Documentation Update Package #4

DOE-2.1E, 1000-Zone Version

Update to the BDL Summary

Please print the pages and use them to update the BDL Summary (2.1E).

Page	Command	Increased value from/to	Page	Command	Increased value from/to
8	PARAMETER	50 to 100	25	UNDERGROUND-WALL or –FLOOR	64 to 256
9	SET-DEFAULT	100 to 300	25	REPORT-BLOCK	64 to 128
9	DAY-SCHEDULE	300 to 1025	26	HOURLY-REPORT	16 to 32
10	WEEK-SCHEDULE	200 to 751	28	CURVE-FIT	100 to 200
10	SCHEDULE	100 to 513	28	DAY-SCHEDULE	300 to 1025
11	MATERIAL	128 to 1024	28	WEEK-SCHEDULE	200 to 751
11	CONSTRUCTION	128 to 256	29	SCHEDULE	100 to 513
11	LAYERS	64 to 256	29	ZONE-CONTROL	50 to 1024
13	GLASS-TYPE	32 to 48	30	ZONE-AIR	50 to 1024
14	BUILDING-SHADE	64 to 128	30	ZONE-FANS	50 to 1024
14	FIXED-SHADE	33 to 100	31	ZONE	128 to 1024
16	SPACE-CONDITIONS	50 to 1024	32	ZONE	128 to 1024
17	SPACE-CONDITIONS	50 to 1024	39	SYSTEM	128 to 256
19	SPACE	128 to 1024	40	SYSTEM	128 to 256
19	EXTERIOR-WALL or -ROOF	2048 to 4096	43	PLANT-ASSIGNMENT	4 to 8
21	WINDOW	2048 to 8192	44	PLANT-ASSIGNMENT	4 to 8
22	WINDOW	2048 to 8192	45	PLANT-ASSIGNMENT	4 to 8
23	DOOR	64 to 1024	46	REPORT-BLOCK	64 to 128
24	INTERIOR-WALL	2048 to 3048	46	HOURLY-REPORT	16 to 32
24	POLYGON	5000 to 8192			

October 31, 2001

This replaces page 8 of the DOE-2.1E BDL Summary; value of PARAMETER increased.

BUILDING-LOCATION (B-L, 1)

		Time Zone Code
LATITUDE (LAT) (♦; -66.5 to 66.5°)	♦ Default is taken	4 Atlantic 6 Central 8 Pacific
LONGITUDE (LON) (♦; -180.0 to 180.0°)	from weather file	5 Eastern 7 Mountain 9 Yukon
TIME-ZONE (T-Z) (--; -12 to all integers)		10 Hawaii

ALTITUDE (ALT) (**0.0**; -1000.0 to 20,000 ft)
AZIMUTH (AZ) (**0.0;** -360 to 360°)

GROSS-AREA (G-A) (♦ **;** 0.0 to 10^7 ft^2)   ♦ Defaults to net area, i.e., the sum of areas of all conditioned SPACEs.

SURF-TEMP-CALC (**NO**; YES, NO)

HOLIDAY (HOL) (**YES**; YES, NO)   YES = U.S. holidays
DAYLIGHT-SAVINGS (D-S) (**YES**; YES, NO)   YES = Daylight savings correction made
SHIELDING-COEF (S-COEF) (**0.24**; 0.0 to 0.32)

X-REF (**0.0**; no limits - ft)   Used only in conjunction with the FIXED-SHADE
Y-REF (**0.0**; no limits - ft)   command.

TERRAIN-PAR1 (T-P1) (**0.85**; 0.47 to 1.3)
TERRAIN-PAR2 (T-P2) (**0.2**; 0.1 to 0.35)
WS-TERRAIN-PAR1 (W-T-P1) (**1.0**; 0.47 to 1.3)
WS-TERRAIN-PAR2 (W-T-P2) (**0.15**; 0.1 to 0.35)
WS-HEIGHT (W-H) (**33.0**; 0.0 to 1000 ft)

GROUND-T (G-T) (♦; -100.0 to 150.0F)   ♦ Takes a list of 12 values, 1 per month.
CLEARNESS-NUMBER (C-N) (♦; 0.5 to 1.2)   Default is taken from weather file.

ATM-TURBIDITY (ATM-T) (**0.12**; 0.0 to 1.0)   (list of 12 monthly values) Used only for daylighting calc.

WS-HEIGHT-LIST (W-H-L) (♦; 1.0 to 1000)   ♦ Takes a list of 12 values, 1 per month.
                                           Default is WS-HEIGHT.

HEAT-PEAK-PERIOD (H-P-P) (**1,24**; 1 to 24) (all integers♦)   ♦ Only one connected interval may be
COOL-PEAK-PERIOD (C-P-P) (**1,24**; 1 to 24) (all integers♦)   defined; minimum hour must be less
                                                 than maximum hour.

FUNCTION (*U-name*,*U-name*)
DAYL-FUNCTION (*U-name*,*U-name*)

ALT-HOLIDAYS (1) (A-H)   {allows user to input non-US Holidays]
    month day   month day   month day   month day … ..

Only one command allowed per loads input. U-name not allowed. There are no keywords; instead, it takes month-day like the RUN-PERIOD command. Up to 40 month-day pairs may be input. Use of this command replaces all the standard holidays hard-wired into DOE-2. Month is JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC. Day is an integer (1 to 31). Holidays may be entered in any order.

PARAMETER (DEFINE, ~~50~~, 100)
    U-NAME = VALUE, U-NAME = VALUE, etc.

This replaces page 9 of the DOE-2.1E BDL Summary; increased the value of SET-DEFAULT and DAY-SCHEDULE commands.

SET-DEFAULT (SET, 300)
- **FOR** command name
  KEYWORD = value, KEYWORD = value, etc.
  A maximum of 300 SET-DEFAULT commands may be used in each of LOADS, SYSTEMS, PLANT and ECONOMICS
- Required keyword

DESIGN-DAY (D-D, 3) Note: if this command is used, then **all** keywords are required.
    CLEARNESS (CL) (--; 0.5 to 1.2)
    CLOUD-AMOUNT (C-A) (--; 0 to 10)
    CLOUD-TYPE (C-T) (--; or 1 or 2) ♦   ♦ 0 = Cirrus or Cirrostratus, 1 = Stratus, 2 = All other cloud types
    DEWPT-HI (DP-H) (--; 100 to 200°F)
    DEWPT-LO (DP-L) (--; 100 to 200°F)
    DHOUR-HI (DH-H) (--; 1 to24)
    DHOUR-LO (DH-L) (--; 1 to24)
    DRYBULB-HI (DB-H) (--; -100 to 200°F)
    DRYBULB-LO (DB-L) (--; -100 to 200°F)
    GROUND-T (G-T) (--; -100 to 200°F)
    HOUR-HI (H-H) (-- 1 to 24)
    HOUR-LO (H-L) (-- 1 to 24)
    WIND-DIR (W-D) (--; 0 to 15) ♦   ♦   0 = North, 4 = East, 8 = South, 12 = West
    WIND-SPEED (W-S) (--; 0.0 to 200.0 kts)

= **DAY-SCHEDULE** (D-SCH, ~~300~~, 1025)
- (see example below)
  Note that all 24 hours must be accounted for.
- Required keyword

In its simplest form, the input for DAY-SCHEDULE takes the form:
    U-NAME = DAY-SCHEDULE (hours covered) (values for each hour) **..**

For example, for weekdays:
    LTG-1 = DAY-SCHEDULE (1,24) (0,0,0,0,0,0,0,0,.3,.6,.8,1,1,1,1,1,1,1,0 ,0,0,0,0,0) **..**

Optionally, this can be shortened by writing:
    LTG-1 = DAY-SCHEDULE (1,8)(0) (9.11) (.3,.6,.8) (12,18) (1) (19,24) (0) **..**

For weekends and holidays:
    LTG-2 = DAY-SCHEDULE (1,24)(0) **..**

This replaces page 10 of the DOE-2.1E BDL Summary; increased values for SCHEDULE and WEEK-SCHEDULE

= **WEEK-SCHEDULE** (W-SCH, ~~200~~, 751)
  (see example below)
  Note that the code-word for the days of the week and holidays is the first three letters of the name.
  ALL = Monday through Sunday plus Holidays
  WEH = weekends plus holidays
  WD = weekdays
  All days of the week must be accounted for.

In its simplest form, the input for DAY-SCHEDULE takes the form:

  U-NAME = WEEK-SCHEDULE (*) (U-NAME of DAY-SCHEDULE referenced) ..
          *days of week covered

Using the previously defined DAY-SCHEDULEs LTG-1 and LTG-2, the example can be carried forward with:

  NORMAL = WEEK-SCHEDULE (MON,FRI) LTG-1
               (SAT,HOL) LTG-2 ..
  VACATION = WEEK-SCHEDULE (ALL) LTG-2 ..

Optionally, NORMAL can be shortened to:

  NORMAL = WEEK-SCHEDULE (WD) LTG-1 (WEH) LTG-2 ..
   where (WD) stands for weekdays and (WEH) for weekends and holidays.

If Saturday is considered part of the normal week, you must write

  (MON,SAT) LTG-1 (SUN,HOL) LTG-2.

= **SCHEDULE** (SCH, ~~100~~, 513)
  (see example below)
  Note that the code-word for the month is the first three letters of the month's name.
  All days of the week must be accounted for.

In its simplest form, the input for SCHEDULE takes the form:

  U-NAME = SCHEDULE(THRU *) (U-NAME of WEEK-SCHEDULE referenced) ..
          *calendar period covered

To finalize the example:

  LIGHTS = SCHEDULE THRU JUN 10 NORMAL
           THRU SEP 5 VACATION
           THRU DEC 31 NORMAL ..

Alternatively, explicit use of DAY-SCHEDULE and WEEK-SCHEDULE can be bypassed by writing:

  LIGHTS = SCHEDULE THRU JUN 10 (WD) (1,8)(0)(9,11)(.3,.6,.8) (12,18)(1) (19,24)(0)
                (WEH)(1,24)(0)
           THRU SEP 5 (ALL)(1,24)(0)
           THRU DEC 31 (WD) (1,8)(0)(9,11)(.3,.6,.8) (12,18)(1)(19,24)(0)
                (WEH)(1,24)(0) ..

This replaces page 11 of the DOE-2.1E BDL Summary; increased the values of MATERIAL, CONSTRUCTION and LAYER.

= MATERIAL (MAT, ~~128~~, 1024)
- RESISTANCE (RES) (--; 0.0 to 40.0 hr-ft^2-°F/Btu)
  or
- THICKNESS (TH) (– –; 0.0 to 10.0 ft)
  and
- CONDUCTIVITY (COND) (--; 0.0 to 30.0 Btu-ft/hr-ft^2-°F)
  and
- DENSITY (DENS) (--; 0.0 to 500.0 lb/ft^3)
  and
- SPECIFIC-HEAT (S-H) (--; 0.0 to 5.0 Btu/lb-°F)

or just use RESISTANCE instead of these keywords

- Required keyword

= **CONSTRUCTION** (CONS, ~~64~~, ~~128~~, 256)

- **LAYERS** (LA) U-name or code-word
  or

- U-VALUE (U) (--; 0.0 to 20.0 Btu/hr-ft^2–°F) — For interior surfaces, this includes resistance of both air films. For exterior surfaces, this includes the film resistance, but not outside film resistance.

  WALL-PARAMETERS (W-P) U-name — Required for Trombe walls/sunspaces with interior venting.

  ABSORPTANCE (ABS) (**0.7;** 0.0 to 1.0) — Not used for interior walls or underground walls/floors.
  ROUGHNESS (RO) (**3;** 1 to 6)(all integers)

Values of ABSORPTANCE and ROUGHNESS are found in the tables on p. 12

- Required keyword

= **LAYERS** (LA, ~~64~~, 256)

- **MATERIAL** (MAT)   Value of MATERIAL must be a list of either the U-names of MATERIALs or code-words from the Materials Library on p. 118.

  THICKNESS (TH)   Must be specified if any thickness is different from those specified in the MATERIAL command or Materials Library. The order of the list must correspond to the list following MATERIALS.

  INSIDE-FILM-RES (I-F-R) (**0.68;** 0.0 to 40.0 hr-ft^2–°F/Btu)

- Required keyword

This replaces page 13 of the DOE-2.1E BDL Summary; increased value of GLASS-TYPE.

= **GLASS-TYPE** (G-T, ~~32~~, 48)

- **PANES** (P) (**1**; 1 to 3) (all integers) ♦   ♦ See *Reference Manual (2.1A)* for defaults when GLASS-TYPE-CODE ≤ 11 or SHADING-COEF specified.

- GLASS-TYPE-CODE (G-T-C) (--; 0.0 to 9999) (all integers, value ≥ 1000 for Window Library)
  or
  SHADING-COEF (S-C) (--; 0.0 to 1.0)

    GLASS-CONDUCTANCE (G-C)   ♦ See *Reference Manual (2.1A)* for defaults when GLASS-
    (♦; 0.0001 to 10.0 Btu/hr-ft^2-°F)   TYPE-CODE ≤ 11 or SHADING-COEF specified. Unused for glass types from the Window Library (GLASS-TYPE-CODE ≥ 1000).

    SPACER-TYPE-CODE (S-T-C) (**1**; 0 to 5) Used only for glass types from the Window Library (GLASS-TYPE-CODE ≥ 1000); default obtained from the Window Library

Between-Glass Spacers	
SPACER-TYPE-CODE	**Spacer Type**
0	Spacer taken from the Window Library
1 (default)	Aluminum
2	Stainless Steel
3	Butyl/Metal
4	Wood or Fiberglass
5	U-edge = U-center

→   VIS-TRANS (V-T) (**0.90**; 0.0 to 1.00)   Used only for daylighting calculation. Unused for glass types from the Window Library (GLASS-TYPE-CODE ≥ 1000).

    INSIDE-EMISS (I-E) (**0.84**; 0.0 to 1.0)   Used only for single glazing (PANES = 1) with SHADING-COEF specified, or with 9 ≤ GLASS-TYPE-CODE ≤ 11.

    OUTSIDE-EMISS (O-E) (**0.0**; 0.0 to 15.0°C)   Used only if SHADING-COEF is specified or if GLASS-TYPE-CODE ≤ 11.

    CONVERGENCE-TOL (C-T) (**0.0**; 0.0 to 15.0°C)   Positive value causes iterative calculation of glass layer temperatures for glass types from the window library (GLASS-TYPE-CODE ≥ 1000); input is °C for English and metric runs.

    FRAME-ABS (F-ABS) (**0.7**; 0.0 to1.0)

    FRAME-CONDUCTANCE (F-C)   See table below. Default obtained from the Window
    (**0.434**; 0.0 to 10.0 Btu/hr-ft^2-°F)   Library if GLASS-TYPE-CODE ≥ 1000.

- Required keyword

Conductance of Typical Frame Constructions (Btu/ft^2–F-h)		
Frame Type	**FRAME-CONDUCTANCE** (excludes OA film)	**U-value*** (includes OA film)
Thermally unbroken aluminum	3.037	1.90
Thermally broken aluminum	1.245	1.00
External Flush Glazed Aluminum	0.812	0.70
Wood with or without cladding	0.434	0.40
Vinyl	0.319	0.30
*FRAME-CONDUCTANCE = [(U-value)$^{-1}$ - 0.197]$^{-1}$		

This replaces page 14 of the DOE-2.1E BDL Summary; increased value of BUILDING-SHADE and FIXED-SHADE.

(=) BUILDING-SHADE (B-S, ~~64~~, 128)

      X (**0.0**; no limits - ft)   Note that X, Y and Z are coordinates of the lower left hand corner of the

      Y (**0.0**; no limits - ft)   shading surface in the building coordinate system when viewed from the tip

      Z (**0.0**; no limits - ft)   of the outwardly drawn normal.

- HEIGHT (H) (--; 0.0 to 2000.0 ft.)
- WIDTH (W) (--; 0.0 to 2000.0 ft.)

      AZIMUTH (AZ) (**0.0**; -360.0 to 360.0°)

      TILT (**90.0**; 0.0 to 180.0°)

      TRANSMITTANCE (TR) (**0.0**; 0.0 to 1.0) [Daylighting calculation assumes TRANSMITTANCE = 0]

      SHADE-SCHEDULE (S-SCH) U-name* [Daylighting calculation assumes TRANSMITTANCE = 0]

      SHADE-VIS-REFL (S-V-R) (**0.5**; 0.0001 to 1.0) [Used only for daylighting calculation.]

      SHADE-GND-REFL (S-G-R) (**0.2**; 0.0001 to 1.0) [Used only for daylighting calculation.]

* Used only to simulate variable exterior shading devices. Use of this keyword overrides TRANSMITTANCE value.

- Required keyword

(=) FIXED-SHADE (B-S, ~~33~~, 100)

      X-REF (**0.0**; no limits - ft)   Note that X, Y and Z are coordinates of the lower left hand corner of the

      Y-REF (**0.0**; no limits - ft)   shading surface in the building coordinate system when viewed from the tip

      Z-REF (**0.0**; no limits - ft)   of the outwardly drawn normal.

- HEIGHT (H) (--; 0.0 to 2000.0 ft.)
- WIDTH (W) (--; 0.0 to 2000.0 ft.)

      AZIMUTH (AZ) (**0.0**; -360.0 to 360.0°)

      TILT (**90.0**; 0.0 to 180.0°)

      TRANSMITTANCE (TR) (**0.0**; 0.0 to 1.0) [Daylighting calculation assumes TRANSMITTANCE = 0]

      SHADE-SCHEDULE (S-SCH) U-name* [Daylighting calculation assumes TRANSMITTANCE = 0]

      SHADE-VIS-REFL (S-V-R) (**0.5**; 0.0001 to 1.0) [Used only for daylighting calculation.]

      SHADE-GND-REFL (S-G-R) (**0.2**; 0.0001 to 1.0) [Used only for daylighting calculation.]

* Used only to simulate variable exterior shading devices. Use of this keyword overrides TRANSMITTANCE value.

Note that FIXED-SHADE is used only for stationary shading surfaces which are NOT *rotated* or *translated* with the building.

- Required keyword

This replaces page 16 of the DOE-2.1E BDL Summary; increased value of SPACE-CONDITIONS.

= **SPACE-CONDITIONS** (S-C, ~~50~~, 1024) [continued on the next page]	
PEOPLE-SCHEDULE (P-SCH) U-name	
NUMBER-OF-PEOPLE (N-O-P) (**0.0**; 0.0 to 10,000.0)	
AREA/PERSON (A/P) (**100.0**; 0.0 to 10,000.0 ft^2) [Used only if NUMBER-OF-PEOPLE not specified.]	
PEOPLE-HEAT-GAIN (P-H-G) (**0.0**; 350.0 to 2000.0 Btu/hr-pers)♦	♦ If no value is input, there is no
or	contribution from people. If all are
PEOPLE-HG-LAT (P-H-L) (**0.0**; 0.0 to 2000.0 Btu/hr-pers)♦	specified, the contribution is
and	cumulative.
PEOPLE-HG-SENS (P-H-S) (**0.0**; 0.0 to 2000.0 Btu/hr-pers)♦	
LIGHTING-SCHEDULE (L-SCH) U-name	
LIGHTING-TYPE (L-T) (**SUS-FLUOR**; SUS-FLUOR, REC-FLUOR-RV, REC-FLUOR-RSV, REC-FLUOR-NV, INCAND)	
LIGHTING-W/SQFT (**0.0**; 0.0 to 10.0 W/ft^2)	
or	[if both specified, contribution is added]
LIGHTING-KW (L-KW) (**0.0**; 0.0 to 200.0 kW)	
LIGHT-HEAT-TO (L-H-T) U-name of space [required if LIGHT-TO-OTHER > 0]	
LIGHT-TO-SPACE (L-T-S) (♦; 0.0 to 1.0)	
LIGHT-TO-OTHER (L-T-O) (♦; 0.0 to 1.0)	♦ See the
LIGHT-TO-RETURN (L-T-R) (♦; 0.0 to 1.0)	"Default Table for LIGHTING-TYPEs"
LIGHT-RAD-FRAC (L-R-F) (♦; 0.0 to 1.0) list of 2	
TASK-LIGHT-SCH (T-L-SCH) U-name	
TASK-LT/W/SQFT (T-L-W) (**0.0**; 0.0 to 10.0 W/ft^2)	
or	[if both specified, contribution is added]
TASK-LIGHTING-KW (T-L-KW) (**0.0**; 0.0 to 200.0 kW)	
EQUIP-SCHEDULE (E-SCH) U-name	
EQUIPMENT-W/SQFT (E-W) (**0.0**; 0.0 to 100.0 W/ft^2)	
or	[if both specified, contribution is added]
EQUIPMENT-KW (E-KW) (**0.0**; 0.0 to 200.0 kW)	
EQUIP-SENSIBLE (E-S) (**1.0**; 0.0 to 1.0)	
EQUIP-LATENT (E-L) (**0.0**; 0.0 to 1.0)	
SOURCE-SCHEDULE (S-SCH) U-name	
SOURCE-TYPE (S-T) (**GAS**; GAS, ELECTRIC, HOT-WATER, PROCESS)	
SOURCE-BTU (S-B) (**0.0**; 1000,000.0 to -1000,000.0 Btu/hr)	
SOURCE-SENSIBLE (S-S) (**1.0**; -1.0 to 1.0)	
SOURCE-LATENT (S-L) (**0.0**; 0.0 to 1.0)	
WEIGHTING FACTOR (W-F) ♦	♦ [Space weighting factor U-name; 8 or
or	less alphanumerical characters]
FLOOR WEIGHT (F-W) (**70**; 0.0 to 200.0 lb/ft^2)	
TEMPERATURE (T) (**70**; 0.0 to 120.0°F) (list of 1)	
FURNITURE-TYPE (F-TYPE) (**HEAVY**; HEAVY, LIGHT)	
FURN-FRACTION (F-F) (**0.0**; 0.0 to 1.0)	[Used only when CWF are to be calculated.]
FURN-WEIGHT (F-WGT) (**0.0**; 0.0 to 300.0 lb/ft^2)	
* See the "Default Table for LIGHTING-TYPEs" on p. 17.	

This replaces page 17 of the DOE-2.1E BDL Summary; increased value of SPACE-CONDITIONS.

= **SPACE-CONDITIONS** (S-C, ~~50~~, 1024)   [continued]
INF-SCHEDULE (I-SCH) U-name
INF-METHOD (I-M) (**NONE**; NONE, CRACK, AIR-CHANGE, RESIDENTIAL, S-G)
AIR-CHANGES/HR (A-C) (**0.0**; 0.0 to 30.0
or   [if both specified, contribution is added]
INF-CFM/SQFT (I-CFM) (**0.0**; 0.0 to 20.0 cfm/ft^2)
ZONE-TYPE (Z-TYPE) (**CONDITIONED**; CONDITIONED, UNCONDITIONED, PLENUM)
RES-INF-COEF (R-I-C) (**0.252, 0.0251, 0.0084**; 0.0 to 20.0 mixed units)
NEUTRAL-ZONE-HT (N-Z-H) (**0.0**; no limits - ft)
HOR-LEAK-FRAC (H-L-F) (**0.4**; 0.0 to 1.0)
NEUTRAL-LEVEL (N-L) (**0.5**; 0.0 to 1.0)
FRAC-LEAK-AREA (F-L-A) (**0.0005**; 0.0 to 1.0)
DAYLIGHTING (DAY) (**NO**; NO, YES)
→   LIGHT-REF-POINT1 (L-R-P1) (**--, --, 2.5**; no limits-ft) (list of 3) [required for daylighting calculation]
→   LIGHT-REF-POINT2 (L-R-P2) (**--, --, 2.5**; no limits-ft) (list of 3)
→   ZONE-FRACTION1 (Z-F1) (**1.0**; 0.0 to 1.0)
→   ZONE-FRACTION2 (Z-F2) (--; 0.0 to 1.0) [required if LIGHT-REF-POINT2 is specified]
→   If ZONE-FRACTION2 is specified, (ZONE-FRACTION1) + (ZONE-FRACTION2) should be ≤ 1.0.
→   LIGHT-SET-POINT1 (L-S-P1) (**50.0**; 0.0 to 500.0 footcandles)
→   LIGHT-SET-POINT2 (L-S-P2) (**50.0**; 0.0 to 500.0 footcandles)
→   LIGHT-CTRL-TYPE1 (L-C-T2) (**CONTINUOUS**; CONTINUOUS, STEPPED)
→   LIGHT-CTRL-TYPE2 (L-C-T2) (**CONTINUOUS**; CONTINUOUS, STEPPED)
→   MIN-POWER-FRAC (M-P-F) (**0.3**; 0.0 to 1.0)
→   MIN-LIGHT-FRAC (M-L-F) (**0.2**; 0.0 to 1.0)
→   LIGHT-CTRL-STEPS (L-C-S) (**3.0**; 0.0 to 20.0)
→   LIGHT-CTRL-PROB (L-C-P) (**1.0**; 0.0 to 1.0)
→   DAYLIGHT-REP-SCH (D-R-SCH) U-name
→   MAX-GLARE (M-G) (**100.0**; 0.0 to 100.0)
→
→   VIEW-AZIMUTH (V-AZ) (♦; -360.0 to 360.0°)   ♦ Default is the direction parallel to the fist window
in the space
SUNSPACE (SUNSP) (**NO**; NO, YES)
→ Used only for daylighting calculations

Default Table for LIGHTING-TYPEs					
	SUS-FLUOR	REC-FLUOR-RV	REC-FLUOR-RSV	INCAND	REC-FLUOR-NV
LIGHT-TO-SPACE	1.0	0.8	0.8	1.0	1.0
LIGHT-TO-OTHER	0.0	0.0	0.0	0.0	0.0
LIGHT-TO-RETURN	*	*	*	*	*
LIGHT-RAD-FRAC					
in this space	0.67	0.59	0.19	0.71	0.67
in other space	1.0	0.09	0.09	1.0	0.9

This replaces page 18 of the DOE-2.1E BDL Summary; increased the value of SPACE command.

(=) SPACE (S, ~~128~~, 1024)
- **AREA** (A) (**– –**; 0.0+ to 100,000.0 ft^2)
- **VOLUME** (V) (**– –**; 0.0 to 10^6 ft^3**)**

    MULTIPLIER (M) (**1.0**; 1.0 to 50.0)
    FLOOR-MULTIPLIER (F-M) (**1.0;** 1.0 to 200.0)

    SPACE-CONDITIONS (S-C) U-name   Any keyword from this subcommand may be placed in the SPACE command

    SHAPE (♦; BOX)
    HEIGHT (H) (♦; 0.0 to 50.0 ft)   ♦ If SHAPE is used, its only value is BOX, and values must be given for HEIGHT, WIDTH and DEPTH. In this case, AREA and VOLUME should be ignored
    WIDTH (W) (♦; 0.o to 10,000.0 ft)
    DEPTH (D) (♦; 0.0 0.o to 10,000.0 ft)
    X (**0.0**; no limits - ft)
    Y (**0.0**; no limits - ft)
    Z (**0.0**; no limits - ft)
    AZIMUTH (AZ) (**0.0**; -360 to 360.0°)
    FUNCTION (*U-name*,*U-name*)
    DAYL-IULLUM-FN (*U-name*,*U-name*) ♦   ♦ Used only for daylighting calculations
    DAYL-LTCTRL-FN (*U-name*,*U-name*) ♦

- Required keyword

Applicability Table of SPACE-CONDITIONS Infiltration-Related Keywords for Different Infiltration Methods						
	INF-METHOD					
		Air Change				
Keyword	**None**	**With Wind Correction**	**Without Wind Correction**	**CRACK**	**Residential**	**S-G**
AIR-CHANGES/HR	not used	required	not used	not used	not used	not used
FRAC-LEAK-AREA	not used	not used	not used	not used	not used	used[3]
HOR-LEAK-FRAC	not used	not used	not used	not used	not used	used[3]
INF-CFM-SQFT	not used	not used	required	not used	not used	not used
INF-COEF[1]	not used	not used	not used	required	not used	not used
INF-SCHEDULE[2]	not used	used	used	used	used	used
NEUTRAL-LEVEL	not used	not used	not used	not used	not used	used[3]
NEUTRAL-ZONE-HT	not used	not used	not used	required	not used	not used
RES-INF-COEF	not used	not used	not used	not used	used[3]	not used

1 This keyword is input under the EXTERIOR-WALL, DOOR and WINDOW commands. Note that for INF-METHOD = RESIDENTIAL, wind and temperature dependence is given through the RES-INF-COEF keyword.
2 If not specified, always on
3 If not specified, takes default value

This replaces page 19 of the DOE-2.1E BDL Summary; increased value of EXTERIOR-WALL or ROOF command.

(=) EXTERIOR-WALL (E-W) or **ROOF** (~~300~~, ~~2048~~, 4096)
Note that a set-default for EXTERIOR-WALL will also reset the default for roof.
- **HEIGHT** (H) (**– –**; 0.0 to 2000.0 ft)
- **WIDTH** (W) (**– –**; 0.0 to 2000.0 ft**)**
- **CONSTRUCTION** (CONS) U-name
   AZIMUTH (AZ) (**0.0°;** -360 to 360°)
   TILT (**90°;** 0.0 to 180.0°)   Tilt for EXTERIOR-WALL must be input, otherwise defaults to 90°.
            Tilt for ROOF must be input, otherwise defaults to 0°.

   POLYGON (POLY) U-name
   INSIDE-SURF-TEMP (**NO**; NO, YES)
   X (0.0; no limits - ft)
   Y (0.0; no limits - ft)
   Z (0.0; no limits - ft)
   MULTIPLIER (M) (1.0; 0.0 to 99.0)
   GND-REFLECTANCE (G-R) (**0.2**; 0.0 to 1.0) [see table on p. 20 for values]

   LOCATION (LOC) (♦; TOP, BOTTOM, LEFT,   ♦ Required if SHAPE keyword is used in the
              RIGHT, FRONT, BACK)   SPACE command. If used, do not use H, W, AZ,
                                           X, Y, Z and TILT.

   SHADING-SURFACE (S-S) (**NO**; NO, YES)
   SHADING-DIVISION (S-D) (**10**; 1 TO 40) (all integers)
   SKY-FORM-FACTORS (S-F-F) (--; 0.0 to 1.0)   Either both or neither of these should be specified.
   GND-FORM-FACTORS (G-F-F) (--; 0.0 to 1.0)   If not specified, the program will calculate them
   INF-COEF (I-C) (**0.0**; 0.0 to 160.0 units)   Used only if INF-METHOD=CRACK in SPACE or
   [see table below for values]   SPACE-CONDITIONS
   SOLAR-FRACTION (S-F) (♦; 0.0 to 1.0)   ♦ If not specified, program will distribute according to
   [used only when CWF are to be calculated]   total surface area, floor receives the greater weight.
   INSIDE-VIS-REFL (I-V-R) (♦; 0.0 to 1.0)   ♦ Default is 0.2 if floor (TILT > 170°), 0.5 if wall
   [used only for daylighting calculations]   ($10° \leq$ TILT $\leq 170°$) and 0.7 if ceiling (TILT < 10°).
   INSIDE-SOL-ABS (I-S-A) (♦; 0.0 to 1.0)   ♦ Default is 0.8 if floor (TILT>170°), 0.5 if wall
                                              ($10° \leq$ TILT $\leq 170°$) and 0.3 if ceiling (TILT < 10°).
   OUTSIDE-EMISS (O-E) (**0.9**; 0.0 to 1.0)   Not used for interior walls, underground floors or
                                              underground walls.
   FUNCTION (*U-name*,*U-name*)
- Required keyword

Exterior Wall Infiltration Coefficients		
Construction of Wall	$\dfrac{\text{cfh}}{\text{ft}^2_{\text{wall}}}$	**INF-COEF**
13" brick with plastered surface	(0.01)	0.002
13" brick, furring, lath, plaster	(0.03)	0.005
Frame wall, lath and plaster	(0.09)	0.016
8-1/2" brick, plain	(5.0)	0.915
16" shingles on shiplap with building paper	(0.50)	0.092
16" shingles on shiplap	(8.00)	1.465
16" shingles on 1x4 boards on 5" center	(40.01)	7.324

This replaces page 21 of the DOE-2.1E BDL Summary; increased value of the WINDOW command.

(=) WINDOW (W1, ~~200~~, ~~2048~~, 8192) [Continued on next page]	
● **HEIGHT** (H) (**--;** 0.0001 to 40.0 ft)	
● **WIDTH** (W) (--; 0.0001 to 1000.0 ft)	
● **GLASS-TYPE** (G-T) U-name	
X (**0.0**; 0.0 to 2000.0 ft)	
Y (**0.0**; 0.0 to 2000.0 ft)	
MULTIPLIER (M) (**0.0**; 0.0 to 99.0)	
SHADING-SCHEDULE (S-SCH) U-name	
MAX-SOLAR-SCH (M-S-SCH) U-name	
SUN-CTRL-PROB (S-C-P) (**1.0**; 0.0 to 1.0)	
OPEN-SHADE-SCH (O-S-SCH) U-name	
WIN-SHADE-TYPE (W-S-T) (**MOVABLE-INTERIOR**; MOVABLE-INTERIOR, MOVABLE-EXTERIOR, FIXED-INTERIOR, FIXED-EXTERIOR)	Used only for exterior windows in spaces with DAYLIGHTING = YES or SUNSPACE = YES; unused if the window has no SHADING-SCHEDULE
CONDUCT-SCHEDULE (C-SCH) U-name CONDUCT-TMIN-SCH (C-T-SCH) U-name	
VIS-TRANS-SCH (V-T-SCH) U-name	This keyword is required for daylighting calculation if SHADE-SCHEDULE is specified.
FRAME-WIDTH (FR-W) (0.0; 0.0 to 2.0 ft) SETBACK (SETB) (0.0; 0.0 to 10.0 ft)	Unused for interior windows
SOL-TRANS-SCH (S-T-SCH) U-name	Used only if there is an exterior window in a space with SUNSPACE =-YES
SKY-FORM-FACTORS (S-F-F-) (**--**; 0.0 to 1.0) GND-FORM-FACTORS (G-F-F-) (**--**; 0.0 to 1.0)	Either both or neither of these should be specified. If not specified, the program will calculate them.

↑	OVERHANG-A (OH-A) (**0.0**; 0.0 to no limits – ft) OVERHANG-B (OH-AB (**0.0;** 0.0 to no limits – ft)	
	OVERHANG-W (OH-W) (**0.0**; 0.0 to no limits – ft) OVERHANG-D (OH-D) (**0.0**; 0.0 to no limits – ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done.
	OVERHANG-ANGLE (OH-ANG) (**0.0**; 0.0 to no limits – ft) LEFT-FIN-A (L-F-A) (**0.0**; 0.0 to no limits – ft) LEFT-FIN-B (L-F-B) (**0.0**; 0.0 to no limits – ft)	
Unused for interior windows	LEFT-FIN-H (L-F-H) (**0.0**; 0.0 to no limits – ft) LEFT-FIN-D (L-F-D) (**0.0**; 0.0 to no limits – ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done.
	RIGHT-FIN-A (R-F-A) (**0.0**; 0.0 to no limits – ft) RIGHT-FIN-B (R-F-B) (**0.0**; 0.0 to no limits – ft)	
	RIGHT-FIN-H (R-F-H) (**0.0**; 0.0 to no limits – ft) RIGHT-FIN-D (R-F-D) (**0.0**; 0.0 to no limits – ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done.
	FUNCTION (*U-name*,*U-name*) SHADING-DIVISION (S-D) (**10**; 1 to 40 units) all integers	
	INF-COEF (I-C) (**0.0**; 1 to 160.0 units)	Used only if INF-METHOD = CRACK in SPACE or SPACE-CONDITIONS
↓	GLARE-CTRL-PROB (G-C-P) (**1.0**; 0.0 to 1.0) INSIDE-VIS-REFL (I-V-R) (**0.15**; 0.0 to 1.0 WINDOW-SPEC-FN *U-name*	
●	Required keyword	

This replaces page 22 of the DOE-2.1E BDL Summary; increased value of the WINDOW command.

(=) WINDOW (W1, ~~200~~, ~~2048~~, 8192) [Continued]

INSIDE-SURF-TEMP (**NO**; YES, NO)

The followiong keywords are used only for switchable glazing in exterior windows
    GLASS-TYPE-SWG (G-T-SW) U-name
    SWITCH-CONTROL (SW-C) (**NO-SWITCH**; NO-SWITCH, DIR-SOL-INC, TOT-SOL-INC,
                    DIR-SOL-TR, TOT-SOL-TR, TOT-SOL-HOR, OUTSIDE-TEMP, SPACE-
                    LOAD, DAYLIGHT-LEVEL)
    SWITCH-SET-HI (SW-SET-HI) (--; -500.0 to 500.0)   Unused for SWITCH-CONTROL=DAYLIGHT-
    SWITCH-SET-LO (SW-SET-LO) (--; -500.0 to 500.0)   LEVEL; see table below for units.
    SWITCH-SCH (SW-SCH) U-name

Exterior Wall Infiltration Coefficients		
Construction of Wall	$\dfrac{\text{cfh}}{\text{ft}^2_{\text{wall}}}$	**INF-COEF**
13" brick with plastered surface	(0.01)	0.002
13" brick, furring, lath, plaster	(0.03)	0.005
Frame wall, lath and plaster	(0.09)	0.016
8-1/2" brick, plain	(5.0)	0.915
16" shingles on shiplap with building paper	(0.5)	0.092
16" shingles on shiplap	(8.0)	1.465
16" shingles on 1x4 boards on 5" center	(40.01)	7.324

SWITCH-CONTROL	Units of SWITCH-SET-HI and -LO (for English and metric runs)
NO-SWITCH	no units used
DIR-SOL-INC	Btu/h-ft^2 [glass]
TOT-SOL-INC	Btu/h-ft^2 [glass]
DIR-SOL-TR	Btu/h-ft^2 [glass]
TOT-SOL-TR	Btu/h-ft^2 [glass]
TOT-SOL-HOR	Btu/h-ft^2
OUTSIDE-TEMP	°F
SPACE-LOAD	Btu/h-ft^2 [glass]
DAYLIGHT-LEVEL	no units used

This replaces page 23 of the DOE-2.1E BDL Summary; the value of DOOR was increased.

 (=) DOOR (~~64~~, 1024)
- HEIGHT (H) (--; 0.0 to 40.0 ft)
- WIDTH (W) (--; 0.0 to 1000.0 ft)
- CONSTRUCTION (CONS) U-name of a quick-type (U-value) CONSTRUCTION

> INSIDE-SURF-TEMP (**NO**; YES, NO)
> MULTIPLIER (M) (**1.0**; 0.0 to 99.0)
> SETBACK (SETB) (**0.0**; 0.0 to 10.0 ft)
> OVERHANG-A (OH-A) (**0.0**; no limits - ft)
> OVERHANG-B (OH-B) (**0.0**; no limits - ft)

OVERHANG-W (OH-W) (**0.0**; no limits - ft) OVERHANG-D (OH-D) (**0.0**; no limits - ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done
LEFT-FIN-A (L-F-A) (**0.0**; no limits - ft) LEFT-FIN-B (L-F-B) (**0.0**; no limits - ft)	
LEFT-FIN-H (L-F-H) (**0.0**; no limits - ft) LEFT-FIN-D (L-F-D) (**0.0**; no limits - ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done
RIGHT-FIN-A (R-F-A) (**0.0**; no limits - ft) RIGHT-FIN-B (R-F-B) (**0.0**; no limits - ft)	
RIGHT-FIN-H (R-F-H) (**0.0**; no limits - ft) RIGHT-FIN-D (R-F-D) (**0.0**; no limits - ft)	Either both or neither of these should be specified. If not specified, shading calculation will not be done
X (**0.0**; no limits - ft) Y (**0.0**; no limits - ft)	
SKY-FORM-FACTORS (S-F-F) (--; 0.0 to 1.0) GND-FORM-FACTORS (G-F-F) (--; 0.0 to 1.0)	Either both or neither of these should be specified. If not specified, the program will calculate them.

> SHADING-DIVISION (S-D) (**10**; 1 to 40) (all integers)
> INF-COEF (I-C) (**0.0**; 0.0 to 500.0 units) [see table below for typical values]
> INSIDE-VIS-REFL (I-V-R) (**0.5**; 0.0 to 1.0) [used only for daylighting calculation]
> FUNCTION (*U-name*,*U-name)

- Required keyword

Door Insulation Coefficients	
Door Configuration	**INF-COEF**
1. Door - Residential 3-ft x -7ft:	
closed with weather stripping	2.4
average use with weather stripping	9.8
average use without weather stripping	12.0
2. Door - Residential 3-ft x -7ft:	
door closed	3.1
door and vestibule open 10% of time	9.3
door open 10% of time	13.5
door open 25% of time	55.0
door open 50% of time	153.0
3. Door - Revolving, average use:	12.0
4. Garage or Shipping Room:	
no use	6.0
average use	60.0

This replaces page 24 of the DOE-2.1E BDL Summary; values of INTERIOR-WALL and POLYGON were increased.

(=) INTERIOR-WALL (I-W, ~~512~~, ~~2048~~, 3048)

- **AREA** (A) (**--**; 0.0 to 100,000.0 ft^2)

  or

  HEIGHT (H) (**--**; 0.0 to 2000.0 ft)
  and
  WIDTH (W) (**--**; 0.0 to 2000.0 ft**)**   Used only if either side of the wall is in a space with SUNSPACE=YES

  or

  LOCATION (LOC) (♦; TOP, BOTTOM, LEFT, RIGHT, FRONT, BACK)   ♦ Required if SHAPE keyword is used in the SPACE command

- **CONSTRUCTION** (CONS) U-name

  NEXT-TO (N-T) U-name of adjacent SPACE   Required if INT-WALL-TYPE=STANDARD or =AIR; otherwise unused

  INT-WALL-TYPE (I-W-TYPE) (**STANDARD**; STANDARD, AIR, ADIABATIC, INTERNAL)
  INSIDE-SURF-TEMP (**NO**; NO YES)
  POLYGON (POLY) U-name

  TILT (**90°;** 0.0 TO 180.0°)   Used only if
  (a) CWF are being calculated;
  (b) either side of wall is in a space with DAYLIGHTING=YES; or
  (c) either side of the wall is in a space with SUNSPACE=YES.

  SOLAR-FRACTION (S-F) (♦; 0.0 to 1.0) (list of 2) [used only when CWF are to be calculated] ♦ ♦   ♦ If not specified, program will distribute according to total surface area with the floor receiving greater weight.

  INSIDE-VIS-REFL (I-V-R) (**; 0.0 to 1.0) (list of 2) [used only for daylighting calculation] ♦ ♦   ♦ ♦ First value in the list of 2 is for the side of the wall that is in the space in which the wall is defined; second value is for the side of the wall in the NEXT-TO space.

  X (**0.0**; no limits - ft)
  Y (**0.0**; no limits - ft)
  Z (**0.0**; no limits - ft)   Used only if either side of the wall is in a space with SUNSPACE=YES
  AZIMUTH (AZ) (**0.0**; -360.0 to 360.0°)

  INSIDE-SOLAR-ABS (I-S-A) (♦; 0.0 to 1.0) (list of 2) First value in the list of 2 is for the side of the wall that is in the space in which the wall is defined; second value is for the side of the wall in the NEXT-TO space.   ♦ Default is (0.8,0.3) if floor (TILT > 170°), (0.5, 0.5) if wall (10° ≤ TILT ≤ 170°) and (0.3,0.8) if ceiling (TILT < 10°).

- Required keyword

(=) POLYGON (4~~000, 5000~~, 8192)

2-D Polygon (vertex 1 in 2-D coordinates) (vertex 2 in 2-D coordinates) etc.
Example of an Exterior Wall 2-D Polygon with Three Sides:
```
     TRIANG = POLYGON
             (0,0)(20,0)(10,20) ..
```
Here, (0,0)(20,0)(10,20) are the vertices of the 2-D polygon in the plane of the wall, which is the polygon's local coordinate system

3-D Polygon (vertex 1 in 3-D coordinates) (vertex 2 in 3-D coordinates) etc.
Example of an Exterior Wall that is a 3-D Polygon with Three Sides:
```
     TRIANG = POLYGON
             (8,3.5,6)(28,3.5,6)(18,3.5,26) ..
```
Here, (8,3.5,6)(28,3.5,6)(18,3.5,26) are the vertices of the 3-D polygon in the space coordinate system.

This replaces page 25 of the DOE-2.1E BDL Summary; increased value of UNDERGROUND-WALL, and REPORT-BLOCK

(=) UNDERGROUND-WALL (U-W) or **UNDERGROUND-FLOOR** (U-F) (~~64~~, 256)

- **AREA** (A) (--; 0.0 to 100,000.0 ft ^{2})

  or

  HEIGHT (H) (**--**; 0.0 to 2000.0 ft)

  and

  WIDTH (W) (**--**; 0.0 to 2000.0 ft**)**

  or

LOCATION (LOC) (♦; TOP, BOTTOM, LEFT, RIGHT, FRONT, BACK)	♦ Required if SHAPE keyword is used in the SPACE command.
TILT (**90°;** 0.0 to 180.0°)	Tilt for UNDERGROUND-FLOOR must be input, otherwise defaults to 180°. A set-default for UNDERGROUND-WALL will also reset the default for UNDERGROUND-FLOOR.
U-EFFECTIVE (U-EFF) (--; 0.0 to 20.0 Btu/hr-ft^2-°F)	If a delayed CONSTRUCTION was input for CWF calculation, U-EFFECTIVE is the appropriate U-value to be used for the hourly simulation. Used only for automatic calculation of Custom Weighting Factors.

- **CONSTRUCTION** (CONS) U-name
  INSIDE-SURF-TEMP (**NO**; NO, YES)
  POLYGON (POLY) U-name
  MULTIPLIER (M) (**1.0**; 0.0 to 99.0)

SOLAR-FRACTION (S-F) (♦; 0.0 to 1.0) [used only if CWF are to be calculated]	♦ If not specified, program will distribute according to total surface area, with floor receiving the greater weight.
INSIDE-VIS-REFL (I-V-R) (♦; 0.0 to 1.0) [used only for daylighting calculations]	♦ Default is 0.2 if floor (TILT > 170°), 0.5 if wall (10° ≤ TILT ≤ 170°) and 0.7 if ceiling (TILT < 10°).
INSIDE-SOL-ABS (I-S-A) (♦; 0.0 to 1.0)	♦ Default is 0.8 if floor (TILT >170°), 0.5 if wall (10° ≤ TILT ≤ 170°) and 0.3 if ceiling (TILT < 10°).
FUNCTION (*U-name*,*U-name*)	

- Required keyword

BUILDING-RESOURCE (B-R, 1)
    See the PLANT-ASSIGNMENT command in SYSTEMS, p. 42.

LOADS-REPORT (L-R, 1)
    VERIFICATION (V) (--; LV-A, LV-B, ... LV-N, ALL-VERIFICATION) (list)
    SUMMARY (S) (**LS-D**; LS-A, LS-B, ..., LS-L, ALL-SUMMARY) (list)
    REPORT-FREQUENCY (R-F) (**HOURLY**; HOURLY, DAILY, MONTHLY, YEARLY)
    HOURLY-DATA-SAVE (H-D-S) (**NO-SAVE**; BINARY, FORMATTED)
    See page 100 for a brief description; Chapter III of the *Reference Manual (2.1A)* for definitions, and Appendix C of the *Supplement (2.1E)* for a full description of all reports.

= REPORT-BLOCK (R-B, ~~64~~, 128)
- VARIABLE-TYPE (V-T) (--; GLOBAL, END-USE, BUILDING, U-name of SPACE, U-name of ROOF or EXTERIOR-WALL, U-name of WINDOW, U-name of DOOR)

- VARIABLE-LIST (V-L) (--; code numbers) (list)
  [for code number list see Appendix A of the *Supplement (2.1E*]*)*

- Required keyword

This replaces page 26 of the DOE-2.1E BDL Summary; increased value of HOURLY-REPORT.

= HOURLY-REPORT (H-R, ~~16~~, 32)	
● REPORT-SCHEDULE (R-SCH) U-name	
● REPORT-BLOCK (R-B)	(list of U-names of Report Blocks, 30 maximum)
OPTION (O) (**PRINT**; PRINT PLOT BINARY-FILE)	
DIVIDE (**1.0**; no limits)	List DIVIDE and AXIS-ASSIGN for all variables listed in R-B in
AXIS-ASSIGN (A-A) (**1**; 1, 2) (integers)	the corresponding order, max 12 variables in PLOT option.
AXIS-MAX (A-MAX) (**--**; no limits)	If PLOT option chosen, then A-MAX and A-MIN are required
AXIS-MIN (A-MIN) (**--**; no limits)	for each axis.
AXIS-TITLES (A-T) (*"Axis 1 Title"*,* Axis 2 Title"*) Each title must be 16 characters or less	
Note: the total number of VARIABLE-LIST variables in all Report Blocks may not exceed 60 in any HOURLY-REPORT	
● Required keyword	

END
Required at the end of LOADS input and before FUNCTION command, if specified.

FUNCTION (100)
●   NAME U-name of function
●   LEVEL (**--**; BUILDING, SPACE, EXTERIOR-WALL, UNDERGROUND-WALL, WINDOW, DOOR)
Note: Up to 100 block sequences of FUNCTION, ASSIGN, CALCULATE and END-FUNCTION may be defined
●   Required keyword

ASSIGN (100)
●   Local variable name = DOE-2 simulation variable name
or a single numeric value
or a PARAMETER name set equal to a numeric or constant
or to a SCHEDULE-NAME (U-name of schedule)
or schedule (global variable name of schedule).
●   Table variable name = table (lists of data points)
●   Required keyword

CALCULATE (100) *Required to do FUNCTON calculation*
Note: follow this command (after the terminator) with the FORTRAN-like statements which define the desired function. As in standard FORTRAN, statement numbers much appear in columns 1-5, column 6 is used to designate a statement continuation, and statements must begin in or after column 7 and end before 72. The last statement must be END. See p. 1.10 of the *DOE-2 Supplement (2.1E)* for a list of valid FORTRAN declarative and executable statements.

END-FUNCTION
Required at the end of the FUNCTION input.

This replaces page 28 of the DOE-2.1E BDL Summary; increased values of CURVE-FIT, DAY-SCHEDULE and WEEK-SCHEDULE.

SYSTEMS SUMMARY

INPUT SYSTEMS   Required for Systems input
　　Note that the maximum total INPUT plus PARAMETRIC-INPUT commands is 100
　　INPUT-UNITS (**ENGLISH**; ENGLISH, METRIC)
　　OUTPUT-UNITS (**ENGLISH**; ENGLISH, METRIC)

PARAMETRIC-INPUT SYSTEMS
　　Note that the maximum total INPUT plus PARAMETRIC-INPUT commands is 100
　　INPUT-UNITS (**ENGLISH**; ENGLISH, METRIC)
　　OUTPUT-UNITS (**ENGLISH**; ENGLISH, METRIC)

TITLE (5)
　　See LOADS

ABORT
　　Only needed when overriding value input in LOADS.

DIAGNOSTIC (LIST)
　　Only needed when overriding value input in LOADS.

PARAMETER (DEFINE)
　　See LOADS

= CURVE-FIT (C-F, ~~100~~, 200)
- 　TYPE (--; LINEAR, BI-LINEAR, QUADRATIC, BI-QUADRATIC, CUBIC)
　　OUTPUT-MIN (--; 1000,m000.0 to 10,000,000.0)
　　OUTPUT-MAX (--; 1000,m000.0 to 10,000,000.0)
- 　DATA (up to 20 lists of data points)
　　　　or
- 　COEFFICIENTS (COEF) (list of up to 6 coefficients)
- 　Required keyword

= **DAY-SCHEDULE** (D-SCH, ~~300~~, 1025)
　　See LOADS

= **WEEK-SCHEDULE** (W-SCH, ~~200~~, 751)
　　See LOADS

This replaces page 29 of the DOE-2.1E BDL Summary; increased values of SCHEDULE and ZONE-CONTROL

= **SCHEDULE** (SCH, ~~100~~, 513)   Note: **LIKE** keyword not allowed
    See LOADS

= **DAY-RESET-SCH** (D-R-SCH, 300 minus the number of D-SCH's)
- **SUPPLY-HI** (S-H) (**--**; 0.0 to 120.0°F) or (**--**; 0.0 to 1.0)
- **SUPPLY-LO** (S-L) (**--**; 0.0 to 120.0°F) or (**--**; 0.0 to 1.0)
- **OUTSIDE-HI** (O-H) (**--**; -20.0 to 120.0°F)
- **OUTSIDE-LO** (O-L) (**--**; -20.0 to 120.0°F)
- Required keyword

= **RESET-SCHEDULE** (R-SCH, 100 minus the number of SCH's) Note: **LIKE** keyword not allowed
    See LOADS

= **ZONE-CONTROL** (Z-C, ~~50~~, 1024)
    DESIGN-HEAT-T (D-H-T) (**70°F**; 0.0 to 80°F)
    HEAT-TEMP-SCH (H-T-SCH) U-name (if omitted, no heating or cooling, respectively, in zone)
    DESIGN-COOL-T (D-C-T) (**76°F**; 0.0 to 90°F)
    COOL-TEMP-SCH (C-T-SCH) U-name (if omitted, no heating or cooling, respectively, in zone)
    BASEBOARD-CTRL (B-C) (**OUTDOOR-RESET**; OUTDOOR-RESET, THERMOSTATIC)
    THERMOSTAT-TYPE (T-TYPE) (**PROPORTIONAL**; PROPORTIONAL, REVERSE-ACTION,
                     TWO-POSITION)
    THROTTLING-RANGE (T-R) (♦; 0.1 TO 10.0°F)   ♦ Default is 2.0 if THERMOSTAT-TYPE =
                                        PROPORTIONAL or REVERSE-ACTION.
                                    Default is 0.5 if THERMOSTAT-TYPE = TWO-
                                    POSITION

This replaces page 30 of the DOE-2.1E BDL Summary; increased values for ZONE-AIR and ZONE-FANS

= **ZONE-AIR** (Z-A, ~~50~~, 1024)

    ASSIGNED-CFM (A-CFM) (**--**; 0.0 TO 9,999,999.0 cfm)
    or
    CFM/SQFT (**--**; 0.0 to 5.0 cfm/ft^2)
    or
    AIR-CHANGES/HR (A-C/HR) (**--**; 0.0 to 10.0/hr)

    OUTSIDE-AIR-CFM (O-A-CFM) (**--**; 0.0 TO 9,999,999.0 cfm)
    or
    OA-CFM/PER (O-CFM/P) (**--**; 0.0 to 60.0 cfm/person)
    or
    OA-CHANGES (O-C) (**--**; 0.0 to 10.0/hr)

EXHAUST-CFM (E-CFM) (♦; 0.0 to 9,999,999.0 cfm) EXHAUST-STATIC (E-S) (♦; 0.0 to 10.0 in of WG) EXHAUST-KW (E-KW) (♦; 0.0 to 0.01)	♦ System-dependent; see page 62, **Index of System Types**, for default values.
EXHAUST-EFF (E-E) (**0.75**; 0.1 to 1.0)	
SS-VENT-SCH (S-V-SCH) U-name SS-VENT-T-SCH (S-V-T-SCH) U-name SS-VENT-CST (S-V-CST) (**5.0**; 0.0 to 20.0 ach) SS-VENT-WND (S-V-WND) (**0.0**; 0.0 to 5.0 ach/knot) SS-VENT-TEMP (S-V-TEMP) (**0.0**; 0.0 to 1.0 ach/°F) SS-VENT-LIMIT-T (S-V-L-T) (**120.0**; 0.0 to 140.0°F) SS-VENT-KW (S-V-KW) (**0.0**; 0.0 to 0.01 kW/cfm) SS-FLOW-SCH (S-F-SCH) U-name	Used only for zones with SUNSPACE = YES
SS-FLOW-T-SCH U-name (defaults to 74°F)	

= **ZONE-FANS** (Z-F, ~~50~~, 1024)   [Used only for PIU systems]

● **ZONE-FAN-RATIO** (Z-F-R) (♦; 0.0 to 10.0) or ● **ZONE-FAN-CFM** (Z-F-CFM) (♦; 0.0 to 9,999,999.0 ft^3/min)	♦ For series PIU, ZONE-FAN-RATIO defaults to 1.0; however, defaulting is not allowed for parallel PIU. User must input -RATIO or -CFM
● **ZONE-FAN-T-SCH** (Z-F-SCH) U-name [Required if TERMINAL-TYPE = PARALLEL-PIU.] ZONE-FAN-KW (Z-F-KW) (**0.00033**; 0.0 to 0.01 kW/cfm)	
● Required keyword	

This replaces page 31 of the DOE-2.1E BDL Summary; increased value of ZONE

= **ZONE** (Z, ~~128~~, 1024) [Continued on next page]

ZONE-TYPE (Z-TYPE) (**CONDITIONED**; CONDITIONED, UNCONDITIONED, PLENUM)	
ZONE-CONTROL (Z-C) U-name	Any keyword from these subcommands
ZONE-AIR (Z-A) U-name	may be placed in the ZONE command.
ZONE-FANS (Z-F) U-name	
ZONE-REPORTS (**YES**; YES or NO for SUMMARY reports for this ZONE)	
MIN-CFM-RATIO (M-C-R) (♦; 0.0 to 1.0)	♦ System-dependent; see page 62,
COOLING-CAPACIY (C-CAP) (♦; 0.0 to 9,999,999.0 Btu/hr)	**Index of System Types**, for default
COOL-SH-CAP (C-S-C) (♦; 0.0 to 9,999,999.0 Btu/hr)	values.
HEATING-CAPACIY (H-CAP) (♦; -9,999,999.0 to 0.0 Btu/hr)	
MIN-CFM-SCH (M-C-SCH) U-name	
SIZING-OPTION (S-O) (**FROM-LOADS**; FROM-LOADS, ADJUST-LOADS)	
TERMINAL-TYPE (TER-TYPE) (**SVAV**; SVAV, SERIES-PIU, PARALLEL-PIU)	
INDUCED-AIR-ZONE (I-A-Z) U-name of ZONE	Used only for PIU systems. I-A-Z
REHEAT-DELTA-T (R-D-T) (--; 0.0 to 100.0°F)	required if TERMINAL-TYPE≠SVAV
BASEBOARD-RATING (B-R) (**0.0**; -9,999,999.0 to 0.0 Btu/hr)	
PANEL-LOSS-RATIO (P-L-R) (**0.0**; 0.0 to 2.0)	
MULTIPLIER (M) (♦; 1.0 to 50.0)	♦ Defaults to value in corresponding SPACE in LOADS.
FLOOR-MULTIPLIER (F-M) (♦; 1.0 to 200.0)	Used only for PIU systems. I-A-Z required if
	TERMINAL-TYPE≠SVAV
MAX-HEAT-RATE (MAX-H-R) (♦; -9,999,999.0 to 0.0 Btu/hr)	♦ System-dependent; see page 62,
MAX-COOL-RATE (MAX-C-R) (♦; 9,999,999.0 to 0.0 Btu/hr)	**Index of System Types**, for default
	values.
TROM-VENT-SCH (T-V-SCH) U-name (use only for vented Trombe walls)	
FUNCTION (*U-name*,*U-name*)	

	REFG-ZONE-LOAD (♦; -9,999,999.0 to 0.0 Btu/hr) list of up to 3	♦ Required for simulation of
These REFG-type keywords are only used for PSZ refrigeration	REFG-DISCHARGE-T (♦; -40.0 to 60.0°F) list of up to 3	refrigeration
	REFG-ZONE-SHR (**0.8, 0.8, 0.8**; 0.0 to 1.0) list of up to 3	
	REFG-ZONE-DES-T (**75.0, 75.0, 75.0**; 30.0 to 100.0°F) list of up to 3	
	REFG-ZONE-DES-RH (**55.0, 55.0, 55.0**; 2.0 to 100.0%) list of up to 3	
	REFG-EVAP-T (♦; -40.0 to 60.0°F) list of up to 3	Defaults to corresponding
		(REFG-DISCHARGE-T) - 10°F
	REFG-SENS-SCH (list of up to 3 U-names)	
	REFG-LAT-SCH (list of up to 3 U-names)	
	REFG-AUX-HEAT (**0.0, 0.0, 0.0**; 0.0 to 9,999,999.0 Btu/hr) list of up to 3	
	REFG-AUX-SCH (list of up to 3 U-names)	
	REFG-AUX-KW (♦; 0.0 to 100.0 kW) list of up to 3	♦ Values must be greater than corresponding
		REFG-EVAP-T values

= **ZONE** (Z, ~~128~~, 1024) [Continued]
    REFG-DEF-MECH (**RESISTANCE, RESISTANCE, RESISTANCE**; RESISTANCE, FREON,
                TIME-OFF, NO-DEFROST) list of up to 3
    REFG-DEF-EFF (♦; 0.1 to 1.0) list of up to 3   ♦ Defaults to 0.9, 0.9, 0.9 unless corresponding
                                         REFG-DEF-MECH = TIME-OPFF, in which case
                                         defaults to 1.0, 1.0, 1.0
    REFG-DEF-CTRL (**THERMOSTATIC, THERMOSTATIC, THERMOSTATIC**; THERMOSTATIC,
                TIMER) list of up to 3

All the metering keywords listed under the PLANT-ASSIGNMENT command on p. 43 may be entered at the ZONE level. The following metering keywords allow you to assign electric and fuel meters to specific end uses.
    MSTR-ELEC-METER (MSTR-EM) (**M1**; M1, M2, M3, M4, M5)
    MSTR-FUEL-METER (MSTR-FM) (**M1**; M1, M2, M3, M4, M5)
    LIGHT-ELEC-METER (LIGHT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    TASK-ELEC-METER (TASK-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    EQUIP-ELEC-METER (EQUIP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    SOURCE-ELEC-METER (SRC-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    HEAT-ELEC-METER (HEAT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    COOL-ELEC-METER (COOL-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    HTREJ-ELEC-METER (HTREJ-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    AUX-ELEC-METER (AUX-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    VENT-ELEC-METER (VENT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    REFG-ELEC-METER (REFG-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    SUPP-ELEC-METER (SUPP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    DHW-ELEC-METER (DHW-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    SOURCE-FUEL-METER (SRC-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    HEAT-FUEL-METER (HEAT-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    COOL-FUEL-METER (COOL-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    SUPP-FUEL-METER (SUPP-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    DHW-FUEL-METER (DHW-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

This replaces page 39 of the DOE-2.1E BDL Summary; increased value of SYSTEM command; increased ZONE-NAMES keyword from 128 to 256

```
= SYSTEM (SYST, ~~100~~, ~~128~~, 256)  [continued on next page]
      SYSTEM-CONTROL (S-C)
      SYSTEM-AIR (S-A)
      SYSTEM-FANS (S-FANS)              Any keyword from these subcommands may be placed in the
      SYSTEM-TERMINAL (S-T)            SYSTEM command
      SYSTEM-FLUID (S-FLU)
      SYSTEM-EQUIPMENT (S-EQ)
      SYSTEM-REPORTS (YES; YES or NO for SUMMRAY reports for this SYSTEM)
      SYSTEM-TYPE (S-TYPE) (--;♦)                           ♦ System-dependent; see page 62, Index
                                                              of System Types, for default values.

      PLENUM-NAMES (P-N) (list of plenum zones in system, 3 max)
      ZONE-NAMES (Z-N) (list of zones in system, including plenum and unconditioned zones, ~~128~~, now 256)
      HEAT-SOURCE (HEAT-S) ♦                    (♦; HOT-WATER, ELECTRIC, FURNACE,
      ZONE-HEAT-SOURCE (Z-H-S) ♦                   HEAT-PUMP GAS-HEAT-PUMP)
      PREHEAT-SOURCE (PREHEAT) ♦
      BASEBOARD-SOURCE (BASEB-S) ♦       System-dependent; see page 62, Index of System
      HUMIDIFIER-TYPE (H-TYPE) ♦         Types, for default values.

      SHW-HP-SIZE (NONE; 0.0 to 9,999,999.0 Btu/hr)
      SHW-HP-SOURCE (ZONE; ZONE, OUTDOOR)
      SHW-HP-ZONE (U-name of zone in which SHW-HP is located)
      SIZING-RATIO (SR) (1.0; 0.1 to 2.0)
      COOL-SIZING-RATIO (1.0; 0.1 to 2.0 )
      HEAT-SIZING-RATIO (1.0; 0.1 to 2.0)
      SIZING-OPTION (S-O) (♦; NON-COINCIDENT, COINCIDENT)   ♦ System-dependent; see page 62,
                                                              Index of System Types, for default
                                                              values.
      RETURN-AIR-PATH (R-A-P) (DIRECT; DIRECT, DUCT, PLENUM-ZONES)
      OA-FROM-SYSTEM (OA-F-S) (NONE; UL-name of SYSTEM)
      DESICCANT (DESIC) (NO-DESICCANT; NO-DESICCANT, LIQ-VENT-AIR-1, -2, SOL-VENT-AIR-1)
      DESICCANT-AIR (DESC-A) (NONE;  0.0 to 1.0 cfmOA/cfmSUPPLY)
      REG-HEAT-SOURCE (R-H-S) (GAS-HYDRONIC; GAS-HYDRONIC, HOT-WATER)
      DESC-CTRL-MODE (NONE; code values 0, 1, 2 which designate type of liquid desiccant units)
      DESC-DEW-SET (NONE; -50.0 to 200.0)
      HEAT-EXCH-EFF (H-E-E) (0.9; 0.0 to 1.0)
      HEAT-EXCH-DELP (H-E-DP) (1.0; 0.10 to 10.0)
      FUNCTION
```

This replaces page 40 of the DOE-2.1E BDL Summary; SYSTEM

= **SYSTEM** (SYST, ~~100~~, ~~128~~, 256) [continued]

<div style="margin-left: 2em">

REFG-SIZING-RAT (**1.2**; 0.8 to 2.0

REFG-COMP-CAP ♦ Defaults to
(♦; 0.0 to 9,999,999.0 Btu/hr) list of 3 (refrigeration equipment design load) * (REFG-SIZING-RAT)

REFG-COMP-GROUP (**SEPARATE, SEPARATE, SEPARATE**; SEPARATE, COMMON) list of 3

REFG-FAN-KW (**0.105**; 0.0 to 100.0)

REFG-PUMP-KW (**0.025**; 0.0 to 100.0)

REFG-MIN-COND-T (**60.0**; 50.0 to 110.0°F)

REFG-COND-TYPE (**WATER**; WATER, AIR)

REFG-HTREC-UNITS (**YES, YES, YES**; YES, NO)

REFG-HTREC-GROUP (**COMMON**; COMMON, SEPARATE)

REFG-HTREC-T (**90.0**; 80.0 to 120.0°F)

REFG-FAN-T (**30.0**; 0.0 to 100.0°F)

REFG-COMP-EER (♦; 0.0 to 20.0 Btu/W) list of 3 ♦ Default is linear with REFG-EVAP-T,
7.3 Btu/W at 25°F, 3.5 Btu/W at -30°F.

REFG-MAX-HTREC (♦; 0.0 to 9.999.999.0 Btu/hr) ♦ Default: all compressor heat is recoverable

</div>

These REFG-type keywords are only used for PSZ refrigeration simulation

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The following metering keywords allow you to assign electric and fuel meters to specific end uses.

<div style="margin-left: 2em">

MSTR-ELEC-METER (MSTR-EM) (**M1**; M1, M2, M3, M4, M5)

MSTR-FUEL-METER (MSTR-FM) (**M1**; M1, M2, M3, M4, M5)

LIGHT-ELEC-METER (LIGHT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

TASK-ELEC-METER (TASK-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

EQUIP-ELEC-METER (EQUIP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

SOURCE-ELEC-METER (SRC-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

HEAT-ELEC-METER (HEAT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

COOL-ELEC-METER (COOL-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

HTREJ-ELEC-METER (HTREJ-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

AUX-ELEC-METER (AUX-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

VENT-ELEC-METER (VENT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

REFG-ELEC-METER (REFG-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

SUPP-ELEC-METER (SUPP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

DHW-ELEC-METER (DHW-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

SOURCE-FUEL-METER (SRC-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

HEAT-FUEL-METER (HEAT-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

COOL-FUEL-METER (COOL-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

SUPP-FUEL-METER (SUPP-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

DHW-FUEL-METER (DHW-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

ELEC-METER (**M1**; M1, M2, M3, M4, M5)

FUEL-METER (**M1;** M1, M2, M3, M4, M5)

</div>

All metering keywords listed under PLANT-ASSIGNMENT command may be entered at the SYSTEM level

This replaces page 43 of the DOE-2.1E BDL Summary; increased value of PLANT-ASSIGNMENT command and SYSTEM-NAMES keyword.

= PLANT-ASSIGNMENT (P-A, 0̶4̶, 8) [Continued on the next page]   Note: **LIKE** keyword not allowed.
[If this command is not used, then the default PLANT-ASSIGNMENT becomes all systems described in the input.]
FUNCTION
SHW-HP-CAP-FT (curve SDL-C51)
SHW-HP-EIR (**0.37**; 0.0 to 1.5 Btu/Btu)
SHW-HP-EIR-FPLR (curve SDL-C61)
SHW-HP-EIR-FT (curve SDL-C56)
●   SYSTEM-NAMES (S-N) (list of system names in this plant) old 1̶0̶0̶, new 256

Note: HP-LOOP-HEATING used for HP only and HP-LOOP-COOLING used for PSZ and PVAVS when
CONDENSER-TYPE = WATER-COOLED
HP-LOOP-HEATING (**FROM-SYSTEMS**; FROM-SYSTEMS, FROM-PLANT)
HP-LOOP-COOLING (**FROM-SYSTEMS**; FROM-SYSTEMS, FROM-PLANT)
PLANT-REPORTS (**YES**; YES, NO) Allows you to suppress unwanted reports.

Note: The following cooling tower and loop pump keywords are used for the HP system and for PSZ and
PVAVS water cooled condensers and water side economizers
TWR-SIZE (**automatically sized**; 0.0 to 100.0 million Btu/hr)
TWR-NUM-CELLS (**automatically determined**; 0 to 100)   Based on a maximum of 15 Mbtu/hr per cell
TWR-SCH (U-name)
0 = tower not available
1 = tower available
>1 = tower available when ambient temperature exceeds this value; if omitted, defaults to CIRC-PUMP-SCH
TWR-EIR (♦; 0.0 to 10.0)   ♦ Defaults to a fan power of 0.0154 hp/gpm;
corresponds to TWR-EIR $\cong$ to 0.0105 Btu/Btu
TWR-SETPT-CTRL (**FIXED**; FIXED, WETBULB-RESET)
TWR-SETPT-T (**80.0**; 32.0 to 100.0°F)
TWR-SETPT-SCH (U-name) [If omitted, defaults to TWR-SETPT-T.]
TWR-THROTTLE (**10.0**; 1.0 to 20.0°F)
MIN-TWR-WTR-T (**66.0**; 32.0 to 100.0°F)
TWR-RESET-RATIO (**0.29**; 0.0 to 1.0)
TWR-CELL-CTRL (**MIN-CELLS**; MIN-CELLS, MAX-CELLS)
TWR-CAP-CTRL (**ONE-SPEED-FAN**; ONE-SPEED-FAN, FLUID-BYPASS, TWO-SPEED-FAN,
VARIABLE-SPEED-FAN)
TWR-FAN-OFF-CFM (**0.17**; 0.0 to 1.0)
TWR-FAN-LOW-CFM (**0.50**; 0.0 to 1.0)   Used only when TWR-CAP-CTRL = TWO-SPEED
TWR-FAN-LOW-ELEC (**0.16**; 0.0 to 1.0)
TWR-PUMP-HEAD (**20.0**; 0.0 to 100.0 ft)
TWR-IMPELLER-EFF (**0.77**; 0.0 to 1.0)
TWR-MOTOR-EFF (**0.90**; 0.0 to 1.0)
TWR-CELL-MAX-GPM (**2.0**; 1.0 to 3.0)
TWR-CELL-MIN-GPM (**0.33**; 0.2 to 1.0)
TWR-DESIGN-WETBULB (**78.0**; 30.0 to 85.0°F)
TWR-DESIGN-APPROACH (**7.0**; 4.0 to 50.0°F)
TWR-FAN-FPLR (**TWRFAN**; U-name of cubic curve)
TWR-GPM-FRA (**GPMRA**; U-name of bi-quadratic curve)
TWR-GPM-FWB (**GPMWB**; U-name of bi-quadratic curve)
TWR-MIN-FAN-SPEED (**40.0**; 0.0 to 1.0)   Used only when TWR-CAP-CTRL = TWO-SPEED
●   Required keyword

This replaces page 44 of the DOE-2.1E BDL Summary; increased value of PLANT-ASSIGNMENT.

= PLANT-ASSIGNMENT (P-A, 04, 8) [Continued on the next page]   Note: **LIKE** keyword not allowed.
[If this command is not used, then the default PLANT-ASSIGNMENT becomes all systems described in the input.]
    CIRC-IMPELLER-EFF (**0.77**; 0.0 to 1.0)
    CIRC-MOTOR-EFF (**0.90**; 0.0 to 1.0)
    CIRC-HEAD (**60.0**; 0.0 to 100.0 ft)
    CIRC-PUMP-TYPE (**FIXED-FLOW**; FIXED-FLOW, VARIABLE-FLOW)
    CIRC-MIN-PLR (**0.50**; 0.0 to 1.0)
    CIRC-PUMP-FPLR (**CIRC-PUMP-CURVE**; U-name of linear or quadratic curve)
    CIRC-PUMP-SCH (**on with any system fans**; U-name of schedule)
    MAX-FLUID-T (**120.0**; 50 to 120°F) Unit high limit protection   [Overrides SYSTEM-FLUID inputs.]
    FLUID-VOLUME (**15.0**; 1.0 to 500.0 gal/ton)
    MIN-FLUID-T (**0.50**; 40.0 to 80.0°F) Unit low limit protection. Provides SYSTEM-FLUID defaults.
    DHW-SIZE (♦; 0.0 to 1000.0 gal)
    DHW-HEAT-RATE (♦; 0.0 to 100,000.0 Btu/hr)
    DHW-EIR (♦; 0.0 to 3.0)   ♦ See keyword description.
    DHW-HSUP-RATE (♦; 0.0 to 100,000.0 Btu/hr)
    DHW-HSTOR-RATE (♦; 0.0 to 100,000.0 Btu/hr)
    DHW-TYPE (**GAS**; GAS, ELECTRIC, HEAT-PUMP, DESUPERHEAT, WASTE-HEAT)
    DHW-LOSS (**0.3**; 0.0 to 1.0)
    DHW-PUMP-ELEC (**0.0**; 0.0 to 0.1 watt/Btu)
    DHW-PUMP-SCH (U-name)
    DHW-EIR-FT (♦)
    DHW-HEAT-RATE-FT (♦)   ♦ See curve default table, p. 3.142.
    DHW-EIR-FPLR (♦)

Note: Following BOILER-type keywords used only for HP loop simulation
    BOILER-SIZE (**Automatically sized**; -1000.0 to 0.0 Millions Btu/hr)
    BOILER-MIN-RATIO (**0.25**; 0.0 to 1.0)
    BOILER-MAX-RATIO (**1.20**; 1.0 to 2.0)
    BOILER-MAX-SCH (U-name) [If omitted, defaults to BOILER-MAX-RATIO.]
    BOILER-EIR (**0.02**; 0.0 to 10.0)
    BOILER-HIR (**1.25**; 0.0 to 3.0)
    BOILER-HIR-FPLR (**BLRHIR2**; U-name of linear or quadratic curve)
    BOILER-TYPE (**ELECTRIC-BOILER**; ELECTRIC-BOILER, FUEL-BOILER)
    BOILER-SCH (U-name) [If omitted, defaults to CIRC-PUMP-SCH.]
    BOILER-SET-POINT (**65.0**; 32.0 to 100.0°F)
    BOILER-SET-SCH (U-name) [If omitted, defaults to BOILER-SET-POINT.]
    BOILER-THROTTLE (**10.0**; 1.0 to 20.0°F)
    BOILER-LOSS (**0.02**; 0.0 to 1.0 fraction of capacity of electric boiler)

Note: The following keywords allow you to input building energy resources that do not contribute to the building
    internal loads. These replace keywords that were formerly entered from BUILDING-RESOURCE in
    LOADS. Metering keywords allow you to assign electric and fuel meters to specific end uses.
    MSTR-ELEC-METER (MSTR-EM) (**M1**; M1, M2, M3, M4, M5)
    MSTR-FUEL-METER (MSTR-FM) (**M1**; M1, M2, M3, M4, M5)
    LIGHT-ELEC-METER (LIGHT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    TASK-ELEC-METER (TASK-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    EQUIP-ELEC-METER (EQUIP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)

This replaces page 45 of the DOE-2.1E BDL Summary; increased value of PLANT-ASSIGNMENT.

= PLANT-ASSIGNMENT (P-A, ~~04~~, 8) [Continued on the next page]   Note: **LIKE** keyword not allowed.
[If this command is not used, then the default PLANT-ASSIGNMENT becomes all systems described in the input.]

    SOURCE-ELEC-METER (SRC-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    HEAT-ELEC-METER (HEAT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    COOL-ELEC-METER (COOL-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    HTREJ-ELEC-METER (HTREJ-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    AUX-ELEC-METER (AUX-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    VENT-ELEC-METER (VENT-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    REFG-ELEC-METER (REFG-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    SUPP-ELEC-METER (SUPP-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    DHW-ELEC-METER (DHW-EM) (**MSTR-ELEC-METER**; M1, M2, M3, M4, M5)
    SOURCE-FUEL-METER (SRC-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    HEAT-FUEL-METER (HEAT-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    COOL-FUEL-METER (COOL-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    SUPP-FUEL-METER (SUPP-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    DHW-FUEL-METER (DHW-FM) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

    INT-FUEL-BTU/HR (I-F-BTU) (**0.0**; 0.0 to 10,000,000 Btu/hr)
    INT-FUEL-SCH (I-F-SCH) (U-name)
    INT-FUEL-METER (I—F-M) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    INT-FUEL-POWER (**0.0**; 0.0 to 10,000,000 Btu/hr)

    EXT-FUEL-BTU/HR (E-F-BTU) (**0.0**; 0.0 to 10,000,000 Btu/hr)
    EXT-FUEL-SCH (E-F-SCH) (U-name)
    EXT-FUEL-METER (E-F-M) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    EXT-FUEL-POWER (**0.0**; 0.0 to 10,000,000 Btu/hr)

    INT-ELEC-KW (I-E-K) (**0.0**; 0.0 to 1000 kW)
    INT-ELEC-SCH (I-E-SCH) (U-name)
    INT-ELEC-METER (I-E-M) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

    EXT-ELEC-KW (E-E-K) (**0.0**; 0.0 to 1000 kW)
    EXT-ELEC-SCH (E-E-SCH) (U-name)
    EXT-ELEC-METER (E-E-M) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)
    EXT-LIGHT-KW (E-L-K) (**0.0**; 0.0 to 1000.0 kW)
    EXT-LIGHT-SCH (E-L-SCH) (U-name)
    EXT-LIGHT-METER (E-L-M) (**MSTR-FUEL-METER**; M1, M2, M3, M4, M5)

    DHW-GAL/MIN (DHW-GPM) (**0.0**; 0.0 to 10,000 gpm)
    DHW-FLOW (same as DHW-GAL/MIN)
    DHW-SCH (U-name)
    DHW-INLET-T-SCH (U-name) [Defaults to ground temperature from the weather file.]
    DHW-SUPPLY-T (**140.0**; 70.0 to 200.0°F)

    PROCESS-HW-BTU/HR (HW-BTU) (**0.0**; 0.0 to 10,000,000 Btu/hr)
    PROCESS-HW-SCH (HW-SCH) (U-name)
    PROCESS-HW-POWER (**0.0**; 0.0 to 10,000,000 Btu/hr)
    PROCESS-CHW-BTU/HR (CHW-BTU) (**0.0**; 0.0 to 10,000,000 Btu/hr)
    PROCESS-CHW-SCH (CHW-SCH) (U-name)
    PROCESS-CHW-POWER (**0.0**; 0.0 to 10,000,000 Btu/hr)

SYSTEMS-REPORT (S-R, 1) Note that the total number of reports generated may not exceed 200.
    VERIFICATION (V) (--; SV-A, SV-B, … REPORT-ONLY) (list)
    SUMMARY (S) (**LS-D**; SS-A, SS-B, ..., SS-L, ALL-SUMMARY) (list)
    REPORT-FREQUENCY (R-F) (**HOURLY**; HOURLY, DAILY, MONTHLY, YEARLY)
    HOURLY-DATA-SAVE (H-D-S) (**NO-SAVE**; BINARY, FORMATTED)
    See page 116 for a brief description; Chapter III of the *Reference Manual (2.1A)* for definitions, and Appendix C of the *Supplement (2.1E)* for a full description of all reports.

= REPORT-BLOCK (R-B, ~~64~~, 128)
    • VARIABLE-TYPE (V-T) (--; GLOBAL, END-USE, BUILDING, U-name of SPACE, U-name of
      ROOF or EXTERIOR-WALL, U-name of WINDOW, U-name of DOOR)

    • VARIABLE-LIST (V-L) (--; code numbers) (list)
    [for code number list see Appendix A of the *Supplement (2.1E*]*)*
•   Required keyword

= HOURLY-REPORT (H-R, ~~16~~, 32)
•   REPORT-SCHEDULE (R-SCH) U-name
•   REPORT-BLOCK (R-B) (list of U-names of Report Blocks, 30 maximum)
    OPTION (O) (**PRINT**; PRINT PLOT♦ BINARY-FILE)   ♦ For PLOT option, see LOADS for additional
                             required and optional keywords.
•   Required keyword

END
    Required at the end of SYSTEMS input.

FUNCTION (100)

ASSIGN (100)

CALCULATE (100) *Required to do FUNCTON calculation*
Note: follow this command (after the terminator) with the FORTRAN-like statements which define the desired function. As in standard FORTRAN, statement numbers much appear in columns 1-5, column 6 is used to designate a statement continuation, and statements must begin in or after column 7 and end before 72. The last statement must be END. See p. 1.10 of the *DOE-2 Supplement (2.1E)* for a list of valid FORTRAN declarative and executable statements.

END-FUNCTION (100)   Required to do the FUNCTION.

COMPUTE SYSTEMS   Required to do the SYSTEMS simulation.

SAVE-FILES   Use only if saving SYSTEMS output for subsequent runs

STOP   Use only if you want BDL and the simulation to stop here.