251,058	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
					Life-Cycle SAVINGS (negative entries indicate increased costs)								
Alt 1	Single Pane Azurlite	($20,580)	($20,580)	$26,250	$417,795	$0	$0	$397,215	$397,215	0.8	0.8	20.3	16.3%
Alt 2	Calif Series - Water White Crystal	($427,740)	($427,740)	$35,910	$571,302	$0	$0	$143,562	$143,562	11.9	16.4	1.3	4.3%
Alt 3	Calif Series - Sea Foam Low-E Clear	($329,460)	($329,460)	$42,410	$676,742	$0	$0	$347,282	$347,282	7.8	9.5	2.1	6.1%
Alt 4	Calif Series - Tahoe Blue	($277,980)	($277,980)	$42,490	$675,426	$0	$0	$397,446	$397,446	6.5	7.8	2.4	6.8%
Alt 5	Viracon - VE1-55 - Low-E Clear	($115,350)	($115,350)	$39,570	$635,551	$0	$0	$520,201	$520,201	2.9	3.2	5.5	10.4%
Alt 6	Viracon - VE1-85 - Low-E Clear	($120,030)	($120,030)	$19,480	$315,515	$0	$0	$195,485	$195,485	6.2	7.2	2.6	7.2%
Alt 7	Viracon - VE7-55 - Low-E Azurlite	($202,170)	($202,170)	$54,700	$875,612	$0	$0	$673,442	$673,442	3.7	4.1	4.3	9.3%
Alt 8	Viracon - VE7-85 - Low-E Azurlite	($191,240)	($191,240)	$44,850	$719,368	$0	$0	$528,128	$528,128	4.3	4.8	3.8	8.7%
Alt 9	Viracon - SolarBan 2000	($170,360)	($170,360)	$53,260	$852,158	$0	$0	$681,798	$681,798	3.2	3.5	5.0	10.0%

Analysis Conditions:

DOE/FEMP Fiscal Year	1999	
Discount Rate for this Analysis	3.1%	
Number of Analysis Years	25	
DOE Fuel Price Escalation Region	4	*(West)*
Analysis Sector	2	*(Commercial)*

"User Friendly"
Building Life-Cycle
Costing

a spreadsheet
implementation of
BLCC

Enhancements to "User-Friendly LCC" spreadsheet

24 January 2000

- ***2nd fuel type*** - the *User-Friendly LCC* spreadsheet permits only two energy types in any analysis. Previously, this was limited to electricity and natural gas. In this latest version, *ANY* non-electric fuel can be selected as the second fuel type.

- ***Savings-to-Investment Ratio (SIR)*** - Savings-to-Investment Ratio (SIR), is now calculated and reported on the "Results Summary" sheet. Note that this required the non-annual recurring costs to e subdivided into two cost categories: <u>Investment-related</u> costs and <u>Operations-related</u> costs. This distinction follows the FEMP convention in the BLCC training materials and permits *User-Friendly LCC* to calculate and report Savings-to-Investment Ratio (SIR).

- ***Adjusted Internal Rate of Return (AIRR)*** - Adjusted Internal Rate of Return (AIRR), is also now calculated and reported on the "Results Summary" sheet.

- ***Discounted Payback*** - User-Friendly LCC has always reported Simple Payback. With this release, Discounted Payback is also reported on the "Results Summary" sheet. Simple Payback, of course, is calculated as: initial investment divided by first year energy savings. Discounted Payback is more comprehensive. Discounted Payback reports year-by-year investment-related costs divided by year-by-year operations-related savings. In effect, Discounted Payback tracks all costs and savings until the sum of the additional savings equals the sum of the additional costs. This point in time when the operations-related savings accumulate to the point where they equal the investment-related costs is the Discounted Payback. It is essentially the same as Simple Payback, except that all costs and savings used in the calculation are appropriately discounted. See the next item for an example.

- ***Net Savings Graph*** - a graph has been added that tracks the cumulative net savings of all project alternatives, over the life of the proposed project (25 years max). This graph is useful to illustrate the shortcoming of Simple Payback to select projects. The Net Savings are illustrated as a negative quantity in year zero. The project alternative having the largest Net Savings at the end of the period of the analysis is the LCC best choice. (Note that the point at which the Net Savings line crosses the X-axis is the Discounted Payback.)

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Previous Version

Alt 1
Single Pane Azurlite

FEMP Fiscal Year: 1999 **Disc. Rate:** 3.1% **DOE Region:** Midwest
Years of Analysis: 25 **Analysis Sector:** Commercial

	NON-ANNUALLY REOCCURRING COSTS			ELECTRIC COSTS			NATURAL GAS COSTS			ANNUALLY REOCCURRING COSTS		TOTAL COSTS	
Year	*Constant $*	Descript. *of Cost*	Discounted *PV $*	Annual Recurring Electric *Constant $*	Electric Differential Escalation *%*	Discounted Electric w/Fuel Esc. *PV $*	Annual Recurring Nat Gas *Constant $*	Nat Gas Differential Escalation *%*	Discounted Nat Gas w/Fuel Esc. *PV $*	Annual Recurring Maintenance *Constant $*	Discounted Annual Maintenance *PV $*	Year	Discounted Total Costs *PV $*
0	$74,880	First Cost	$74,880	$630,000			$25,380			$0		0	$74,880
1	$0		$0	$630,000	-1.09%	$604,412	$25,380	0.41%	$24,718	$0	$0	1	$629,130
2	$0		$0	$630,000	-1.65%	$576,571	$25,380	-0.20%	$23,926	$0	$0	2	$600,496
3	$0		$0	$630,000	-1.93%	$548,436	$25,380	-0.20%	$23,159	$0	$0	3	$571,595
4	$0		$0	$630,000	-0.10%	$531,394	$25,380	0.00%	$22,462	$0	$0	4	$553,857
5	$0		$0	$630,000	-0.05%	$515,149	$25,380	-0.41%	$21,698	$0	$0	5	$536,847
6	$0		$0	$630,000	-0.62%	$496,548	$25,380	0.00%	$21,045	$0	$0	6	$517,594
7	$0		$0	$630,000	-0.16%	$480,864	$25,380	0.21%	$20,455	$0	$0	7	$501,318
8	$0	Repair	$0	$630,000	-0.31%	$464,941	$25,380	-0.41%	$19,758	$0	$0	8	$484,699
9	$0		$0	$630,000	-0.63%	$448,122	$25,380	-0.41%	$19,085	$0	$0	9	$467,207
10	$0		$0	$630,000	-0.53%	$432,353	$25,380	-0.41%	$18,434	$0	$0	10	$450,788
11	$0		$0	$630,000	-0.69%	$416,460	$25,380	-0.42%	$17,806	$0	$0	11	$434,266
12	$0		$0	$630,000	-1.18%	$399,188	$25,380	-0.21%	$17,234	$0	$0	12	$416,422
13	$0		$0	$630,000	-2.54%	$377,343	$25,380	-0.42%	$16,646	$0	$0	13	$393,990
14	$0		$0	$630,000	-1.72%	$359,701	$25,380	-0.21%	$16,112	$0	$0	14	$375,813
15	$0		$0	$630,000	-1.58%	$343,370	$25,380	-0.21%	$15,594	$0	$0	15	$358,964
16	$0		$0	$630,000	-1.15%	$329,224	$25,380	0.21%	$15,157	$0	$0	16	$344,381
17	$0		$0	$630,000	-1.39%	$314,877	$25,380	0.21%	$14,733	$0	$0	17	$329,610
18	$0		$0	$630,000	-1.00%	$302,353	$25,380	0.21%	$14,320	$0	$0	18	$316,673
19	$0		$0	$630,000	-0.83%	$290,821	$25,380	0.00%	$13,889	$0	$0	19	$304,710
20	$0	Salvage	$0	$630,000	-0.96%	$279,371	$25,380	-0.21%	$13,443	$0	$0	20	$292,814
21	$0		$0	$630,000	-1.09%	$268,018	$25,380	-0.21%	$13,012	$0	$0	21	$281,030
22	$0		$0	$630,000	-0.31%	$259,164	$25,380	0.21%	$12,647	$0	$0	22	$271,811
23	$0		$0	$630,000	0.00%	$251,372	$25,380	0.42%	$12,318	$0	$0	23	$263,690
24	$0		$0	$630,000	0.00%	$243,814	$25,380	0.42%	$11,998	$0	$0	24	$255,811
25	$0		$0	$630,000	0.00%	$236,483	$25,380	0.42%	$11,686	$0	$0	25	$248,168
	$74,880		**$74,880**	$15,750,000		**$9,770,351**	$634,500		**$431,335**	$0	***$0***		***$10,276,566***

New Version

Alt 1
Single Pane Azurlite

FEMP Fiscal Year: 1999 **Disc. Rate:** 3.1% **DOE Region:** West
Years of Analysis: 25 **Analysis Sector:** Commercial

	NON-ANNUAL RECURRING COSTS						ELECTRIC COSTS		
	Investment-Related Costs *(e.g., 1st cost, replacement, residual)*			**Operations-Related Costs** *(e.g., non-annual maintenance)*					
Year	*Description of Cost*	*Constant $*	Discounted *PV $*	*Description of Cost*	*Constant $*	Discounted *PV $*	Annual Recurring Electric *Constant $*	Electric Differential Escalation *%*	Discounted Electric w/Fuel Esc *PV $*
0	First Cost	$74,880	$74,880	n/a	*n/a*	*n/a*	$630,000		
1		$0	$0		$0	$0	$630,000	-1.30%	$603,125
2		$0	$0		$0	$0	$630,000	-1.46%	$576,472
3		$0	$0		$0	$0	$630,000	-2.29%	$546,347
4		$0	$0		$0	$0	$630,000	-0.44%	$527,593
5		$0	$0		$0	$0	$630,000	-0.10%	$511,228
6		$0	$0		$0	$0	$630,000	-0.10%	$495,370
7		$0	$0		$0	$0	$630,000	0.34%	$482,126
8		$0	$0	Overhaul	$0	$0	$630,000	-0.59%	$464,884
9		$0	$0		$0	$0	$630,000	-0.49%	$448,687
10		$0	$0		$0	$0	$630,000	-0.45%	$433,259
11		$0	$0		$0	$0	$630,000	-0.65%	$417,518
12		$0	$0		$0	$0	$630,000	-1.30%	$399,699
13		$0	$0		$0	$0	$630,000	-0.61%	$385,325
14		$0	$0		$0	$0	$630,000	-0.36%	$372,405
15	Replace	$0	$0		$0	$0	$630,000	0.15%	$361,762
16		$0	$0		$0	$0	$630,000	-0.36%	$349,630
17		$0	$0		$0	$0	$630,000	-0.51%	$337,379
18		$0	$0		$0	$0	$630,000	-0.62%	$325,212
19		$0	$0		$0	$0	$630,000	0.21%	$316,088
20		$0	$0	Overhaul	$0	$0	$630,000	-0.98%	$303,570
21		$0	$0		$0	$0	$630,000	-0.94%	$291,673
22		$0	$0		$0	$0	$630,000	-0.21%	$282,307
23		$0	$0		$0	$0	$630,000	0.00%	$273,818
24		$0	$0		$0	$0	$630,000	0.00%	$265,585
25	Residual	$0	$0		$0	$0	$630,000	0.00%	$257,599
		$74,880	**$74,880**		$0	**$0**	$15,750,000		**$10,028,662**

Year	NATURAL GAS COSTS			ANNUAL RECURRING COSTS		TOTAL COSTS		COSTS	CUMULATIVE SAVINGS	Payback
Year	Annual Recurring Nat Gas *Constant $*	Nat Gas Differential Escalation *%*	Discounted Nat Gas w/Fuel Esc. *PV $*	Annual Recurring *Constant $*	Discounted Recurring (e.g., maintenance) *PV $*	Year	Discounted Total Costs *PV $*	Discounted Cumulative Costs *PV $*	Discounted Cumulative Savings *PV $*	Discounted *Payback yrs*
0	$25,380			$0		0	$74,880	$74,880	($20,580)	
1	$25,380	1.09%	$24,884	$0	$0	1	$628,010	$702,890	$4,549	0.8
2	$25,380	0.36%	$24,223	$0	$0	2	$600,695	$1,303,585	$28,566	
3	$25,380	0.18%	$23,536	$0	$0	3	$569,883	$1,873,468	$51,327	
4	$25,380	0.71%	$22,991	$0	$0	4	$550,584	$2,424,052	$73,306	
5	$25,380	0.18%	$22,340	$0	$0	5	$533,567	$2,957,619	$94,603	
6	$25,380	0.35%	$21,744	$0	$0	6	$517,114	$3,474,733	$115,239	
7	$25,380	0.53%	$21,202	$0	$0	7	$503,328	$3,978,061	$135,323	
8	$25,380	-0.35%	$20,493	$0	$0	8	$485,377	$4,463,438	$154,689	
9	$25,380	-0.88%	$19,702	$0	$0	9	$468,389	$4,931,827	$173,381	
10	$25,380	-1.06%	$18,906	$0	$0	10	$452,165	$5,383,992	$191,430	
11	$25,380	-1.08%	$18,140	$0	$0	11	$435,658	$5,819,650	$208,823	
12	$25,380	-1.45%	$17,340	$0	$0	12	$417,039	$6,236,690	$225,475	
13	$25,380	-1.29%	$16,602	$0	$0	13	$401,927	$6,638,616	$241,527	
14	$25,380	-1.30%	$15,893	$0	$0	14	$388,298	$7,026,915	$257,042	
15	$25,380	-1.13%	$15,241	$0	$0	15	$377,003	$7,403,917	$272,114	
16	$25,380	-0.57%	$14,698	$0	$0	16	$364,328	$7,768,245	$286,680	
17	$25,380	-0.38%	$14,201	$0	$0	17	$351,581	$8,119,826	$300,736	
18	$25,380	0.00%	$13,774	$0	$0	18	$338,986	$8,458,812	$314,285	
19	$25,380	0.00%	$13,360	$0	$0	19	$329,448	$8,788,260	$327,454	
20	$25,380	0.19%	$12,983	$0	$0	20	$316,553	$9,104,813	$340,101	
21	$25,380	0.19%	$12,617	$0	$0	21	$304,290	$9,409,104	$352,252	
22	$25,380	0.38%	$12,285	$0	$0	22	$294,591	$9,703,695	$364,013	
23	$25,380	0.38%	$11,961	$0	$0	23	$285,779	$9,989,474	$375,420	
24	$25,380	0.38%	$11,645	$0	$0	24	$277,230	$10,266,704	$386,483	
25	$25,380	0.38%	$11,338	$0	$0	25	$268,938	$10,535,642	$397,215	
	$634,500		**$432,100**	$0	***$0***		***$10,535,642***	***$10,535,642***	***$397,215***	***0.8***

Now permits ANY second fuel type
(e.g., fuel oil, coal, none, etc.)

Investment-related vs Operations-related costs
(permits SIR calculation)

Cumulative costs and savings
(permits Discounted Payback)

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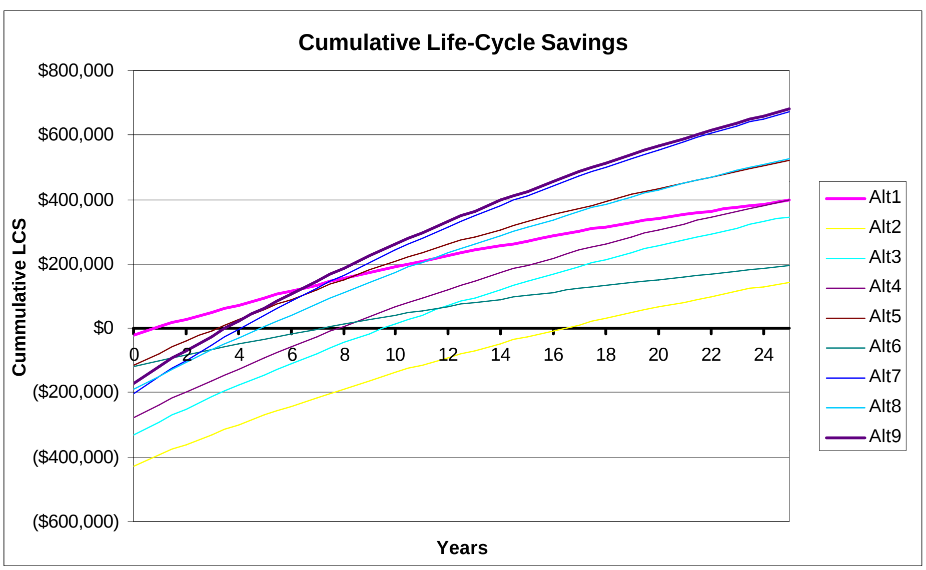
New Results Summary Table

Life-Cycle Costs Summary
Glazing Selection Example Analysis

Case	Description	One-Time Costs 1st year $	One-Time Costs LCC PV $	Total Utility Costs 1st year $	Total Utility Costs LCC PV $	Maintenance 1st year $	Maintenance LCC PV $	Total LCC PV $	Net Savings NS	Simple Payback yrs	Discnt'd Payback yrs	Saving-to-Invest Ratio SIR	Adjusted Internal Rate-of-Return AIRR
							Life-Cycle COSTS						
Base	Single Clear	$54,300	$54,300	$681,630	$10,878,556	$0	$0	$10,932,856	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 1	Single Pane Azurlite	$74,880	$74,880	$655,380	$10,460,762	$0	$0	$10,535,642	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 2	Calif Series - Water White Crystal	$482,040	$482,040	$645,720	$10,307,255	$0	$0	$10,789,295	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 3	Calif Series - Sea Foam Low-E Clear	$383,760	$383,760	$639,220	$10,201,814	$0	$0	$10,585,574	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 4	Calif Series - Tahoe Blue	$332,280	$332,280	$639,140	$10,203,131	$0	$0	$10,535,411	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 5	Viracon - VE1-55 - Low-E Clear	$169,650	$169,650	$642,060	$10,243,006	$0	$0	$10,412,656	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 6	Viracon - VE1-85 - Low-E Clear	$174,330	$174,330	$662,150	$10,563,041	$0	$0	$10,737,371	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 7	Viracon - VE7-55 - Low-E Azurlite	$256,470	$256,470	$626,930	$10,002,944	$0	$0	$10,259,414	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 8	Viracon - VE7-85 - Low-E Azurlite	$245,540	$245,540	$636,780	$10,159,188	$0	$0	$10,404,728	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Alt 9	Viracon - SolarBan 2000	$224,660	$224,660	$628,370	$10,026,398	$0	$0	$10,251,058	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
							Life-Cycle SAVINGS (negative entries indicate increased costs)						
Alt 1	Single Pane Azurlite	($20,580)	($20,580)	$26,250	$417,795	$0	$0	$397,215	$397,215	0.8	0.8	20.3	16.3%
Alt 2	Calif Series - Water White Crystal	($427,740)	($427,740)	$35,910	$571,302	$0	$0	$143,562	$143,562	11.9	16.4	1.3	4.3%
Alt 3	Calif Series - Sea Foam Low-E Clear	($329,460)	($329,460)	$42,410	$676,742	$0	$0	$347,282	$347,282	7.8	9.5	2.1	6.1%
Alt 4	Calif Series - Tahoe Blue	($277,980)	($277,980)	$42,490	$675,426	$0	$0	$397,446	$397,446	6.5	7.8	2.4	6.8%
Alt 5	Viracon - VE1-55 - Low-E Clear	($115,350)	($115,350)	$39,570	$635,551	$0	$0	$520,201	$520,201	2.9	3.2	5.5	10.4%
Alt 6	Viracon - VE1-85 - Low-E Clear	($120,030)	($120,030)	$19,480	$315,515	$0	$0	$195,485	$195,485	6.2	7.2	2.6	7.2%
Alt 7	Viracon - VE7-55 - Low-E Azurlite	($202,170)	($202,170)	$54,700	$875,612	$0	$0	$673,442	$673,442	3.7	4.1	4.3	9.3%
Alt 8	Viracon - VE7-85 - Low-E Azurlite	($191,240)	($191,240)	$44,850	$719,368	$0	$0	$528,128	$528,128	4.3	4.8	3.8	8.7%
Alt 9	Viracon - SolarBan 2000	($170,360)	($170,360)	$53,260	$852,158	$0	$0	$681,798	$681,798	3.2	3.5	5.0	10.0%

Discounted Payback,
Savings-to-Investment Ratio (SIR),
Adjusted IRR
are added

New Cumulative Life-Cycle (Net Savings) Graph



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Underground Surfaces

How to Get a Better Underground Surface Heat Transfer Calculation in DOE-2.1E

by
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Simulation Research Group
Lawrence Berkeley National Laboratory

Underground surfaces in DOE-2.1E are walls or floors that are in contact with the ground. An example is a slab-on-grade or a basement wall. Underground surfaces are entered using the UNDERGROUND-WALL command, or the equivalent command, UNDERGROUND-FLOOR. Check the description of these commands in the *Reference Manual* for information on the keywords for these surfaces.

Heat Transfer

Care needs to be taken in describing the construction of an underground surface in order to get a correct calculation of the heat transfer through the surface and a correct accounting for the thermal mass of the surface, which is important in the weighting factor calculation for the space. In the LOADS program, DOE-2 calculates the heat transfer through the underground surface as

$$Q = UA(T_g - T_i)$$

where U is the conductance of the surface, A is the surface area, T_g is the ground temperature and T_i is the inside air temperature. *If the raw U-value of the surface is used in this expression the heat transfer will be grossly overcalculated.* This is because the heat transfer occurs mainly through the surface's exposed perimeter region (since this region has relatively short heat flow paths to the outside air) rather than uniformly over the whole area of the surface. For this reason, users are asked to specify an effective U-value with the U-EFFECTIVE keyword. This gives

$$Q = [U\text{-}EFFECTIVE]*A(T_g - T_i)$$

In general U-EFFECTIVE is much less than the raw U-value.

The following procedure shows how to determine U-EFFECTIVE for different foundation configurations. It also shows how to define an effective construction for an underground surface that properly accounts for its thermal mass when custom weighting factors are specified. The procedure assumes that the monthly ground temperature is the average outside air temperature delayed by three months, which is similar to how the ground temperatures on the weather file are calculated. To force the program to use the weather file values, do *not* enter ground temperatures using the GROUND-T keyword in the BUILDING-LOCATION command.

Procedure for defining the underground surface construction

1. Choose a value of the perimeter conduction factor, *F2*, from Table 1, 2 or 3 for the configuration that best matches the type of surface (slab floor, basement wall, crawl-space wall), foundation depth and amount/location of insulation.

2. Using *F2*, calculate R_{eff}, the *effective resistance* of the underground surface, which is defined by the following equation:

   $R_{eff} = A / (F2 * P_{exp})$

   where *A* is the area of the surface (ft^2 or m^2) and P_{exp} is the length (ft or m) of the surface's perimeter that is exposed to the outside air. Figures 1 and 2 show values of P_{exp} for example foundation configurations. If P_{exp} is zero**, set R_{eff} to a large value, e.g. R_{eff} = 1000.

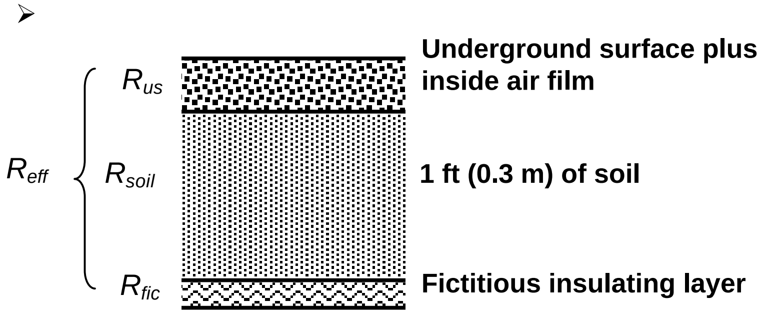
3. Set U-EFFECTIVE = 1/R_{eff}.

   The program will calculate the heat transfer through the underground surface to be

   $Q = [U\text{-}EFFECTIVE] * A\ (T_g - T_i)$

4. Define a construction, shown in the figure below, consisting of the following:

   - The underground wall or floor, including carpeting, if present, and inside film resistance (overall resistance = R_{us})
   - A 1-ft (0.3-m) layer of soil (resistance = R_{soil} = 1.0 hr-ft^2-F/Btu [0.18 m^2-K/W])
   - A fictitious insulating layer (resistance = R_{fic})
   -



The layer of a soil represents the thermal mass of the ground in contact with the underground surface (a 1-ft [0.3-m] layer is sufficient to account for most of the thermal mass effect). The fictitious insulating layer is required to give the correct effective resistance for the construction, i.e.

$$R_{eff} = R_{us} + R_{soil} + R_{fic}$$

From this we get

$$R_{fic} = R_{eff} - R_{us} - R_{soil}$$

** The procedure makes the approximation that the heat transfer through an underground surface with no exposed perimeter, such as a basement floor, is zero.

The procedure for defining this construction is shown in the following example.

Example: 50' x 100' slab-on-grade.

The slab consists of uncarpeted, 4-in (10-cm) heavy-weight concrete (CC03 in the DOE-2.1E library), with resistance = 0.44 hr-ft^2-F/Btu (0.078 m^2-K/W). The foundation depth is 4 ft (1.22 m) with R-10 (1.76 m^2-K/W) exterior insulation, which gives F2 = 0.50 Btu/hr-F-ft (0.86 W/m-K) from Table 1. We then have:

Slab surface area:	A = 50x100 = 5000 ft^2
Slab exposed perimeter:	P_{exp} = (2x50) + (2x100) = 300 ft
Effective slab resistance:	$R_{eff} = A/(F2*P_{exp})$ = 5000/(0.68*300) = 33.3
Effective slab U-value:	U-EFFECTIVE = 1/R_{eff} = 0.030
Actual slab resistance:	R_{us} = 0.44 + R_{film} = 0.44 + 0.77 = 1.21
Resistance of fictitious layer:	$R_{fic} = R_{eff} - R_{us} - R_{soil}$ = 33.3 – 1.21 – 1.0 = 31.1

Here, 0.77 hr-ft^2-F/Btu (0.14 m^2-K/W) is the average of the air film resistance for heat flow up— 0.61 hr-ft^2-F/Btu (0.11 m^2-K/W)—and heat flow down— 0.92 hr-ft^2-F/Btu (0.16 m^2-K/W). For vertical surfaces, such as basement walls, you can use R_{film} = 0.68 hr-ft^2-F/Btu (0.12 m^2-K/W).

The input would look like:

```
$ Slab-on-grade $

MAT-FIC-1  = MATERIAL  RESISTANCE = 31.1  .. $ the Rfic value

SOIL-12IN = MATERIAL  THICKNESS = 1.0  CONDUCTIVITY = 1.0
                      DENSITY = 115  SPECIFIC-HEAT = 0.1 ..

LAY-SLAB-1 = LAYERS  MATERIAL = (MAT-FIC-1,SOIL-12IN,CC03)
                     INSIDE-FILM-RES = 0.77 ..

CON-SLAB-1 = CONSTRUCTION LAYERS = LAY-SLAB-1 ..
  .
  .
SLAB-1 = UNDERGROUND-FLOOR HEIGHT = 50
                           WIDTH = 100
                           TILT = 180
                           U-EFFECTIVE = 0.030
                           CONSTRUCTION = CON-SLAB-1 ..
```

Caution: If you change the dimensions of the slab later, be sure to recalculate R_{fic}. For example, if the 50x100-ft slab is changed to 50x80-ft exposed perimeter becomes 260-ft, and we get R_{eff} = 4000/(0.50*260) = 30.8 (rather than 33.3), U-EFFECTIVE = 1/30.8 = 0.033 (rather than 0.030), and R_{fic} = 30.8 – 1.21 – 1.0 = 28.6 (rather than 31.1).

Note (1):
For basements (Table 2) and crawl spaces (Table 3) an 8-in (20.3-cm) high section between ground level and the top of the underground wall is included in the F2 calculation and so does not have to be entered as a separate exterior wall. However, for shallow basements (Table 2) the wall section between the top of the underground wall and main level of the building should be entered as a separate exterior wall.

Note (2):
The floor of a crawl space (Table 3) should be entered as an UNDERGROUND-FLOOR consisting of a 1-ft (0.3-m) layer of soil with a fictitious insulation layer underneath it. Because the exposed perimeter of the floor in this case is zero, the heat transfer is zero, so the fictitious insulation layer should have a very high resistance and U-EFFECTIVE should be zero. The input would look like:

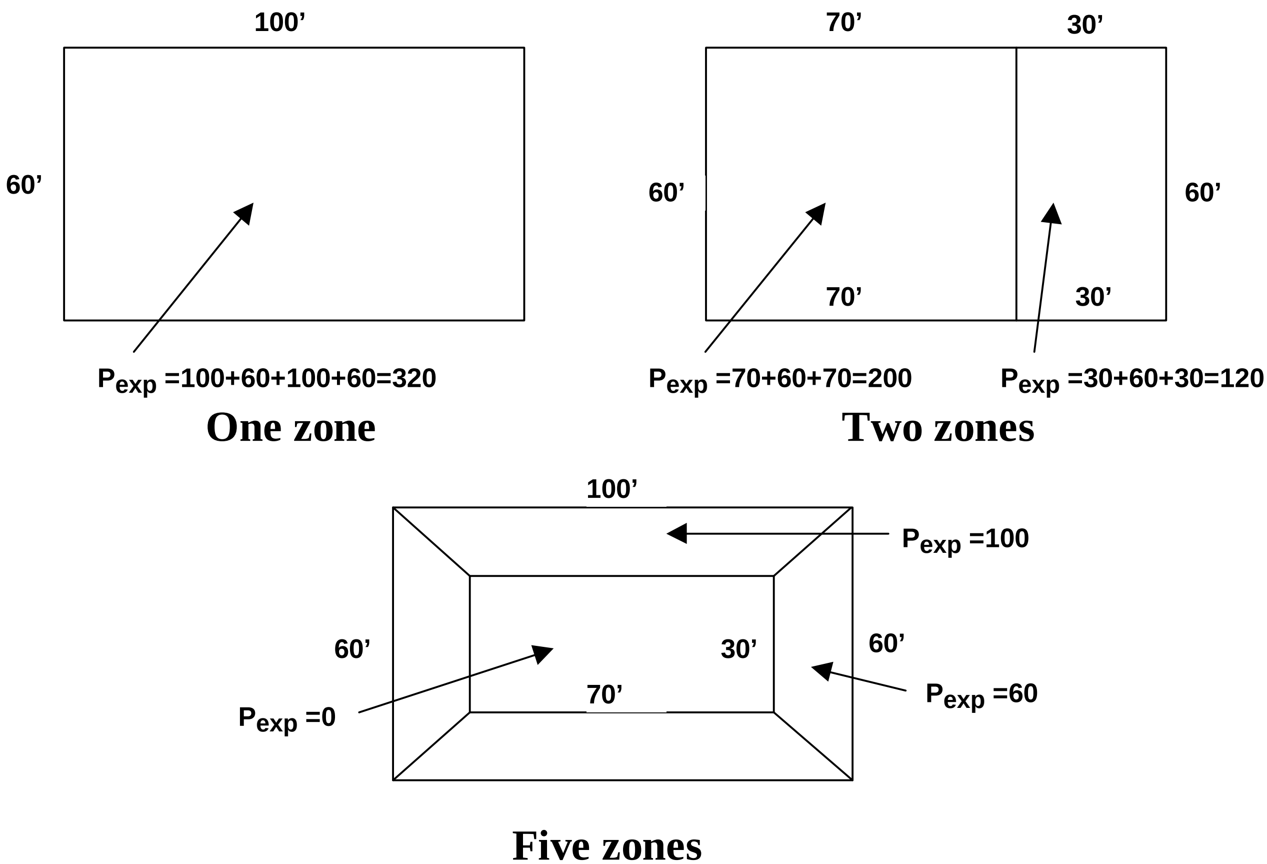
```
$ Crawl space floor $

MAT-FIC-1  = MATERIAL RESISTANCE = 1000  ..

SOIL-12IN = MATERIAL  THICKNESS = 1.0
                      CONDUCTIVITY = 1.0
                      DENSITY = 115
                      SPECIFIC-HEAT = 0.1 ..

LAY-FLOOR-1 = LAYERS  MATERIAL = (MAT-FIC-1, SOIL-12IN)
                      INSIDE-FILM-RES = 0.77 ..

CON-FLOOR-1 = CONSTRUCTION LAYERS = LAY-FLOOR-1 ..
 ....

FLOOR-1 = UNDERGROUND-FLOOR HEIGHT = 50
                            WIDTH = 100
                            TILT = 180
                            U-EFFECTIVE = 0.0
                            CONSTRUCTION = CON-SLAB-1 ..
```

Thermal Mass

Underground surfaces are usually concrete and therefore have high thermal mass. Because of its heat storage capacity this mass attenuates loads due to heat gains (from lights, solar, people, etc.) and causes a time delay between when the heat gain occurs and when it appears as a load on the HVAC system. In general, the higher the heat capacity and the more closely coupled the mass is to the room air, the larger this delay and attenuation will be.

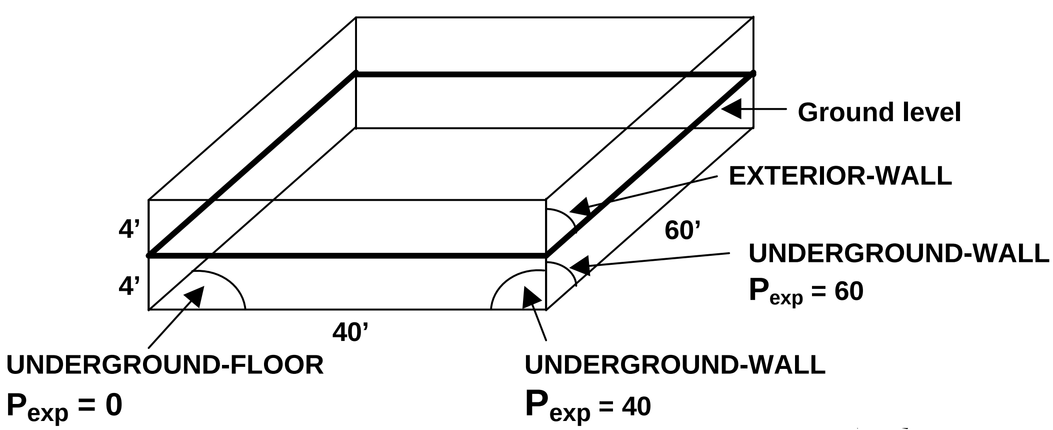
DOE-2 will account for thermal mass only if (1) the underground surface is entered with a layers-type construction, following the procedure described in the previous section; and (2) custom weighting factors are calculated for the space, i.e., FLOOR-WEIGHT = 0 in the SPACE or SPACE-CONDITIONS command.

Slab-On-Grade



Exposed perimeter calculation for slab-on-grade examples.

Basement



Exposed perimeter calculation for basement.

Table 1: Perimeter Conduction Factors for Concrete Slab-On-Grade*

Slab-On-Grade			
		PERIM-CONDUCT Btu/hr-F-ft (W/m-K)	
Foundation depth	Insulation Configuration (see sketch for location of insulation)	Uncarpetted	Carpetted
2 ft	Uninsulated	1.10 (1.90)	0.77 (1.33)
	R-5 exterior	0.73 (1.26)	0.54 (0.93)
	R-10 exterior	0.65 (1.12)	0.49 (0.85)
	R-5 interior; R-5 gap	0.75 (1.30)	0.57 (0.98)
	R-10 interior	0.89 (1.54)	0.46 (0.79)
	R-10 interior; R-5 gap	0.70 (1.21)	0.53 (0.92)
	R-10 interior; R-10 gap	0.68 (1.17)	0.52 (0.90)
	R-5 2-ft perimeter; R-5 gap	0.78 (1.35)	0.60 (1.04)
	R-10 2-ft perimeter; R-5 gap	0.73 (1.26)	0.57 (0.98)
	R-10 4-ft perimeter	0.79 (1.36)	0.59 (1.02)
	R-10 15-ft perimeter, R-5 gap	0.39 (0.67)	0.34 (0.59)
	R-5 16-in exterior, R-5 2-ft horizontal	0.65 (1.12)	0.48 (0.83)
	R-5 16-in exterior, R-5 4-ft horizontal	0.58 (1.00)	0.43 (0.74)
	R-10 16-in exterior, R-5 2-ft horizontal	0.56 (0.97)	0.41 (0.71)
	R-10 16-in exterior, R-5 4-ft horizontal	0.47 (0.81)	0.35 (0.60)
4 ft	Uninsulated	1.10 (1.90)	0.77 (1.33)
	R-5 exterior	0.61 (1.05)	0.46 (0.79)
	R-10 exterior	0.50 (0.86)	0.37 (0.64)
	R-15 exterior	0.44 (0.76)	0.33 (0.57)
	R-20 exterior	0.40 (0.69)	0.30 (0.52)
	R-5 interior; R-5 gap	0.63 (1.09)	0.48 (0.83)
	R-10 interior; R-5 gap	0.54 (0.93)	0.42 (0.73)
	R-15 interior; R-5 gap	0.50 (0.86)	0.38 (0.66)
	R-20 interior; R-5 gap	0.47 (0.81)	0.36 (0.62)
	R-5 4-ft perimeter; R-5 gap	0.68 (1.17)	0.54 (0.93)
	R-10 4-ft perimeter; R-5 gap	0.61 (1.05)	0.49 (0.85)
	R-10 4-ft perimeter	0.79 (1.36)	0.59 (1.02)
	R-10 15-ft perimeter, R-5 gap	0.39 (0.67)	0.34 (0.59)
	R-5 16-in exterior, R-5 2-ft horizontal	0.65 (1.12)	0.48 (0.83)
	R-5 16-in exterior, R-5 4-ft horizontal	0.58 (1.00)	0.43 (0.74)
	R-10 16-in exterior, R-5 2-ft horizontal	0.56 (0.97)	0.41 (0.71)
	R-10 16-in exterior, R-5 4-ft horizontal	0.47 (0.81)	0.35 (0.60)

*Source: Y.J.Huang, L.S.Shen, J.C.Bull and L.F.Goldberg, "Whole-House Simulation of Foundation Heat Flows Using the DOE-2.1C Program," ASHRAE Trans. 94 (2), 1988, updated by Y.J.Huang, private communication.

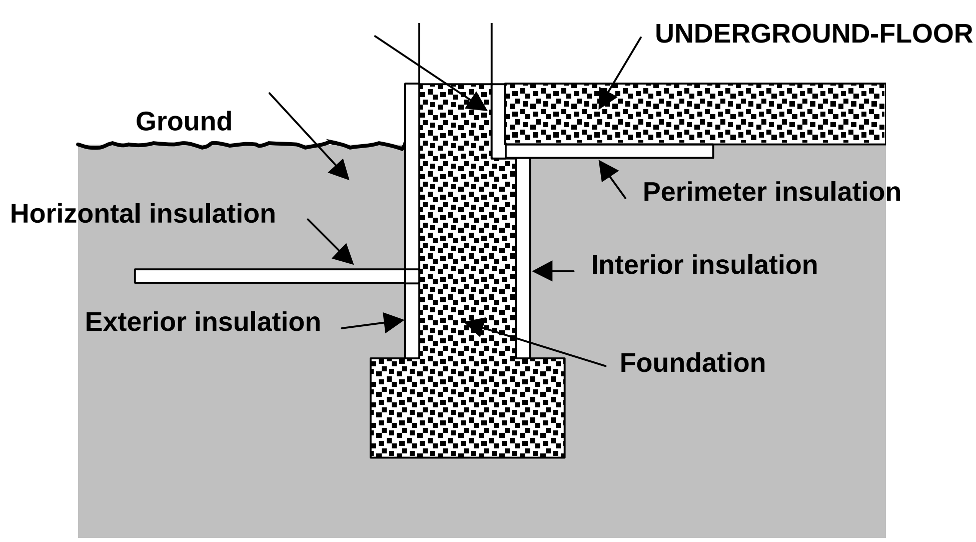
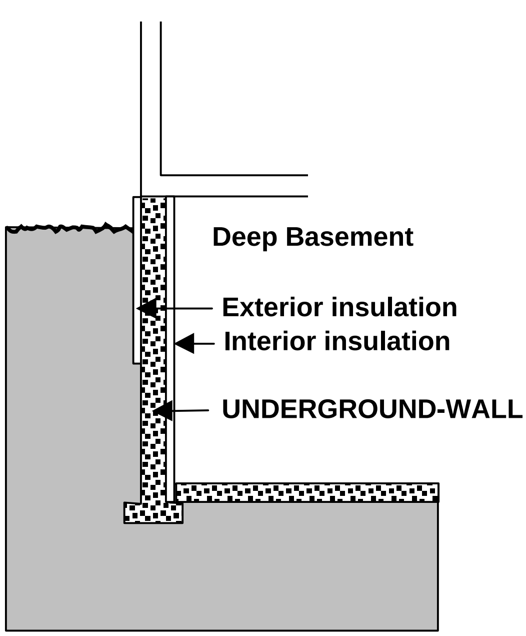


Table 2: Perimeter Conduction Factors for Basement Walls*

Basement Wall		
Underground Wall Height	**Construction (see sketch for location of insulation)**	**PERIM-CONDUCT Btu/hr-F-ft (W/m-K)**
8 ft (deep basement)	R-0 (uninsulated), concrete	1.94 (3.35)
	4-ft R-5 exterior, concrete	1.28 (2.21)
	8-ft R-5 exterior, concrete	0.99 (1.71)
	4-ft R-10 exterior, concrete	1.15 (1.99)
	8-ft R-10 exterior, concrete	0.75 (1.30)
	8-ft R-15 exterior, concrete	0.63 (1.09)
	8-ft R-20 exterior, concrete	0.56(0.97)
	8-ft R-10 interior, concrete	0.78 (1.35)
	R-0, wood frame	1.30 (2.25)
	R-11, wood frame	0.88 (1.52)
	R-19, wood frame	0.79 (1.37)
	R-30, wood frame	0.66 (1.14)
4 ft (shallow basement)	R-0 (uninsulated), concrete	1.61 (2.78)
	R-5 exterior, concrete	0.89 (1.54)
	R-10 exterior, concrete	0.73 (1.26)
	R-15 exterior, concrete	0.66 (1.14)
	R-20 exterior, concrete	0.65 (1.12)
	R-10 interior, concrete	0.79 (1.37)
	R-0, wood frame	1.10 (1.90)
	R-11, wood frame	0.80 (1.38)
	R-19, wood frame	0.74 (1.28)

*Source: Y.J.Huang, L.S.Shen, J.C.Bull and L.F.Goldberg, "Whole-House Simulation of Foundation Heat Flows Using the DOE-2.1C Program," ASHRAE Trans. 94 (2), 1988, updated by Y.J. Huang, private communication.



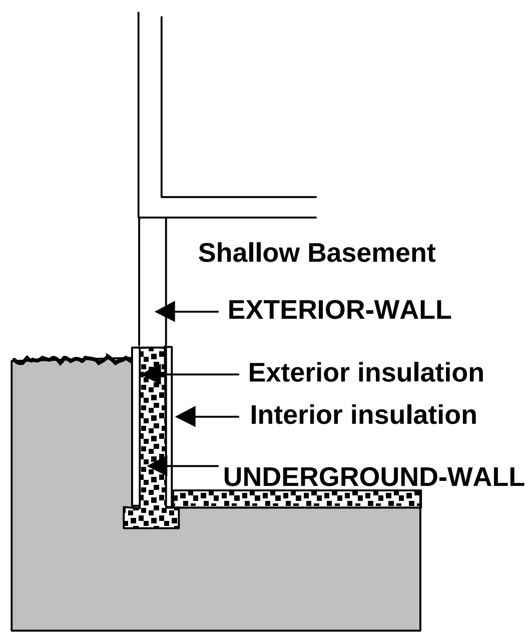
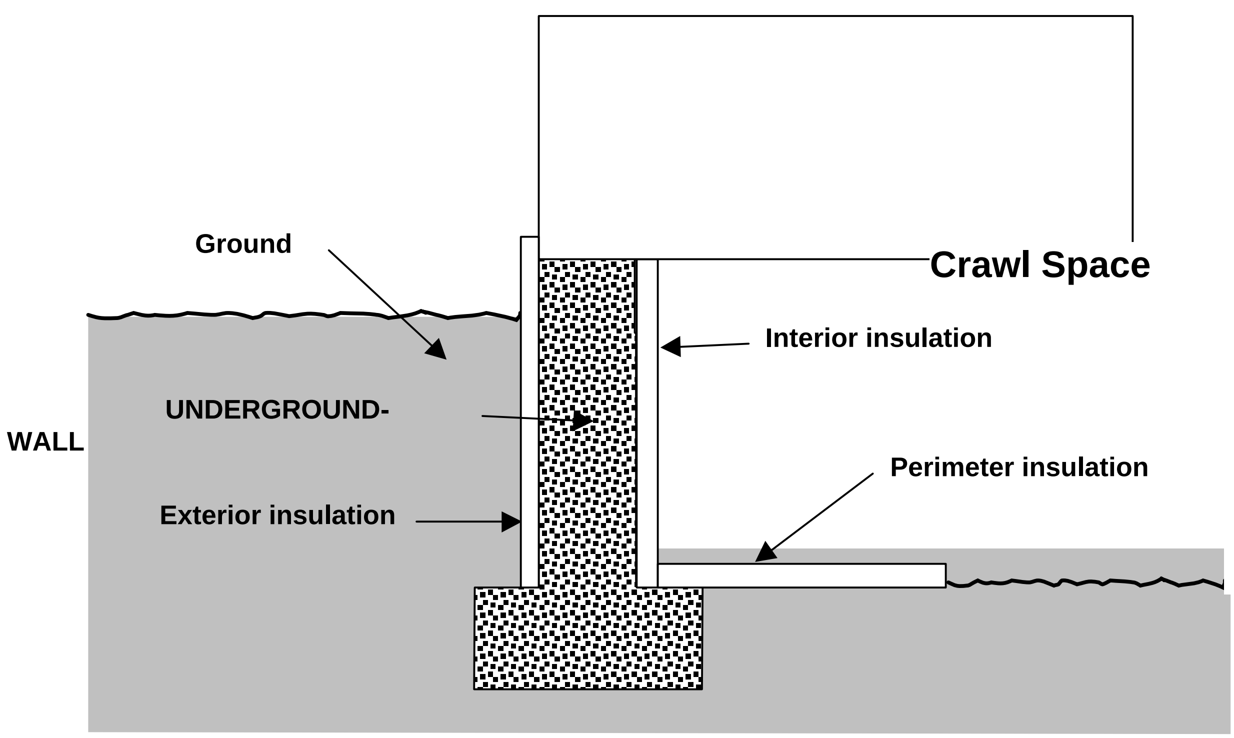


Table 3: Perimeter Conduction Factors for Crawl Space Walls*

Crawl Space Wall		
Wall Height	Construction (see sketch for location of insulation)	PERIM-CONDUCT Btu/hr-F-ft (W/m-K)
2 ft	R-0 (uninsulated), concrete	1.29 (2.23)
	R-5 exterior, concrete	0.93 (1.61)
	R-10 exterior, concrete	0.87 (1.95)
	R-5 interior, concrete	0.97 (1.50)
	R-10 interior, concrete	0.91 (1.57)
	R-5 interior; R-5 4-ft perimeter, concrete	0.73 (1.26)
	R-10 interior; R-10 4-ft perimeter, concrete	0.68 (1.18)
	R-0, wood frame	1.00 (1.73)
	R-11, wood frame	0.88 (1.52)
	R-19, wood frame	0.86 (1.49)
4 ft	R-0 (uninsulated), concrete	1.28 (2.21)
	R-5 exterior, concrete	0.71 (1.23)
	R-10 exterior, concrete	0.59 (1.02)
	R-15 exterior, concrete	0.54 (0.93)
	R-20 exterior, concrete	0.50 (0.86)
	R-5 interior; R-5 4-ft perimeter, concrete	0.64 (1.11)
	R-10 interior; R-10 4-ft perimeter, concrete	0.58 (1.00)
	R-0, wood frame	0.83 (1.44)
	R-11, wood frame	0.59 (1.02)
	R-19, wood frame	0.55 (0.95)

*Source: Y.J.Huang, L.S.Shen, J.C.Bull and L.F.Goldberg, "Whole-House Simulation of Foundation Heat Flows Using the DOE-2.1C Program," ASHRAE Trans. 94 (2), 1988, updated by Y.J. Huang, private communication.



Summary Comparison of Features

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Public/Proprietary	Public Domain	Proprietary	Proprietary	Proprietary	Proprietary
Simulation Method	8760 hours	8760 hours	8760 hours	48 dys (4 dys/mo	8760 hours
Loads Methodology	Cstm Wtg Factor	Cstm Wtg Factor	Cstm Wtg Factor	Std Wtg Factor	Std Wtg Factor
Max # of Zones	512	512	256	1000	1200
Front End Type	text / command	Windows	Windows	Windows	Windows/DOS
On-screen help	none	extensive	substantial	substantial	substantial
User-Selectable Hourly Outpu	●	●	●	limited	limited
Graphic Results Summary		●	●		●
"3-D" Building Drawing		●	●		
Accepts CAD input files		●	●		
Materials/Assemblies Library	●	●	●	●	●
Schedules Library	●	●	●	●	●
Graphic Schedule Input		●	●		●
Bldgs/Prototype Library		●		●	
Detailed Shading	●	●	●	●	●
Automatic Equip Sizing	●	●	●	●	●
Human Comfort Prediction					
Expression Inputs	●	●			
Multiple schemes / parametric	●	●	●	●	
# Terminal Systems Types	28	28	28	23	21
# Primary Equipment Types	27	27	24	24	22
Runtime (40 zones, PentiumII)	1.0 min	1.0 min	1.3 min	7 min	6 min
Approximate Cost	freeware	freeware	$800	$1995 + $413/yr	$1195 + $240/yr
Documentation	extensive	extensive	extensive	moderate	limited
Telephone Help	available	available	available	available	available
Hardware Recommendations	Pentium 32 MB	Pentium 32 MB	Pentium 32 MB	Pentium 32 MB	Pentium 32 MB

- *available features*

see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Comparison of LOADS Modeling Capabilities

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Weather data					
Number of weather data days used	365	365	365	12/365	365
Statistical weather summaries available	●	●	●		limited
User-processing of custom weather data	●	●	●		
Calculation Time Step					
1-hour in LOADS	●	●	●	●	●
15 min or 30 min kW reporting	●	●			
Spaces and Zones					
Max # of Spaces / Zones	512	512	512	1000	1200
Spaces used as components of HVAC zones	①	①		●	●
Spaces/Zones named or numbered?	names	names	names	names	names
Floor and/or Space multipliers	●	●	●	●	●
Shading					
Overhangs	●	●	●	●	●
Fins	●	●	●	●	●
Setbacks (I.e., "Reveals")	●	●	●	●	●
Detached (e.g., adjacent building)	●	●	●	●	
Self-shading	●	●	●		
Shade transmittance schedulable	●	●	●	●	
Operable interior/exterior shading	●	●	●	●	●
Glazing Systems Input Methods					
Simple shading coefficient & conductance	●	●	●	●	●
Glazing library	●	●	●		
User-definable layer-by-layer specification	●	●			
Lighting Systems Input Methods					
Simple lighting power and/or density	●	●	●	●	●
Luminaire characteristics and Count	●	●			
Desired illuminance (program calc's lighting power	●	●			
Max Number of Lighting & Equipment Loads per Zon	5	5	1	1	1
Daylighting Levels Predicted on Request	●	●	●		
Natural Ventilation	limited	limited	limited		

① *anticipated in 2002*

see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Comparison of Air-Side SYSTEM Modeling Capabilities

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Air-Side SYSTEMS Types					
Single Supply Duct Types					
Packaged single-zone system	●	●	●	●	●
Single-zone fan system w optional sub-zone rehea	●	●	●	●	●
Constant volume reheat fan system	●	●	●	●	●
Single-zone inducion fan system	●	●	●	●	●
Variable volume (VAV) fan system, optional rehea	●	●	●	●	●
Fan-powered VAV (powered induction unit) systen	●	●	●	●	●
Packaged variable volume system	●	●	●	●	●
Ceiling bypass variable volume system	●	●	●	●	●
Packaged variable volume / variable temperature	●	●	●	●	●
Packaged total gas solid desiccant system	●	●			
Evaporative cooling system	●	●	●	●	
Air Mixing Systems					
Dual duct system	●	●	●	●	●
Dual fan dual duct system	●	●		●	●
Multizone system	●	●	●	●	●
Packaged multizone system	●	●	●	●	●
Terminal Unit Systems					
Packaged terminal air conditioner	●	●	●	●	●
Unitary hydronic ("California") heat pump system	●	●	●	●	●
Two-pipe fan coil system	●	●	●	●	●
Four-pipe fan coil system	●	●	●	●	●
Two-pipe induction system	●	●	●	●	●
Four-pipe induction system	●	●	●	●	●
Ground-source heat pump system	●	●	●		
Gas engine-driven heat pump system	●	●	●	●	
Residential Systems					
Packaged rooftop system	●	●	●	●	●
Split system	●	●	●	●	●
Variable volume / variable temperature system	●	●	●	●	●
Heating Only Systems					
Heating and ventilating system	●	●	●	●	●
Unit heater	●	●	●	●	●

see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Comparison of Air-Side SYSTEM Options

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Air-Side SYSTEMS Options					
Coil Sizing based on:					
Coincident (building block) load	●	●	①	●	●
Non-coincident (sum of each zone) load	●	●	①	●	●
User-input	●	●	●	●	●
Thermostat Action Options					
Two-position	●	●	●	●	●
Proportional	●	●	●	●	●
Reverse-acting	●	●	●	●	●
Automatic start-up cycles	●	●	●	●	●
Coil Control Options					
Constant temperature	●	●	●	●	●
Reset by OSA	●	●	●	●	●
Reset by zone demand	●	●	●	●	●
User scheduled	●	●	●		
Fan Control Options					
Constant volume	●	●	●	●	●
Cycling	●	●	●	●	●
Two-speed	●	●	●	●	●
Inlet vane	●	●	●	●	●
Discharge dampers	●	●	●	●	●
Variable speed drives	●	●	●	●	●
User-definable curve	●	●	●	●	●
Air-Side Economizer & Ventilation Options					
Dry-bulb economizer	●	●	●	●	●
Enthalpy economizer	●	●	●	●	●
Fixed volume VAV control	●	●	●		●
Schedulable OSA quantities	●	●	●		●
Duct losses					
Direct, plenum, and ducted return paths	●	●	●	●	●
CFM loss reduces air to zone	●	●	●		●
Thermal & air losses affect surrounding zone tem	●	●			

① *block loads only for single fan system buildings*
see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Comparison of Water-Side PLANT Equipment Modeling Capabilities

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Water-Side PLANT Equipment Types					
Heating					
Electric HW or steam boiler	●	●	●	●	●
Fuel HW or steam boiler	●	●	●	●	●
Cooling					
1-Stage & 2-stage HW or steam absorption chiller	●	●	●	●	●
Direct-fired 2-stage absorption chiller	●	●	●	●	●
Open/hermetic centrifugal chiller (water/air-cooled	●	●	●	●	●
Open/hermetic reciprocating (water/air-cooled)	●	●	●	●	●
Rotary screw chiller (water/air-cooled)	●	●	●	●	●
Double bundle chiller	●	●	●	●	
Engine-driven chiller	●	●	●	●	●
Heat Rejection					
Open cross-flow or counter-flow tower	●	●	●	●	●
Open cross-flow or counter-flow tower with HX	●	●		●	●
Ground loop	●	●			
Scheduled temperature (e.g., lake, aquifer)	●	●			●
Evaproative precooling for DX systems	●	●	●	●	●
Thermal Storage					
Hot water storage	●	●	●	●	
Chilled water storage	●	●	●	●	●
Ice or eutectic thermal storage	●	●	●	●	●
Electric Generating Equipment					
Diesel engine	●	●	●	●	
Steam or gas turbine	●	●	●	●	
Water-Side Economizer					
Condenser water coils for DX systems	●	●	●	●	
"Parallel" plate&frame or strainer cycle	①	①	●	●	●
"Series" plate&frame	①	①			
Other					
purchased steam or chilled water	●	●	●		●

① *anticipated in 2002*
see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Comparison of Water-Side PLANT Options

FEATURE	DOE2.2	eQUEST	VisualDOE (DOE2.1E)	TRANE TRACE	CARRIER HAP
Water-Side PLANT Equipment Options					
Plant Equipment Sizing based on:					
User-defined design day weather	●	●		●	●
Annual weather file data	●	●	●	●	
Heating and Cooling Equip Control Options					
mixed equipment types	●	●	●	●	●
lead-lag equipment control	●	●	●	●	●
seasonal equipment control	●	●	●	●	●
time-of-day equipment control	●	●	●	●	●
preferential equipment loading	●	●	●		
Cooling Tower Control Options					
Fixed leaving water temperature	●	●	●	●	●
Wet-bulb reset	●	●	●	●	●
One-speed fans	●	●	●	●	●
Two-speed fans	●	●	●	●	●
Variable-speed fans	●	●	●	●	●

see also, articles by Henry Amistadi of Scientific Computing, in Engineered Systems Vol 10 #8 (Oct 1993) and Vol 13 #2 (Feb 1995)

Schedule GS-2
GENERAL SERVICE - DEMAND

APPLICABILITY

Applicable to single- and three-phase service including lighting and power, except that the customer whose monthly Maximum Demand, in the opinion of the Company, is expected to exceed 500 kW or has exceeded 500 kW for any three months during the preceding 12 months is ineligible for service under this schedule. Effective with the date of ineligibility of any customer served under this schedule, the customer's account shall be transferred to Schedule TOU-8. Further, any customer served under this schedule whose monthly Maximum Demand has registered 20 kW or less for 12 consecutive months is eligible for service under another applicable rate schedule. However, a Schedule GS-2 customer who makes a permanent change in operating conditions that Edison in its sole opinion anticipates will reduce the customer's demand to 20 kW or less may transfer to another applicable rate schedule before completing 12 consecutive months at 20 kW or less. Such customer shall be required to sign the Permanent Change in Operating Conditions Declaration, Form No. 14-548. This schedule is subject to meter availability.

TERRITORY

Within the entire territory served.

RATES

	Per Meter Per Month Summer	Per Meter Per Month Winter
Customer Charge	$60.30	$60.30
Demand Charge (to be added to Customer Charge):		
Facilities Related Component:		
All kW of Billing Demand, except that the Billing Demand shall not be less than the levels set forth in Special Condition No. 3 below, per kW	$5.40	$5.40
Time Related Component (to be added to the Facilities Related Component):		
All kW of Billing Demand, per kW	$7.75	$0.00

	Per Meter Per Month
Energy Charge (to be added to Demand Charge):	
For the first 300 kWh per kW of Maximum Demand, per kWh	$0.07692
All excess kWh, per kWh	$0.04391

The above charges used for customer billing are determined using the components shown in the Rate Components Section following the Special Conditions Section.

(Continued)

GENERAL SERVICE - DEMAND
(Continued)

SPECIAL CONDITIONS

1. Summer and Winter Seasons are defined as follows:

   The summer season shall commence at 12:00 a.m. on the first Sunday in June and continue until 12:00 a.m. of the first Sunday in October of each year. The winter season shall commence at 12:00 a.m. on the first Sunday in October of each year and continue until 12:00 a.m. of the first Sunday in June of the following year. A pro rata computation will be made for seasonal billing purposes.

2. Voltage: Service will be supplied at one standard voltage.

3. Billing Demand: The Billing Demand shall be the kilowatts of Maximum Demand, determined to the nearest kW. The Demand Charge shall include the following billing components. The Time Related Component shall be for the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period. The Facilities Related Component shall be for the greater of the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period or 50% of the highest Maximum Demand established in the preceding eleven months (Ratcheted Demand). However, when the Utility determines the Customer's meter will record little or no energy use for extended periods of time or when the Customer's meter has not recorded a Maximum Demand in the preceding eleven months, the Facilities Related Component of the Demand Charge may be established at 50 percent of the Customer's connected load.

4. Maximum Demand: The maximum demand in any month shall be the measured maximum average kilowatt input, indicated or recorded by instruments to be supplied by the Company, during any 15-minute metered interval in the month, but, where applicable, shall not be less than the diversified resistance welder load computed in accordance with the section designated Welder Service in Rule No. 2. Where the demand is intermittent or subject to violent fluctuations, a 5-minute interval may be used.

5. Single-Phase Service: Where the Company provides single-phase service, the billing will be reduced by $2.40 per month.

6. Excess Transformer Capacity: Excess Transformer Capacity is the amount of transformer capacity requested by a customer in excess of that which the Company would normally install to serve the customer's Maximum Demand. Excess Transformer Capacity shall be billed at $1.00 per kVA per month.

(Continued)

SPECIAL CONDITIONS (Continued)

7. Voltage Discount: The monthly Facilities Related Demand Charge will be reduced by 23.3% for service delivered and metered at voltages of 2 kV through 50 kV and by 71.1% for service delivered and metered at voltages over 50 kV. The discount applied to Energy Charges is calculated by taking the Base Rate Energy Charge in effect on June 10, 1996 of $0.02307 per kWh and multiplying by 3.2% for service delivered and metered at voltages of 2 kV through 50 kV, and by 14.8% for service delivered and metered at voltages over 50 kV.

8. Power Factor Adjustment: When the Maximum Demand has exceeded 200 kW for three consecutive months, kilovar metering will be installed as soon as practical, and, thereafter, until the Maximum Demand has been less than 150 kW for twelve consecutive months, the billing will be adjusted each month for power factor.

   a. Adjustment Rate:

      (1) For service delivered and metered at voltages greater than 50 kV, including Cogeneration and Small Power Production customers, the billing will be increased by $0.18 per kilovar of maximum reactive demand imposed on the Company.

      (2) For service delivered and metered at voltages of 50 kV or less, including Cogeneration and Small Power Production customers, the billing will be increased by $0.23 per kilovar of maximum reactive demand imposed on the Company.

   b. Determining the Reactive Demand:

      (1) Service delivered and metered at voltages of 4 kV or greater and for all Cogeneration and Small Power Production customers:

      The maximum reactive demand shall be the highest measured maximum average kilovar demand indicated or recorded by metering to be supplied by the Company during any 15-minute metered interval in the month. The kilovars shall be determined to the nearest unit. A device will be installed on each kilovar meter to prevent reverse operation of the meter.

(Continued)

SPECIAL CONDITIONS (Continued)

8. Power Factor Adjustment: (Continued)

b. Determining the Reactive Demand: (Continued)

(2) Service delivered and metered at voltages Less than 4 kV, except for Cogeneration and Small Power Production customers:

The kilovars of reactive demand shall be calculated by multiplying the kilowatts of measured maximum demand by the ratio of the kilovar-hours to the kilowatthours. Demands in kilowatts and kilovars shall be determined to the nearest unit. A ratchet device will be installed on the kilovar-hour meter to prevent its reverse operation on leading power factors.

9. Temporary Discontinuance of Service: Where the use of energy is seasonal or intermittent, no adjustments will be made for a temporary discontinuance of service. Any customer resuming service within twelve months after such service was discontinued will be required to pay all charges which would have been billed if service had not been discontinued.

10. Customer-Owned Electrical Generation Equipment: Where customer-owned electrical generation equipment is used to meet a part or all of the customer's electrical requirements, service shall be provided concurrently under the terms and conditions of Schedule S and this schedule. Parallel operation of such generation equipment with the Company's electrical system is permitted.

The use of customer-owned electrical generation equipment for auxiliary, emergency, or standby purposes (auxiliary/emergency generation equipment) is permitted under this schedule. However, auxiliary/emergency generation equipment may be used by the customer to serve the customer's load only during a period when the Company's service is unavailable and only when such load is isolated from the service of the Company. Auxiliary/emergency generation equipment may not be operated in parallel with the Company's electrical system, except that upon approval by the Company, momentary parallel operation may be permitted to allow the customer to test the auxiliary/emergency generation equipment. A Momentary Parallel Generation Contract is required for this type of service.

(Continued)

SPECIAL CONDITIONS (Continued)

11. CARE Discount: Customers who meet the definition of a group living facility as defined in the Preliminary Statement, Part O, Section 3.g., may qualify for a 15% discount off of their bill prior to application of the PUC Reimbursement Fee and any applicable user fees, taxes, and late payment charges. Customers eligible for the CARE Discount will not be required to pay the CARE Surcharge. as set forth in Preliminary Statement, Part O, Section 5. An Application and Eligibility Declaration (Form No. 14-526), as defined in the Preliminary Statement, Part O, Section 3.h., is required for service under this special condition. Eligible customers shall be billed on this schedule commencing no later than one billing period after receipt and approval of the customer's application by the Company. Customers may be rebilled on the applicable rate schedule for periods in which they do not meet the eligibility requirements for the CARE discount as defined in the Preliminary Statement, Part O, Section 3.g. and Section 3.h.

(Continued)

(To be inserted by utility)
Advice 1245-E-B
Decision 97-08-056
ce30-12.doc

Issued by
John Fielder
Vice President

(To be inserted by Cal. PUC)
Date Filed Dec 23, 1997
Effective Jan 01, 1998
Resolution E-3510

SPECIAL CONDITIONS (Continued)

12. Bill Limiter: For Customers transferred to Schedule GS-2 for the first time due to becoming ineligible for service under Schedule GS-1, the customer's total monthly bill for charges under Schedule GS-2, excluding the Public Utilities Reimbursement Fee, California Alternate Rates for Energy Surcharge, as set forth in Preliminary Statement, Part O, Section 5, Power Factor Adjustment, and Excess Transformer Capacity charge, shall for the first three years following transfer be limited to no more than the customer's comparable monthly bill for charges under Schedule GS-1 (excluding the 10% rate reduction from June 10, 1996, rates provided under AB 1890) for the same period plus the following percentages:

Period	Percentages
1st Year	10
2nd Year	20
3rd Year	30

The Bill Limiter shall not apply commencing in the fourth year after the customer has transferred to Schedule GS-2.

(Continued)

SPECIAL CONDITIONS (Continued)

13. Billing: A Customer's bill is first calculated according to the total rates and conditions above. The following adjustments are made depending on the option applicable to the customer.

    a. Bundled Service Customers receive supply and delivery services solely from Edison. The Customer's bill is based on the total rates set forth above. The Power Exchange (supply) component is equal to the Averaged Power Exchange (PX) Energy Charge as set forth in Schedule PX.

    b. Direct Access Customers purchase energy from an Energy Service Provider and continue receiving delivery services from Edison. The Averaged PX Energy Charge is determined as specified for a Bundled Service Customer. The customer's bill will be calculated as for a Bundled Service Customer, but the Customer will receive a credit for the Averaged PX Energy Charge. If the Averaged PX Energy Charge is greater than the amount of the Bundled Service bill, the minimum bill for a Direct Access Customer is zero.

    c. Hourly PX Pricing Option Customers receive supply and delivery services solely from Edison. A Customer taking Hourly PX Pricing Option service must have an interval meter installed at its premise to record hourly usage, since PX Energy Costs change hourly. If such metering is not currently installed, it shall be installed at the Customer's expense before Hourly PX Pricing can be provided. Edison's charges for such metering are determined as set forth in Rule 2. The bill for a Hourly PX Pricing Option Customer is determined by calculating the bill as if it were for a Bundled Service Customer, then crediting the bill by the amount of the Averaged PX Energy Charge, as determined for Bundled Service and Direct Access Customers, then adding the hourly PX Energy Cost amount which is determined by multiplying the hourly energy used in the billing period by the hourly PX Energy Cost determined as set forth in Section 1 of Schedule PX, and the appropriate hourly Line Loss Adjustment Factors as set forth in Section 3 of Schedule PX, and the Uncollectibles expense factor of 1.00313.

14. Generation Charge: The generation charge is calculated based on the total rate less the sum of: Distribution, Transmission, Public Purpose Programs, Nuclear Decommissioning, and Fixed Transition Amount (where applicable) charges, the Transmission Revenue Balancing Account Adjustment (TRBAA), and the Public Utilities Commission Reimbursement Fee. The Competition Transition Charge (CTC) is calculated residually by subtracting the Averaged PX Energy Charge calculated as set forth in Schedule PX from the generation charge (See Rate Components Table).

15. Negotiating of CTC Payment Method: Nothing in this rate schedule prohibits a marketer or broker from negotiating with Customers the method by which their Customer will pay the CTC.

(Continued)

Schedule GS-2
GENERAL SERVICE - DEMAND
(Continued)

RATE COMPONENTS

Rate Components Table

Rate Schedule Summary	Trans[1]	Distrbtn[2]	Gen[3,4]	NDC[5]	PPPC[6]	TRBAA[7]	PUCRF[8]	Total
Energy Charge - $/kWh								
1st Block	0.00000	0.00175	0.07021	0.00165	0.00328	(0.00009)	0.00012	0.07692
2nd Block	0.00000	0.00175	0.03720	0.00165	0.00328	(0.00009)	0.00012	0.04391
Customer Charge - $/month	0.00	48.06	12.24					60.30
Facilities Related								
Demand Charge - $/kW	0.09	3.08	2.23					5.40
Time Related								
Demand Charge - $/kW								
Summer	2.27	5.48	0.00					7.75
Winter	0.00	0.00	0.00					0.00
Single Phase Service - $/month	0.00	(2.40)	0.00					(2.40)
Excess Transformer								
Capacity - $/kVA/month	0.00	1.00	0.00					1.00
Voltage Discount, Demand - %								
From 2 kV to 50 kV		100.00						100.00*
Above 50 kV		100.00						100.00*
Voltage Discount, Energy - %								
From 2 kV to 50 kV	0.00	20.00	80.00					100.00*
Above 50 kV	0.00	20.00	80.00					100.00*
Power Factor Adjustment - $/kVA								
Greater than 50 kV	0.00	0.18	0.00					0.18
50 kV or less	0.00	0.23	0.00					0.23
California Alternate Rates for								
Energy Discount - %					100.00			100.00*
Average Rate Limiter/Bill Limiter - %	2.97	20.98	76.05					100.00*

*The "total" shown above represents 100% of the discount percentage as set forth in the specific rate schedule.

1 Trans = Transmission

2 Distrbtn = Distribution

3 Gen = Generation

4 Competition Transition Charge (CTC) = Total Generation charge minus Averaged Power Exchange (PX) Energy Charge as set forth in Schedule PX.

5 NDC = Nuclear Decommissioning Charge

6 PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge and Discount where applicable.)

7 TRBAA = Transmission Revenue Balancing Account Adjustment (FERC approved).

8 PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.

Schedule TOU-8

TIME-OF-USE
GENERAL SERVICE - LARGE

APPLICABILITY

Applicable to general service including lighting and power, except agricultural water pumping accounts as described in Special Condition No. 14. This schedule is applicable to and mandatory for all customers whose monthly maximum demand, in the opinion of the Company, is expected to exceed 500 kW or has exceeded 500 kW in any three months during the preceding 12 months, except that customers served on this schedule may elect service under any applicable schedules optional hereto. Except for interruptible service customers, any existing customer on this schedule whose monthly maximum demand has registered 500 kW or less for 12 consecutive months is ineligible for service under this schedule (See Special Condition No. 11). Service under this schedule is subject to meter availability.

TERRITORY

Within the entire territory served.

RATES

The following rates are set forth for service metered and delivered at secondary, primary, and subtransmission voltages.

SERVICE METERED AND DELIVERED AT VOLTAGES BELOW 2 kV

	Per Meter Per Month Summer*	Per Meter Per Month Winter
Customer Charge	$298.65	$298.65
Demand Charge (to be added to Customer Charge):		
Facilities Related Component:		
All kW of Billing Demand, except that the Billing Demand shall not be less than the levels set forth in Special Condition No. 4 below, per kW	$ 6.40	$ 6.40
Time Related Component (to be added to Facilities Related Component):		
All kW of On-Peak Billing Demand, per kW	$ 17.55	N/A
Plus all kW of Mid-Peak Billing Demand, per kW	$ 2.80	$ 0.00
Plus all kW of Off-Peak Billing Demand, per kW	$ 0.00	$ 0.00

(Continued)

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATES (Continued)

SERVICE METERED AND DELIVERED AT VOLTAGES BELOW 2 kV (Continued)

	Per Meter Per Month Summer*	Winter
Energy Charge (to be added to Demand Charge):		
All On-Peak kWh, per kWh	$0.09485	N/A
Plus all Mid-Peak kWh, per kWh	$0.05989	$0.07336
Plus all Off-Peak kWh, per kWh	$0.03810	$0.03925

* During Summer months a Peak Period Rate Limiter of $1.09530 per kilowatthour and Average Rate Limiter of $0.30844 per kilowatthour will apply (See Special Condition Nos. 12 and 13).

The above charges used for customer billing are determined using the components shown in the Rate Components Section following the Special Conditions Section.

SERVICE METERED AND DELIVERED AT VOLTAGES FROM 2 kV THROUGH 50 KV

	Per Meter Per Month Summer*	Winter
Customer Charge	$299.00	$299.00
Demand Charge (to be added to Customer Charge):		
Facilities Related Component:		
All kW of Billing Demand, except that the Billing Demand shall not be less than the levels set forth in the Special Condition No. 4 below, per kW	$ 6.60	$ 6.60
Time Related Component (to be added to Facilities Related Component):		
All kW of On-Peak Billing Demand, per kW	$ 17.95	N/A
Plus all kW of Mid-Peak Billing Demand, per kW	$ 2.70	$ 0.00
Plus all kW of Off-Peak Billing Demand, per kW	$ 0.00	$ 0.00

(Continued)

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATES (Continued)

SERVICE METERED AND DELIVERED AT VOLTAGES FROM 2 kV THROUGH 50 KV
(Continued)

	Per Meter Per Month Summer*	Winter
Energy Charge (to be added to Demand Charge):		
All On-Peak kWh, per kWh	$0.09422	N/A
Plus all Mid-Peak kWh, per kWh	$0.05847	$0.07071
Plus all Off-Peak kWh, per kWh	$0.03758	$0.03874

* During Summer months a Peak Period Rate Limiter of $1.09315 per kilowatthour and Average Rate Limiter of $0.30844 per kilowatthour will apply (See Special Condition Nos. 12 and 13).

The above charges used for customer billing are determined using the components shown in the Rate Components Section following the Special Conditions Section.

SERVICE METERED AND DELIVERED AT VOLTAGES ABOVE 50 KV

	Per Meter Per Month Summer*	Winter
Customer Charge	$349.45	$349.45
Demand Charge (to be added to Customer Charge):		
Facilities Related Component:		
All kW of Billing Demand, except that the Billing Demand shall not be less than the levels set forth in Special Condition No. 4 below, per kW	$ 0.65	$ 0.65
Time Related Component (to be added to Facilities Related Component):		
All kW of On-Peak Billing Demand, per kW	$ 16.15	N/A
Plus all kW of Mid-Peak Billing Demand, per kW	$ 2.45	$ 0.00
Plus all kW of Off-Peak Billing Demand, per kW	$ 0.00	$ 0.00

(Continued)

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATES (Continued)

SERVICE METERED AND DELIVERED AT VOLTAGES ABOVE 50 KV (Continued)

	Per Meter Per Month Summer*	Winter
Energy Charge (to be added to Demand Charge):		
All On-Peak kWh, per kWh	$0.07397	N/A
Plus all Mid-Peak kWh, per kWh	$0.05053	$0.06093
Plus all Off-Peak kWh, per kWh	$0.03755	$0.03872

* During Summer months a Peak Period Rate Limiter of $0.92250 per kilowatthour will apply (See Special Condition No. 12).

The above charges used for customer billing are determined using the components shown in the Rate Components Section following the Special Conditions Section.

SPECIAL CONDITIONS

1. Time periods are defined as follows:

On-Peak:	Noon to 6:00 p.m. summer weekdays except holidays
Mid-Peak:	8:00 a.m. to Noon and 6:00 p.m. to 11:00 p.m. summer weekdays except holidays 8:00 a.m. to 9:00 p.m. winter weekdays except holidays
Off-Peak:	All other hours.

Holidays are New Year's Day (January 1), Washington's Birthday (third Monday in February), Memorial Day (last Monday in May), Independence Day (July 4), Labor Day (first Monday in September), Veterans Day (November 11), Thanksgiving Day (fourth Thursday in November), and Christmas (December 25).

See Special Condition No. 15 for Time Periods applicable to Qualifying Facilities.

When any holiday listed above falls on Sunday, the following Monday will be recognized as an off-peak period. No change will be made for holidays falling on Saturday.

The summer season shall commence at 12:00 a.m. on the first Sunday in June and continue until 12:00 a.m. of the first Sunday in October of each year. The winter season shall commence at 12:00 a.m. on the first Sunday in October and continue until 12:00 a.m. of the first Sunday in June of the following year.

(Continued)

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

SPECIAL CONDITIONS (Continued)

2. Voltage: Service will be supplied at one standard voltage.

3. Maximum Demand: Maximum demands shall be established for the On-Peak, Mid-Peak, and Off-Peak periods. The maximum demand for each period shall be the measured maximum average kilowatt input indicated or recorded by instruments to be supplied by the Company, during any 15-minute metered interval, but, where applicable, not less than the diversified resistance welder load computed in accordance with the section designated Welder Service in Rule No. 2. Where the demand is intermittent or subject to violent fluctuations, a 5-minute interval may be used.

4. Billing Demand: The Billing Demand shall be the kilowatts of Maximum Demand, determined to the nearest kW. The Demand Charge shall include the following billing components. The Time Related Component shall be for the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period for each of the On-Peak, Mid-Peak, and Off-Peak Time Periods. The Facilities Related Component shall be for the greater of the kilowatts of Maximum Demand recorded during (or established for) the monthly billing period or 50% of the highest Maximum Demand established in the preceding eleven months (Ratcheted Demand). However, when the Utility determines the Customer's meter will record little or no energy use for extended periods of time or when the Customer's meter has not recorded a Maximum Demand in the preceding eleven months, the Facilities Related Component of the Demand Charge may be established at 50 percent of the Customer's connected load. Separate Demand Charge(s) for the On-Peak, Mid-Peak, and Off-Peak Time Periods shall be established for each monthly billing period. The Demand Charge for each time period shall be based on the Maximum Demand for that time period occurring during the respective monthly billing period.

5. Excess Transformer Capacity: Excess Transformer Capacity is the amount of transformer capacity requested by a customer, or required by the Company, in excess of that which the Company would normally install to serve the customer's Maximum Demand. Excess Transformer Capacity shall be billed at $1.00 per kVA per month.

(Continued)

SPECIAL CONDITIONS (Continued)

6. Power Factor Adjustment:

a. Adjustment Rate:

(1) For service delivered and metered at voltages greater than 50 kV, including Cogeneration and Small Power Production Customers, the billing will be increased by $0.18 per kilovar of maximum reactive demand imposed on the Company.

(2) For service delivered and metered at voltages of 50 kV or less, including Cogeneration and Small Power Production Customers, the billing will be increased by $0.23 per kilovar of maximum reactive demand imposed on the Company.

b. Determining the Reactive Demand:

The maximum reactive demand shall be the highest measured maximum average kilovar demand indicated or recorded by metering to be supplied by the Company during any 15-minute metered interval in the month. The kilovars shall be determined to the nearest unit. A device will be installed on each kilovar meter to prevent reverse operation of the meter.

7. Temporary Discontinuance of Service: Where the use of energy is seasonal or intermittent, no adjustments will be made for a temporary discontinuance of service. Any customer prior to resuming service within twelve months after such service was discontinued will be required to pay all charges which would have been billed if service had not been discontinued.

(Continued)

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

SPECIAL CONDITIONS (Continued)

8. Supplemental Visual Demand Meter: Subject to availability, and upon written application by the customer, the Company will, within 180 days, supply and install a Company-owned supplemental visual demand meter. The customer shall provide the required space and associated wiring beyond the point of interconnection for such installation. Said supplemental visual demand meter shall be in parallel with the standard billing meter delineated in Special Condition 3 above. The readings measured or recorded by the supplemental visual demand meter are for customer information purposes only and shall not be used for billing purposes in lieu of meter readings established by the standard billing meter. If a meter having visual capability of displaying real time demand is installed by Edison as the standard billing meter, no additional metering will be installed pursuant to this Special Condition.

   One of the following types of supplemental visual demand meters will be provided in accordance with provisions above at no additional cost to the customer: Dial Wattmeter or Electronic Demand Monitor.

   If the customer desires a supplemental visual demand meter having features not available in any of the above listed meters, such as an electronic microprocessor-based meter, the Company will provide such a supplemental visual demand meter subject to a monthly charge, if the meter and its associated equipment have been approved for use by the Company. Upon receipt from the customer of a written application the Company will design the installation and will thereafter supply, install, and maintain the supplemental visual demand meter subject to all conditions stated in the first and last paragraph of this Special Condition. For purposes of computing the monthly charge, any such supplemental visual demand meter and associated equipment shall be treated as Added Facilities in accordance with Rule No. 2, Paragraph H, Section 1 and 2 of the tariff rules. Added investment for computing the monthly charge shall be reduced by the Company's estimated total installed cost at the customer location of the Electronic Demand Monitor offered otherwise herein at no additional cost.

   The Company shall have sole access for purposes of maintenance and repair to any supplemental visual demand meter installed pursuant to this Special Condition and shall provide all required maintenance and repair. Periodic routine maintenance shall be provided at no additional cost to the customer. Such routine maintenance includes making periodic adjustments, lubricating moving parts and making minor repairs. Non-routine maintenance and major repairs or replacement shall be performed on an actual cost basis with the customer reimbursing the Company for such cost.

9. Contracts: An initial three-year facilities contract may be required where applicant requires new or added serving capacity exceeding 2,000 kVA.

(Continued)

SPECIAL CONDITIONS (Continued)

10. Customer-Owned Electrical Generation Equipment: Where customer-owned electrical generation equipment is used to meet a part or all of the customer's electrical requirements, service shall be provided concurrently under the terms and conditions of Schedule S and this schedule. Parallel operation of such generation equipment with the Company's electrical system is permitted.

    The use of customer-owned electrical generation equipment for auxiliary, emergency, or standby purposes (auxiliary/emergency generation equipment) is permitted under this schedule. However, auxiliary/emergency generation equipment may be used by the customer to serve the customer's load only during a period when the Company's service is unavailable and only when such load is isolated from the service of the Company. Auxiliary/emergency generation equipment may not be operated in parallel with the Company's electrical system, except that upon approval by the Company, momentary parallel operation may be permitted to allow the customer to test the auxiliary/emergency generation equipment. A Momentary Parallel Generation Contract is required for this type of service.

11. Removal From Schedule: Customers receiving service under this schedule whose monthly Maximum Demand has registered 500 kW or less for 12 consecutive months shall be changed to an applicable rate schedule effective with the date the customer became ineligible for service under this schedule. This Special Condition is not applicable to customers taking service under Schedule I-6.

12. Peak Period Rate Limiter: A firm service customer's total monthly bill under this schedule, excluding the Public Utilities Commission (PUC) Reimbursement Fee, California Alternate Rates for Energy (CARE) Surcharge, as set forth in Preliminary Statement, Part O, Section 5, Power Factor Adjustment, Excess Transformer Capacity charge, Non-Time Related Demand Charge, and customer charges, shall be reduced, if necessary, so that the average rate during the On-Peak Period in a summer month does not exceed the peak period rate limiter for the appropriate service voltage level shown on this schedule. This Special Condition is also applicable to firm service customers taking service under Schedule S. This Special Condition is not applicable to customers taking service under Schedule I-6.

13. Average Rate Limiter: For firm service customers with service metered and delivered at voltages 50 kV and below, the customer's total monthly bill under this schedule, excluding the PUC Reimbursement Fee, CARE Surcharge, as set forth in Preliminary Statement, Part O, Section 5, Power Factor Adjustment, Excess Transformer Capacity charge, and customer charges, shall be reduced, if necessary, so that the average rate during a summer month does not exceed the average rate limiter for the appropriate service voltage level shown on this schedule. This Special Condition is not applicable to customers taking service under Schedule I-6.

14. Agricultural Water Pumping Accounts: Large individual water agency and other large water pumping accounts with 70% or more of the water pumped used for agricultural purposes are not eligible for service under this schedule and must take service on an agricultural class rate schedule.

(Continued)

Schedule TOU-8
TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

SPECIAL CONDITIONS (Continued)

15. Qualifying Facilities Time Periods: Time Periods for power purchase payments to a cogeneration or small power production source which meets the criteria for a Qualifying Facility as defined under 18 CFR, Chapter 1, part 292, subpart B of the Federal Energy Regulatory Commission regulations and whose power purchase payments are based on the time-of-use periods set forth in this schedule, shall be as defined under Special Condition No. 1 herein, except that: 1) consistent with the effective dates listed in the table below, the summer season shall commence at 12:00 a.m. on June 1 and continue until 12:00 a.m. on October 1 of each year; 2) consistent with the effective dates listed in the table below, the winter season shall commence at 12:00 a.m. on October 1 of each year and continue until 12:00 a.m. on June 1 of the following year; 3) for the winter season a Super Off-Peak time period of midnight to 6:00 a.m., everyday, shall apply.

    The Summer and Winter Season modifications defined above shall become effective for each Qualifying Facility based on its date of Firm Operation (or initial operation for non-firm Qualifying Facilities) as shown on the table below. Qualifying Facilities that began operation after the end of the Summer Season will be considered to have begun operation in the next year.

Firm Operation	Effective June 1
1985 and prior years	1994
1986	1993
1987	1992
1988	1992
1989	1993
1990	1994
1991	1993
1992 and years beyond	1992

(Continued)

SPECIAL CONDITIONS (Continued)

16. Compensated Metering. This provision is applicable to service metered and delivered at voltages above 50 kV. Where customer/applicant requests and Edison agrees, Edison may install a transformer loss compensating device (Compensated Metering) acceptable to Edison in order to provide high voltage (over 50 kV) metered service. Where provided, this service will be considered as metered and delivered on Edison's side of the serving transformer. Edison shall rely on transformer loss data provided by the transformer manufacturer or transformer loss tests performed by Edison to calibrate the compensating device. Service under this provision is contingent upon customer/applicant's entering into an agreement which requires payment for the serving transformer and related substation equipment in accordance with Rule 2., Section H, Added Facilities, except where such transformer equipment is owned, operated, and maintained by the customer/applicant. Where the transformer equipment is owned, operated, and maintained by the customer/applicant, the customer/applicant is required to pay for the Compensated Metering and related equipment in accordance with Rule 2.H, Added Facilities, and shall also agree to provide Edison unrestricted access to the serving transformer, metering, and compensating equipment.

17. Economic Development Rate Discount: The economic development rate discount is applicable to new customers who agree to a written non-renewable contract and will locate new operations (new electric usage) within: Enterprise Zones designated by the State of California under the Enterprise Zone Act; Economic Incentive Areas designated by the State under the Employment and Economic Incentive Act; Recycling Market Development Zones designated by the California Integrated Waste Management Board under the Public Resource Code relating to solid waste; or federal military bases that are scheduled to be closed. Such new operations shall have loads that exceed 500 kW of monthly Maximum Demand. New customers locating on federal military bases scheduled for closure must declare their intention to continue as a customer of the utility after the base closure. Application will be limited to either a maximum of 50 qualified participants or a combined net load addition for all participants of 50 megawatts. The discount which is limited to a 3-year period, is 15 percent for the first 12 month period, 10 percent for the second 12 month period, and 5 percent for the third 12 month period. It shall be applied to the customer's total monthly bill excluding the PUC Reimbursement Fee, CARE Surcharge, as set forth in Preliminary Statement, Part O, Section 5, and any other applicable taxes and charges as specified in the Contract. For purposes of revenue accounting the discount will be deducted from the distribution component of the total rate.

(Continued)

SPECIAL CONDITIONS (Continued)

17. Economic Development Rate Discount: (Continued)

New electric usage does not represent kWh and kW that already exists within the State of California.

The Contract provides for a delay in the commencement of the three-year economic development rate discount for up to a 24 month period to provide time to establish operations within Enterprise Zones, Economic Incentive Areas, or federal military bases scheduled for closure.

This Special Condition is not applicable to governmental entities, to customers taking service under Schedule S, or existing customers for incremental increases in electric load at existing operations whether or not such operations are located within Enterprise Zones, Economic Incentive Areas, Recycling Market Development Zones, or federal military bases scheduled for closure.

This Special Condition is closed to new customers as of December 31, 1998 and will expire December 31, 2003.

18. Rate Eligibility Criteria for Energy Efficiency (RECEE)

The purpose of the RECEE is to determine a customer's continued eligibility for service under this schedule. The RECEE is applicable to customers currently receiving service under this schedule and who have implemented energy efficiency measures on or after June 5, 1994 which have reduced the customer's monthly Maximum Demand to 500 kW or less. The RECEE is a fixed level of demand, determined by the Utility, based on the customer's permanent demand reduction resulting from the implementation of energy efficiency measures. The RECEE demand is set forth in the Energy Efficiency Declaration, Form No.16-327.

The RECEE demand plus the customer's actual demand will be evaluated each billing period for purposes of determining the customer's continued eligibility for service under this schedule. If the RECEE demand plus the customer's actual demand equals 500 kW or less for 12 consecutive months, the customer is ineligible for service under this schedule and ineligible for application of the RECEE. The RECEE demand will not be used for purposes of calculating the customer's demand charge.

(Continued)

SPECIAL CONDITIONS (Continued)

19. Voltage Discount: For customers receiving service at 220 kV, the customer's total monthly bill for charges under this schedule, excluding the PUC Reimbursement Fee and CARE Surcharge as set forth in Preliminary Statement, Part O, Section 5, shall be reduced by 12.4 percent.

20. Billing: A Customer's bill is first calculated according to the total rates and conditions above. The following adjustments are made depending on the option applicable to the customer.

    a. Bundled Service Customers receive supply and delivery services solely from Edison. The Customer's bill is based on the total rates set forth above. The Power Exchange (supply) component is equal to the Averaged Power Exchange (PX) Energy Charge as set forth in Schedule PX.

    b. Direct Access Customers purchase energy from an Energy Service Provider and continue receiving delivery services from Edison. The Averaged PX Energy Charge is determined as specified for a Bundled Service Customer. The customer's bill will be calculated as for a Bundled Service Customer, but the Customer will receive a credit for the Averaged PX Energy Charge. If the Averaged PX Energy Charge is greater than the amount of the Bundled Service bill, the minimum bill for a Direct Access Customer is zero.

    c. Hourly PX Pricing Option Customers receive supply and delivery services solely from Edison. A Customer taking Hourly PX Pricing Option service must have an interval meter installed at its premise to record hourly usage, since PX Energy Costs change hourly. If such metering is not currently installed, it shall be installed at the customer's expense before Hourly PX Pricing can be provided. Edison's charges for such metering are determined as set forth in Rule 2. The bill for a Hourly PX Pricing Option Customer is determined by calculating the bill as if it were for a Bundled Service Customer, then crediting the bill by the amount of the Averaged PX Energy Charge, as determined for Bundled Service and Direct Access Customers, then adding the hourly PX Energy Cost amount which is determined by multiplying the hourly energy used in the billing period by the hourly PX Energy Cost determined as set forth in Section 1 of Schedule PX, and the appropriate hourly Line Loss Adjustment Factors as set forth in Section 3 of Schedule PX, and the Uncollectibles expense factor of 1.00313.

21. Generation Charge: The generation charge is calculated based on the total rate less the sum of: Distribution, Transmission, Public Purpose Programs, Nuclear Decommissioning, and Fixed Transition Amount (where applicable) charges, the Transmission Revenue Balancing Account Adjustment (TRBAA), and the Public Utilities Commission Reimbursement Fee. The Competition Transition Charge (CTC) is calculated residually by subtracting the Averaged PX Energy Charge calculated as set forth in Schedule PX from the generation charge (See Rate Components Table).

22. Negotiating of CTC Payment Method: Nothing in this rate schedule prohibits a marketer or broker from negotiating with Customers the method by which their Customer will pay the CTC.

(Continued)

Schedule TOU-8
TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATE COMPONENTS

Rate Components Table

Rate Schedule Summary		Trans[1]	Distrbtn[2]	Gen[3,4]	NDC[5]	PPPC[6]	TRBAA[7]	PUCRF[8]	Total
Below 2 kV									
Energy Charge - $/kWh									
Summer Season									
	On-Peak	0.00000	0.00063	0.08992	0.00139	0.00288	(0.00009)	0.00012	0.09485
	Mid-peak	0.00000	0.00063	0.05496	0.00139	0.00288	(0.00009)	0.00012	0.05989
	Off-Peak	0.00000	0.00063	0.03317	0.00139	0.00288	(0.00009)	0.00012	0.03810
Winter Season									
	On-Peak	NA	NA	NA	N/A	N/A	N/A	N/A	N/A
	Mid-peak	0.00000	0.00063	0.06843	0.00139	0.00288	(0.00009)	0.00012	0.07336
	Off-Peak	0.00000	0.00063	0.03432	0.00139	0.00288	(0.00009)	0.00012	0.03925
Customer Charge - $/month		0.00	174.67	123.98					298.65
Facilities Related									
Demand Charge - $/kW		0.13	3.61	2.66					6.40
Time Related									
Demand Charge - $/kW									
Summer									
	On-Peak	2.36	6.28	8.91					17.55
	Mid-Peak	0.20	0.54	2.06					2.80
	Off-Peak	0.00	0.00	0.00					0.00
Winter									
	On-Peak	N/A	N/A	N/A					N/A
	Mid-Peak	0.00	0.00	0.00					0.00
	Off-Peak	0.00	0.00	0.00					0.00

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[6] PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge and Discount where applicable.)
[7] TRBAA = Transmission Revenue Balancing Account Adjustment (FERC approved).
[8] PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.

(Continued)

Schedule TOU-8
TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATE COMPONENTS (Cont'd)

Rate Components Table

Rate Schedule Summary		Trans[1]	Distrbtn[2]	Gen[3,4]	NDC[5]	PPPC[6]	TRBAA[7]	PUCRF[8]	Total
From 2 kV to 50 kV									
Energy Charge - $/kWh									
Summer Season									
	On-Peak	0.00000	0.00054	0.08982	0.00121	0.00262	(0.00009)	0.00012	0.09422
	Mid-peak	0.00000	0.00054	0.05407	0.00121	0.00262	(0.00009)	0.00012	0.05847
	Off-Peak	0.00000	0.00054	0.03318	0.00121	0.00262	(0.00009)	0.00012	0.03758
Winter Season									
	On-Peak	NA	NA	NA	N/A	N/A	N/A	N/A	N/A
	Mid-peak	0.00000	0.00054	0.06631	0.00121	0.00262	(0.00009)	0.00012	0.07071
	Off-Peak	0.00000	0.00054	0.03434	0.00121	0.00262	(0.00009)	0.00012	0.03874
Customer Charge - $/month		0.00	174.89	124.11					299.00
Facilities Related									
Demand Charge - $/Kw		0.13	3.74	2.73					6.60
Time Related									
Demand Charge - $/kW									
Summer									
	On-Peak	2.46	6.55	8.94					17.95
	Mid-Peak	0.21	0.56	1.93					2.70
	Off-Peak	0.00	0.00	0.00					0.00
Winter									
	On-Peak	N/A	N/A	N/A					N/A
	Mid-Peak	0.00	0.00	0.00					0.00
	Off-Peak	0.00	0.00	0.00					0.00

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(Continued)

Schedule TOU-8
TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATE COMPONENTS (Cont'd)

Rate Components Table

Rate Schedule Summary		Trans[1]	Distrbtn[2]	Gen[3,4]	NDC[5]	PPPC[6]	TRBAA[7]	PUCRF[8]	Total
Above 50 kV									
Energy Charge - $/kWh									
Summer Season									
	On-Peak	0.00000	0.00018	0.07121	0.00070	0.00185	(0.00009)	0.00012	0.07397
	Mid-peak	0.00000	0.00018	0.04777	0.00070	0.00185	(0.00009)	0.00012	0.05053
	Off-Peak	0.00000	0.00018	0.03479	0.00070	0.00185	(0.00009)	0.00012	0.03755
Winter Season									
	On-Peak	NA	NA	NA	N/A	N/A	N/A	N/A	N/A
	Mid-peak	0.00000	0.00018	0.05817	0.00070	0.00185	(0.00009)	0.00012	0.06093
	Off-Peak	0.00000	0.00018	0.03596	0.00070	0.00185	(0.00009)	0.00012	0.03872
Customer Charge - $/month		0.00	204.39	145.06					349.45
Facilities Related									
Demand Charge - $/kW		0.15	0.24	0.26					0.65
Time Related									
Demand Charge - $/kW									
Summer	On-Peak	2.89	4.83	8.43					16.15
	Mid-Peak	0.24	0.42	1.79					2.45
	Off-Peak	0.00	0.00	0.00					0.00
Winter	On-Peak	N/A	N/A	N/A					N/A
	Mid-Peak	0.00	0.00	0.00					0.00
	Off-Peak	0.00	0.00	0.00					0.00

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(Continued)

Schedule TOU-8

TIME-OF-USE
GENERAL SERVICE - LARGE
(Continued)

RATE COMPONENTS (Cont'd)

Rate Components Table

Rate Schedule Summary	Trans[1]	Distrbtn[2]	Gen[3,4]	NDC[5]	PPPC[6]	TRBAA[7]	PUCRF[8]	Total
Other Charges								
Excess Transformer								
Capacity - $/kVA/month	0.00	1.00	0.00					1.00
Power Factor Adjustment - $/kVA								
Greater than 50 kV	0.00	0.18	0.00					0.18
50 kV or less	0.00	0.23	0.00					0.23
Peak Period Rate Limiter - $/kWh								
Summer only								
Below 2 kV			1.09530					1.09530
From 2 kV to 50 kV			1.09315					1.09315
Above 50 kV			0.92250					0.92250
Average Rate Limiter - $/kWh								
Summer only								
Below 2 kV			0.30844					0.30844
From 2 kV to 50 kV			0.30844					0.30844
Economic Development Rate								
Discount - %		100.00						100.00*
Voltage Discount, 220 kV - %		100.00						100.00*

*The "total" shown above represents 100% of the discount percentage as set forth in the specific rate schedule.

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[6] PPPC = Public Purpose Programs Charge (includes California Alternate Rates for Energy Surcharge and Discount where applicable.)
[7] TRBAA = Transmission Revenue Balancing Account Adjustment
[8] PUCRF = The PUC Reimbursement Fee is described in Schedule RF-E.
[9] FTAC = The Fixed Transition Amount Charge is described in Schedule RRB.