Converting DOE-2.1E Input Files for Use with DOE-2.2 and PowerDOE

Using existing DOE-2.1E input files (BDL files) with the DOE-2.2 and PowerDOE programs, requires some restructuring of the BDL input. Once you have made these conversions, you can use the new input file with DOE-2.2 in exactly the same way as with DOE-2.1E. That is, you can run the DOS version of DOE-2.2 and generate similar standard reports. You can use macros and parametric runs as with DOE-2.1E. PowerDOE's rich, new functionality is available by importing the converted DOE-2.2 input file into PowerDOE. PowerDOE may make further conversions of the input file, all of which will still be compatible with DOE-2.2.

Combined SYSTEMS and PLANT

The most significant difference between DOE-2.1E and DOE-2.2 is the combination of the old SYSTEM and PLANT DOE-2 programs into a new, combined HVAC simulation program. One reason for this change is to improve the connectivity between the loads incurred by the secondary HVAC systems (air handler coils, reheat coils, etc.), and the primary HVAC equipment (boilers, chillers, etc.) Thus, DOE-2.2 and PowerDOE use the concept of circulation loops, which are defined using the new CIRCULATION-LOOP command.

In consequence of these changes, the old DOE2-1E commands, COMPUTE LOADS, COMPUTE SYSTEMS, COMPUTE PLANT, and COMPUTE ECONOMICS, are no longer necessary or permitted in DOE2-2. A single COMPUTE command is now used placed immediately before to the STOP command. Similarly, a single END command is now used, place immediately before to the COMPUTE command

U-Names

U-names of up to 256 characters were previously permitted; however, only the first 16 characters were significant. In DOE-2.2 and PowerDOE, u-names cannot exceed 32 characters and all 32 characters are significant, however, only the first 16 characters are printed on some reports. U-names may now include embedded blanks, provided that the u-name begins and ends with double quotes, e.g., both Heating-Loop and “Heating Loop” are legal u-names.

Schedules

The format of <u>all</u> schedules has changed in DOE-2.2 and PowerDOE. All schedules must specify the keyword TYPE and the type specified must be compatible with the keyword that refers to the schedule. The schedule TYPE must be specified in the DAY-SCHEDULE, WEEK-SCHEDULE, and the SCHEDULE commands; the TYPE keyword must be the first keyword, other than LIKE, in these commands. If a SCHEDULE, WEEK-SCHEDULE, or DAY-SCHEDULE is LIKE’d to another, the other must be of the same TYPE. Like in DOE-2.1, it is possible to define an entire annual schedule using only the SCHEDULE command (i.e., as a “nested” schedule). Use the following conversion as a guideline:

DOE-2.1E version:

```
SHADE-MULT  = SCHEDULE THRU DEC 31 (ALL) (1,24) (.5)  ..
```

DOE-2.2 version:

```
SHADE-MULT  = SCHEDULE          TYPE = MULTIPLIER
                                THRU DEC 31 (ALL) (1,24) (.5) ..
```

OR

```
SHADE-DAY   = DAY-SCHEDULE      TYPE = MULTIPLIER (1,24) (.5) ..
SHADE-WEEK  = WEEK-SCHEDULE     TYPE = MULTIPLIER(ALL)SHADE-DAY ..
```

```
SHADE-MULT  = SCHEDULE          TYPE = MULTIPLIER
                                THRU DEC 31 SHADE-WEEK  ..
OR
SHADE-DAY   = DAY-SCHEDULE      TYPE = MULTIPLIER (1,24) (.5) ..
SHADE-MULT  = SCHEDULE          TYPE = MULTIPLIER
                                THRU DEC 31 (ALL) SHADE-DAY ..
```

The second DOE-2.2 version listed above is the preferred format, since this is how PowerDOE will convert all schedules. New schedule commands have been added to DOE-2.2 for complete compatibility with PowerDOE; SCHEDULE-PD, WEEK-SCHEDULE-PD, and DAY-SCHEDULE-PD. These new commands use the standard DOE-2 keyword = value structure of DOE-2 commands (unlike the older commands that have a unique structure.) The LIKE keyword is optional for these but the TYPE is required for SCHEDULE-PD and WEEK-SCHEDULE-PD. The example below illustrates their use (in the same format PowerDOE uses to export BDL projects):

DOE-2.1E version:

```
SHADE-MULT  = SCHEDULE THRU DEC 31 (ALL) (1,24) (.5)  ..
```

PowerDOE version:

```
"SHADE-DAY" = DAY-SCHEDULE-PD
   TYPE            =MULTIPLIER
   VALUES  =(0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,
   0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5,0.5)
   ..
"SHADE-WEEK" = WEEK-SCHEDULE-PD
   DAY-SCHEDULES   =("SHADE-DAY","SHADE-DAY","SHADE-DAY",
   "SHADE-DAY","SHADE-DAY","SHADE-DAY","SHADE-DAY","SHADE-DAY")
   ..
"SHADE-MULT" = SCHEDULE-PD
   TYPE            =MULTIPLIER
   MONTH           =(12)
   DAY             =(31)
   WEEK-SCHEDULES  =("SHADE-WEEK")
   ..
```

Note that the WEEK-SCHEDULE and WEEK-SCHEDULE-PD commands now allow for ten-day weeks: the eight original days (i.e., Monday through Holiday) plus heating and cooling design days. The code-words HDD and CDD specify the heating and cooling design days, respectively. These design days default to the day schedule specified for Monday if not explicitly assigned. When DESIGN-DAYs are defined, they are run for the single month and day specified within the DESIGN-DAY command and all schedules use the HDD or CDD day schedule based upon the TYPE of the DESIGN-DAY being run.

The allowed TYPEs for each keyword that accepts a schedule are listed below.

Loads Schedules	Type
SHADE-SCHEDULE	Fraction or Multiplier
PEOPLE-SCHEDULE	Fraction or Multiplier
LIGHTING-SCHEDUL	Fraction or Multiplier
TASK-LIGHT-SCH	Fraction or Multiplier
EQUIP-SCHEDULE	Fraction or Multiplier
SOURCE-SCHEDULE	Fraction or Multiplier
INF-SCHEDULE	Fraction or Multiplier
DAYLIGHT-REP-SCH	On/Off
PEOPLE-SCHEDULE	Fraction or Multiplier
LIGHTING-SCHEDULE	Fraction or Multiplier
TASK-LIGHT-SCH	Fraction or Multiplier
EQUIP-SCHEDULE	Fraction or Multiplier
SOURCE-SCHEDULE	Fraction or Multiplier
DAYLIGHT-REP-SCH	On/Off
SHADING-SCHEDULE	Fraction or Multiplier
CONDUCT-SCHEDULE	Fraction or Multiplier
MAX-SOLAR-SCH	Radiation
VIS-TRANS-SCH	Fraction or Multiplier
CONDUCT-TMIN-SCH	Temperature
OPEN-SHADE-SCH	Fraction or Multiplier
SOL-TRANS-SCH	Fraction or Multiplier
SWITCH-SCH	On/Off
SLAT-SCHEDULE	Exp-fraction or Fraction
SLAT-TRIGG-SCH	Temperature or Radiation
BLIND-SCHEDULE	Fraction or Multiplier
BLIND-TRIGG-SCH	Temperature or Radiation
REPORT-SCHEDULE	On/Off
SHADE-SCHEDULE	Fraction or Multiplier

HVAC Schedules	Type
HEATING-SCHEDULE	On/Off/Temp or On/Off or Temperature
HEAT-RESET-SCH	Reset Temp
HEAT-SET-SCH	Temperature
COOLING-SCHEDULE	On/Off/Temp or On/Off or Temperature
COOL-RESET-SCH	Reset Temp
COOL-SET-SCH	Temperature
BASEBOARD-SCH	Reset Ratio
MIN-AIR-SCH	Fraction or Frac/Design
VENT-TEMP-SCH	Temperature
NATURAL-VENT-SCH	On/Off or On/Off/Flag
OPEN-VENT-SCH	Fraction
FAN-SCHEDULE	On/Off/Flag or On/Off
NIGHT-VENT-SCH	On/Off
EXHAUST-FAN-SCH	On/Off
HFAN-SCHEDULE	On/Off or On/Off/Flag
INDUC-MODE-SCH	On/Off
MIN-SUPPLY-SCH	Temperature
EVAP-PCC-SCH	On/Off or On/Off/Temp or On/Off/Flag
RECOV-SCH	On/Off or On/Off/Temp or On/Off/Flag
MIN-FLOW-SCH	Fraction or Frac/Design
SS-FLOW-T-SCH	Temperature
SS-FLOW-SCH	Fraction
SS-VENT-T-SCH	Temperature
SS-VENT-SCH	On/Off
HEAT-TEMP-SCH	Temperature
COOL-TEMP-SCH	Temperature
ZONE-FAN-T-SCH	Temperature
TROM-VENT-SCH	On/Off
REFG-SENS-SCH	Fraction or Multiplier
REFG-LAT-SCH	Fraction or Multiplier
REFG-AUX-SCH	Fraction or Multiplier or On/Off
HMIN-FLOW-SCH	Fraction or Frac/Design
CMIN-FLOW-SCH	Fraction or Frac/Design
HEATING-SCHEDULE	On/Off
COOLING-SCHEDULE	On/Off
PUMP-SCHEDULE	On/Off
HEAT-RESET-SCH	Reset Temp
HEAT-SETPT-SCH	Temperature
COOL-RESET-SCH	Reset Temp
COOL-SETPT-SCH	Temperature
LOOP-TUNNEL-SCH	Temperature **(new)**
PROCESS-LOAD-SCH	Fraction or Multiplier
LOOP-AUX-SCH	Fraction or Multiplier
DHW-INLET-T-SCH	Temperature
AUX-SCHEDULE	Fraction or Multiplier
ASSIGN-SCH-1	Flag
ASSIGN-SCH-2	Flag
ASSIGN-SCH-3	Flag
ASSIGN-SCH-4	Flag
ASSIGN-SCH-5	Flag
INTERIOR-SCH	Fraction or Multiplier **(new)**
EXTERIOR-SCH	Fraction or Multiplier **(new)**

Economics Schedules	Type
QUAL-SCH	Flag
ENERGY-CHG-SCH	Fraction or Multiplier
ENERGY-ADJ-SCH	Fraction or Multiplier
BLOCK-SCH	Flag
RATCHET-SCH	Flag

Loads

Key concepts in Loads remain the same, but there are a number of command and keyword changes.

Run Period

This command and its associated keywords do <u>not</u> need to be converted to work with DOE-2.2 except if multiple periods are specified. A new version of the command is available and used by PowerDOE. The new command, RUN-PERIOD-PD uses the standard BDL keyword=value syntax. Instead of placing multiple periods into a single command, one RUN-PERIOD-PD command is entered for each period.

Single run period example:

DOE-2.1E version:

```
      RUN-PERIOD   JAN 1 1988 THRU  DEC 31 1988   ..
```

DOE-2.2 and PowerDOE version:

```
RUN-PERIOD-PD
   BEGIN-MONTH     = 1
   BEGIN-DAY       = 1
   BEGIN-YEAR      = 1988
   END-MONTH       = 12
   END-DAY         = 31
   END-YEAR        = 1988
   ..
```

Multiple run period example:

DOE-2.1E version:

```
RUN-PERIOD   JAN 1 1988 THRU  JAN 31 1988
             AUG 1 1988 THRU  AUG 31 1988   ..
```

DOE-2.2 and PowerDOE version:

```
RUN-PERIOD-PD
   BEGIN-MONTH     = 1
   BEGIN-DAY       = 1
   BEGIN-YEAR      = 1988
   END-MONTH       = 1
   END-DAY         = 31
   END-YEAR        = 1988
   ..
RUN-PERIOD-PD
   BEGIN-MONTH     = 8
   BEGIN-DAY       = 1
   BEGIN-YEAR      = 1988
   END-MONTH       = 8
   END-DAY         = 31
   END-YEAR        = 1988
   ..
```

RUN-PERIODs are NOT specified for DESIGN-DAYS. Rather, the DESIGN-DAY command now includes MONTH and DAY keywords which identify the design day dates (June 21st and Dec 21st are the defaults for the cooling and heating design day, respectively).

Location

The DOE-2.1E LOCATION command and its associated keywords has been replaced with two commands in DOE-2.2: BUILD-PARAMETERS and SITE-PARAMETERS. As the names imply, BUILD-PARAMETERS is concerned with the old BUILDING-LOCATION keywords dealing with the building; SITE-PARAMETERS includes the old BUILDING-LOCATION keywords dealing with the site.

DOE-2.1E version:

```
BUILDING-LOCATION
   LATITUDE    = 42
   LONGITUDE   = 88
   TIME-ZONE   = 6
   GROSS-AREA  = 10000
   AZIMUTH     = 30
   ..
```

DOE-2.2 and PowerDOE version:

```
BUILD-PARAMETERS
   GROSS-AREA = 10000
```

```
   AZIMUTH    = 30
   ..
SITE-PARAMETERS
   LATITUDE   = 42
   LONGITUDE  = 88
   TIME-ZONE  = 6
   ..
```

The following is a complete listing of the keywords (and their abbreviations) associated with the new commands. The keyword descriptions remain the same (refer to existing documentation for DOE-2.1E or check PowerDOE's on-line help).

BUILD-PARAMETERS:

AZIMUTH	AZ
HOLIDAYS	HOL
GROSS-AREA	G-A
HEAT-PEAK-PERIOD	H-P-P
COOL-PEAK-PERIOD	C-P-P
X-REF	X-REF
Y-REF	Y-REF
FUNCTION	
DAYL-FUNCTION	
SOLAR-REFL-CALC	

SITE-PARAMETERS:

LATITUDE	LAT
LONGITUDE	LON
TIME-ZONE	T-Z
ALTITUDE	ALT
DAYLIGHT-SAVINGS	D-S
GROUND-T	G-T
CLEARNESS-NUMBER	C-N
ATM-MOISTURE	ATM-M
ATM-TURBIDITY	ATM-T
SHIELDING-COEF	S-COEF
TERRAIN-PAR1	T-P1
TERRAIN-PAR2	T-P2
WS-TERRAIN-PAR1	W-T-P1
WS-TERRAIN-PAR2	W-T-P2
WS-HEIGHT	W-H
WS-HEIGHT-LIST	W-H-L

Design Days

The syntax of Design Day specifications has changed slightly to use common data sources such as ASHRAE. The design day is designated as either a heating or cooling day; this information is required so that the proper schedule day can be used during the design calculations. The day to be used for the design calculations is specified within this command rather than in the RUN-PERIOD command as in DOE-2.1E. Other differences include: wetbulb temperatures are now used in place of dewpoint temperatures; DRYBULB-LO is replaced with RANGE; the humidity ratio is now assumed to be constant throughout the day (unless the drybulb temperature falls below the dewpoint); CLEARNESS and CLOUD-TYPE are now replaced by CLIMATE and VISIBILIY. Use the following conversion as a guideline:

DOE-2.1E version:

```
HOT-CLEAR-SUMMER = DESIGN-DAY
        DRYBULB-HI   = 91    DRYBULB-LO = 71
        HOUR-HI      = 15    HOUR-LO    = 7
        DEWPT-HI     = 65.5  DEWPT-LO   = 60
        DHOUR-HI     = 16    DHOUR-LO   = 8
        WIND-SPEED   = 7.5   WIND-DIR   = 10
        CLOUD-AMOUNT = 0     CLOUD-TYPE = 0
        CLEARNESS    = 1     GROUND-T   = 61  ..

COLD-CLOUDY-WINTER = DESIGN-DAY
        DRYBULB-HI   = 6     DRYBULB-LO = -4
        HOUR-HI      = 15    HOUR-LO    = 2
        DEWPT-HI     = 6     DEWPT-LO   = -4
        DHOUR-HI     = 16    DHOUR-LO   = 3
```

```
              WIND-SPEED   = 15    WIND-DIR   = 14
              CLOUD-AMOUNT = 5     CLOUD-TYPE = 2
              CLEARNESS    = 1     GROUND-T   = 46  ..
```

DOE-2.2 and PowerDOE version:

```
      "Chicago CDD" = DESIGN-DAY
              TYPE            = COOLING
              DRYBULB-HIGH    = 91    DRYBULB-RANGE   = 20
              HOUR-HIGH       = 15    HOUR-LOW        = 7
              WETBULB-AT-HIGH = 77
              WIND-SPEED      = 7.5   WIND-DIR        = SW
              CLOUD-AMOUNT    = 0     CLIMATE         = MIDLATITUDE
              VISIBILITY      = HIGH  GROUND-T        = 61
              ..

      "Chicago HDD" = DESIGN-DAY
              TYPE            = HEATING
              DRYBULB-HIGH    = 6     DRYBULB-RANGE  = 10
              HOUR-HIGH       = 15    HOUR-LOW       = 2
              WIND-SPEED      = 15    WIND-DIR       = NW
              CLOUD-AMOUNT    = 5     CLIMATE         = MIDLATITUDE
              VISIBILITY      = LOW   GROUND-T       = 46
              ..
```

The following is a complete listing of the keywords associated with the new DESIGN-DAY command. Many of the keyword descriptions remain the same (refer to existing documentation for DOE-2.1E or check the on-line help of PowerDOE). New keywords or code words are shown in bold.

Design-Day:

```
TYPE = HEATING or COOLING     (THIS KEYWORD IS REQUIRED)
DRYBULB-HIGH
DRYBULB-RANGE
WETBULB-AT-HIGH
HOUR-HIGH
HOUR-LOW
WIND-SPEED
WIND-DIR = N, NNE, NE, ....., NNW  (new)
CLOUD-AMOUNT
CLIMATE = TROPICAL, MIDLATITUDE, SUBARCTIC  (new)
VISIBILITY = HIGH, LOW  (new)
MONTH (integer)   (month of day to run; default is 6 for COOLING and
                  12 for HEATING)
DAY (integer)     (day of month for run; default is 21)
GROUND-T
```

Unlike DOE-2.1, all keywords for DESIGN-DAY in DOE-2.2 are not required. Minimal input for heating and cooling design days for Los Angeles looks like this:

DOE-2.2 and PowerDOE:

```
      LOSANGELES-CDD = DESIGN-DAY
         TYPE            =COOLING
         DRYBULB-HIGH    =89
         DRYBULB-RANGE   =20
         WETBULB-AT-HIGH =70  ..
      LOSANGELES-HDD = DESIGN-DAY
         TYPE            =HEATING
         DRYBULB-HIGH    =40  ..
```

Space Conditions

The keywords used to describe area lighting and equipment in the SPACE-CONDITIONS command can now accept lists (within parenthesis) of up to five values or a single value (without parenthesis.) Density-related keywords used to be named in terms of square feet (i.e., LIGHTING-W/SQFT), but now refer to "area" instead (i.e., LIGHTING-W/AREA). Use the following conversion as a guideline (changes are in bold):

DOE-2.1E version:

```
      OFFICE = SPACE-CONDITIONS
         TEMPERATURE       =(75)
         FLOOR-WEIGHT      =70
         LIGHTING-W/SQFT   =1.5
         EQUIPMENT-W/SQFT  =1
         PEOPLE-HEAT-GAIN  =450
         EQUIP-SCHEDULE    =EQ1
         LIGHTING-SCHEDULE =LT1
         PEOPLE-SCHEDULE   =OCCUP
         AIR-CHANGES/HR    =.3
         INF-SCHEDULE      =INF1
         LIGHT-TO-SPACE    =.80
         INF-METHOD        =AIR-CHANGE
         LIGHTING-TYPE     =REC-FLUOR-RV ..
```

DOE-2.2 and PowerDOE version:

```
      OFFICE = SPACE-CONDITIONS
         TEMPERATURE       =(75)
         FLOOR-WEIGHT      =70
         LIGHTING-W/AREA   =(1.0,0.75)
         EQUIPMENT-W/AREA  =(1,.25)
         PEOPLE-HEAT-GAIN  =450
         EQUIP-SCHEDULE    =(EQ1,EQ2)
         LIGHTING-SCHEDULE =(LT1,LT2)
         PEOPLE-SCHEDULE   =OCCUP
         AIR-CHANGES/HR    =.3
         INF-SCHEDULE      =INF1
         LIGHT-TO-SPACE    =.80
         INF-METHOD        =AIR-CHANGE
         LIGHTING-TYPE     =(REC-FLUOR-RV, REC-FLUOR-RV)
               ..
```

GLASS TYPE

The GLASS-TYPE-CODE (G-T-C) values of 1 - 11 are no longer valid and the G-T-C must be defined in the window library. The library identifier designation, previously a value in the range of 1000 to 9999, is now a u-name (32 characters max). For consistency with DOE-2.1E, the u-names of the glass entries in the DOE-2.2 glass library retain their previous designations (i.e., 1000 to 9999). The alternative method of specifying GLASS-COND and SHADING-COEF can still be used. PANES is no longer a valid keyword, as this is incorporated into the G-T-C library entry.

Additionally, the GLASS-TYPE command now requires the specification of the TYPE keyword. As in other "TYPE" commands, the TYPE keyword must be present and be the first keyword specified. The values for TYPE are either GLASS-TYPE-CODE or SHADING-COEF; these values specify

which input keywords are to be used (are required) for this GLASS-TYPE command. Examples of each TYPE are as follows:

```
"Lib 1205 - Grey" = GLASS-TYPE
  TYPE                =GLASS-TYPE-CODE
  GLASS-TYPE-CODE     ="1205"
  ..
```

OR

```
"Lib 1404 - Ref-A-M" = GLASS-TYPE
  TYPE                =SHADING-COEF
  SHADING-COEF        =0.86
  ..
```

MATERIAL

The MATERIAL command now requires the specification of the TYPE keyword. As in other "TYPE" commands, the TYPE keyword must be present and be the first keyword specified. The values for TYPE are either PROPERTIES or RESISTANCE; these values specify which input keywords are to be used (are required) for this MATERIAL command. Examples of each TYPE are as follows:

```
"Mat 2ft Gnd" = MATERIAL
  TYPE          =PROPERTIES
  THICKNESS     =2
  CONDUCTIVITY  =0.5
  DENSITY       =100
  SPECIFIC-HEAT =0.25
  ..
```

OR

```
"Mat R11M" = MATERIAL
  TYPE          =RESISTANCE
  RESISTANCE    =5.5
  ..
```

All materials previously contained in the DOE2.1E materials library are also contained in the PowerDOE materials library, however, each 4-digit or 5-digit material code word previously used in DOE2.1E has been replaced with a more descriptive material name in PowerDOE. Therefore, it is necessary to convert the old DOE2.1E material code words to the current PowerDOE material names. An alphabetical listing of the old DOE2.1E material code words and the new PowerDOE material names is provided below. Note that new material names containing blanks must be surrounded in double quotes when included in BDL lists, as illustrated below.

DOE-2.1E version:

```
Blt-Up-Roof-LA = LAYERS
   MATERIAL = ( BR01, IN36, AS01 )
   ..
```

DOE-2.2 and PowerDOE version:

```
"Built Up Roof Layer" = LAYERS
```

```
        MATERIAL = ( "Blt-Up Roof 3/8in (BR01)",
                     "Polystyrene 3in (IN36)",
                     "Steel Siding (AS01)" )
        ..
```

DOE2/PowerDOE MATERIALs Library Revisions

DOE.1E Code Word	PowerDOE Library Item Name	PowerDOE Library Category
AB01	AbsCem Bd 1/8in (AB01)	Asbestos Cement
AB02	AbsCem Bd 1/4in (AB02)	Asbestos Cement
AB03	AbsCem Shingle (AB03)	Asbestos Cement
AB04	AbsCem Siding (AB04)	Asbestos Cement
AC01	AcousTile 3/8in (AC01)	Acoustic Tile
AC02	AcousTile 1/2in (AC02)	Acoustic Tile
AC03	AcousTile 3/4in (AC03)	Acoustic Tile
AL01	Surf Air Film Vert (AL01)	Surface Air Film
AL02	Surf Air Film Slope (AL02)	Surface Air Film
AL03	Surf Air Film Horiz (AL03)	Surface Air Film
AL11	Air Lay <3/4in Vert (AL11)	Air Layer
AL12	Air Lay <3/4in Slope (AL12)	Air Layer
AL13	Air Lay <3/4in Horiz (AL13)	Air Layer
AL21	Air Lay <4in Vert (AL21)	Air Layer
AL22	Air Lay <4in Slope (AL22)	Air Layer
AL23	Air Lay <4in Horiz (AL23)	Air Layer
AL31	Air Lay >4in Vert (AL31)	Air Layer
AL32	Air Lay >4in Slope (AL32)	Air Layer
AL33	Air Lay >4in Horiz (AL33)	Air Layer
AR01	Asph Roll Roof (AR01)	Asphalt
AR02	Asph Siding (AR02)	Asphalt
AR03	Asph Tile (AR03)	Asphalt
AS01	Steel Siding (AS01)	Steel Siding
AV01	AbsVinyl Tile (AV01)	Asbestos Vinyl
BK01	Com Brick 4in (BK01)	Brick
BK02	Com Brick 8in (BK02)	Brick
BK03	Com Brick 12in (BK03)	Brick
BK04	Face Brick 3in (BK04)	Brick
BK05	Face Brick 4in (BK05)	Brick
BP01	Bldg Paper Felt (BP01)	Building Paper
BP02	Bldg Paper Seal (BP02)	Building Paper
BP03	Plastic Film Seal (BP03)	Building Paper
BR01	Blt-Up Roof 3/8in (BR01)	Built-Up Roofing
CB01	CMU HW 4in Hollow (CB01)	Conc Blk Hvy Wt
CB02	CMU HW 4in ConcFill (CB02)	Conc Blk Hvy Wt
CB03	CMU HW 4in PerlFill (CB03)	Conc Blk Hvy Wt
CB04	CMU HW 4in PartFill (CB04)	Conc Blk Hvy Wt
CB05	CMU HW 4in Conc/Perl (CB05)	Conc Blk Hvy Wt
CB06	CMU HW 6in Hollow (CB06)	Conc Blk Hvy Wt
CB07	CMU HW 6in ConcFill (CB07)	Conc Blk Hvy Wt

CB08	CMU HW 6in PerlFill (CB08)	Conc Blk Hvy Wt
CB09	CMU HW 6in PartFill (CB09)	Conc Blk Hvy Wt
CB10	CMU HW 6in Conc/Perl (CB10)	Conc Blk Hvy Wt
CB11	CMU HW 8in Hollow (CB11)	Conc Blk Hvy Wt
CB12	CMU HW 8in ConcFill (CB12)	Conc Blk Hvy Wt
CB13	CMU HW 8in PerlFill (CB13)	Conc Blk Hvy Wt
CB14	CMU HW 8in PartFill (CB14)	Conc Blk Hvy Wt
CB15	CMU HW 8in Conc/Perl (CB15)	Conc Blk Hvy Wt
CB16	CMU HW 12in Hollow (CB16)	Conc Blk Hvy Wt
CB17	CMU HW 12in ConcFill (CB17)	Conc Blk Hvy Wt
CB18	CMU HW 12in PartFill (CB18)	Conc Blk Hvy Wt
CB21	CMU MW 4in Hollow (CB21)	Conc Blk Med Wt
CB22	CMU MW 4in ConcFill (CB22)	Conc Blk Med Wt
CB23	CMU MW 4in PerlFill (CB23)	Conc Blk Med Wt
CB24	CMU MW 4in PartFill (CB24)	Conc Blk Med Wt
CB25	CMU MW 4in Conc/Perl (CB25)	Conc Blk Med Wt
CB26	CMU MW 6in Hollow (CB26)	Conc Blk Med Wt
CB27	CMU MW 6in ConcFill (CB27)	Conc Blk Med Wt
CB28	CMU MW 6in PerlFill (CB28)	Conc Blk Med Wt
CB29	CMU MW 6in PartFill (CB29)	Conc Blk Med Wt
CB30	CMU MW 6in Conc/Perl (CB30)	Conc Blk Med Wt
CB31	CMU MW 8in Hollow (CB31)	Conc Blk Med Wt
CB32	CMU MW 8in ConcFill (CB32)	Conc Blk Med Wt
CB33	CMU MW 8in PerlFill (CB33)	Conc Blk Med Wt
CB34	CMU MW 8in PartFill (CB34)	Conc Blk Med Wt
CB35	CMU MW 8in Conc/Perl (CB35)	Conc Blk Med Wt
CB36	CMU MW 12in Hollow (CB36)	Conc Blk Med Wt
CB37	CMU MW 12in ConcFill (CB37)	Conc Blk Med Wt
CB38	CMU MW 12in PartFill (CB38)	Conc Blk Med Wt
CB41	CMU LW 4in Hollow (CB41)	Conc Blk Lt Wt
CB42	CMU LW 4in ConcFill (CB42)	Conc Blk Lt Wt
CB43	CMU LW 4in PerlFill (CB43)	Conc Blk Lt Wt
CB44	CMU LW 4in PartFill (CB44)	Conc Blk Lt Wt
CB45	CMU LW 4in Conc/Perl (CB45)	Conc Blk Lt Wt
CB46	CMU LW 6in Hollow (CB46)	Conc Blk Lt Wt
CB47	CMU LW 6in ConcFill (CB47)	Conc Blk Lt Wt
CB48	CMU LW 6in PerlFill (CB48)	Conc Blk Lt Wt
CB49	CMU LW 6in PartFill (CB49)	Conc Blk Lt Wt
CB50	CMU LW 6in Conc/Perl (CB50)	Conc Blk Lt Wt
CB51	CMU LW 8in Hollow (CB51)	Conc Blk Lt Wt
CB52	CMU LW 8in ConcFill (CB52)	Conc Blk Lt Wt
CB53	CMU LW 8in PerlFill (CB53)	Conc Blk Lt Wt
CB54	CMU LW 8in PartFill (CB54)	Conc Blk Lt Wt
CB55	CMU LW 8in Conc/Perl (CB55)	Conc Blk Lt Wt
CB56	CMU LW 12in Hollow (CB56)	Conc Blk Lt Wt
CB57	CMU LW 12in ConcFill (CB57)	Conc Blk Lt Wt
CB58	CMU LW 12in PartFill (CB58)	Conc Blk Lt Wt
CC01	Conc HW 140lb 1.25in (CC01)	Concrete 140 lbs
CC02	Conc HW 140lb 2in (CC02)	Concrete 140 lbs

CC03	Conc HW 140lb 4in (CC03)	Concrete 140 lbs
CC04	Conc HW 140lb 6in (CC04)	Concrete 140 lbs
CC05	Conc HW 140lb 8in (CC05)	Concrete 140 lbs
CC06	Conc HW 140lb 10in (CC06)	Concrete 140 lbs
CC07	Conc HW 140lb 12in (CC07)	Concrete 140 lbs
CC11	Conc HW 140lb 3/4in (CC11)	Concrete 140 lbs
CC12	Conc HW 140lb 1-1/8in (CC12)	Concrete 140 lbs
CC13	Conc HW 140lb 1.75in (CC13)	Concrete 140 lbs
CC14	Conc HW 140lb 4in (CC14)	Concrete 140 lbs
CC15	Conc HW 140lb 6in (CC15)	Concrete 140 lbs
CC16	Conc HW 140lb 8in (CC16)	Concrete 140 lbs
CC21	Conc LW 80lb 3/4in (CC21)	Concrete 80 lbs
CC22	Conc LW 80lb 1.25in (CC22)	Concrete 80 lbs
CC23	Conc LW 80lb 2in (CC23)	Concrete 80 lbs
CC24	Conc LW 80lb 4in (CC24)	Concrete 80 lbs
CC25	Conc LW 80lb 6in (CC25)	Concrete 80 lbs
CC26	Conc LW 80lb 8in (CC26)	Concrete 80 lbs
CC31	Conc LW 30lb 3/4in (CC31)	Concrete 30 lbs
CC32	Conc LW 30lb 1.25in (CC32)	Concrete 30 lbs
CC33	Conc LW 30lb 2in (CC33)	Concrete 30 lbs
CC34	Conc LW 30lb 4in (CC34)	Concrete 30 lbs
CC35	Conc LW 30lb 6in (CC35)	Concrete 30 lbs
CC36	Conc LW 30lb 8in (CC36)	Concrete 30 lbs
CM01	Cmt Mortar 1in (CM01)	Cement Mortar
CM02	Cmt Mortar 1.75in (CM02)	Cement Mortar
CM03	Cmt Plaster 1in (CM03)	Cement Mortar
CP01	Carpet & Fiber Pad (CP01)	Carpet
CP02	Carpet & Rubber Pad (CP02)	Carpet
CT01	Hol ClayTile 3in (CT01)	Clay Tile
CT02	Hol ClayTile 4in (CT02)	Clay Tile
CT03	Hol ClayTile 6in (CT03)	Clay Tile
CT04	Hol ClayTile 8in (CT04)	Clay Tile
CT05	Hol ClayTile 10in (CT05)	Clay Tile
CT06	Hol ClayTile 12in (CT06)	Clay Tile
CT11	ClayTile Paver 3/8in (CT11)	Clay Tile
GL01	Glass Wool 1/4in (GL01)	Board Insul
GP01	GypBd 1/2in (GP01)	Gypsum
GP02	GypBd 5/8in (GP02)	Gypsum
GP03	GypBd 3/4in (GP03)	Gypsum
GP04	Gypsum LW Agg 3/4in (GP04)	Gypsum
GP05	Gypsum LW Agg 1in (GP05)	Gypsum
GP06	Gypsum Sand Agg 3/4in (GP06)	Gypsum
GP07	Gypsum Sand Agg 1in (GP07)	Gypsum
HB01	Hd Bd 3/4in Md Dens (HB01)	Hard Board
HB02	Hd Bd 3/4in Md Dens (HB02)	Hard Board
HB03	Hd Bd 3/4in Std Temp (HB03)	Hard Board
HB04	Hd Bd 3/4in Srv Temp (HB04)	Hard Board
HF-A1	Stucco 1in (HF-A1)	Stucco
HF-A2	Face Brick 4in (HF-A2)	Brick

HF-A3	Steel Siding (HF-A3)	Steel Siding
HF-A6	Finish (HF-A6)	Finish
HF-A7	Face Brick 4in (HF-A7)	Brick
HF-B1	Air Space (HF-B1)	Air Layer
HF-B2	Insul Bd 1in (HF-B2)	Board Insul
HF-B3	Insul Bd 2in (HF-B3)	Board Insul
HF-B4	Insul Bd 3in (HF-B4)	Board Insul
HF-B5	Insul Bd 1in (HF-B5)	Board Insul
HF-B6	Insul Bd 2in (HF-B6)	Board Insul
HF-B7	Wood 1in (HF-B7)	Wood
HF-B8	Wood 2.5in (HF-B8)	Wood
HF-B9	Wood 4in (HF-B9)	Wood
HF-B10	Wood 2in (HF-B10)	Wood
HF-B11	Wood 3in (HF-B11)	Wood
HF-B12	Insul Bd 3in (HF-B12)	Board Insul
HF-C1	ClayTile 4in (HF-C1)	Clay Tile
HF-C2	CMU LW 4in (HF-C2)	Conc Blk Lt Wt
HF-C3	CMU HW 4in (HF-C3)	Conc Blk Hvy Wt
HF-C4	Com Brick 4in (HF-C4)	Brick
HF-C5	Conc HW 140lb 4in (HF-C5)	Concrete 140 lbs
HF-C6	ClayTile 8in (HF-C6)	Clay Tile
HF-C7	CMU LW 8in (HF-C7)	Conc Blk Lt Wt
HF-C8	CMU HW 8in (HF-C8)	Conc Blk Hvy Wt
HF-C9	Com Brick 8in (HF-C9)	Brick
HF-C10	Conc HW 8in (HF-C10)	Concrete 140 lbs
HF-C11	Conc HW 12in (HF-C11)	Concrete 140 lbs
HF-C12	Conc HW 140lb 2in (HF-C12)	Concrete 140 lbs
HF-C13	Conc HW 6in (HF-C13)	Concrete 140 lbs
HF-C14	Conc LW 40lb 4in (HF-C14)	Concrete 40 lbs
HF-C15	Conc LW 40lb 6in (HF-C15)	Concrete 40 lbs
HF-C16	Conc LW 40lb 8in (HF-C16)	Concrete 40 lbs
HF-E1	GypBd 3/4in (HF-E1)	Gypsum
HF-E2	Stone 1/2in (HF-E2)	Stone
HF-E3	Felt 3/8in (HF-E3)	Felt
HF-E4	Clg Air Space (HF-E4)	Air Layer
HF-E5	AcousTile (HF-E5)	Acoustic Tile
IN01	MinWool Batt R7 (IN01)	Batt Insulation
IN02	MinWool Batt R11 (IN02)	Batt Insulation
IN03	MinWool Batt R19 (IN03)	Batt Insulation
IN04	MinWool Batt R24 (IN04)	Batt Insulation
IN05	MinWool Batt R30 (IN05)	Batt Insulation
IN11	MinWool Fill 3.5in R11 (IN11)	Fill Insulation
IN12	MinWool Fill 5.5in R19 (IN12)	Fill Insulation
IN13	Cellulose 3.5in R-13 (IN13)	Fill Insulation
IN14	Cellulose 5.5in R-20 (IN14)	Fill Insulation
IN21	MinBd 7/8in R-3 (IN21)	Board Insul
IN22	MinBd 1in R-3.5 (IN22)	Board Insul
IN23	MinBd 2in R-6.9 (IN23)	Board Insul
IN24	MinBd 3in R-10.3 (IN24)	Board Insul

IN31	Polystyrene 1/2in (IN31)	Polystyrene
IN32	Polystyrene 3/4in (IN32)	Polystyrene
IN33	Polystyrene 1in (IN33)	Polystyrene
IN34	Polystyrene 1.25in (IN34)	Polystyrene
IN35	Polystyrene 2in (IN35)	Polystyrene
IN36	Polystyrene 3in (IN36)	Polystyrene
IN37	Polystyrene 4in (IN37)	Polystyrene
IN41	Polyurethane 1/2in (IN41)	Polyurethane
IN42	Polyurethane 3/4in (IN42)	Polyurethane
IN43	Polyurethane 1in (IN43)	Polyurethane
IN44	Polyurethane 1.25in (IN44)	Polyurethane
IN45	Polyurethane 2in (IN45)	Polyurethane
IN46	Polyurethane 3in (IN46)	Polyurethane
IN47	Polyurethane 4in (IN47)	Polyurethane
IN51	Urea Formald 3.5in R19 (IN51)	Urea Formaldehyde
IN52	Urea Formald 5.5in R30 (IN52)	Urea Formaldehyde
IN61	Insul Bd 1/2in (IN61)	Board Insul
IN62	Insul Bd 3/4in (IN62)	Board Insul
IN63	Insul Bd 3/8in (IN63)	Board Insul
IN64	Insul Bd 1/2in (IN64)	Board Insul
IN71	Roof Insul 1/2in (IN71)	Board Insul
IN72	Roof Insul 1in (IN72)	Board Insul
IN73	Roof Insul 1.5in (IN73)	Board Insul
IN74	Roof Insul 2in (IN74)	Board Insul
IN75	Roof Insul 2.5in (IN75)	Board Insul
IN76	Roof Insul 3in (IN76)	Board Insul
LT01	Linoleum Tile (LT01)	Linoleum Tile
PB01	PartBd Lo Dens 3/4in (PB01)	Particle Board
PB02	PartBd Md Dens 3/4in (PB02)	Particle Board
PB03	PartBd Hi Dens 3/4in (PB03)	Particle Board
PB04	PartBd Underlay 5/8in (PB04)	Particle Board
PW01	Plywd 1/4in (PW01)	Plywood
PW02	Plywd 3/8in (PW02)	Plywood
PW03	Plywd 1/2in (PW03)	Plywood
PW04	Plywd 5/8in (PW04)	Plywood
PW05	Plywd 3/4in (PW05)	Plywood
PW06	Plywd 1in (PW06)	Plywood
RG01	Gravel 1/2in (RG01)	Roof Gravel
RG02	Gravel 1in (RG02)	Roof Gravel
RT01	Rubber Tile (RT01)	Rubber Tile
SC01	Stucco 1in (SC01)	Stucco
SL01	Slate 1/2in (SL01)	Slate
ST01	Stone 1in (ST01)	Stone
TZ01	Terrazzo 1in (TZ01)	Terrazzo
WD01	Wood Sft 3/4in (WD01)	Wood
WD02	Wood Sft 1.5in (WD02)	Wood
WD03	Wood Sft 2.5in (WD03)	Wood
WD04	Wood Sft 3.5in (WD04)	Wood
WD05	Wood Sft 4in (WD05)	Wood

WD11	Wood Hd 3/4in (WD11)	Wood
WD12	Wood Hd 1in (WD12)	Wood
WS01	Wood Shingle (WS01)	Wood
WS02	Wood Shingle (WS02)	Wood

CONSTRUCTION

The CONSTRUCTION command is also now a TYPE command. As in other "TYPE" commands, the TYPE keyword must be present and be the first keyword specified. The values for TYPE are either LAYERS or U-VALUE; these values specify which input keywords are to be used (are required) for this CONSTRUCTION command. Examples of each TYPE are as follows:

```
"Cons Roof" = CONSTRUCTION
  TYPE          =LAYERS
  LAYERS         ="Lay Roof"
  ..
```

OR

```
"Cons Ceiling" = CONSTRUCTION
  TYPE          =U-VALUE
  U-VALUE        =0.5
  ..
```

All LAYERS previously contained in the DOE2.1E library are also contained in the PowerDOE library, however, each 6-digit or 7-digit code word previously used in DOE2.1E has been replaced with a more descriptive layers name in PowerDOE. Therefore, it is necessary to convert the old DOE2.1E layers code words to the current PowerDOE layers names. An alphabetical listing of the old DOE2.1E layers code words and the new PowerDOE layers names is provided below. Note that new layers names containing blanks must be surrounded in double quotes, as illustrated below.

DOE-2.1E version:

```
Roof-Deck-Cons = CONSTRUCTION    ROUGHNESS = 1
   LAYERS = ASHR-17   ..
```

DOE-2.2 and PowerDOE version:

```
"Built Up Roof Cons" = CONSTRUCTION    ROUGHNESS = 1
   LAYERS = "ASH Roof-17 lay"
   ..
```

DOE2/PowerDOE LAYERs Library Revisions

DOE.1E Code Word	PowerDOE Library Item Name	PowerDOE Library Category
ASHI-1	ASH Int Wall-1 lay	I-Clay Tile
ASHI-2	ASH Int Wall-2 lay	I-Concrete, Lt
ASHI-3	ASH Int Wall-3 lay	I-Concrete, Hvy
ASHI-4	ASH Int Wall-4 lay	I-Brick
ASHI-5	ASH Int Wall-5 lay	I-Concrete, Hvy
ASHI-6	ASH Int Wall-6 lay	I-Clay Tile
ASHI-7	ASH Int Wall-7 lay	I-Conc Blk, Lt
ASHI-8	ASH Int Wall-8 lay	I-Conc Blk, Hvy

ASHI-9	ASH Int Wall-9 lay	I-Brick
ASHI-10	ASH Int Wall-10 lay	I-Concrete, Hvy
ASHI-11	ASH Int Wall-11 lay	I-Concrete, Hvy
ASHI-12	ASH Int Wall-12 lay	I-Clay Tile
ASHI-13	ASH Int Wall-13 lay	I-Conc Blk, Lt
ASHI-14	ASH Int Wall-14 lay	I-Conc Blk, Lt
ASHI-15	ASH Int Wall-15 lay	I-Brick
ASHI-16	ASH Int Wall-16 lay	I-Concrete, Hvy
ASHI-17	ASH Int Wall-17 lay	I-Clay Tile
ASHI-18	ASH Int Wall-18 lay	I-Conc Blk, Lt
ASHI-19	ASH Int Wall-19 lay	I-Conc Blk, Hvy
ASHI-20	ASH Int Wall-20 lay	I-Brick
ASHI-21	ASH Int Wall-21 lay	I-Concrete, Hvy
ASHI-22	ASH Int Wall-22 lay	I-Concrete, Hvy
ASHI-23	ASH Int Wall-23 lay	I-Frame
ASHI-24	ASH Int Wall-24 lay	I-Wood
ASHI-25	ASH Int Wall-25 lay	I-Wood
ASHI-26	ASH Int Wall-26 lay	I-Wood
ASHI-27	ASH Int Wall-27 lay	I-Wood
ASHI-28	ASH Int Wall-28 lay	I-Wood
ASHI-29	ASH Int Wall-29 lay	I-Wood
ASHI-30	ASH Int Wall-30 lay	I-Wood
ASHI-31	ASH Int Wall-31 lay	I-Concrete, Hvy
ASHI-32	ASH Int Wall-32 lay	I-Concrete, Hvy
ASHI-33	ASH Int Wall-33 lay	I-Concrete, Lt
ASHI-34	ASH Int Wall-34 lay	I-Concrete, Hvy
ASHI-35	ASH Int Wall-35 lay	I-Concrete, Lt
ASHI-36	ASH Int Wall-36 lay	I-Wood
ASHI-37	ASH Int Wall-37 lay	I-Wood
ASHI-38	ASH Int Wall-38 lay	I-Concrete, Hvy
ASHI-39	ASH Int Wall-39 lay	I-Concrete, Hvy
ASHI-40	ASH Int Wall-40 lay	I-Concrete, Lt
ASHI-41	ASH Int Wall-41 lay	I-Concrete, Hvy
ASHI-42	ASH Int Wall-42 lay	I-Concrete, Lt
ASHI-43	ASH Int Wall-43 lay	I-Wood
ASHI-44	ASH Int Wall-44 lay	I-Wood
ASHI-45	ASH Int Wall-45 lay	I-Concrete, Hvy
ASHI-46	ASH Int Wall-46 lay	I-Wood
ASHI-47	ASH Int Wall-47 lay	I-Steel Deck
ASHR-1	ASH Roof-1 lay	R-Concrete, Hvy
ASHR-2	ASH Roof-2 lay	R-Wood
ASHR-3	ASH Roof-3 lay	R-Wood
ASHR-4	ASH Roof-4 lay	R-Wood
ASHR-5	ASH Roof-5 lay	R-Wood
ASHR-6	ASH Roof-6 lay	R-Wood
ASHR-7	ASH Roof-7 lay	R-Wood
ASHR-8	ASH Roof-8 lay	R-Concrete, Lt
ASHR-9	ASH Roof-9 lay	R-Concrete, Lt
ASHR-10	ASH Roof-10 lay	R-Concrete, Lt

ASHR-11	ASH Roof-11 lay	R-Concrete, Hvy
ASHR-12	ASH Roof-12 lay	R-Concrete, Hvy
ASHR-13	ASH Roof-13 lay	R-Concrete, Hvy
ASHR-14	ASH Roof-14 lay	R-Concrete, Hvy
ASHR-15	ASH Roof-15 lay	R-Concrete, Hvy
ASHR-16	ASH Roof-16 lay	R-Concrete, Hvy
ASHR-17	ASH Roof-17 lay	R-Sheet Metal
ASHR-18	ASH Roof-18 lay	R-Sheet Metal
ASHR-19	ASH Roof-19 lay	R-Concrete, Hvy
ASHR-20	ASH Roof-20 lay	R-Wood
ASHR-21	ASH Roof-21 lay	R-Wood
ASHR-22	ASH Roof-22 lay	R-Wood
ASHR-23	ASH Roof-23 lay	R-Wood
ASHR-24	ASH Roof-24 lay	R-Wood
ASHR-25	ASH Roof-25 lay	R-Wood
ASHR-26	ASH Roof-26 lay	R-Concrete, Lt
ASHR-27	ASH Roof-27 lay	R-Concrete, Lt
ASHR-28	ASH Roof-28 lay	R-Concrete, Lt
ASHR-29	ASH Roof-29 lay	R-Concrete, Hvy
ASHR-30	ASH Roof-30 lay	R-Concrete, Hvy
ASHR-31	ASH Roof-31 lay	R-Concrete, Hvy
ASHR-32	ASH Roof-32 lay	R-Concrete, Hvy
ASHR-33	ASH Roof-33 lay	R-Concrete, Hvy
ASHR-34	ASH Roof-34 lay	R-Concrete, Hvy
ASHR-35	ASH Roof-35 lay	R-Sheet Metal
ASHR-36	ASH Roof-36 lay	R-Sheet Metal
ASHW-1	ASH Wall-1 lay	W-Brick/Block
ASHW-2	ASH Wall-2 lay	W-Concrete, Lt
ASHW-3	ASH Wall-3 lay	W-Brick
ASHW-4	ASH Wall-4 lay	W-Brick/Block
ASHW-5	ASH Wall-5 lay	W-Brick/Block
ASHW-6	ASH Wall-6 lay	W-Brick/Clay Tile
ASHW-7	ASH Wall-7 lay	W-Brick/Block
ASHW-8	ASH Wall-8 lay	W-Brick
ASHW-9	ASH Wall-9 lay	W-Brick/Block
ASHW-10	ASH Wall-10 lay	W-Brick/Block
ASHW-11	ASH Wall-11 lay	W-Concrete, Hvy
ASHW-12	ASH Wall-12 lay	W-Concrete, Hvy
ASHW-13	ASH Wall-13 lay	W-Concrete, Hvy
ASHW-14	ASH Wall-14 lay	W-Concrete, Hvy
ASHW-15	ASH Wall-15 lay	W-Concrete, Hvy
ASHW-16	ASH Wall-16 lay	W-Brick
ASHW-17	ASH Wall-17 lay	W-Brick
ASHW-18	ASH Wall-18 lay	W-Brick/Block
ASHW-19	ASH Wall-19 lay	W-Stucco
ASHW-20	ASH Wall-20 lay	W-Brick
ASHW-21	ASH Wall-21 lay	W-Brick/Conc
ASHW-22	ASH Wall-22 lay	W-Brick/Conc
ASHW-23	ASH Wall-23 lay	W-Brick/Conc

ASHW-24	ASH Wall-24 lay	W-Brick/Conc
ASHW-25	ASH Wall-25 lay	W-Wood Frame
ASHW-26	ASH Wall-26 lay	W-Wood Frame
ASHW-27	ASH Wall-27 lay	W-Curtain Wall
ASHW-28	ASH Wall-28 lay	W-Curtain Wall
ASHW-29	ASH Wall-29 lay	W-Curtain Wall
ASHW-30	ASH Wall-30 lay	W-Concrete, Hvy
ASHW-31	ASH Wall-31 lay	W-Concrete, Hvy
ASHW-32	ASH Wall-32 lay	W-Concrete, Hvy
ASHW-33	ASH Wall-33 lay	W-Concrete, Hvy
ASHW-34	ASH Wall-34 lay	W-Concrete, Hvy
ASHW-35	ASH Wall-35 lay	W-Concrete, Hvy
ASHW-36	ASH Wall-36 lay	W-Wood Frame
ASHW-37	ASH Wall-37 lay	W-Wood Frame
ASHW-38	ASH Wall-38 lay	W-Wood Frame
ASHW-39	ASH Wall-39 lay	W-Wood Frame
ASHW-40	ASH Wall-40 lay	W-Concrete, Hvy
ASHW-41	ASH Wall-41 lay	W-Concrete, Hvy
ASHW-42	ASH Wall-42 lay	W-Brick
ASHW-43	ASH Wall-43 lay	W-Conc Blk, Hvy
ASHW-44	ASH Wall-44 lay	W-Conc Blk, Lt
ASHW-45	ASH Wall-45 lay	W-Clay Tile
ASHW-46	ASH Wall-46 lay	W-Conc Blk, Hvy
ASHW-47	ASH Wall-47 lay	W-Brick
ASHW-48	ASH Wall-48 lay	W-Conc Blk, Hvy
ASHW-49	ASH Wall-49 lay	W-Conc Blk, Lt
ASHW-50	ASH Wall-50 lay	W-Clay Tile
ASHW-51	ASH Wall-51 lay	W-Brick/Conc
ASHW-52	ASH Wall-52 lay	W-Brick/Conc
ASHW-53	ASH Wall-53 lay	W-Brick
ASHW-54	ASH Wall-54 lay	W-Brick/Conc
ASHW-55	ASH Wall-55 lay	W-Brick/Conc
ASHW-56	ASH Wall-56 lay	W-Brick/Block
ASHW-57	ASH Wall-57 lay	W-Brick/Block
ASHW-58	ASH Wall-58 lay	W-Brick/Clay Tile
ASHW-59	ASH Wall-59 lay	W-Brick/Conc
ASHW-60	ASH Wall-60 lay	W-Brick
ASHW-61	ASH Wall-61 lay	W-Brick/Block
ASHW-62	ASH Wall-62 lay	W-Brick
ASHW-63	ASH Wall-63 lay	W-Conc Blk, Hvy
ASHW-64	ASH Wall-64 lay	W-Conc Blk, Hvy
ASHW-65	ASH Wall-65 lay	W-Conc Blk, Lt
ASHW-66	ASH Wall-66 lay	W-Conc Blk, Lt
ASHW-67	ASH Wall-67 lay	W-Brick/Clay Tile
ASHW-68	ASH Wall-68 lay	W-Brick/Clay Tile
ASHW-69	ASH Wall-69 lay	W-Brick/Clay Tile
ASHW-70	ASH Wall-70 lay	W-Clay Tile
ASHW-71	ASH Wall-71 lay	W-Clay Tile
ASHW-72	ASH Wall-72 lay	W-Clay Tile

ASHW-73	ASH Wall-73 lay	W-Concrete, Hvy
ASHW-74	ASH Wall-74 lay	W-Concrete, Hvy
ASHW-75	ASH Wall-75 lay	W-Concrete, Hvy
ASHW-76	ASH Wall-76 lay	W-Concrete, Hvy
ASHW-77	ASH Wall-77 lay	W-Brick
ASHW-78	ASH Wall-78 lay	W-Brick
ASHW-79	ASH Wall-79 lay	W-Brick
ASHW-80	ASH Wall-80 lay	W-Brick
ASHW-81	ASH Wall-81 lay	W-Conc Blk, Hvy
ASHW-82	ASH Wall-82 lay	W-Brick/Block
ASHW-83	ASH Wall-83 lay	W-Brick/Block
ASHW-84	ASH Wall-84 lay	W-Brick/Block
ASHW-85	ASH Wall-85 lay	W-Conc Blk, Lt
ASHW-86	ASH Wall-86 lay	W-Conc Blk, Lt
ASHW-87	ASH Wall-87 lay	W-Conc Blk, Lt
ASHW-88	ASH Wall-88 lay	W-Brick/Clay Tile
ASHW-89	ASH Wall-89 lay	W-Brick/Clay Tile
ASHW-90	ASH Wall-90 lay	W-Brick/Clay Tile
ASHW-91	ASH Wall-91 lay	W-Clay Tile
ASHW-92	ASH Wall-92 lay	W-Clay Tile
ASHW-93	ASH Wall-93 lay	W-Clay Tile
ASHW-94	ASH Wall-94 lay	W-Sheet Metal
ASHW-95	ASH Wall-95 lay	W-Sheet Metal
ASHW-96	ASH Wall-96 lay	W-Sheet Metal

FLOOR

A new command, FLOOR, is provided in DOE-2.2. It is used to group SPACEs together for display purposes in PowerDOE. **FLOOR is a required command and a FLOOR must be defined prior to any SPACE**. Although all spaces may be assigned to the same FLOOR, for the greatest display utility in PowerDOE, care should be taken to assign SPACEs to the correct FLOOR.

FLOOR also adds a fifth coordinate system to DOE-2.2. DOE-2.1E's coordinate system hierarchy was: Reference coordinate system, Building coordinate system, Space coordinate system, and Surface coordinate system. DOE-2.2's coordinate system hierarchy is: Reference coordinate system, Building coordinate system, Floor coordinate system, Space coordinate system, and Surface coordinate system. Therefore, geometry keywords X, Y, Z, and AZ all apply to FLOOR, and are defined relative to the building coordinate system. Accordingly, in DOE-2.2 the SPACE geometry keywords X, Y, Z, and AZ, are now defined relative to the floor coordinate system, rather than the Building coordinate system.

An example of minimum input for this new command would be:

DOE-2.2 and PowerDOE:

```
      ALL-FLOORS = FLOOR
                   SHAPE = NO-SHAPE
                   FLOOR-HEIGHT = 12
                   SPACE-HEIGHT = 9
                   ..
```

Shapes and Surface AREA vs Surface HEIGHT and WIDTH

Since PowerDOE presents a graphic illustration of the building description, it is important to specify the HEIGHT and WIDTH of all building surfaces, and HEIGHT, WIDTH, and DEPTH for SPACE's (if you wish to see the floor plan). As of this writing, both DOE-2.2 and PowerDOE will accept the AREA specification, but this may change with future versions. **All FLOOR's and SPACE's must have SHAPE specified as either NO-SHAPE (meaning AREA, VOLUME or HEIGHT are required), BOX (meaning HEIGHT, WIDTH, and DEPTH are required), or POLYGON (meaning POLYGON and HEIGHT are required).**

For DOE-2.2 the shapes of FLOOR's, SPACE's, and walls may be specified by referencing a POLYGON command. THE POLYGON command is used to describe a non-rectangular shape by specifying the X and Y coordinates of the shape vertices in a counter-clockwise order; a POLYGON may have up to 20 vetches so specified. A POLYGON may be referenced by multiple surfaces or FLOOR's or SPACE's so as to make each have the same shape. The first vertex of a POLYGON is usually the origin, but that is not required. Examples are:

```
"FlrPoly" = POLYGON
  V1          =(0,0)
  V2          =(100,0)
  V3          =(100,80)
  V4          =(0,80)
  ..
```

OR

```
"LongTrapPoly" = POLYGON
  V1          =(0,0)
  V2          =(100,0)
  V3          =(75,25)
  V4          =(25,25)
  ..
```

For DOE-2.2 the use of POLYGON's and LOCATION can greatly simplify the input and allow automatic relocation of FLOOR's, SPACE's and their surfaces. This is accomplished by specifying the POLYGON shape for all FLOOR's and SPACE's and using the LOCATION keyword in SPACE and wall commands to specify the vertex of the "parent" command's POLYGON at which you want this item to be located; using this technique BDL will calculate the X, Y, and AZ for the SPACE or wall as well as the WIDTH for walls. The following examples shows this use:

```
"Floor 1" = FLOOR           SHAPE = POLYGON
  MULTIPLIER     =1
POLYGON        ="FlrPoly"
  ..

"Flr:1 > North" = SPACE   SHAPE = POLYGON
HEIGHT         =18
LOCATION = FLOOR-V1
POLYGON        ="LongTrapPoly"
…
  ..
"Flr:1 Spc:N > North Wall" = EXTERIOR-WALL
LOCATION = SPACE-V1
```

…
..

Additional Changes

The statements END and COMPUTE LOADS are replaced by a single instance of END and COMPUTE placed at the very end of the BDL file (immediately before to the STOP command). Any FUNCTIONS should be commented out for now.

METERS

The metering capabilities of DOE-2.2 have been greatly expanded. There are now ELEC-METER, FUEL-METER, STEAM-METER and CHW-METER commands to define each meter. A MASTER-METER command has been added to set the default meter connection for all electric and fuel uses either globally or by end use. **A MASTER-METER command must appear before any HVAC equipment description; if not a MASTER-METER command will be created that defaults all electric use to EM1 (fetched from the library) and all FUEL use to FM1 (fetched from the library).** The form of the commands is:

```
MASTER-METER
            MSTR-ELEC-METER   EM1
            MSTR-FUEL-METER   FM1 ..
```

SYSTEMS

The most time-consuming aspect of converting the SYSTEMS section of the DOE-2.1E input file is likely changing all of the SCHEDULES to the new format (see above). Relatively simple changes are required of the ZONE and SYSTEMS commands. The PLANT-ASSIGNMENT command no longer exists, and all of the PLANT-ASSIGNMENT keywords have been moved to other sections of the program.

Loops

Circulation Loops are a new concept in DOE-2.2. Read about the Circulation Loops in the DOE-2.2 and PowerDOE documentation.

For all system types except WLHP and 2-pipe systems, ignoring the commands and keywords associated with the circulation loops will cause DOE-2.2 to create default loops as required. For WLHP and 2-pipe systems, you must define the loop(s) and attach all components.

Zone

There are a few changes to the ZONE command. TYPE is now a required keyword (i.e., must be specified as either Conditioned, Unconditioned, or Plenum). TYPE must be either the first keyword or the second keyword after a LIKE keyword. Also, the ZONE u-name must now be different from the SPACE u-name that the zone refers to. This necessitates an additional keyword (SPACE) to specify the associated space.

DOE-2.1E version:

```
      RZ1       = ZONE  ZONE-AIR=SAIR
                        ZONE-CONTROL=CONTROL
                        CFM/SQFT=.9  ..
      RZ2       = ZONE  LIKE RZ1  ..
```

DOE-2.2 and PowerDOE version:

```
      RZZ1      = ZONE  TYPE=CONDITIONED
                        ZONE-AIR=SAIR
                        ZONE-CONTROL=CONTROL
                        CFM/SQFT=.9
                        SPACE = RZ1  ..
      RZZ2      = ZONE  LIKE RZZ1
                        SPACE = RZ2  ..
```

System

Under the SYSTEM command, the keyword SYSTEM-TYPE has been changed to TYPE, and must be the first keyword listed. **The ZONE-NAMES keyword is no longer used; as for FLOOR, SPACE, wall, ZONE's are placed after the SYSTEM to which they are attached and a SYSTEM must be specified prior to any ZONE.** The keyword CONTOL-ZONE is used to specify the zone in which the thermostat is located for SYSTEMS's having a control ZONE (SZRH, PSZ, RESYS, etc.).

The PLENUM-NAMES keyword has been removed, therefore, it is sufficient to simply list the plenums in the ZONE-NAMES list.

For central systems, specify the heating and cooling loops (**HEAT-SOURCE is now required for chilled water coil SYSTEMS**):

DOE-2.1E version:

```
      SYST-1 = SYSTEM  SYSTEM-TYPE=VAVS
                       ZONE-NAMES=(ZONE5-1Z,ZONE2-1Z,ZONE3-1Z,
                                   ZONE4-1Z,ZONE1-1Z,PLENUM-1Z)
                       PLENUM-NAMES=(PLENUM-1Z)
                       SYSTEM-CONTROL  = S-CONT
                       SYSTEM-FANS     = S-FAN
                       SYSTEM-TERMINAL = S-TERM
                       SYSTEM-FLUID    = S-FLUID
                       RETURN-AIR-PATH = PLENUM-ZONES
                       HEAT-SOURCE     = HOT-WATER
                       ..
```

DOE-2.2 and PowerDOE version:

```
      SYST-1 = SYSTEM  TYPE=VAVS
      SYSTEM-CONTROL  = S-CONT
                       SYSTEM-FANS     = S-FAN
                       SYSTEM-TERMINAL = S-TERM
                       SYSTEM-FLUID    = S-FLUID
                       RETURN-AIR-PATH = PLENUM-ZONES
                       HEAT-SOURCE     = HOT-WATER
                       HW-LOOP         = "Heating Loop"
                       CHW-LOOP        = "Cooling Loop"
                       ..
      ZONE5-1Z = ZONE  TYPE=CONDITIONED ..
      ZONE2-1Z = ZONE  TYPE=CONDITIONED ..
      ZONE3-1Z = ZONE  TYPE=CONDITIONED ..
      ZONE4-1Z = ZONE  TYPE=CONDITIONED ..
      ZONE1-1Z = ZONE  TYPE=CONDITIONED ..
      PLENUM-1Z = ZONE TYPE=PLENUM ..
```

Note that the zone names in the 2.1E version above are changed in the DOE2-2 version, since the zone names are no longer the same as the space names (see Zone discussion above).

Plant Assignment

The functionality of the PLANT-ASSIGNMENT concept has been expanded using CIRCULATION-LOOPS, and the PLANT-ASSIGNMENT command has been eliminated. All of the keywords associated with this command have been moved to other commands. Miscellaneous energy use is now handled with the ELEC-METER, FUEL-METER, STEAM-METER and CHW-METER commands using the keywords INTERIOR-POWER, INTERIOR-SCH, EXTERIOR-POWER and EXTERIOR-SCH.

Additional Changes

The statements END and COMPUTE LOADS are replaced by a single instance of END and COMPUTE placed at the very end of the BDL file (immediately before to the STOP command). Any FUNCTIONS should be commented out for now.

Plant

The plant section has been almost entirely re-structured into a more consistent and intuitive format. The keywords under PLANT-EQUIPMENT, PLANT-PARAMETERS, PART-LOAD-RATIO, and EQUIPMENT-QUAD have been moved to their respective equipment commands, i.e., CHILLER, BOILER, PUMP, etc.

Circulation-Loops

For central systems, a heating loop and a cooling loop should be defined. If a cooling tower is included in the plant, a condenser loop should also be defined. Each of these loops must have an associated loop-pump.

Note that you can define more than one loop of any given type. For example, your project may have 3 chilled water loops that operate completely separately from each other. In this case, your various HVAC systems can be attached to different (or the same) loops, and separate chiller(s) will have to be created and attached to each of these loops.

This capability replaces the old PLANT-ASSIGNMENT concept, but gives you far more flexibility in how you serve your loads. For example, individual zone reheat coils may be attached to different hot-water loops, even though the zones are served by the same central air handler.

Primary/secondary loop arrangements are also possible, as are various pumping arrangements. The concept of Circulation-Loops is a major expansion of the program's capabilities, and you are urged to read the documentation on this feature before attempting to use this feature in more than its most basic form.

The following commands define the basic circulation loops referred to in the other plant and system commands.

```
"Heating Loop"   =CIRCULATION-LOOP
                  TYPE             HW
                  LOOP-OPERATION   DEMAND
                  LOOP-PUMP       "Heating Pump"
                  ..

"Cooling Loop"   =CIRCULATION-LOOP
                  TYPE            CHW
                  LOOP-OPERATION  DEMAND
                  LOOP-PUMP       "Cooling Pump"
                  ..

"Condenser Loop" =CIRCULATION-LOOP
                  TYPE            CW
                  LOOP-OPERATION  DEMAND
                  LOOP-PUMP       "Condenser Pump"
                  ..
```

If you do not specify the circulation loops, the program will automatically create the necessary loops for all system types except WLHP and 2-pipe systems. These loops will be given the names DEFAULT-HW, DEFAULT-CHW, and DEFAULT-CW. The program will also create pumps for these default loops, named DEFAULT-HW-PUMP, DEFAULT-CHW-PUMP, and DEFAULT-CW-PUMP. While the program will create the loop(s) and pump(s) by default, you must still define the boilers, chillers, etc. that serve these loops.

Chillers

Nine chiller types are implemented as of this writing, electric-hermetic-centrifugal (ELEC-HERM-CENT), electric-open-centrifugal (ELEC-OPEN-CENT), electric-hermetic-reciprocating (ELEC-HERM-REC), and electric-open-reciprocating (ELEC-OPEN-REC), heat recovery (ELEC-HTREC), single stage absorption (ABSOR-1), two stage absorption (ABSOR-2), direct gas fired absorption (GAS-ABSOR), and gas engine driven (ENGINE). **CONDENSER-TYPE is a required input for chillers; it can be WATER-COOLED or AIR-COOLED.**

All keywords regarding the chiller are specified within the CHILLER command. In other words, chiller-related keywords that used to be specified using the PART-LOAD-RATIO, PLANT-PARAMETERS, and EQUIPMENT-QUAD commands are now defined within the CHILLER command. Each CHILLER command specifies one chiller, and all chillers are specified separately, even if identical (INSTALLED-NUMBER and MAX-NUMBER-AVAIL are not longer used). This allows the performance characteristics of each chiller to be unique from all others. For example, previously all open-centrifugal chillers had to have the same electric input ratio and performance curves, even if they were different sizes, makes, and ages. Now, each chiller is completely unique.

The following is the minimum specifications for a 0.7 kW/ton , 200 ton chiller connected to the defined cooling and condenser loops:

```
MAINCHLR = CHILLER
             TYPE       = ELEC-HERM-CENT
             CAPACITY   = 2.4
             EIR        = 0.20
             CHW-LOOP   = "Cooling Loop"
             CW-LOOP    = "Condenser Loop"
             ..
```

Note that, if you did not specify the CHW-LOOP and CW-LOOP for the chiller, these loop attachments will default to DEFAULT-CHW and DEFAULT-CW. This will cause problems if you actually did define the loops (not created by default), but forgot to attach the chiller to the loops you defined.

Boilers

The following is the minimum specifications for a 7 million BTU/hr boiler connected to the defined heating loop:

```
MAINBLR  = BOILER
             TYPE       = HW-BOILER
             CAPACITY   = 7.0
             HW-LOOP    = "Heating Loop"
             ..
```

Towers

Cooling towers are defined with the COOLING-TWR command. The following is the minimum specifications for a cooling tower connected to the defined condenser loop:

```
CTOWER  = COOLING-TWR  TYPE    = OPEN-TWR
                       CW-LOOP = "Condenser Loop"  ..
```

Energy Meters: The electric and fuel meters have been expanded from 5 each to 100 and 15 each respectively. You now define these meters using the ELEC-METER and FUEL-METER commands, and may give each meter your own name. The ENERGY-RESOURCE command has been eliminated, and all characteristics of the energy (consumption units, etc.) are now defined within the meter command. As before, you define the cost structure of the energy in the UTILITY-RATE command. The ELEC-METER command is a TYPE command; the TYPE can be either UTILITY, BUILDING, or SUB-METER. All SUB-METER TYPE ELEC-METER's must be included in the BLDG/SUB-METER list of a UTILITY meter or the SUB-METER list for a BUILDING TYPE ELEC-METER; similarly, all BUILDING TYPE ELEC-METER's must be included in the BLDG/SUB-METER list of a UTILITY meter.

```
"EM20" = ELEC-METER
  TYPE          =UTILITY
  SOURCE-SITE-EFF =0.37
  ..
```

In addition, purchased steam and chilled water may be specified using the STEAM-METER and CHW-METER commands.

If you do not define any meters, you may still assign various loads to different meters using the default meters predefined in the library. For electricity, these are EM1 through EM25, and for fuel they are FM1 through FM25. You use these meter names identically to the old names (the old codewords M1, M2, M3, M4, and M5 no longer exist).

To change the default hierarchy of the meters, use the MASTER-METERS command. This command replaces the function of the MSTR-ELEC-METER, MSTR-FUEL-METER, etc. keywords that used to exist in the PLANT-ASSIGNMENT command.

Pumps

Pumps are now specified with the PUMP command, similar to other plant equipment. See the DOE-2.2 documentation for a description of the keywords available for pumps. For most central systems, a heating pump and a cooling pump should be defined; if a cooling tower is used, a condenser pump should also be defined. The following lines define the necessary pumps for a central system with a cooling tower:

```
"Heating Pump"   =PUMP      CAP-CTRL = ONE-SPEED-PUMP  ..
"Cooling Pump"   =PUMP      CAP-CTRL = VAR-SPEED-PUMP  ..
"Condenser Pump" =PUMP  ..
```

Other Components

LOAD-MANAGEMENT, LOAD-ASSIGNMENT, HEAT-RECOVERY control commands as well as other Equipment types have been implemented; see 22HVAC for details and examples. The LOAD-MANAGEMENT and LOAD-ASSIGNMENT commands have been replaced with a new LOAD-MANAGEMENT and EQUIP-CTRL commands that offer expanded capabilities. The HEAT-

RECOVERY command is replaced using the expanded capabilities of the CIRCULATION-LOOP and EQUIP-CTRL commands. The ELEC-GENERATOR and THERMAL-STORAGE command are used to define different TYPEs of generator sets and storage tanks.

Additional Changes

The statements: INPUT PLANT, END and COMPUTE PLANT are eliminated.

Economics

Again, the most time-consuming aspect of converting the ECONOMICS section of the DOE-2.1E input file is likely changing all of the relevant SCHEDULES to the new format (see above). Otherwise, very few of the ECONOMICS specifications have changed, with the following exceptions:

Utility-Rate

The RESOURCE keyword is changed to TYPE.

Block Charges

The BLOCK1-DATA keyword, which required a list of values of different units (sets of block level, costs, and (optionally) limits) is replaced with three keywords. Use the following conversion as a guideline:

DOE-2.1E version:

```
WINTER-ON-P  = BLOCK-CHARGE
               BLOCK-SCH   = SEASONS-SCH
               SCH-FLAG    = 3
               BLOCK1-TYPE = KWH/KW
               BLOCK1-DATA = (200,.050,0,
                              800,0.060,0)  ..
```

DOE-2.2 version:

```
WINTER-ON-P  = BLOCK-CHARGE
               BLOCK-SCH   = SEASONS-SCH
               SCH-FLAG    = 3
               BLOCK1-TYPE = KWH/KW
               BLOCKS-1    = (200 ,800)
               COSTS-1     = (.050,.060)
               LIMITS-1    = ( 0  , 0)   ..
```

Additional Changes

The statements: END and COMPUTE are placed at the end for the BDL input file (immediately before to the STOP command), COMPUTE ECONOMICS is eliminated.