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LBL–34946

DOE–2

BDL SUMMARY

Version 2.1E

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Introduction

This document contains summary information on all commands and keywords in the DOE-2 Building Description Language (BDL). It also contains supplementary tables and maps. The fundamentals of BDL are discussed in Chapter II of the *Reference Manual (2.1A)*; detailed descriptions of the commands and keywords summarized here can be found in the *Reference Manual (2.1A)* and in the *Supplement (2.1E)*.

You are also referred to the *Alphabetical List of Commands and Keywords Found in DOE-2* (Appendix F of the *Supplement (2.1E)*). This list includes all commands and keywords in the current version of DOE-2 and where they are found in the documentation. The list is updated yearly and printed in the summer issue of the *DOE-2 User News*. Copies of the list may be obtained by writing to the Simulation Research Group, Bldg. 90—Room 3147, Lawrence Berkeley Laboratory, Berkeley, CA 94720 (or FAX us at 510-486-4089).

Key to Command and Keyword Summary:

COMMAND(abbreviation,maximum number allowed) [comments]

• **KEYWORD**(abbreviation)(**default**;range and units)

::

■ KEYWORD(abbreviation)(**default**;range and units)
KEYWORD(abbreviation)(**default**;range and units)

Note: The most often used keywords are printed above a demarcation line (a row of double dots); those that are more advanced or of special use are printed below the demarcation line.

A bullet (•) indicates a required keyword

A black box (■) indicates an addition or change in DOE-2.1E

Notes:

1. The most frequently used commands and keywords are in **boldface**.
2. = before a command signifies that a u-name is mandatory.
4. (=) before a command signifies that a u-name is optional.
5. Otherwise no u-name is permitted.
6. Unless otherwise noted, the LIKE keyword is permitted for each command.
7. To exceed the listed keyword range values, use the code-word NO–LIMITS under the DIAGNOSTIC command.
8. "CWF" refers to Custom Weighting Factors.
9. An arrow (→) indicates a keyword used only for daylighting calculation

LOADS SUMMARY

INPUT LOADS Required for Loads input
Note: Maximum total INPUT plus PARAMETRIC–INPUT plus LIBRARY–INPUT commands is 100
INPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)

[Caution: Defaults to ENGLISH at each subprogram; if all-metric run is desired, METRIC must be specified at each level.]

PARAMETRIC–INPUT LOADS
INPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)

Replaces INPUT LOADS for parametric run.
[Caution: Defaults to ENGLISH at each subprogram; if a metric run is desired, METRIC must be specified at beginning of the parametric run.]

LIBRARY–INPUT LOADS
INPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)

Replaces INPUT LOADS for library run

TITLE(5) LINE-*n* *Up to 40 characters enclosed by asterisks*
where *n*=1,2,...,5

Note: In SYSTEMS, PLANT, and ECONOMICS, lines may be replaced, up to an *overall* total of 5.
Also, any particular LINE-*n* may be substituted for lines input in LOADS by using TITLE command followed by LINE-*n* *changed text*, where *n* is the line to be changed.

ABORT(**ERRORS**;ERRORS,WARNINGS,CAUTIONS)

DIAGNOSTIC(LIST) takes up to six optional code-words
WARNINGS;ERRORS,WARNINGS,CAUTIONS,DEFAULTS,COMMENTS

(**default**;options)
ECHO;ECHO,NO–ECHO
SINGLE–SPACED;SINGLE–SPACED,DOUBLE–SPACED
LIMITS;LIMITS, NO–LIMITS
No listing of library;LIBRARY–CONTENTS†

† To be used only when user wishes to list the contents of the materials, walls, and weighting factors library.
Warning: Use of this code-word may produce many pages of output.

RUN–PERIOD(1) Required for LOADS input
month day year THRU month day year (e.g., JAN 1 1985 THRU DEC 31 1985)

Remember: Beginning and ending dates must be within a calendar year
Code-word for month is the first three letters of month name
A maximum of 15 THRU's allowed

BUILDING–LOCATION(B–L,1)
- **LATITUDE**(LAT)(†;-66.5 to 66.5°)
- **LONGITUDE**(LON)(†;–180.0 to 180.0°)
- **ALTITUDE**(ALT)(**0.0**;–1,000.0 to 20,000.0 ft)
- **TIME–ZONE**(T–Z)(†;–12 to (all integers)
- **GROSS–AREA**(G–A)(††;0.0 to 10^7ft^2)
- **AZIMUTH**(AZ)(**0.0**;–360.0 to 360.0°)

Time Zone Code	
4–Atlantic	8–Pacific
5–Eastern	9–Yukon
6–Central	10–Hawaii
7–Mountain	

- HOLIDAY(HOL)(**YES**;YES,NO)
- DAYLIGHT–SAVINGS(D–S)(**YES**;YES,NO)
- GROUND–T(G–T)(‡;–100.0 to 150.0°F)
- CLEARNESS–NUMBER(C–N)(‡;0.5 to 1.2)
- HEAT–PEAK–PERIOD(H–P–P)(**1,24**;1 to 24) (all integers)*
- COOL–PEAK–PERIOD(C–P–P)(**1,24**;1 to 24) (all integers)*
- X–REF(0.0;no limits - ft) [Used only in conjunction with FIXED–SHADE command.]
- Y–REF(0.0;no limits - ft) [Used only in conjunction with FIXED–SHADE command.]
- SHIELDING–COEF(S–COEF)(**0.24**;0.0 to 0.32)
- 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 1000.0 ft)
- WS–HEIGHT–LIST(W–H–L)(******;1.0 to 1000.)
- → ATM–MOISTURE(ATM–M)(**0.7**;0.0 to 3.0 in.)(list of 12 monthly values)
- → ATM–TURBIDITY(ATM–T)(**0.12**;0.0 to 1.0) (list of 12 monthly values)
- FUNCTION (*u-name*,*u-name*)
- DAYL–FUNCTION (*u-name*,*u-name*)

Note: HOL = YES ~ U.S. Holidays assumed; HOL = NO ~ no holidays assumed

Note: D–S = YES ~ Daylight Savings correction; D–S = NO ~ no Daylight Savings correction

* Only one connected interval may be defined; minimum hour must be less than maximum hour.

** Takes a list of 12 values; one per month. Default is WS–HEIGHT.

† Default is taken from the weather file.

†† Defaults to net area, i.e., the sum of areas of all conditioned SPACE's.

‡ Takes a list of twelve values; one per month. Default is taken from the weather file.

→ Used only for daylighting calculation.

■ ALT–HOLIDAYS(1)(A–H) [allows user to input non-US holidays]

month day month day month day month day . . . ..

Only one command is allowed per loads input. It does not allow a u-name. It has **no** keywords; instead, it takes month day like the RUN–PERIOD command. Up to 40 month-day pairs may be input. Use of ALT–HOLIDAYS replaces all the standard holidays hardwired into DOE-2. Month is JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, or DEC (a code-word) and day is an integer (1-31). The holidays may be entered in any order.

PARAMETER(DEFINE,†)

U–NAME = VALUE,U–NAME = VALUE,etc. Note: for parametric runs

† A maximum of 50 commands in each LOADS, SYSTEMS, PLANT and ECONOMICS with a total of 50 parameters defined.

SET-DEFAULT(SET,†)
- ● FOR command name
  KEYWORD = value, KEYWORD = value, etc.

[† A maximum of 100 SET-DEFAULT commands may be used in each of LOADS, SYSTEMS, PLANT and ECONOMICS.]

(=) 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)(—;0 or 1 or 2)**
- DEWPT-HI(DP-H)(—;-100 to 200°F)
- DEWPT-LO(DP-L)(—;-100 to 200°F)
- DHOUR-HI(DH-H)(—;1 to 24)
- DHOUR-LO(DH-L)(—;1 to 24)
- 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)*
- WIND-SPEED(W-S)(—;0.0 to 200.0 kts)

* 0=North; 4=East; 8=South; 12=West

** 0=Cirrus or Cirrostratus; 1=Stratus; 2=all other cloud types

= **DAY-SCHEDULE**(D-SCH,300)

(see example below)

Note: All 24 hours must be accounted for

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 week-ends and holidays:

LTG-2 = DAY-SCHEDULE (1,24)(0) ..

= **WEEK–SCHEDULE**(W–SCH,200) (see example below)
Note: Code-word for days of week and holidays is first three letters of name. ALL=Monday thru Sunday + Holidays; WEH=weekends + Holidays; and WD=weekdays Note: Must preserve order of Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, Holiday Note: All days of week + Holiday must be accounted for

In its simplest form, the input for WEEK–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 week-days and (WEH) for week-ends 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) Note: **LIKE** keyword not allowed (see example below)
Note: Every day of run period must be accounted for Note: Code-word for month is first three letters of month name Note: A maximum of 52 THRU's per command

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) ..
```

= MATERIAL(MAT,128)
- THICKNESS(TH)(—;0.0 to 10.0 feet)

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 RESISTANCE instead of all the above:
- RESISTANCE(RES)(—;0.0 to 40.0 hr-ft^2-°F/Btu)

Note: for materials data see Chapter 23 of the *ASHRAE Handbook of Fundamentals*, 1985.

= **CONSTRUCTION**(CONS,64)
- **LAYERS**(LA) u-name or code-word

or
- U–VALUE(U)(—;0.0 to 20.0 Btu/hr-ft^2-°F)†

ABSORPTANCE(ABS)(**0.7**;0.0 to 1.0)[Not used for interior walls, underground walls, or underground floors]
ROUGHNESS(RO)(**3**;1 to 6)(all integers) [Not used for interior walls, underground walls, or underground floors]
[Values of ABSORPTANCE and ROUGHNESS are found in the following tables]

WALL–PARAMETERS(W–P) u-name [Required for Trombe walls and sunspaces with interior venting.]

† For interior surfaces, includes resistance of both air films;
for exterior surfaces, includes inside film resistance, but not outside film resistance.

= **LAYERS**(LA,64) Note: **LIKE** keyword not allowed
- **MATERIAL**(MAT)

Note:Value must be a list of either the u-names of MATERIALs or code-words from the Materials Library on p.118.

THICKNESS(TH)
Note: Must be specified if any thickness is different from those specified in MATERIAL commands or Materials Library. Order of list must correspond to list following MATERIALs
INSIDE–FILM–RES(I–F–R)(**0.68**;0.0 to 40.0 hr-ft^2-°F/Btu)

Note: List materials (a maximum of 9) from outside to inside; do not specify inside or outside air film as a material

Solar ABSORPTANCE for Various Exterior Surfaces (Clean)

Material	ABSORP-TANCE	Paint	ABSORP-TANCE
Aluminum, polished reflector sheet	0.12	Aluminum paint	0.40
Asphalt pavement, weathered	0.82	Black, flat	0.95
Brick, buff, light	0.55	Black, lacquer	0.92
Brick, red	0.88	Black, oil	0.90
Brick, Stafford blue	0.89	Black, optical flat	0.98
Brick, white glazed	0.25	Blue, azure lacquer	0.88
Cement, uncolored asbestos	0.75	Blue, dark	0.91
Cement, white asbestos	0.61	Blue, medium	0.51
Concrete, black	0.91	Blue-gray, dark	0.88
Concrete, brown	0.85	Brown, dark brown	0.88
Concrete, uncolored	0.65	Brown lacquer	0.79
Film, Mylar aluminized	0.10	Brown, medium	0.84
Felt, bituminous	0.88	Brown, medium light	0.80
Felt, bituminous, aluminized	0.40	Gray, dark	0.91
Gravel	0.29	Gray, light oil	0.75
Iron, white-on-galvanized	0.26	Green, lacquer	0.79
Lab vapor deposited coatings	0.02	Green, lacquer, dark	0.88
Marble, white	0.58	Green, light	0.47
Roof, white built-up	0.50	Green, medium dull	0.59
Roofing, green	0.86	Green, medium Kelly	0.51
Slate, blue-gray	0.87	Olive, dark drab	0.89
Tin surface	0.05	Orange, medium	0.58
Wood, smooth	0.78	Red, oil	0.74
		Rust, medium	0.78
		Silver	0.25
		White, gloss	0.25
		White, lacquer	0.21
		White, semi-gloss	0.30
		Yellow	0.57

ROUGHNESS Code for Exterior Surface Finish

Wall	Roof	Code–number
Stucco	Wood shingles or Built-up roof w/stones	1
Brick or Plaster		2
Concrete (poured)	Asphalt shingles	3*
Clear pine		4
Smooth plaster	Metal	5
Glass or Paint on pine		6

* 3 is the default value

= **GLASS–TYPE**(G–T,32)
PANES(P)(**1**;1 to 3) (all integers)†
• GLASS–TYPE–CODE(G–T–C)(—;0 to 9999) (all integers; value ≥ 1000 for Window Library) ■ changed in 2.1E
or
• SHADING–COEF(S–C)(—;0.0 to 1.0)

GLASS–CONDUCTANCE(G–C)(*;0.0001 to 10.0 Btu/hr-ft^2-°F) †
→ VIS–TRANS(V–T)(**0.90**;0.0 to 1.00)[Used only for daylighting calculation.]†
■ FRAME–CONDUCTANCE(F–C)(**0.434**; 0.0 to 10.0 Btu/hr-ft^2-°F) [See table below] ‡‡
■ FRAME–ABS(F–ABS)(**0.7**;0.0 to 1.00)
■ SPACER–TYPE–CODE(S–T–C)(**0**;0 to 4)(all integers) ‡, ‡‡ [See table below]
INSIDE–EMISS(I–E)(**0.84**;0.0 to 1.00)**
■ OUTSIDE–EMISS(O–E)(**0.84**;0.0 to 1.00) ††
■ CONVERGENCE–TOL(C–T)(**0.0**;0.0 to 15.0°C) †††

* See *Reference Manual (2.1A)* for defaults when GLASS–TYPE–CODE ≤ 11 or SHADING–COEF specified.
** Used only for single glazing (PANES = 1), with SHADING–COEF specified, or with 9 ≤ GLASS–TYPE–CODE ≤ 11
† Unused for glass types from Window Library (GLASS–TYPE–CODE ≥ 1000)
†† Used only if SHADING–COEF specified, or if GLASS–TYPE–CODE ≤ 11
††† Positive value causes iterative calculation of glass layer temperatures for glass types from window library (GLASS–TYPE–CODE ≥ 1000); input is °C for English and metric runs.
‡ Used only for glass types from Window Library (GLASS–TYPE–CODE ≥ 1000)
‡‡ Default obtained from Window Library if GLASS–TYPE–CODE ≥ 1000

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 = $[(\text{U-value})^{-1} - 0.197]^{-1}$

Between-Glass Spacers

SPACER–TYPE–CODE	Spacer type
0	Spacer is taken from Window Library
1(default)	Aluminum
2	Glass
3	Butyl/Metal
4	Wood or Fibreglas

(=) BUILDING–SHADE(B–S,64)
X(**0.0**;no limits - ft)
Y(**0.0**;no limits - ft)
Z(**0.0**;no limits - ft)
• HEIGHT(H)(—;0.0 to 2,000.0 ft)
• WIDTH(W)(—;0.0 to 2,000.0 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: X,Y,Z are coordinates of lower left hand corner of the shading surface in the building coordinate system when viewed from the tip of the outwardly drawn normal

(=) FIXED–SHADE(F–S,33)
X–REF(**0.0**;no limits - ft)
Y–REF(**0.0**;no limits - ft)
Z–REF(**0.0**;no limits - ft)
• HEIGHT(H)(—;0.0 to 2,000.0 ft)
• WIDTH(W)(—;0.0 to 2,000.0 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.]

Note: FIXED–SHADE command used only for stationary shading surfaces which are NOT *rotated or translated* with the building

† Used only to simulate variable exterior shading devices; use of this keyword overrides TRANSMITTANCE value.

Note: X,Y,Z are coordinates of lower left hand corner of the shading surface in the building coordinate system when viewed from the tip of the outwardly drawn normal

= WALL-PARAMETERS(W-P,4)
- • FOR(—;TROMBE-WALL-V,TROMBE-WALL-NV,INTERIOR-WALL)
  EMISSIVITY(EM)(**0.93**;0.0 to 1.0)
  CHANNEL-WIDTH(C-W)(*;0.0 to 1.0 ft) * Required for TROMBE-WALL.
  LOWER-VENT-AREA(L-V-A)(†;0.0 to 100 ft^2)
  UPPER-VENT-AREA(U-V-A)(†;0.0 to 100 ft^2)
  VERT-VENT-SEP(V-V-S)(†;0.0 to 20.0 ft)
  AIR-FLOW-TYPE(A-F-T)(**NO-AIR-FLOW**;NO-AIR-FLOW,FORCED-RECIRC, FORCED-OA-PREHT,FREE-RECIRC,FREE-DOORWAY)**
  AIR-FLOW-RATE(A-F-R)(††;0.0 to 999999.00 ft^3/min)
  AIR-FLOW-CTRL-DT(A-F-C-DT)(**3.0**;-100.0 to 50.0°F)‡**
  FAN-KW(F-KW)(**0.00003**;0.0 to 0.01 kW/cfm)††**
  DOORWAY-H(D-H)(‡‡;0.0 to 8.0 ft)**
  DOORWAY-W(D-W)(‡‡;0.0 to 99.0 ft)**

** Used only for INTERIOR-WALL.
† Required for TROMBE-WALL-V; unused for TROMBE-WALL-NV.
For sunspaces, required if AIR-FLOW-TYPE = FREE-RECIRC; unused for others.
†† Used only if AIR-FLOW-TYPE = FORCED-RECIRC or FORCED-OA-PREHT.
AIR-FLOW-RATE is required.
‡ Defaults to -100.0° for AIR-FLOW-TYPE = FORCED-OA-PREHT.
‡‡ Required and used only if AIR-FLOW-TYPE = FREE-DOORWAY.

= **SPACE–CONDITIONS**(S–C,50) [Continued on the next page]
PEOPLE–SCHEDULE(P–SCH) u-name
NUMBER–OF–PEOPLE(N–O–P)(**0.0**;0.0 to 10000.0)
AREA/PERSON(A/P)(**100.0**;0.0 to 10,000.0ft^2)[Used only if NUMBER–OF–PEOPLE not specified]
PEOPLE–HEAT–GAIN(P–H–G)(**0.0**;350.0 to 2,000.0 Btu/hr-pers)†
or
PEOPLE–HG–LAT(P–H–L)(**0.0**;0.0 to 2,000.0 Btu/hr-pers)†
and
PEOPLE–HG–SENS(P–H–S)(**0.0**;0.0 to 2,000.0 Btu/hr-pers)†
LIGHTING–SCHEDULE(L–SCH) u-name
LIGHTING–TYPE(L–T)(**SUS–FLUOR**; Options are: SUS–FLUOR, REC–FLUOR–RV, REC–FLUOR–RSV, REC–FLUOR–NV, and INCAND.)
LIGHTING–W/SQFT(**0.0**;0.0 to 10.0 W/ft^2) [If both specified, contribution is added]
or
LIGHTING–KW(L–KW)(**0.0**;0.0 to 200.0 kW)[If both specified, contribution is added.]
LIGHT–TO–SPACE(L–T–S)(*;0.0 to 1.0)
LIGHT–TO–OTHER(L–T–O)(*;0.0 to 1.0)
LIGHT–HEAT–TO(L–H–T) u-name of space [Required if LIGHT–TO–OTHER > 0.]
LIGHT–TO–RETURN(L–T–R)(*;0.0 to 1.0)
LIGHT–RAD–FRAC(L–R–F)(*;0.0 to 1.0) (list of two)
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) [If both specified, contribution is added.]
or
TASK–LIGHTING–KW(T–L–KW)(**0.0**;0.0 to 200.0 kW) [If both specified, contribution is added.]
EQUIP–SCHEDULE(E–SCH) u-name
EQUIPMENT–W/SQFT(E–W)(**0.0**;0.0 to 100.0 W/ft^2) [If both specified, contribution is added]
or
EQUIPMENT–KW(E–KW)(**0.0**;0.0 to 200.0 kW)[If both specified, contribution is added.]

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/HR(S–B)(**0.0**;–1,000,000.0 to 1,000,000.0 Btu/hr)
SOURCE–SENSIBLE(S–S)(**1.0**;-1.0 to 1.0)
SOURCE–LATENT(S–L)(**0.0**;0.0 to 1.0)
TEMPERATURE(T)((**70.0**);0.0 to 120.0°F) (list of 1)
WEIGHTING–FACTOR(W–F) [Space weighting factor u-name; 8 or less alphanumeric characters]††
or
FLOOR–WEIGHT(F–W)(**70.0**;0.0 to 200.0 lb/ft^2)††, †††
FURNITURE–TYPE(F–TYPE)(**HEAVY**;LIGHT,HEAVY)[Used only when CWF are to be calculated.]
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)[Used only when CWF are to be calculated.]

* See the following "Default Table for LIGHTING–TYPEs".
† If no value is input, there is no contribution from people. If all are specified, the contribution is cumulative.
†† If neither is specified, default value for FLOOR–WEIGHT is used. WEIGHTING–FACTOR is required for Custom Weighting Factor (CWF) library creation run; i.e., a LIBRARY–INPUT LOADS run.
††† For standard ASHRAE weighting factors, 30=light, 70=medium, 130=heavy. For automatic calculation of CWF, specify FLOOR–WEIGHT=0.

= **SPACE–CONDITIONS**(S–C,50) [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) [If both specified, contribution is added.]
or
INF–CFM/SQFT(I–CFM)(**0.0**;0.0 to 20.0 cfm/ft^2)[If both specified, contribution is added.]
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 calc.]
→ 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 $\leq$ 1.0.]
→ LIGHT–SET–POINT1(L–S–P1)(**50.0**;1.0 to 500.0 footcandles)
→ LIGHT–SET–POINT2(L–S–P2)(**50.0**;1.0 to 500.0 footcandles)
→ LIGHT–CTRL–TYPE1(L–C–T1)(**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**;1.0 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=direction parallel to 1st window in space.]
SUNSPACE(SUNSP)(**NO**;NO,YES)

→ Used only for daylighting calculation.

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

*Defaults to 1.0 minus LIGHT–TO–SPACE minus LIGHT–TO–OTHER.

= **SPACE**(S,128)
- • **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

::::::

(=)**EXTERIOR-WALL**(E-W) or **ROOF**(300)
Note that a set-default for EXTERIOR-WALL will also reset the default for ROOF.

- **HEIGHT**(H)(—;0.0 to 2,000.0 ft)
- **WIDTH**(W)(—;0.0 to 2,000.0 ft)
- **CONSTRUCTION**(CONS) u-name
  AZIMUTH(AZ)(**0.0**;-360.0 to 360.0°)
  TILT(**0.0**;0.0 to 180.0°) [Tilt for ROOF must be input, otherwise defaults to 0°]

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, next page, for values]
LOCATION(LOC)(†;TOP,BOTTOM,LEFT,RIGHT,FRONT,BACK)
SHADING-SURFACE(S-S)(NO;NO,YES)
SHADING-DIVISION(S-D)(**10**;1 to 40) (all integers)
SKY-FORM-FACTOR(S-F-F)(—;0.0 to 1.0)*
and
GND-FORM-FACTOR(G-F-F)(—;0.0 to 1.0)*
INF-COEF(I-C)(**0.0**;0.0 to 160.0 units) [See table below for values] ‡
SOLAR-FRACTION(S-F)(††;0.0 to 1.0) [Used only when CWF are to be calculated.]
INSIDE-VIS-REFL(I-V-R)(**;0.0 to 1.0) [Used only for daylighting calculation.]
INSIDE-SOL-ABS(I-S-A)(***;0.0 to 1.0)

- ■ OUTSIDE-EMISS(O-E)(**0.9**;0.0 to 1.0) †††
  FUNCTION (*u-name*,*u-name*)

* Either both or neither of these should be specified. If not specified, the program will calculate them.
** Default is 0.2 if floor (TILT > 170°),
0.5 if wall (10° ≤ TILT ≤ 170°), and
0.7 if ceiling (TILT < 10°).
*** Default is 0.8 if floor (TILT > 170°),
0.5 if wall (10° ≤ TILT ≤ 170°), and
0.3 if ceiling (TILT < 10°).
† Required if SHAPE keyword is used in SPACE command.
If used, do not use H, W, AZ, X, Y, Z, and TILT.
†† If not specified, program will distribute according to total surface area, with the floor receiving the greater weight.
††† Not used for interior walls, underground walls, or underground floors
‡ Used only if DAYLIGHTING-METHOD = CRACK in SPACE or SPACE-CONDITIONS

Exterior Wall Infiltration Coefficients		
Construction of Wall	$\frac{cfh}{ft^2_{wall}}$	INF-COEF
13" brick w/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 w/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

Typical Ground Reflectance Values			
Surface	GND–REFLECTANCE		
Asphalt (Paved)	0.18	Field (Wheat)	0.07
Concrete (Bituminous)	0.10	Grass (Dry)	0.24
Concrete (Light-Colored)	0.32	Ocean	0.05
Concrete (Old)	0.22	Rock (Crushed) Surface	0.20
Field (Green)	0.12–0.25	Soil (Dark)	0.08

(=)TROMBE–WALL–V(T–W–V) or TROMBE–WALL–NV(T–W–NV)(300)
300 means total of EXTERIOR–WALL, ROOF, and TROMBE–WALL)
- HEIGHT(H)(—;0.0 to 2,000.0 ft)
- WIDTH(W)(—;0.0 to 2,000.0 ft)
- CONSTRUCTION(CONS) u-name

X(**0.0**;no limits - ft)
Y(**0.0**;no limits - ft)
Z(**0.0**;no limits - ft)
AZIMUTH(AZ)(**0.0**;–360.0 to 360.0°)
TILT(**90.0**;0.0 to 180.0°)
GND–REFLECTANCE(G–R)(**0.2**;0.0 to 1.0) [See table previous page for typical values.]
MULTIPLIER(M)(**1.0**;0.0 to 99.0)
SHADING–DIVISION(S–D)(**10**;1 to 40) (all integers)
SKY–FORM–FACTOR(S–F–F)(—;0.0 to 1.0)*
and*
GND–FORM–FACTOR(G–F–F)(—;0.0 to 1.0)*
INF–COEF(I–C)(**0.0**;0.0 to 160.0 units) †
LOCATION(LOC)(†;TOP,BOTTOM,LEFT,RIGHT,FRONT,BACK)
SOLAR–FRACTION(S–F)(††;0.0 to 1.0) [Used only when CWF are to be calculated.]
SHADING–SURFACE(S–S)(**NO**;NO,YES)
→ INSIDE–VIS–REFL(I–V–R)(**;0.0 to 1.0) [Used only for daylighting calculation.]
INSIDE–SOL–ABS(I–S–A)(***;0.0 to 1.0)

* Either both or neither of these should be specified.
If not specified, the program will calculate them.

** Default is 0.2 if floor (TILT > 170°),
0.5 if wall (10 ≤ TILT ≤ 170°), and
0.7 if ceiling (TILT < 10°).

*** Default is 0.8 if floor (TILT > 170°),
0.5 if wall (10° ≤ TILT ≤ 170°), and
0.3 if ceiling (TILT < 10°).

† Required if SHAPE keyword is used in SPACE command.
If used, do not use H, W, AZ, X, Y, Z, and TILT.

†† If not specified, program will distribute according to total surface area, with the floor receiving the greater weight.

(=) **WINDOW**(WI)(200) [Continued on the 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 2,000.0 ft)
Y(**0.0**;0.0 to 2,000.0 ft)
SETBACK(SETB)(**0.0**;0.0 to 10.0 ft) [Unused for interior windows]
MULTIPLIER(M)(**1.0**;0.0 to 99.0)
■ FRAME-WIDTH(FR-W)(**0.0**;0.0 to 2.0 ft) [Unused for interior windows]
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 [Unused for interior windows]
WIN-SHADE-TYPE(W-S-T)(**MOVABLE-INTERIOR**;MOVABLE-INTERIOR, MOVABLE-EXTERIOR,FIXED-INTERIOR,FIXED-EXTERIOR)††
CONDUCT-SCHEDULE(C-SCH) u-name
CONDUCT-TMIN-SCH(C-T-SCH) u-name
OVERHANG-A(OH-A)(**0.0**;no limits - ft) [Unused for interior windows]
OVERHANG-B(OH-B)(**0.0**;no limits - ft) [Unused for interior windows]
OVERHANG-W(OH-W)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
and**
OVERHANG-D(OH-D)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
OVERHANG-ANGLE(OH-ANG)(**90.0**;0.0 to 180°) [Unused for interior windows]
LEFT-FIN-A(L-F-A)(**0.0**;no limits - ft) [Unused for interior windows]
LEFT-FIN-B(L-F-B)(**0.0**;no limits - ft) [Unused for interior windows]
LEFT-FIN-H(L-F-H)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
and**
LEFT-FIN-D(L-F-D)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
RIGHT-FIN-A(R-F-A)(**0.0**;no limits - ft) [Unused for interior windows]
RIGHT-FIN-B(R-F-B)(**0.0**;no limits - ft) [Unused for interior windows]
RIGHT-FIN-H(R-F-H)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
and**
RIGHT-FIN-D(R-F-D)(**0.0**;0.0 to no limits - ft) [Unused for interior windows]**
SKY-FORM-FACTOR(S-F-F)(—;0.0 to 1.0)*
and*
GND-FORM-FACTOR(G-F-F)(—;0.0 to 1.0) [Unused for interior windows]*
SHADING-DIVISION(S-D)(**10**;1 to 40) (all integers) [Unused for interior windows]
INF-COEF(I-C)(**0.0**;0.0 to 160.0 units) [Unused for interior windows]‡
SOL-TRANS-SCH(S-T-SCH) u-name ***
VIS-TRANS-SCH(V-T-SCH) u-name [Unused for interior windows]†
GLARE-CTRL-PROB(G-C-P)(**1.0**;0.0 to 1.0) [Unused for interior windows]
INSIDE-VIS-REFL(I-V-R)(**0.15**;0.0 to 1.0) [Unused for interior windows]
FUNCTION (*u-name*,*u-name*) [Unused for interior windows]
WINDOW-SPEC-FN *u-name* [Unused for interior windows]

* Either both or neither of these should be specified. If not specifed, the program will calculate them.
** Either both or neither of these should be specified. If not specifed, shading calculation will not be done.
*** Used only if an exterior window in a space with SUNSPACE = YES.
† Required for daylighting calculation if SHADING-SCHEDULE is specified.
†† Used only for exterior windows in spaces with DAYLIGHTING = YES or SUNSPACE = YES; unused if window has no SHADING-SCHEDULE.
‡ Used only if DAYLIGHTING-METHOD = CRACK in SPACE or SPACE-CONDITIONS

(=) **WINDOW**(WI)(200) [Continued]

The following keywords are used only for switchable glazing in exterior windows:

- ■ GLASS-TYPE-SW(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) [See table below for units] †
- ■ SWITCH-SET-LO(SW-SET-LO) (–; -500.0 to 500.0) [See table below for units] †
- ■ SWITCH-SCH(SW-SCH) u-name

† Unused for SWITCH-CONTROL=DAYLIGHT-LEVEL

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	^{o}F
SPACE-LOAD	Btu/h-ft^2[floor]
DAYLIGHT-LEVEL	no units used

(=) DOOR(64)
- 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

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**;0.0 to no limits - ft)**
and**
OVERHANG-D(OH-D)(**0.0**;0.0 to no limits - ft)**
OVERHANG-ANGLE(OH-ANG)(**90.0**;0.0 to 180°)
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**;0.0 to no limits - ft)**
and**
LEFT-FIN-D(L-F-D)(**0.0**;0.0 to no limits - ft)**
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**;0.0 to no limits - ft)**
and**
RIGHT-FIN-D(R-F-D)(**0.0**;0.0 to no limits - ft)**
X(**0.0**;no limits - ft)
Y(**0.0**;no limits - ft)
SKY-FORM-FACTOR(S-F-F)(—;0.0 to 1.0)*
and*
GND-FORM-FACTOR(G-F-F)(—;0.0 to 1.0)*
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*)

* Either both or neither of these should be specified. If not specifed, the program will calculate them.
** Either both or neither of these should be specified. If not specified, shading calculation will not be done.

Door Infiltration Coefficients	
Door Configuration	INF-COEF
1. Door—Residential 3-ft x 7-ft:	
closed with weather stripping	2.4
average use with weather stripping	9.8
average use without weather stripping	12.0
2. Door—Office 3.5ft x 7-ft:	
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 Door:	
no use	6.0
average use	60.0

(=) **INTERIOR–WALL**(I–W,512)

- • **AREA**(A)(—;0.0 to 100,000.0 ft^2)
  or
  HEIGHT(H)(—;0.0 to 2,000.0 ft)***
  and
  WIDTH(W)(—;0.0 to 2,000.0 ft)***
  or
  LOCATION(LOC)(†;TOP,BOTTOM,LEFT,RIGHT,FRONT,BACK)
- • **CONSTRUCTION**(CONS) u-name
- **NEXT–TO**(N–T) u-name of adjacent SPACE*

INT–WALL–TYPE(I–W–TYPE)(**STANDARD**;STANDARD,AIR,ADIABATIC,INTERNAL)
TILT(**90.0**;0.0 to 180.0°)‡
SOLAR–FRACTION(S–F)(††);0.0 to 1.0) (list of two) [used only when CWF are to be calculated]†††
INSIDE–VIS–REFL(I–V–R)(**;0.0 to 1.0) (list of two) [Used only for daylighting calculation.]†††
X(**0.0**; no limits - ft)***
Y(**0.0**; no limits - ft)***
Z(**0.0**; no limits - ft)***
AZIMUTH(AZ)(**0.0**;-360.0 to 360.0°)***
INSIDE–SOL–ABS(I–S–A)(‡‡;0.0 to 1.0) (list of 2)†††

* Required if INT–WALL–TYPE = STANDARD or AIR; otherwise, unused.
** Default is 0.2 if floor (TILT > 170 °, 0.5 if wall (10 ≤ TILT ≤ 170°, and 0.7 if ceiling (TILT < 10°).
*** Used only if either side of wall is in a space with SUNSPACE = YES.
† Required if SHAPE keyword is used in SPACE command.
†† If not specified, program will distribute according to total surface area, with the floor receiving the greater weight.
††† First value in the list of two is for the side of the wall that is in the space the wall is defined in; second value is for the side of the wall that is in the NEXT–TO space.
‡ 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 wall is in a space with SUNSPACE = YES.
‡‡ 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°).

(=) **UNDERGROUND–WALL**(U–W) or **UNDERGROUND–FLOOR**(U–F)(64)
- **AREA**(A)(—;0.0 to 100,000.0 ft^2)
  or
  HEIGHT(H)(—;0.0 to 2,000.0 ft)
  and
  WIDTH(W)(—;0.0 to 2,000.0 ft)
  or
  LOCATION(LOC)(†;TOP,BOTTOM,LEFT,RIGHT,FRONT,BACK)
- **CONSTRUCTION**(CONS) u-name
  TILT(**90.0**;0.0 to 180.0°) ‡
- * **U–EFFECTIVE**(U–EFF)(—;0.0 to 20.0 Btu/hr-ft^2-°F)†††

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.]
INSIDE–VIS–REFL(I–V–R)(**;0.0 to 1.0) [Used only for daylighting calculation.]
INSIDE–SOL–ABS(I–S–A)(***;0.0 to 1.0)
FUNCTION (*u-name*,*u-name*)

* If a delayed CONSTRUCTION was input for CWF calculation, U–EFFECTIVE is the appropriate U–value to be used for the hourly simulation.
** Default is 0.2 if floor (TILT > 170°), 0.5 if wall (10 ≤ TILT ≤ 170°), and 0.7 if ceiling (TILT < 10°).
*** Default is 0.8 if floor (TILT > 170°), 0.5 if wall (10° ≤ TILT ≤ 170°), and 0.3 if ceiling (TILT < 10°).
† Required if SHAPE keyword is used in SPACE command.
†† If not specified, program will distribute according to total surface area, with the floor receiving the greater weight.
††† Used only for automatic calculation of Custom Weighting Factors.
‡ Tilt for UNDERGROUND–FLOOR must be input, otherwise it will default to 180°
A set-default for UNDERGROUND–WALL will also reset the default for UNDERGROUND–FLOOR.

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–M,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**;BINARY,FORMATTED) ■ changed in 2.1E

[See page 100 for 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)
- 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 lists, see Appendix A of the *Supplement (2.1E)*

= HOURLY-REPORT(H-R,16)
- • REPORT-SCHEDULE(R-SCH) u-name
- • REPORT-BLOCK(R-B) (list of u-names of Report Blocks)(30 max.)
  OPTION(O)(PRINT;PRINT,PLOT,BINARY-FILE)
  DIVIDE(**1.0**;no limits)†
  AXIS-ASSIGN(A-A)(**1**;1,2) (integers)†
  AXIS-MAX(A-MAX)(—;no limits)‡
  AXIS-MIN(A-MIN)(—;no limits)‡
  AXIS-TITLES(A-T) (*"Axis 1 Title"*,*"Axis 2 Title"*)[Each title must be 16 characters or less.]

Note: Total number of VARIABLE-LIST variables in all Report Blocks may not exceed 60 in any HOURLY-REPORT

† List DIVIDE and AXIS-ASSIGN for all variables listed in R-B in the corresponding order; max 12 variables in PLOT option.

‡ If PLOT option chosen, then A-MAX and A-MIN are required for each axis.

END

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

FUNCTION(100)
- • NAME u-name of function
- • LEVEL(—;BUILDING(or BLDG),SPACE,EXTERIOR-WALL(or E-W),
  UNDERGROUND-WALL(or U-W), WINDOW, DOOR)

Note: Up to 100 block sequences of FUNCTION, ASSIGN, CALCULATE, and END-FUNCTION may be defined.

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 a schedule)
  or schedule(global variable name of schedule).
- • Table variable name = table (lists of data points)

CALCULATE(100)

Required to do FUNCTION calculation

Note: Follow this command (after the terminator) with the FORTRAN-like statements which define the desired function. As in standard FORTRAN, statement numbers must 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.1.11 of the *Supplement (2.1E)* for a list of valid FORTRAN declarative and executable statements.]

END-FUNCTION(100)

Required at end of FUNCTION input

COMPUTE LOADS
(Maximum of 100 total COMPUTE LOADS, SYSTEMS, PLANT, ECONOMICS commands)
Required to do Loads simulation

SAVE–FILES
Use only if saving LOADS output for subsequent runs

STOP
Use only if want BDL and simulation to stop here

SYSTEMS SUMMARY

INPUT SYSTEMS Required for Systems input
Note: Maximum total INPUT plus PARAMETRIC–INPUT commands is 100
INPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)

PARAMETRIC–INPUT SYSTEMS
Note: Maximum total INPUT plus PARAMETRIC–INPUT commands is 100
INPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT–UNITS(**ENGLISH**;ENGLISH,METRIC)

Note: Replaces INPUT SYSTEMS for parametric runs

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)
- TYPE(—;LINEAR,BI–LINEAR,QUADRATIC,BI–QUADRATIC,CUBIC)
  OUTPUT–MIN(—;-1,000,000.0 to 10,000,000.0)
  OUTPUT–MAX(—;-1,000,000.0 to 10,000,000.0)

- DATA (up to 20 lists of data points)
  or
- COEFFICIENTS(COEF) (list of up to 6 coefficients)

= **DAY–SCHEDULE**(D–SCH,300)
See LOADS

= **WEEK–SCHEDULE**(W–SCH,200)
See LOADS

= **SCHEDULE**(SCH,100) 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)

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

= **ZONE–CONTROL**(Z–C,50)

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, 0.5 if TWO–POSITION.

= **ZONE–AIR**(Z–A,50)

ASSIGNED–CFM(A–CFM)(—;0.0 to 99999999.0 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 99999999.0 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 99999999.0 cfm)
EXHAUST–STATIC(E–S)(†;0.0 to 10.0 in of WG)
EXHAUST–EFF(E–E)(**0.75**;0.1 to 1.0)
EXHAUST–KW(E–KW)(†;0.0 to 0.01)
SS–VENT–SCH(S–V–SCH) u-name [Used only for zones with SUNSPACE = YES.]
SS–VENT–T–SCH(S–V–T–SCH) u-name [Used only for zones with SUNSPACE = YES.]
SS–VENT–CST(S–V–CST)(**5.0**;0.0 to 20.0 ach) [Used only for zones with SUNSPACE = YES.]
SS–VENT–WND(S–V–WND)(**0.0**;0.0 to 5.0 ach/knot) [Used only for zones with SUNSPACE = YES.]
SS–VENT–TEMP(S–V–TEMP)(**0.0**;0.0 to 1.0 ach/°F) [Used only for zones with SUNSPACE = YES.]
SS–VENT–LIMIT–T(S–V–L–T)(**120.0**;0.0 to 140.0 °F) [Used only for zones with SUNSPACE = YES.]
SS–VENT–KW(S–V–KW)(**0.0**;0.0 to 0.01 kW/cfm) [Used only for zones with SUNSPACE = YES.]
SS–FLOW–SCH(SS–F–SCH) u-name [Used only for zones with SUNSPACE = YES.]
SS–FLOW–T–SCH *u-name* (Defaults to 74°F)

† System-dependent; see page 62, **Index of System Types**, for default values

= **ZONE–FANS**(Z–F,50) [Used only for PIU system.]

- **ZONE–FAN–RATIO**(Z–F–R)(†;0.0 to 10.0)

or

- **ZONE–FAN–CFM**(Z–F–CFM)(†;0.0 to 99999999.0 ft^3/min)
- **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)

† For series PIU, ZONE–FAN–RATIO defaults to 1.0. However, defaulting is not allowed for parallel PIU; therefore, user must input –RATIO or –CFM.

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

ZONE-TYPE(Z-TYPE)(**CONDITIONED**;CONDITIONED,UNCONDITIONED,PLENUM)
ZONE-CONTROL(Z-C) u-name §
ZONE-AIR(Z-A) u-name §
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)
COOLING-CAPACITY(C-CAP)(†;0.0 to 99999999.0 Btu/hr)
COOL-SH-CAP(C-S-C)(†;0.0 to 99999999.0 Btu/hr)
HEATING-CAPACITY(H-CAP)(†;-99999999.0 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††
REHEAT-DELTA-T(R-D-T)(—;0.0 to 100.0°F) ††
BASEBOARD-RATING(B-R)(**0.0**;-99999999.0 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) [Defaults to value in corresponding SPACE in LOADS]
MAX-HEAT-RATE(MAX-H-R)(†;-99999999.0 to 0.0 Btu/hr)
MAX-COOL-RATE(MAX-C-R)(†;0.0 to 999999999.0 Btu/hr)
TROM-VENT-SCH(T-V-SCH) u-name [Used only for vented Trombe walls]
FUNCTION(*u-name*,*u-name*)

Note: the following REFG-type keywords used only for PSZ refrigeration simulation.
REFG-ZONE-LOAD(*;-99999999.0 to 0.0 Btu/hr) (list of up to three)
REFG-ZONE-SHR(**0.8,0.8,0.8**;0.0 to 1.0) (list of up to three)
REFG-ZONE-DES-T(**75.0,75.0,75.0**;30.0 to 100.0°F) (list of up to three)***
REFG-ZONE-DES-RH(**55.0,55.0,55.0**;20.0 to 100.0%) (list of up to three)
REFG-DISCHARGE-T(*;-40.0 to 60.0°F) (list of up to three)
REFG-EVAP-T(**;-40.0 to 60.0°F) (list of up to three)
REFG-SENS-SCH (list of up to three u-names)
REFG-LAT-SCH (list of up to three u-names)
REFG-AUX-KW (†††; 0.0 to 100.0 kW) (list of up to three)
REFG-AUX-HEAT (**0.0,0.0,0.0**;0.0 to 99999999.0 Btu/hr) (list of up to three)
REFG-AUX-SCH (list of up to three u-names)

* Required for simulation of refrigeration
** Defaults to corresponding (REFG-DISCHARGE-T) - 10°F
*** Values must be greater than corresponding REFG-EVAP-T values
† System-dependent; see page 62, **Index of System Types**, for default values
†† Used only for PIU system; I-A-Z required if TERMINAL-TYPE ≠ SVAV
††† Defaults to (0.4) * (the corresponding REFG-ZONE-LOAD value/12,000)
‡ Defaults to 0.9,0.9,0.9, unless corresponding REFG-DEF-MECH=TIME-OFF in which case defaults to 1.0,1.0,1.0.
§ Any keyword from these subcommands may be placed in the ZONE command

= **ZONE**(Z,128) [Continued]

REFG-DEF-MECH (**RESISTANCE,RESISTANCE,RESISTANCE**;
RESISTANCE,FREON,TIME-OFF,NO-DEFROST) (list of up to three)
REFG-DEF-EFF (‡;0.1 to 1.0) (list of up to three)
REFG-DEF-CTRL (**THERMOSTATIC,THERMOSTATIC,THERMOSTATIC**;
THERMOSTATIC,TIMER) (list of up to three)

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) (**M1**;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)

*	Required for simulation of refrigeration
**	Defaults to corresponding (REFG-DISCHARGE-T) - 10°F
***	Values must be greater than corresponding REFG-EVAP-T values
†	System-dependent; see page 62, **Index of System Types**, for default values
††	Used only for PIU system; I-A-Z required if TERMINAL-TYPE ≠ SVAV
†††	Defaults to (0.4) * (the corresponding REFG-ZONE-LOAD value/12,000)
‡	Defaults to 0.9,0.9,0.9, unless corresponding REFG-DEF-MECH=TIME-OFF in which case defaults to 1.0,1.0,1.0.
§	Any keyword from these subcommands may be placed in the **ZONE** command

= **SYSTEM–CONTROL**(S–C,50)

MAX–SUPPLY–T(MAX–S–T)(†;50.0 to 200.0°F)
MIN–SUPPLY–T(MIN–S–T)(†;35.0 to 70.0°F) ■ changed in 2.1E
COOL–CONTROL(C–C)(**CONSTANT**;CONSTANT,WARMEST,RESET,SCHEDULED)
ECONO–LIMIT–T(E–L–T)(†;45.0 to 80.0°F)
■ DRYBULB–LIMIT(**none**;45.0 to 80.0°F)
■ ENTHALPY–LIMIT(**none**;0.0 to 100Btu/lb-dry air)

::

BASEBOARD–SCH(B–SCH) u-name
HEATING–SCHEDULE(H–SCH) u-name
COOLING–SCHEDULE(C–SCH) u-name
HEAT–CONTROL(H–C)(**CONSTANT**;CONSTANT,COLDEST,RESET,SCHEDULED)
HEAT–SET–T(H–S–T)(†;50.0 to 200.0°F)
HEAT–RESET–SCH(H–R–SCH) u-name of RESET–SCHEDULE
HEAT–SET–SCH(H–S–SCH) u-name
COOL–SET–T(C–S–T)(†;35.0 to 70.0°F) ■ changed in 2.1E
COOL–RESET–SCH(C–R–SCH) u-name of RESET–SCHEDULE
COOL–SET–SCH(C–S–SCH) u-name
■ MIN–SUPPLY–SCH(M–S–SCH) u-name
MAX–HUMIDITY(MAX–H)(**100.0**;30.0 to 80.0%)
MIN–HUMIDITY(MIN–H)(**0.0**;0.0 to 70.0%)
■ ECONO–LOCKOUT(—;YES for PSZ, NO for PVAVS, PMZS, and PVVT)
ECONO–LOW–LIMIT(E–L–L)(**0.0**;0.0 to 80.0°F)
PREHEAT–T(P–T)(**45.0**;-50.0 to 70.0°F)
■ WS–ECONO(**NO**;NO,YES for System Type PSZ, PVAVS, and PVVT)
■ WS–ECONO–MIN–DT(**5.0**;0.0 to 10.0F for System Type PSZ, PVAVS, and PVVT)

† System-dependent; see page 62, Index of System Types, for default values

= **SYSTEM–AIR**(S–A,50)

OA–CONTROL(O–CTRL)(**TEMP**;TEMP,FIXED,ENTHALPY)

::

SUPPLY–CFM(S–CFM)(††;10.0 to 9999999.0 cfm) [†† Calculated from ZONE–AIR input and zone loads.]
RETURN–CFM(R–CFM)(††;10.0 to 9999999.0 cfm) [†† Calculated from ZONE–AIR input and zone loads.] see page 62, **Index of System Types**, for default values.]
MIN–OUTSIDE–AIR(M–O–A)(††;0.0 to 1.0) [†† Calculated from ZONE–AIR input and zone loads.]
MAX–OA–FRACTION(M–O–F)(**1.0**;0.0 to 1.0)
MIN–AIR–SCH(M–A–SCH) u-name
RECOVERY–EFF(REC–E)(**0.0**;0.2 to 0.8 Btu/Btu)
DUCT–AIR–LOSS(D–A–L)(**0.0**;0.0 to 1.0)
DUCT–DELTA–T(D–D–T)(**0.0**;0.0 to 10.0°F)
VENT–METHOD(V–M)(**AIR–CHANGE**,AIR–CHANGE,S–G)‡
MAX–VENT–RATE(M–V–R)(**20**;0.0 to 100.0)‡
HOR–VENT–FRAC(H–V–F)(**0**;0.0 to 1.0)‡
FRAC–VENT–AREA(F–V–A)(**0.5**;0.0 to 1.0)‡
OPEN–VENT–SCH(O–V–S) u-name‡
NATURAL–VENT–AC(N–V–A)(—;0.0 to 100.0 air changes/hr)‡
NATURAL–VENT–SCH(N–V–SCH) u-name‡
VENT–TEMP–SCH(V–T–SCH) u-name‡

‡ Used only for SYSTEM–TYPE = RESYS.

= **SYSTEM–FANS**(S–FANS,50)

FAN–SCHEDULE(F–SCH) u-name

FAN–CONTROL(F–C)(†;CONSTANT–VOLUME,SPEED,INLET,DISCHARGE,CYCLING,
TWO–SPEED,FAN–EIR–FPLR)

SUPPLY–STATIC(S–S)(†;0.0 to 15.0 in of WG)
and
SUPPLY–EFF(S–E)(†;0.1 to 1.0)
or
SUPPLY–DELTA–T(SUP–D–T)(†;0.0 to 30.0°F)
and
SUPPLY–KW(S–KW)(†;0.0 to 0.0 kW/cfm)

SUPPLY–MECH–EFF(S–M–E)(†;0.1 to 1.0)
MOTOR–PLACEMENT(M–P)(**IN–AIRFLOW**;IN–AIRFLOW,OUTSIDE–AIRFLOW)
FAN–PLACEMENT(F–P)(**DRAW–THROUGH**;DRAW–THROUGH,
BLOW–THROUGH)

RETURN–STATIC(R–S)(†;0.0 to 10.0 in of WG)
and
RETURN–EFF(R–E)(†;0.1 to 1.0)
or
RETURN–DELTA–T(RET–D–T)(†;0.0 to 30.0°F)
and
RETURN–KW(R–KW)(†;0.0 to 0.01 kW/cfm)

NIGHT–CYCLE–CTRL(N–C–C)(†;STAY–OFF,CYCLE–ON–ANY,
CYCLE–ON–FIRST, ZONE–FANS–ONLY*) [*Used only for PIU systems]

::

NIGHT–VENT–CTRL(N–V–C)(**NOT–AVAILABLE**;NOT–AVAILABLE,NIGHT–FAN,
NIGHT–FAN+REVERT,WHEN–SCHEDULED,SCHEDULED+DEMAND)
NIGHT–VENT–SCH(NT–V–SCH) u-name††
NIGHT–VENT–DT(N–V–D)(**5.0**;0.0 to 30.0°F)
NIGHT–VENT–RATIOS(N–V–R)(‡‡;0.0 to 5.0) (list of 6)
MAX–FAN–RATIO(MAX–F–R)(**1.1**;1.0 to 1.5)
MIN–FAN–RATIO(MIN–F–R)(**0.3**;0.1 to 1.0)
LOW–SPEED–RATIOS(L–S–R)(‡;0.0 to 1.0) (list of 4) [‡ Defaults are (1.0,1.0,1.0,1.0).]
FAN–EIR–FPLR(F–E–FPLR) u-name of linear, quadratic or cubic
■ INDOOR–FAN–MODE(I–F–M)(**CONTINUOUS**;CONTINUOUS,INTERMITTENT)
■ OUTSIDE–FAN–CFLT u-name of quadratic curve
■ OUTSIDE–FAN–HFLT u-name of quadratic curve
(PSZ, PVAVS, and PVVT only)

† System-dependent; see page 62, **Index of System Types**, for default values
†† Required if NIGHT–VENT–CTRL = WHEN–SCHEDULED or SCHEDULED+DEMAND.
‡‡ Required if NIGHT–VENT–CTRL ≠ NOT–AVAILABLE.

= **SYSTEM–TERMINAL**(S–T,50)

REHEAT–DELTA–T(R–D–T)(†;0.0 to 100.0°F)
MIN–CFM–RATIO(M–C–R)(†;0.0 to 1.0)

INDUCTION–RATIO(I–R)(—;1.0 to 10.0)‡ [‡ Required only for TPIU and FPIU systems.]

† System-dependent; see page 62, Index of System Types, for default values

= **SYSTEM–FLUID**(S–FLU,50)

MIN–FLUID–T(MIN–F–T)(from **PLANT–ASSIGNMENT**;32.0 to 80.0°F)
[Only applies to HP systems.] ■ changed in 2.1E
MAX–FLUID–T(MAX–F–T)(from **PLANT–ASSIGNMENT**;50.0 to 100.0°F)
[Applies to HP, PSZ and PVAVS systems.] ■ changed in 2.1E
FLUID–HEAT–CAP(F–H–C)(—;1.0 to 999999999.0 Btu/hr–°F) ■ [Removed in 2.1E.]
■ FLUID–VOLUME(**from PLANT–ASSIGNMENT**;1.0 to 500.0 gal/ton for HP, PSZ and PVAVS)
■ COND–FLOW–TYPE(**FIXED–FLOW**;FIXED–FLOW,VARIABLE–FLOW for PSZ and PVAVS)
■ COND–WTR–FLOW(**3.0**;1.0 to 5.0 Gpm for PSZ and PVAVS)
INDUC–MODE–SCH(I–M–SCH) u-name [Required only for TPIU systems.]

= SYSTEM-EQUIPMENT(S-EQ,50) [Continued on next page]
COOLING-CAPACITY(C-CAP)(†;0.0 to 99999999.0 Btu/hr)
COOL-SH-CAP(C-S-C)(†;0.0 to 99999999.0 Btu/hr)
COOLING-EIR(C-EIR)(†;0.0 to 1.0 Btu/Btu)
HEATING-CAPACITY(H-CAP)(†;-99999999.0 to 0.0 Btu/hr)
HEATING-EIR(H-EIR)(†;0.0 to 2.0 Btu/Btu)
■ CONDENSER-TYPE(**AIR-COOLED**; Note: WATER-COOLED for PSZ, PVAVS, PVVT and EVAP-PRECOOLED for PSZ, PMZS, PVAVS, PVVT, PTAC, RESYS)
■ WS-ECONO-XEFF(**0.60**;0.10 to 1.00) (for HP, PSZ and PVAVS only)
FURNACE-HIR(F-HIR)(**1.35**;1.0 to 1.75 Btu/Btu)
FURNACE-AUX(F-A)(**800.0**;0.0 to 10,000.0 Btu/hr)
FURNACE-AUX-KW(F-A-KW)(**0.0**;0.0 to 1.0 kW)
COIL-BF(C-BF)(†;0.0 to 0.99 cfm/cfm)
COOL-CTRL-RANGE(C-C-R)(**4.0**;0.0 to 15.0°F)
MIN-UNLOAD-RATIO(M-U-R)(**0.25**;0.0 to 1.0)
MIN-HGB-RATIO(M-H-R)(**0.25**;0.0 to 1.0)
MAX-COND-RCVRY(M-C-R)(†;0.0 to 1.0)
CRANKCASE-HEAT(C-H)(†;0.0 to 1.0 kW)
CRANKCASE-MAX-T(C-M-T)(†;0.0 to 100.0°F)
OUTSIDE-FAN-ELEC(†;0.0 to 20.0 kW) ■ changed in 2.1E
OUTSIDE-FAN-T(O-F-T)(†;0.0 to 200.0°F)
OUTSIDE-FAN-MODE(O-F-M)(**INTERMITTENT**;INTERMITTENT, CONTINUOUS)
COMPRESSOR-TYPE(C-TYPE)(**SINGLE-SPEED**;SINGLE-SPEED, DUAL-SPEED)
HP-SUPP-HT-CAP(S-H-C)(†;-99999999.0 to 0.0 Btu/hr)
HP-SUPP-SOURCE(SUPP-S)(**ELECTRIC**;ELECTRIC,HOT-WATER, FURNACE,GAS-HYDRONIC) ■ changed in 2.1E
MIN-HP-T(M-H-T)(†;-30.0 to 70.0°F)
MAX-HP-SUPP-T(M-SUPP-T)(†;-30.0 to 70.0°F)
■ DEFROST-TYPE(D-TYPE)(**RESISTIVE**;RESISTIVE,REVERSE-CYCLE)
■ DEFROST-CTRL(D-CTRL)(**TIMED**;TIMED,ON-DEMAND)
■ RESIST-CAP-RATIO(R-CAP-R)(**.75**;0.0 to 1.0)
DEFROST-T(D-T)(**40.0**;0.0 to 70.0°F)
■ DEFROST-FRAC-FT(D-F-FT)(**no default**;u-name of a curve fit)
■ EVAP-CL-TYPE(**NONE**;NONE,INDIRECT,INDIRECT/DIRECT)
■ RES-EVAP-COOLER(**NO**;NO,YES) applies only to RESYS
■ RES-EVAP-CL-CFM(**no residential evap cooler**;10.0 to 999999.0 cfm) applies only to RESYS
■ EVAP-CL-KW(**no evaporative cooler**;0.0 to 0.01 kW/cfm)
■ EVAP-CL+M-SUP(**TOGETHER**;TOGETHER,SEPARATE)
■ EVAP-CL+REC-RA(**NO**;NO,YES)
■ DIRECT-EFF(**0.85**;0.1 to 1.0 fraction)
■ INDIR-EFF(**0.80**;0.1 to 1.0 fraction)
■ EVAP-CL-LIMIT-T(**199**;45.0 to 200°F)
■ EVAP-CL-AIR(**no evaporative cooler**;0.0 to 1.0 cfmOA/cfmSUPPLY)

† System-dependent; see page 62, **Index of System Types**, for default values

= SYSTEM-EQUIPMENT(S-EQ,50) [Continued]
- ■ DIRECT-EFF-FCFM u-name of quadratic curve
- ■ INDIR-EFF-FCFM u-name of quadratic curve
- ■ COOL-EIR-LS-FT u-name of bi-quadratic curve
- ■ HEAT-EIR-LS-FT u-name of cubic curve
- ■ COOL-RPM-LIMITS(C-R-LIM) (†;100 to 10,000 rpm)
- COOL-CAP-FT(C-C-FT) u-name of bi-linear or bi-quadratic ‡
- COOL-EIR-FT(C-E-FT) u-name of bi-linear or bi-quadratic ‡
- COOL-EIR-FPLR(C-E-FP) u-name of linear, quadratic or cubic ‡
- COOL-SH-FT(C-S-FT) u-name of bi-linear or bi-quadratic‡
- ■ COIL-BF-FPLR(C-B-FPLR) u-name of quadratic curve
- COIL-BF-FCFM(C-BF-FC) u-name of linear, quadratic or cubic‡
- COIL-BF-FT(C-BF-FT) u-name of bi-linear or bi-quadratic‡
- COOL-FT-MIN(C-FT-MIN)(**70.0**;0.0 to 120.0°F)
- FURNACE-HIR-FPLR(F-H-FP) u-name of linear, quadratic or cubic‡
- HEAT-CAP-FT(H-C-FT) u-name of bi-linear or bi-quadratic ‡
- HEAT-EIR-FT(H-E-FT) u-name of bi-linear or bi-quadratic ‡
- HEAT-EIR-FPLR(H-E-FP) u-name of linear, quadratic or cubic‡
- HR8-FWB1WB6(HR-FWB) (u-name of bi-linear or bi-quadratic)**
- HR8PL-FWB1WB6(HRPL-FWB) (u-name of bi-linear or bi-quadratic)**
- QREG-FWB1WB6(QR-FWB) (u-name of bi-linear or bi-quadratic)**
- QREGPL-FWB1WB6(QRPL-FWB) (u-name of bi-linear or bi-quadratic)**
- REFG-KW-FTCOND (u-name of linear, quadratic, or cubic)(list of up to three)**
- REFG-KW-FPLR (u-name of linear, quadratic, or cubic)(list of up to three)**
- T8-FWB1WB6(T-FWB) (u-name of bi-linear or bi-quadratic)**
- T8PL-FWB1WB6(TPL-FWB) (u-name of bi-linear or bi-quadratic)**
- TWR-RFACT-FRT (u-name of bi-linear or bi-quadratic)(list of up to three)*
- TWR-APP-FRFACT (u-name of bi-linear or bi-quadratic)(list of up to three)*
- ■ DESC-GAS-FTW u-name of quadratic curve
- ■ DESC-KW-FTW u-name of quadratic curve
- ■ DESC-T-FTW u-name of quadratic curve
- ■ DESC-W-FTW u-name of quadratic curve

† System-dependent; see page 62, Index of System Types, for default values

= SYSTEM-EQUIPMENT(S-EQ,50) [Continued]

Keywords for HEAT-SOURCE = GAS-HEAT-PUMP

- ■ COOL-CAP-FRPM(C-C-FRPM) u-name of quadratic curve
- ■ COOL-CLOSS-FPLR u-name of quadratic curve
- ■ COOL-CLOSS-MIN(C-C-MIN)(**.8**;0.0 to 1.0)
- ■ COOL-EIR-FRPM(C-E-FRPM) u-name of quadratic curve
- ■ COOL-WASTE-HEAT(C-W-HEAT)(**.7**;0.0 to 1.0)
- ■ COOL-WH-FRPM(C-W-FRPM) u-name of quadratic curve
- ■ COOL-WH-FT(C-W-FT) u-name of quadratic curve
- ■ HEAT-CAP-FRPM(H-C-FRPM) u-name of quadratic curve
- ■ HEAT-RPM-LIMITS(H-R-LIM) (†; 100 to 10,000 rpm)
- ■ HEAT-EIR-FRPM(H-E-FRPM) u-name of quadratic curve
- ■ HEAT-WH-FT(H-W-FT) u-name of quadratic curve
- ■ HEAT-WH-FRPM(H-W-FRPM) u-name of quadratic curve
- ■ HEAT-CLOSS-FPLR u-name of quadratic curve
- ■ HEAT-CLOSS-MIN(H-C-MIN)(**.8**;0.0 to 1.0)
- ■ HEAT-WASTE-HEAT(H-W-HEAT)(**.7**;0.0 to 1.0)
- ■ UNIT-PUMP-ELEC(U-P-ELEC)(**.0017**;0.0 to 1.0 Watts/Btu)
- ■ UNIT-AUX-KW(U-A-KW)(**.02**;0.0 to 1.0 kW)
- ■ WASTE-HEAT-USE (**SPACE-HEAT**;SPACE-HEAT,SPACE-HEAT+DHW)
- ■ OUTSIDE-FAN-CFLT u-name of quadratic curve
- ■ OUTSIDE-FAN-HFLT u-name of quadratic curve
- ■ EVAP-PCC-SCH(E-P-SCH) u-name
- ■ EVAP-PCC-EFF(E-P-EFF) (**.8**;0.0 to 1.0 watts/Btu)
- ■ EVAP-PCC-ELEC(E-P-ELEC) (**.0017**;0.0 to 1.0)
- ■ SYSTEM-REPORT(**YES**;YES,NO) [Allows user to suppress unwanted reports.]

* Used only for PSZ refrigeration simulation; see the *Supplement (2.1E)* for default curves.

** Used only for SYSTEM-TYPE=PTGSD.

† System-dependent; see page 62, **Index of System Types**, for default values

‡ See the *Supplement (2.1E)* for default curves.

= **SYSTEM**(SYST,100) [Continued on next page]

SYSTEM–CONTROL(S–C)§
SYSTEM–AIR(S–A)§
SYSTEM–FANS(S–FANS)§
SYSTEM–TERMINAL(S–T)§
SYSTEM–FLUID(S–FLU)§
SYSTEM–EQUIPMENT(S–EQ)§
SYSTEM–REPORTS(**YES**;YES or NO for SUMMARY reports for this SYSTEM)
• **SYSTEM–TYPE**(S–TYPE)(—;†)
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)
HEAT–SOURCE(HEAT–S)(†;HOT–WATER,ELECTRIC, HEAT–PUMP, GAS–HEAT–PUMP, GAS–HYDRONIC, FURNACE)
(Note that GAS–HEAT–PUMP for PSZ, PVVT, PTAC, RESYS, PVAVS only)
ZONE–HEAT–SOURCE(Z–H–S)(†;HOT–WATER,ELECTRIC,FURNACE HEAT–PUMP,GAS–HEAT–PUMP)
PREHEAT–SOURCE(PREHEAT)(†;HOT–WATER,ELECTRIC,FURNACE HEAT–PUMP,GAS–HEAT–PUMP)
BASEBOARD–SOURCE(BASEB–S)(†;HOT–WATER,ELECTRIC,FURNACE HEAT–PUMP,GAS–HEAT–PUMP,GAS–HYDRONIC)
HUMIDIFIER–TYPE(H–TYPE)(†;HOT–WATER,ELECTRIC,FURNACE HEAT–PUMP,GAS–HEAT–PUMP)

■ SHW–HP–SIZE(**NONE**;0.0 to 9999999 Btu/hr)
■ SHW–HP–SOURCE(**ZONE**;ZONE,OUTDOOR)
■ SHW–HP–ZONE (u-name of zone in which SHW–HP is located)
SIZING–RATIO(S–R)(**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)
RETURN–AIR–PATH(R–A–P)(**DIRECT**;DIRECT,DUCT,PLENUM–ZONES)
■ OA–FROM–SYSTEM(OA–F–S)(**NONE**;u-name of SYSTEM)
■ DESICCANT(DESIC)(**NO–DESICCANT**;NO–DESICCANT,LIQ–VENT–AIR–1, LIQ–VENT–AIR–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

Note: REFG–type keywords used only for PSZ refrigeration simulation.
† System-dependent; see page 62, **Index of System Types**, for default values
§ Any keyword from these subcommands may be placed in the **SYSTEM** command

= **SYSTEM**(SYST,100) [Continued]

Note: REFG-type keywords used only for PSZ refrigeration simulation.

REFG-SIZING-RAT(**1.2**;0.8 to 2.0)
REFG-COMP-CAP(‡;0.0 to 99999999.0 Btu/hr) (list of up to three)
REFG-COMP-EER(††;0.0 to 20.0 Btu/W) (list of up to three)
REFG-COMP-GROUP(**SEPARATE,SEPARATE,SEPARATE**;
SEPARATE,COMMON)(list of up to three)
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-MAX-HTREC(‡‡;0.0 to 99999999.0 Btu/hr)[‡‡ Default: all compressor heat is recoverable.]
REFG-HTREC-UNITS(**YES,YES,YES**;YES,NO) (list of up to three)
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)

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) (**M1**;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)

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

†† Default is linear with REFG-EVAP-T, 7.3 Btu/W at 25°F, 3.5 Btu/W at -30°F.

‡ Defaults to (refrigeration equipment design load) * (REFG-SIZING-RAT.)

The **Index of System Types** is printed here for your convenience; see the tables (**Applicability of Commands and Keywords to System Types**) beginning on page 62.

Index of System Types			
CBVAV	Ceiling Bypass	PVAVS	Packaged DX VAV
DDS	Dual Duct	PVVT	Packaged DX Variable Volume Variable Temperature
EVAP-COOL	Evaporation Cooling Unit		
FNSYS1	*(User–Defined)*	RESVVT	Residential Variable Volume Variable Temperature
FPFC	Four Pipe Fan Coil		
FPH	Panel Heating	RESYS	Furnace and Condensing Unit
FPIU	Four Pipe Induction	RHFS	Reheat
HP	Water/Air Heat Pump	SUM	Sums Zone Loads
HVSYS	Central Ventilation	SZCI	Ceiling Induction
MZS	Multizone	SZRH	Variable Temperature
PIU	Powered Induction Unit	TPFC	Two Pipe Fan Coil
PMZS	Packaged DX Multizone	TPIU	Two Pipe Induction
PSZ	Packaged DX Variable Temp	UHT	Unit Heater
PTAC	Packaged Air Conditioner	UVT	Classroom Unit Ventilator
PTGSD	Packaged Total Gas Solid Desiccant	VAVS	Variable Air Volume

SUBR–FUNCTIONS

BERNOU–1=*u-name*
CFMINF–0=*u-name*
CFMINF–1=*u-name*
CONCHN=*u-name*
DAYCLS–1=*u-name*
DAYCLS–2=*u-name*
DAYCLS–3=*u-name*
DAYCLS–4=*u-name*
DAYCLS–5=*u-name*
DAYCLS–6=*u-name*
DDSF–0=*u-name*
DDSF–1=*u-name*
DESFO–0=*u-name*
DESFO–1=*u-name*
DESIGN=*u-name*
DESIND–0=*u-name*
DESIND–1=*u-name*
DESPIU–0=*u-name*
DESPIU–1=*u-name*
DKTEMP–0=*u-name*
DKTEMP–1=*u-name*
DKTEMP–2=*u-name*
DKTEMP–3=*u-name*
DOETRM–0=*u-name*
DOETRM–1=*u-name*
DOUBLE–0=*u-name*
DOUBLE–1=*u-name*
EBAL–0=*u-name*
EBAL–1=*u-name*
ECONO–1=*u-name*
ECONO–2=*u-name*
ECONO–3=*u-name*
ECONO–4=*u-name*
FANPWR=*u-name*
FCOIL–0=*u-name*
FCOIL–1Z=*u-name*
FCOIL–2Z=*u-name*
FCOIL–3=*u-name*
FTDEV=*u-name*
FNSYS1–1=*u-name*
FNSYS1–2Z=*u-name*
FNSYS1–3Z=*u-name*
FNSYS1–4Z=*u-name*
FNSYS1–5=*u-name*
FURNAC=*u-name*
HE=*u-name*
HOURIN=*u-name*
HPUNIT=*u-name*
HTPUMP–0Z=*u-name*
HTPUMP–1Z=*u-name*
HTPUMP–2=*u-name*
HVUNIT–0=*u-name*
HVUNIT–1Z=*u-name*
HVUNIT–2=*u-name*
HVUNIT–3=*u-name*
INDUC–0=*u-name*
INDUC–1Z=*u-name*
INDUC–2=*u-name*
OPSTRT=*u-name*
PANEL–0Z=*u-name*
PANEL–1=*u-name*
PIU–0=*u-name*
PIU–1=*u-name*
PTAC–0=*u-name*
PTAC–1Z=*u-name*
PTAC–2=*u-name*
RESYS–0=*u-name*
RESYS–1Z=*u-name*
RESYS–2Z=*u-name*
RESYS–3Z=*u-name*
RESYS–4Z=*u-name*
RESYS–5=*u-name*
SDSF–0=*u-name*
SDSF–1=*u-name*
SSBASB=*u-name*
SSFCOR=*u-name*
SUM–1=*u-name*
SUM–2Z=*u-name*
SUM–3Z=*u-name*
SUM–4Z=*u-name*
SUM–5=*u-name*
SZCI–0=*u-name*
SZCI–1Z=*u-name*
SZCI–2=*u-name*
TDVPIU–0=*u-name*
TDVPIU–1=*u-name*
TEMDEV–0=*u-name*
TEMDEV–1=*u-name*
TEMDEV–2=*u-name*
TEMDEV–3=*u-name*
TSOLVE–0=*u-name*
TSOLVE–1=*u-name*
UNITH–0=*u-name*
UNITH–1Z=*u-name*
UNITH–2Z=*u-name*
UNITH–3=*u-name*
UNITV–0=*u-name*
UNITV–1Z=*u-name*
UNITV–2=*u-name*
VARVOL–0=*u-name*
VARVOL–1Z=*u-name*
VARVOL–2=*u-name*
VARVOL–3=*u-name*

= PLANT-ASSIGNMENT(P-A,4)† [Continued on next page]

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)

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-PLANT,FROM-SYSTEMS)
- ■ HP-LOOP-COOLING(**FROM-SYSTEMS**;FROM-PLANT,FROM-SYSTEMS)
- ■ PLANT-REPORTS(**YES**;YES,NO) [Allows user 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)
- ■ TWR-EIR(†††; 0.0 to 10.0)
- ■ 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-SETPT-CTRL(**FIXED**; FIXED,WETBULB-RESET)
- ■ TWR-SETPT-T(**80.0**; 32.0 to 100.0F)
- ■ TWR-SETPT-SCH(u-name) [If omitted, defaults to TWR-SETPT-T]
- ■ TWR-THROTTLE(**10.0**; 1.0 to 20.0F)
- ■ MIN-TWR-WTR-T(**66.0**; 32.0 to 100.0F)
- ■ 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) [Used only when TWR-CAP-CTRL = TWO-SPEED]
- ■ TWR-MIN-FAN-SPEED(**0.40**; 0.0 to 1.0) [Used only when TWR-CAP-CTRL = VARIABLE-SPEED-FAN]
- ■ 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 85.0F)
- ■ TWR-DESIGN-APPROACH(**7.0**; 4.0 to 50.0F)
- ■ 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)

Note: **LIKE** keyword not allowed

† If this command is not used, the default PLANT-ASSIGNMENT is all systems described in input.

†† Based on a maximum of 15 MBtu/hr per cell.

††† Defaults to a fan power of 0.0154 hp/gpm; corresponds to TWR-EIR ≃ to 0.0105 Btu/Btu

= PLANT-ASSIGNMENT(P-A,4)† [Continued]

- 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 Feet)
- 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 120F) [unit high limit protection] overrides SYSTEM-FLUID inputs
- MIN-FLUID-T(**50.0**;40 to 80F) [unit low limit protection] provides SYSTEM-FLUID defaults
- FLUID-VOLUME(**15.0**;1.0 to 500.0 gal/ton) overrides SYSTEM-FLUID inputs.
- DHW-SIZE(*****;0.0 to 1000 gal) *see keyword description
- DHW-HEAT-RATE(*****;0.0 to 100000 Btu/hr) *see keyword description
- DHW-TYPE(**GAS**;)
- DHW-EIR(*****;0.0 to 3.0) *see keyword description
- DHW-LOSS(**.03**;0.0 to 1.0)
- DHW-EIR-FT(******;) ** see curve default table, p.3.142
- DHW-HEAT-RATE-FT(******;) ** see curve default table, p.3.142
- DHW-EIR-FPLR(******;) ** see curve default table, p.3.142
- DHW-PUMP-ELEC(**0.0**;0.0 to 0.1 watt/Btu)
- DHW-PUMP-SCH(—;)
- DHW-HSUP-RATE(*****;0.0 to 100000 Btu/hr) *see keyword description
- DHW-HSTOR-RATE(*****;0.0 to 100000 Btu/hr) *see keyword description

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)
- BOILER-TYPE(**FUEL-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)

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 under 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)

= PLANT-ASSIGNMENT(P-A,4)† [Continued]

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

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

- ■ DHW-GAL/MIN (DHW-GPM)(**0.0**; 0.0 to 10,000 gal/min)
- ■ DHW-FLOW (same as DHW-GAL/MIN)(
- ■ DHW-SCH (u-name)
- ■ DHW-INLET-T-SCH (u-name)[defaults to ground temperatures from 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 (u-name)
- ■ PROCESS-CHW-POWER (**0.0**;0.0 to 10,000,000 Btu/hr)

SYSTEMS–REPORT(S–R,1)†
VERIFICATION(V)(**SV–A**;SV–A,SV–B,REPORT–ONLY) (list)
SUMMARY(S)(**SS–A**;SS–A,SS–B,...,SS–Q,REFG,ALL–SUMMARY) (list)
REPORT–FREQUENCY(R–F)(**HOURLY**;HOURLY,DAILY,MONTHLY,YEARLY)
HOURLY–DATA–SAVE(H–D–S)(**NO**;BINARY,FORMATTED) added in 2.1D, changed in 2.1E

Note: See pages 116-117 for a brief description and Appendix C of the *Supplement (2.1E)* for a full description of all reports.

† The total number of reports generated may not exceed 200.

= REPORT–BLOCK(R–B,64)
- VARIABLE–TYPE(V–T)(—;GLOBAL,u-name of ZONE, u-name of SYSTEM, u-name of PLANT–ASSIGNMENT,END–USE,LOADS–DATA)
- **VARIABLE–LIST**(V–L)(—;code-numbers†)(list)

† For code-number lists, see Appendix A in the *Supplement (2.1E)*.

= HOURLY–REPORT(H–R,16)
- REPORT–SCHEDULE(R–SCH) u-name
- REPORT–BLOCK(R–B) (list of u-names of Report Blocks)

OPTION(O)(**PRINT**;PRINT,PLOT†,BINARY–FILE)

† For PLOT option see LOADS for additional required and optional keywords.

END Required at end of Systems input

FUNCTION(100)

ASSIGN(100)

CALCULATE(100) Required to do FUNCTION calculation

Note: Follow this command (after the terminator) with the FORTRAN-like statements that define the desired function. As in standard FORTRAN, statement numbers must 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 page 1.10 of the *Supplement (2.1E)* for a list of valid FORTRAN declarative and executable statements.

END–FUNCTION(100) Required at end of FUNCTION input

COMPUTE SYSTEMS Required to do SYSTEMS simulation

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

STOP Use only if want BDL and simulation to stop here

PLANT SUMMARY

[Note: LIKE keyword not allowed in PLANT input except in DAY-ASSIGN-SCH, DAY-SCHEDULE, and WEEK-SCHEDULE]

INPUT PLANT Required for Plant input
INPUT-UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT-UNITS(**ENGLISH**;ENGLISH,METRIC)

PARAMETRIC-INPUT PLANT
INPUT-UNITS(**ENGLISH**;ENGLISH,METRIC)
OUTPUT-UNITS(**ENGLISH**;ENGLISH,METRIC)

[Note: Replaces INPUT PLANT for parametric runs]

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)
See SYSTEMS

= DAY-ASSIGN-SCH(D-A-SCH,300 minus the number of D-SCH's)
See LOADS† .

† In place of fractional values, D-A-SCH takes u-name of LOAD-ASSIGNMENT.

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

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

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

u-name = PLANT–ASSIGNMENT(P–A,1)

[Note: u-name must be the u-name of a P–A in SYSTEMS; if P–A is defined in SYSTEMS, it must be defined in PLANT.]

= **PLANT–EQUIPMENT**(P–E,60) [Six PLANT–EQUIPMENT instructions are allowed for each equipment type, so that up to six different sizes may be specified for each type. Exceptions are cooling towers, and hot and cold water tanks. Only one of each of these may be specified.]

- **TYPE**(—;†)
  SIZE(**0.0**;–1,000.0 to 100.0 MBtu/hr)
  INSTALLED–NUMBER(I–N)(**1**;1 to 10) (all integers)
  Note: For a cooling tower, INSTALLED–NUMBER is the number of cells.

::::::

Equipment Cost Reference Default Values †

Equipment TYPE Code-Word	SIZE (10^6 Btu/hr)	FIRST COST (dollar)	INSTAL-LATION COST FACTOR	CON-SUM-ABLES (dollar)	MAIN-TEN-ANCE (hrs/yr)	EQUIP-MENT-LIFE (hrs)	MINOR-OVHL -INT Interval (hrs)	MINOR-OVHL -COST each (dollar)	MAJOR-OVHL -INT Interval (hrs)	MAJOR-OVHL -COST each (dollar)
STM-BOILER	40.0	300K	1.4	0.0	8	220K	10K	2K	50K	25K
HW-BOILER	40.0	300K	1.4	0.0	8	220K	10K	2K	50K	25K
ELEC-STM-BOILER	40.0	300K	1.4	0.0	8	220K	10K	2K	50K	25K
ELEC-HW-BOILER	40.0	300K	1.4	0.0	8	220K	10K	2K	50K	25K
FURNACE DHW-HEATER ELEC-DHW-HEATER	There are no defaults for these TYPEs.									
OPEN-CENT-CHLR	12.0	150K	1.2	0.0	25	100K	20K	5K	50K	15K
OPEN-REC-CHLR	12.0	100K	1.2	0.0	16	100K	20K	5K	50K	15K
HERM-CENT-CHLR	12.0	120K	1.2	0.0	25	100K	20K	5K	50K	15K
HERM-REC-CHLR	12.0	100K	1.2	0.0	16	100K	20K	5K	50K	15K
DBUN-CHLR	12.0	200K	1.3	0.0	25	100K	20K	5K	50K	15K
ABSOR1-CHLR	12.0	110K	1.2	0.0	25	100K	20K	8K	50K	15K
ABSOR2-CHLR	12.0	160K	1.2	0.0	25	100K	20K	8K	50K	15K
ABSOR3-CHLR	12.0	170K	1.2	0.0	25	100K	20K	8K	50K	15K
OPEN-TWR	12.0	60K	1.3	0.0	80	100K	5K	5K	50K	15K
HTANK-STORAGE	10.0*	10K	1.2	0.0	16	250K	0	0	0	0
CTANK-STORAGE	10.0*	25K	1.2	0.0	16	250K	0	0	0	0
DIESEL-GEN	8.5	750K	1.2	1.5	150	100K	24K	9K	50K	21K
GTURB-GEN	8.5	600K	1.2	1.2	100	220K	0	0	30K	12K
STURB-GEN	8.5	450K	1.3	1.0	100	220K	0	0	40K	20K

* Size is in MBtu and not MBtuh

† The cost values in this table have not been updated since 1980 and should, therefore, be used with caution.

PART-LOAD-RATIO(P-L-R,25) [One PART-LOAD-RATIO instruction may be used for each equipment type.]

- TYPE(—;*) [* Takes same code-words as TYPE in PLANT-EQUIPMENT.]

MIN-RATIO(MIN-R)(‡;0.0 to 1.0) ‡ see table below for default values

MAX-RATIO(MAX-R)(‡;1.0 to 2.0) ‡ see table below for default values

OPERATING-RATIO(O-R)(‡;0.0 to 2.0) ‡ see table below for default values

ELEC-INPUT-RATIO(E-I-R)(‡;0.0 to 10.0) ‡ see table below for default values

Equipment PART-LOAD-RATIO Default Values

TYPE	PART LOAD RATIOS MIN	MAX	OPER.	Electric Input Ratio
Heating Equipment:				
ELEC-STM-BOILER	1.0	1.0	1.0	1.0
STM-BOILER	1.2	1.0	1.0	.022
HW-BOILER	1.2	1.0	1.0	.022
ELEC-HW-BOILER	1.0	1.0	1.0	1.0
FURNACE	—	—	—	.023
Cooling Equipment:				
ABSOR1-CHLR	.10	1.15	1.0	.004
ABSOR2-CHLR	.10	1.15	.7	.007
ABSORG-CHLR	.10	1.15	1.0	.0071
OPEN-CENT-CHLR	.10	1.0	.80	.192
OPEN-REC-CHLR	.25	1.0	1.0	.26
HERM-CENT-CHLR	.10	1.0	.80	.20
HERM-REC-CHLR	.25	1.0	1.0	.274
DBUN-CHLR	.10	1.0	1.0	.220
ENG-CHLR	.066	1.25	.06	.0053
OPEN-TWR	.33	2.0	—	.0105
Electric Generation:				
DIESEL-GEN	.15	1.1	.95	—
GTURB-GEN	.30	1.1	1.0	—
STURB-GEN	.10	1.1	1.0	—
Storage:				
HTANK-STORAGE	.01	1.0	1.0	0.0
CTANK-STORAGE	.01	1.0	1.0	0.0
Domestic Hot Water:				
DHW-HEATER	—	—	—	0.0
ELEC-DHW-HEATER	—	—	—	1.0

PLANT-PARAMETERS(P-P,1) [Continued on the next page]

Automatic Sizing of Plant Heating and Cooling Equipment:

- ■ PLANT-SIZING-BY(**DD-IF-PRESENT**;DD-IF-PRESENT,WEATHER)

Chillers:

CHILLER-CONTROL(**DEMAND-ONLY**;DEMAND-ONLY,STANDBY)
OPEN-CENT-COND-TYPE(**TOWER**;TOWER,AIR)
OPEN-REC-COND-TYPE(**TOWER**:TOWER,AIR)
HERM-CENT-COND-TYPE(**TOWER**;TOWER,AIR)
HERM-REC-COND-TYPE(**TOWER**;TOWER,AIR)
OPEN-CENT-COND-PWR(**0.3**;0.0 to 1.0 Btu/Btu) ■ changed in 2.1E
OPEN-REC-COND-PWR(**0.03**;0.0 to 1.0 Btu/Btu)
HERM-CENT-COND-PWR(**0.3**;0.0 to 1.0 Btu/Btu) ■ changed in 2.1E
HERM-REC-COND-PWR(**0.03**;0.0 to 1.0 Btu/Btu)
OPEN-CENT-UNL-RAT(**0.1**;0.0 to 1.0)
OPEN-REC-UNL-RAT(**0.25**;0.0 to 1.0)
HERM-CENT-UNL-RAT(**0.1**;0.0 to 1.0)
HERM-REC-UNL-RAT(**0.25**;0.0 to 1.0)
OPEN-CENT-MOTOR-EFF(**0.9**;0.0 to 1.0)
OPEN-REC-MOTOR-EFF(**0.9**;0.0 to 1.0)
ABSOR1-HIR(**1.6**;0.0 to 3.0)
ABSOR2-HIR(**1.0**;0.0 to 3.0)
ABSORG-HIR(**1.0**; 0.0 to 3.0)
ABSORG-HCAPR(**1.0**; 0.0 to 2.0)
ABSORG-HEAT-XEFF(**0.8**; 0.1 to 1.0)
ABSOR-TO-TWR-WTR(**3.6**;0.0 to 100.0 gpm/ton)
DBUN-TO-TWR-WTR(**3.0**;1.0 to 5.0 gpm/ton)
DBUN-COND-T-ENT(**85.0**;60.0 to 100.0°F)
DBUN-COND-T-REC(**105.0**;80.0 to 120.0°F)
DBUN-CAP-COR-REC(—;0.0 to 1.0)
DBUN-EIR-COR-REC(—;1.0 to 2.0)
DBUN-UNL-RAT-DES(**0.1**;0.0 to 1.0)
DBUN-UNL-RAT-REC(**0.3**;0.0 to 1.0)
DBUN-HT-REC-RAT(**0.95**;0.0 to 1.0)
■ DESICCANT-XEFF(**0.8**;0.1 to 1.0 Btu/Btu)
ENG-CH-COP(**1.4**; 0.1 to 3.0)
ENG-CH-REC-EFF(**.519**; 0.1 to 1.0)
ENG-CH-COND-TYPE(**TOWER**;TOWER,AIR)
ENG-CH-IDLE-RAT(**.3125**; 0.0 to 1.0)
DBUN-MIN-HEAT(**0.0**;0.0 to 10^6 MBtu)
COMP-TO-TWR-WTR(**3.0**;1.0 to 5.0 gpm/ton)
MIN-COND-AIR-T(**65.0**;0.0 to 100.0°F)
CHILL-WTR-T(**44.0**;32.0 to 80.0°F)
CHILL-WTR-THROTTLE(**2.5**;1.0 to 15.0°F)

* The options are: DIESEL-OIL,NATURAL-GAS,FUEL-OIL,LPG,COAL,METHANOL,BIOMASS.

PLANT-PARAMETERS(P-P,1) [Continued]

Boilers:

BOILER-CONTROL(**DEMAND-ONLY**;DEMAND-ONLY,STANDBY)
STM-BOILER-HIR(**1.3**;0.0 to 3.0)
HW-BOILER-HIR(**1.25**;0.0 to 3.0)
E-STM-BOILER-LOSS(**0.02**;0.0 to 1.0)
E-HW-BOILER-LOSS(**0.02**;0.0 to 1.0)

Domestic Hot Water Heaters:

ELEC-DHW-LOSS(**0.03**;0.0 to 1.0 Btu/Btu)
DHW-HIR(**1.39**;0.0 to 3.0)

Gas Furnace:

FURNACE-HIR(**1.35**;0.0 to 3.0)
FURNACE-AUX(**800.0**;0.0 to 2,000.0 Btu/hr)

Thermal Energy Storage:

- ■ TES-TYPE(**NO-TES**;NO-TES,ICE-ON-COIL,ICE-HARVESTER,BRINE, ICE-SLURRY,EUTECTIC)
- ■ TES-PRIORITY(**STORAGE**;STORAGE,CHILLER)
- ■ PERCENT-STORED(**100.0**;0.0 to 100% of daily integrated load)
- ■ HOURS-CHARGING(**12.0**;0.0 to 24.0 hours)
- ■ HOURS-DISCHARGING(**12.0**;0.0 to 24.0 hours)
- ■ COMP-MODE-DCHG(**RATED-T**;RATED-T,LOW-T,DEM-LIM+RATED-T, DEM-LIM+LOW-T)
- ■ PER-COMP-REDUCT/F(**2.0**;0.0 to 100% of chiller rated capacity per °F)
- ■ REFRIG-T-AT-PC(**26.0**;10.0 to 100.0°F)
- ■ COMP-KW/TON-START(**0.96**;0.0 to 10.0 kW/ton)
- ■ COMP-KW/TON-END(**0.96**;0.0 to 10.0 kW/ton)
- ■ EVAP-DELTA-T(**16.0**;0.0 to 40.0°F)
- ■ PUMP+AUX-KW(**0.0**;0.0 to 10.0 kW)
- ■ PUMP+AUX-SCH(u-name of schedule)
- ■ ICE-HARVEST-RATIO(**0.75**;0.0 to 1.0)
- ■ DELAY-CHARGE-HOUR(**first hour in COOL-STORE-SCH**;0 to 12 hours)

PLANT–PARAMETERS(P–P,1) [Continued on the next page]

Towers:

- ■ **TWR–DESIGN–WETBULB(78.0;** 30.0 to 85.0F)
- ■ TWR–DESIGN–APPROACH(**7.0;** 4.0 to 50.0F)
- ■ TWR–DESIGN–RANGE(**10.0;** 4.0 to 20.0F)
- ■ TWR–SETPT–CTRL(**FIXED;** FIXED,WETBULB–RESET)
- ■ TWR–SETPT–T(**80.0;** 32.0 to 100.0F)
- ■ TWR–THROTTLE (**5.0;** -20.0 to 20.0F)
  MIN–TWR–WTR–T (**66.0;** 32.0 to 100.0F)
- ■ 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(**0.18;** 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)
  Used only when TWR–CAP–CTRL = TWO–SPEED
- ■ TWR–MIN–FAN–SPEED(**0.40;** 0.0 to 1.0)
  Used only when TWR–CAP–CTRL = VARIABLE–SPEED–FAN
- ■ TWR–PUMP–HEAD(**60.0;** 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)
- ■ DIRECT–COOL–MODE(**NOT–AVAILABLE;**NOT–AVAILABLE,STRAINER–CYCLE, THERMO–CYCLE)
- ■ DC–MAX–OAT(**65.0;** 35.0 to 70.0F)
- ■ DC–MAX–CHILL–WTR–T(**50.0;** 30.0 to 60.0F)
- ■ DC–TWR–WTR–SETPT(**45.0** if STRAINER–CYCLE, **40.0** if THERMO–CYCLE; 38.0 to 50.0F)
- ■ DIRECT–COOL–SCH(no default) u-name
- ■ DIRECT–COOL–KW(**0.0** if STRAINER–CYCLE, **0.02** if THERMO–CYCLE; 0.0 to 1.0 kW/ton)

PLANT–PARAMETERS(P–P,1) [Continued]

Pumps:

- ■ HCIRC–ELEC–METER (**M1**;M1,M2,M3,M4,M5)
- ■ CCIRC–ELEC–METER (**M1**;M1,M2,M3,M4,M5)
- ■ MISC–ELEC–METER (**M1**;M1,M2,M3,M4,M5)

HCIRC–MOTOR–EFF(**0.9**;0.0 to 1.0)
HCIRC–IMPELLER–EFF(**0.77**;0.0 to 1.0)
HCIRC–HEAD(**60.0**;0.0 to 100.0 ft)
HCIRC–DESIGN–T–DROP(**30.0**;0.0 to 100.0°F)
HCIRC–LOSS(**0.01**;0.0001 to 1.0)
CCIRC–MOTOR–EFF(**0.9**;0.0 to 1.0)
CCIRC–IMPELLER–EFF(**0.77**;0.0 to 1.0)
CCIRC–HEAD(**60.0**;0.0 to 100.0 ft)
CCIRC–DESIGN–T–DROP(**10.0**;0.0 to 20.0°F)
CCIRC–LOSS(**0.01**;0.0001 to 1.0)
CCIRC–SIZE–OPT(**SYSTEM–PEAK**;SYSTEM–PEAK,INST–PLANT–EQUIP)
HCIRC–SIZE–OPT(**SYSTEM–PEAK**;SYSTEM–PEAK,INST–PLANT–EQUIP)
CCIRC–PUMP–TYPE(**FIXED–SPEED**;FIXED–SPEED,VARIABLE–SPEED)
HCIRC–PUMP–TYPE(**FIXED–SPEED**;FIXED–SPEED,VARIABLE–SPEED)
CCIRC–MIN–PLR(**0.5**;0.0001 to 1.0)
HCIRC–MIN–PLR(**0.5**;0.0001 to 1.0)

Generators:

STURB–PRES(†;–15.0 to 700.0 lb/in^2-gage)
STURB–T(†;212.0 to 1,000.0°F)
STURB–EXH–PRES(**0.0**;–15.0 to 1,000.0 lb/in^2-gage) ■ changed in 2.1E
STURB–WTR–RETURN(**0.97**;0.0 to 1.0 lb/lb)
STM–PRES(†;–15.0 to 700.0 lb/in^2-gage)
STM–SATURATION–T(†;212.0 to 500.0°F)
COGEN–TRACK–MODE(**TRACK–ELEC**;TRACK–ELEC,TRACK–THERMAL, TRACK–LESSER,TRACK–GREATER,MAX–OUTPUT,DONT–RUN)
COGEN–TRACK–SCH u-name‡‡
MIN–TRACK–LOAD(**0.0**;0.0 to 1,000.0 MBtu/hr)
DIESEL–TRACK–MOD(**TRACK–BOTH**;TRACK–BOTH,TRACK–EXH,TRACK–JAC/LUB)
DIESEL–GEN–EFF(**0.35**;0.0+ to 1.0)
DIESEL–J/L–EFF(**0.20**;0.0+ to 1.0)
DIESEL–EXH–EFF(**0.23**;0.0+ to 1.0)
GTURB–GEN–EFF(**0.19**;0.0+ to 1.0)
GTURB–EXH–EFF(**0.55**;0.0+ to 1.0)
STURB–MECH–EFF(**0.10**;0.0+ to 1.0) ■ changed in 2.1E

† If user does not input values for these keywords, the program will calculate values for the equipment specified.

‡ The options are: DIESEL–OIL, NATURAL–GAS, FUEL–OIL, LPG, COAL, METHANOL, BIOMASS.

‡‡ Associated DAY–SCHEDULE takes the following values:

0 = DONT–RUN,
1 = TRACK–ELEC,
2 = TRACK–THERMAL,
3 = TRACK–LESSER,
4 = TRACK–GREATER,
5 = MAX–OUTPUT.

EQUIPMENT-QUAD(E-Q,1) [See the *Reference Manual (2.1A)* Chap. V, Table 6 for default curves.]
- STM-BOILER-HIR-FPLR u-name of linear or quadratic
- HW-BOILER-HIR-FPLR u-name of linear or quadratic
- FURNACE-HIR-FPLR u-name of linear or quadratic
- DHW-HIR-FPLR u-name of linear or quadratic
- OPEN-CENT-CAP-FT u-name of bi-linear or bi-quadratic
- OPEN-CENT-EIR-FT u-name of bi-linear or bi-quadratic
- OPEN-CENT-EIR-FPLR u-name of linear or quadratic
- OPEN-REC-CAP-FT u-name of bi-linear or bi-quadratic
- OPEN-REC-EIR-FT u-name of bi-linear or bi-quadratic
- OPEN-REC-EIR-FPLR u-name of linear or quadratic
- HERM-CENT-CAP-FT u-name of bi-linear or bi-quadratic
- HERM-CENT-EIR-FT u-name of bi-linear or bi-quadratic
- HERM-CENT-EIR-FPLR u-name of linear or quadratic
- HERM-REC-CAP-FT u-name of bi-linear or bi-quadratic
- HERM-REC-EIR-FT u-name of bi-linear or bi-quadratic
- HERM-REC-EIR-FPLR u-name of linear or quadratic
- ABSOR1-CAP-FT u-name of bi-linear or bi-quadratic
- ABSOR1-HIR-FT u-name of bi-linear or bi-quadratic
- ABSOR1-HIR-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ABSOR2-CAP-FT u-name of bi-linear or bi-quadratic
- ABSOR2-HIR-FT u-name of bi-linear or bi-quadratic
- ABSOR2-HIR-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ABSORG-CAP-FT u-name of bi-linear or bi-quadratic
- ABSORG-HIR-FT u-name of bi-linear or bi-quadratic
- ABSORG-HIR-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ABSORG-HIR1-FTI u-name of linear or quadratic
- ABSORG-HCAP-FQC u-name of linear or quadratic
- ENG-CH-CAP-FT u-name of linear or quadratic
- ENG-CH-COP-FPLR1 u-name of linear or quadratic
- ENG-CH-COP-FPLR2 u-name of linear or quadratic
- ENG-CH-COP-FT u-name of linear or quadratic
- ENG-CH-HREJ-FPLR u-name of linear or quadratic
- ENG-CH-HREJ-FT u-name of linear or quadratic
- ENG-CH-COP-FPLRS u-name of linear or quadratic
- ENG-CH-COP-FTS u-name of linear or quadratic
- DBUN-CAP-FT u-name of bi-linear or bi-quadratic
- DBUN-EIR-FT u-name of bi-linear or bi-quadratic
- DBUN-EIR-FPLR u-name of linear or quadratic
- DBUN-CAP-FTRISE u-name of linear or quadratic
- DBUN-EIR-FTRISE u-name of linear or quadratic
- ■ TWR-FAN-FPLR u-name of cubic [See the *Supplement (2.1E)* for default curves.]
- ■ TWR-GPM-FRA u-name of bi-quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ TWR-GPM-FWB u-name of bi-quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ TC-CHLR-CAP-FT u-name of bi-linear or bi-quadratic [See the *Supplement (2.1E)* for default curves.]
- DIESEL-I/O-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- DIESEL-EXH-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- DIESEL-JCLB-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- DIESEL-TEX-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- GTURB-CAP-FT u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- GTURB-I/O-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- GTURB-EXH-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]

EQUIPMENT-QUAD(E-Q,1) [Continued]
- GTURB-TEX-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- STURB-ENTH-FPIX u-name of bi-linear or bi-quadratic [See the *Supplement (2.1E)* for default curves.]
- STURB-I/O-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ DIESEL-JAC-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ DIESEL-LUB-FPLR u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ DIESEL-STACK-FU u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ GTURB-STACK-FU u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ GTURB-EXH-FTO u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ GTURB-I/O-FTO u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]
- ■ GTURB-TEX-FTO u-name of linear or quadratic [See the *Supplement (2.1E)* for default curves.]

HEAT-RECOVERY(HEAT-R,1)
- SUPPLY-1(S-1)(**DBUN-CHLR**;†)
- DEMAND-1(D-1)(**SPACE-HEAT**;†)
- SUPPLY-2(S-2)(—;†)
- DEMAND-2(D-2)(—;†)

•
•
•

- SUPPLY-5(S-5)(—;†)
- DEMAND-5(D-5)(—;†)
- ■ DIESEL-TRACK-MOD(**TRACK-BOTH**;TRACK-BOTH,TRACK-EXH,TRACK-JAC/LUB)
- ■ COGEN-TRACK-MODE(**TRACK-ELEC**;TRACK-ELEC,TRACK-THERMAL, TRACK-LESSER,TRACK-GREATER,MAX-OUTPUT,DONT-RUN)
- ■ COGEN-TRACK-SCH u-name‡
- ■ DBUN-MIN-HEAT(**0.0**;0.0 to 10^6 MBtu)

† Each keyword can have a list of up to three code-words of the appropriate type from the following: ABSOR1-CHLR (DEMAND), ABSOR2-CHLR (DEMAND), DBUN-CHLR (SUPPLY), DIESEL-GEN (SUPPLY), DIESEL-JACKET (SUPPLY), ENG-CHLR (SUPPLY), GTURB-GEN (SUPPLY), HTANK-STORAGE (SUPPLY,DEMAND), PROCESS-HEAT (DEMAND), ■ REGEN-HEAT†† (DEMAND), SPACE-HEAT (DEMAND), STURB-GEN (SUPPLY)

†† for use of this code-word, see "Add-On (Integrated) Desiccant Cooling", *Supplement (2.1E)*, p.3.76.

‡ Associated DAY-SCHEDULE takes the following values: 0 = DONT-RUN, 1 = TRACK-ELEC, 2 = TRACK-THERMAL, 3 = TRACK-LESSER, 4 = TRACK-GREATER, 5 = MAX-OUTPUT.

= LOAD-ASSIGNMENT(L-A,50)
- • TYPE(—;HEATING,COOLING,ELECTRICAL)
  OPERATION-MODE(O-M)(**RUN-NEEDED**;RUN-NEEDED,RUN-ALL)
- • LOAD-RANGE(L-R)(—;0.0 to 1,000.0 MBtu/hr)
- • PLANT-EQUIPMENT(P-E) u-name or UTILITY
- • NUMBER(N)(—;0.0 to 1,000.0)†
- ■ COGEN-TRACK-MODE(**TRACK-ELEC**;TRACK-ELEC,TRACK-THERMAL, TRACK-LESSER,TRACK-GREATER,MAX-OUTPUT,DONT-RUN)
- ■ COGEN-TRACK-SCH u-name††
- ■ DBUN-MIN-HEAT(**0.0**;0.0 to 10^6 MBtu)
- ■ DIESEL-TRACK-MOD(**TRACK-BOTH**;TRACK-BOTH,TRACK-EXH,TRACK-JAC/LUB)

† If UTILITY is value of P-E keyword, NUMBER is the number of MBtu's from the utility and thus can exceed INSTALLED-NUMBER.

†† Associated DAY-SCHEDULE takes the following values: 0 = DONT-RUN, 1 = TRACK-ELEC, 2 = TRACK-THERMAL, 3 = TRACK-LESSER, 4 = TRACK-GREATER, 5 = MAX-OUTPUT.

ENERGY-STORAGE(E-S,1)
- HEAT-STORE-RATE(H-ST-R)(**0.0**;0.0 to 1,000.0 MBtu/hr)
- HEAT-SUPPLY-RATE(H-SU-R)(**0.0**;0.0 to 1,000.0 MBtu/hr)
- COOL-STORE-RATE(C-ST-R)(**0.0**;-1,000 to 1,000.0 MBtu/hr) ■ 2.1E will accept -999
- COOL-SUPPLY-RATE(C-SU-R)(**0.0**;-1,000 to 1,000.0 MBtu/hr) ■ 2.1E will accept -999
- HEAT-STORE-SCH(H-ST-SCH) u-name
- COOL-STORE-SCH(C-ST-SCH) u-name
- HTANK-LOSS-COEF(H-L-C)(**0.0**;0.0 to 10^5 Btu/hr-°F)
- CTANK-LOSS-COEF(C-L-C)(**0.0**;0.0 to 10^5 Btu/hr-°F)
- HTANK-BASE-T(H-B-T)(**100.0**;32.0 to 212.0°F)
- CTANK-BASE-T(C-B-T)(**60.0**;32.0 to 212.0°F)
- HTANK-T-RANGE(H-T-R)(**10.0**;0.0 to 180.0°F)
- CTANK-T-RANGE(C-T-R)(**10.0**;0.0 to 180.0°F)
- HTANK-ENV-T(H-E-T)(**ambient temperature**;0.0 to 212.0°F)
- CTANK-ENV-T(C-E-T)(**ambient temperature**;0.0 to 212.0°F)
- HTANK-FREEZ-T(H-F-T)(**32.0**;-30.0 to 212.0°F)
- CTANK-FREEZ-T(C-F-T)(**32.0**;-30.0 to 212.0°F)
- ■ CTANK-ENV-T-SCH u-name of schedule

LOAD-MANAGEMENT(L-M,1)
- HEAT-MULTIPLIER(H-M)(**0.0**;0.0 to 10.0)
- COOL-MULTIPLIER(C-M)(**0.0**;0.0 to 10.0)
- ELEC-MULTIPLIER(E-M)(**1.0**;0.0 to 10.0)
- • PRED-LOAD-RANGE(PRED-L-R)(—;0.0 to 1,000.0 MBtu/hr)

- • ASSIGN-SCHEDULE(A-SCH) (list of u-names of schedules)(3 max.)

  or
- • LOAD-ASSIGNMENT(L-A) (list of u-names of L-As)(3 max.)

PLANT-COSTS(P-C,1)
- DISCOUNT-RATE(D-R)(**10.0**;0.0 to 100.0 %/yr)
- LABOR-INFLTN(L-I)(**0.0**;0.0 to 100.0 %/yr)
- MATERIALS-INFLTN(M-I)(**0.0**;0.0 to 100.0 %/yr)
- PROJECT-LIFE(P-L)(**25.0**;1.0 to 25.0 yr)
- SITE-FACTOR(S-F)(**1.0**;0.0 to 100.0)
- LABOR(L)(**25.0**;0.0 to 100.0 dollar/hr)
- FIRST-COST-EXP(F-C-E)(**0.67**;0.0 to 2.0)
- INSTALLATION-EXP(**0.0**;no limits)
- CONSUMABLES-EXP(C-E)(**0.4**;0.0 to 2.0)
- MAINTENANCE-EXP(M-E)(**0.2**;0.0 to 2.0)
- LIFE-EXP(L-E)(**0.1**;0.0 to 2.0)
- MIN-OVHL-INT-EXP(MIN-O-I)(**0.2**;0.0 to 2.0)
- MIN-OVHL-CST-EXP(MIN-O-C)(**0.67**;0.0 to 2.0)
- MAJ-OVHL-INT-EXP(MAJ-O-I)(**0.2**;0.0 to 2.0)
- MAJ-OVHL-CST-EXP(MAJ-O-C)(**0.67**;0.0 to 2.0)

ENERGY-RESOURCE(E-R,7)
- • RESOURCE(R)(—;ELECTRICITY,DIESEL-OIL,NATURAL-GAS, STEAM,CHILLED-WATER,LPG,COAL,METHANOL,OTHER-FUEL)
  SOURCE-SITE-EFF(S-S-E)(†;0.0 to 1.0) [† See the *Supplement (2.1E)* for default values.]
- ■ FUEL-METERS (F-M) (M1;M1,M2,M3,M4,M5)
- ■ ENERGY-UNIT(-;0.0 to 10,000,000 Btu/Unit)
- ■ UNIT-NAME(-;up to 8 characters - alphnumeric)
- ■ DEM-UNIT-NAME(-;up to 8 characters - alphanumeric)
- ■ OTHER-FUEL-NAME(-;up to 16 characters - alphanumeric)

REFERENCE-COSTS(R-C,25)
- • TYPE(—;†) [† Takes same code-words as TYPE in PLANT-EQUIPMENT command.]
  SIZE-REF(S-R)(—;0.0 to 10^9 Btu/hr)
  FIRST-COST-REF(F-C-R)(—;0.0 to 10^6 dollar)
  INSTALLATION-REF(I-R)(—;0.0 to 100.0)
  CONSUMABLES-REF(C-R)(—;0.0 to 1,000.0 dollar/hr)
  MAINTENANCE-REF(M-R)(—;0.0 to 1,000.0 hr/yr)
  LIFE-REF(L-R)(—;0.0 to 10^6 hr)
  MIN-OVHL-INT-REF(MIN-O-I)(—;0.0 to 10^5 hr)
  MIN-OVHL-CST-REF(MIN-O-C)(—;0.0 to 10,000.0 dollar)
  MAJ-OVHL-INT-REF(MAJ-O-I)(—;0.0 to 10^5 hr)
  MAJ-OVHL-CST-REF(MAJ-O-C)(—;0.0 to 10,000.0 dollar)

PLANT-REPORT(P-R,1)
- VERIFICATION(V)(**PV-A**;PV-A,PV-B,PV-C,PV-E,PV-F,PV-G,PV-H, ALL-VERIFICATION)(list)
- SUMMARY(S)(**PS-A,PS-B,PS-D**;PS-A,PS-B,PS-C,PS-D,PS-E,PS-F, PS-G,PS-H,PS-I,BEPS,BEPU,ALL-SUMMARY)(list)
- REPORT-FREQUENCY(R-F)(**HOURLY**; HOURLY,DAILY,MONTHLY,YEARLY)
- HOURLY-DATA-SAVE(H-D-S)(**NO-SAVE**;NO-SAVE,BINARY,FORMATTED)

[See page 116 for brief description; and Appendix C of the *Supplement (2.1E)* for a full description of all reports.]

= REPORT-BLOCK(R-B,64)
- • VARIABLE-TYPE(V-T)(—;GLOBAL,PLANT,HEAT-RECOVERY END-USE, LOADS-DATA,SYSTEMS-DATA or code-word of equipment type)
- • VARIABLE-LIST(V-L)(—;code-numbers)†

† List of code-numbers; see Appendix A in the *Supplement (2.1E)*.

= HOURLY-REPORT(H-R,16) See LOADS

END Required at end of Plant input

COMPUTE PLANT Required to do Plant simulation

STOP Use only if want BDL and simulation to stop here

ECONOMICS SUMMARY

INPUT ECONOMICS
Required for Economics input

PARAMETRIC-INPUT ECONOMICS
Replaces INPUT ECONOMICS for parametric runs

TITLE
See LOADS

ABORT
(Only needed when overriding LOADS input)

DIAGNOSTIC(LIST)
(Only needed when overriding LOADS input)

PARAMETER(DEFINE)
See LOADS

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

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

= **SCHEDULE**(SCH,100)
See LOADS

= **BLOCK-CHARGE**(B-C)(30)
- BLOCK-SCH(B-SCH) (u-name)
- SCH-FLAG(FLAG)(**1.0**;key to hourly value used in a SCHEDULE)
- BLOCK1-TYPE(B1-T)(**ENERGY**;ENERGY,KWH/KW,KWH/KW-LIMITSUM,DEMAND)
- BLOCK1-DATA(B1-D)(**0.0**;list of up to 10 sets of block-size,cost/unit,limit)
- BLOCK2-TYPE(B2-T)(**ENERGY**;ENERGY,KHW/KW,KWH/KW-LIMITSUM,DEMAND)
- BLOCK2-DATA(B2-D)(**0.0**;list of up to 10 sets of block-size, cost/unit, limit)
- BLOCK3-TYPE(B3-T)(**ENERGY**; ENERGY, KWH/KW, KWH/KW-LIMITSUM, DEMAND)
- BLOCK3-DATA(B3-D)(**0.0**; list of up to 10 sets of block-size, cost/unit, limit)
- DEMAND-RATCHETS(D-R)(accepts list of u-names of up to five RATCHETs)
- TOU-SEASON-LINKS(TOU-LINK)(accepts list of u-names of BLOCK-CHARGEs)

= **UTILITY-RATE**(U-R)(15)

- • **RESOURCE**(R)(—;ELECTRICITY,DIESEL-OIL,NATURAL-GAS,FUEL-OIL, STEAM,CHILLED-WATER,LPG,COAL,METHANOL,OTHER-FUEL, and for cogeneration ELEC-BUY/SELL,ELEC-NET-SALE)

METERS(**M1**;M1,M2,M3,M4,M5)
SCH-FLAG(FLAG)(**1.0**;key to hourly value used in a SCHEDULE)
MONTH-CHGS(M-CHG)(**0.0**;0.0 to 100K/month) list of 1 to 12 values.
ENERGY-CHG(E-CHG)(**0.0**;0.0 to 100M/unit)
ENERGY-CHG-SCH(E-SCH) (u-name)
DEMAND-CHGS(D-CHG)(**0.0**;0.0 to 100M/unit-hr) list of 1 to 12 values
DEMAND-RATCHETS(D-R)(-;list of up to five u-names of RATCHETs)
BLOCK-CHARGES(B-C)(-;list of up to ten u-names of BLOCK-CHARGEs)
MIN-MON-CHGS(M-M-CHG)(**0.0**;0.0 to 100M/month) list of 1 to 12 values
MIN-MON-DEM-CHGS(M-D-CHG)(**0.0**;0.0 to 1K/month) list of 1 to 12 values
RATE-LIMITATION(R-LIM)(**0.0**;0.0 to 100M/unit)

::

LIKE (-;accepts u-name of another UTILITY-RATE)
BILLING-DAYS(B-D)(**31 or last day of month**;list of 12 days, one for each month; 1 to 31)
ENERGY-QUALS(E-Q)(**0.0,0.0**)(list of two monthly energy usages in kWh)
DEMAND-QUALS(D-Q)(**0.0,0.0**)(list of two monthly demands in kW)
USE-MIN-QUALS(U-M-Q)(**NO**;YES or NO)
QUALIFY-RATE(Q-R)(**ALL-MONTHS**;ALL-MONTHS,ONE-MONTH-MIN, ALL-MONTHS-MIN,MONTH-BY-MONTH)
QUAL-SCH(Q-SCH) (u-name)
ENERGY-COST-ADJS(E-C-A)(**0.0**;-1M to 100M/unit) list of 1 to 12 values
DEMAND-WINDOW(D-WIN)(**HOUR**;HOUR,DAY)
POWER-FACTOR(P-F)(**0.8**;0.3 to 1.0)
EXCESS-KVAR-FRAC(E-K-F)(**0.3**;0.0 to 1.0)
EXCESS-KVAR-CHG(E-K-CHG)(**0.0**;0.0 to 100M/kVAR)
ESCALATION(ESC)(**5.0%**;0.0 to 100%)
MIN-MON-RATCHETS(M-M-R)(-;u-name of up to 5 DEMAND-RATCHETs)
PCT-TAX-DATA(PCT-TX)(-;list of up to 3 sets of charges)
PCT-TAXES-APPLY(TX-APLY)(**BASE**;BASE,ECA,SRCHGS)
UNIT-TAX-DATA(UNT-TX)(-;list of up to 3 sets of charges)
PCT-SRCHG-DATA(PCT-SRG)(-;list of up to 3 sets of charges)
PCT-SRCHGS-APPLY(SRG-APLY)(**BASE**;BASE,ECA,TAXES)
UNIT-SRCHG-DATA(UNT-CHG)(-;list of up to 3 sets of charges)

= **RATCHET**(30)

- ■ NUM-MONTHS(N-M)(**12**;1 to 12)
- ■ RATCHET-SCH(R-SCH) (u-name)
- ■ SCH-FLAG(FLAG)(**1.0**; key to hourly value used in a SCHEDULE)
- ■ TYPE(**HIGHEST-PEAK**;HIGHEST-PEAK,AVERAGE)
- ■ OFFSET(**0.0**;-100,000,000 to 100,000,000 kW)
- ■ FRACTION(FRAC)(**1.0**;0.0 to 1.0)

(=) COMPONENT-COST(C-C,15)
UNIT-NAME(U-N) [any alphanumeric name, ≤ 16 characters]†
NUMBER-OF-UNITS(N-O-U)(**1.0**;0.0 to 10^5)
FIRST-COST(F-C)(**0.0**;0.0 to 10^7 dollar)
INSTALL-COST(I-C)(**0.0**;0.0 to 10^6 dollar)
ANNUAL-COST(A-C)(**0.0**;0.0 to 10^4 dollar)
COMPONENT-LIFE(C-L)(**999.0**;0.1 to 100.0 yrs)
MIN-OVHL-INT(MIN-O-I)(**999.0**;0.1 to 50.0 yrs)
MIN-OVHL-COST(MIN-O-C)(**0.0**;0.0 to 10^5 dollar)
MAJ-OVHL-INT(MAJ-O-I)(**999.0**;0.1 to 50.0 yrs)
MAJ-OVHL-COST(MAJ-O-C)(**0.0**;0.0 to 2×10^5 dollar)

† Optional keyword; for user convenience only.
[Note: Costs are per unit; program calculates net cost by multiplying per-unit cost by NUMBER-OF-UNITS]
[Note: All costs should be in current dollars]

(=) BASELINE(1)
FIRST-COST(F-C)(**0.0**;0.0 to 10^6 dollar)
REPLACE-COST(R-C)(**0.0**;0.0 to 10^6 dollar)
OPERATIONS-COST(O-C)(**0.0**;0.0 to 10^5 dollar)†
ENERGY-COST(E-C)(**0.0**;0.0 to 10^6 dollar)†
ENERGY-USE-SITE(E-U-SITE)(**0.0**;0.0 to 10^8 MBtu)
ENERGY-USE-SRC(E-U-SRC)(**0.0**;0.0 to 10^8 MBtu)

† The value of these keywords is a list, up to 25 entries long, giving the present value of operations and energy costs for each year of the baseline project lifetime.

ECONOMICS-REPORT(E-R,1)
VERIFICATION(V)(—;EV-A,EV-B) (list)
SUMMARY(S)(ES-A;ES-A,ES-B,ES-C,ES-D,ES-E,ES-F,ALL-SUMMARY) (list)

[See page 116 for brief description; and Appendix C of the the *Supplement (2.1E)* for a full description of all reports.]

END

Required at end of Economics input

COMPUTE ECONOMICS

Required for Economics simulation

STOP

Use only if want BDL and simulation to stop here

Applicability of Commands and Keywords to System Types

The following applicability tables for each HVAC system type have been updated for DOE-2.1E. Because there have been additions to the tables and many changes to the "Default Value or Consequence" column, we caution you **NOT** to use the same material found in the *Reference Manual (2.1A)*.

The tables on the following pages indicate those commands and keywords in SYSTEMS that apply to the various system types. Keywords that are not used by a particular system type are not shown. The last column in each table shows one of two things:

1) for the SYSTEM–TYPE being described, either the default value that will be provided by the program if you choose not to enter the keyword, or

2) the consequence for the simulation of not entering the keyword.

Index of System Types

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● = Required keyword

■ = Added/changed in 2.1E

ZONE–level Commands and Keywords

For all System Types EXCEPT FPH, PIU, RESYS, PSZ, and SUM
(see individual Applicability Tables for these five systems)

Command	Keyword	Default Value or Consequence
ZONE–CONTROL	DESIGN–HEAT–T	70°F
	HEAT–TEMP–SCH	No active heating control
	DESIGN–COOL–T	76°F
	COOL–TEMP–SCH	No active cooling control (Not used for UHT and HVSYS)
	THERMOSTAT–TYPE	PROPORTIONAL
	THROTTLING–RANGE	2°F
	BASEBOARD–CTRL	OUTDOOR–RESET
ZONE–AIR	ASSIGNED–CFM	Based on heating/cooling
	CFM/SQFT	loads, supply air, ΔT, and
	AIR–CHANGES/HR	sizing ratio
	OUTSIDE–AIR–CFM	Based on
	OA–CFM/PER	MIN–OUTSIDE–AIR
	OA–CHANGES	(Not used for UHT)
	EXHAUST–CFM	0.0 (Not used for UHT, UVT, HP, and PTAC)
	EXHAUST–EFF	0.75 (Not used for UHT, UVT, HP, and PTAC)
	EXHAUST–STATIC	0.0 (Not used for UHT, UVT, HP, and PTAC)
	EXHAUST–KW	From EXHAUST–EFF and EXHAUST–STATIC (Not used for UHT, UVT, HP, and PTAC)
	SS–VENT–SCH	No venting of sunspace
	SS–VENT–T–SCH	No venting of sunspace
	SS–VENT–CST	5.0 ach
	SS–VENT–WND	0.0 1/knot
	SS–VENT–TEMP	0.0 1/°F
	SS–VENT–LIMIT–T	120.0°F
	SS–VENT–KW	0.0
	SS–FLOW–SCH	No effect on air flow
	SS–FLOW–T–SCH	74°F
ZONE	ZONE–CONTROL	§
	ZONE–AIR	§
	ZONE–TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR–MULTIPLIER	Taken from SPACE in LOADS
	MAX–HEAT–RATE	Peak load or 1.08 × ΔT × CFM
	MAX–COOL–RATE	Peak load or 1.08 × ΔT × CFM (Not used for UHT and UVT)
	BASEBOARD–RATING	No baseboard heating
	HEATING–CAPACITY COOLING–CAPACITY COOL–SH–CAP	From SYSTEM–EQUIPMENT (Used only for UHT, UVT, TPFC, FPFC, TPIU, FPIU, HP, and PTAC) (UHT and UVT do not use COOLING–CAPACITY and COOL–SH–CAP)
	MIN–CFM–RATIO	From SYSTEM–TERMINAL †
	MIN–CFM–SCH	MIN–CFM–RATIO §
	SIZING–OPTION	FROM–LOADS
	TROM–VENT–SCH	•(only if TROMBE–WALL–V specified)

Note: meter keywords default to System Values

§ Any keyword from this subcommand may be placed in the ZONE command.
† Used only for SZRH, MZS, DDS, VAVS, RHFS, CBVAV, PMZS, and PVAVS

SZRH–System Type:
Single Zone Fan System with Optional Sub-Zone Reheat

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■ changed in 2.1E
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	2.42°F
	SUPPLY-KW	0.000783 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	CONSTANT-VOLUME
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)

Continued on next page.

Continuation of

SZRH–System Type:

Single Zone Fan System with Optional Sub-Zone Reheat

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	REHEAT–DELTA–T	No reheat simulated in subzones
	MIN–CFM–RATIO	Constant volume system
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=SZRH	•
	ZONE–NAMES	• (First listed must be control zone)
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

MZS–System Type: Multi-Zone Fan System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-CONTROL	CONSTANT
	HEAT-SET-T	From MAX-SUPPLY-T
	HEAT-RESET-SCH	•(only if HEAT-CONTROL=RESET)
	HEAT-SET-SCH	•(only if HEAT-CONTROL=SCHEDULED)
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■ changed in 2.1E
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	2.723°F
	SUPPLY-KW	0.00088 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	CONSTANT-VOLUME
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
		Continued on next page.

Continuation of

MZS–System Type: Multi-Zone Fan System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	MIN–CFM–RATIO	Constant volume system
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=MZS	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

DDS–System Type: Dual Duct Fan System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	HEAT–CONTROL	CONSTANT
	HEAT–SET–T	From MAX–SUPPLY–T
	HEAT–RESET–SCH	•(only if HEAT–CONTROL=RESET)
	HEAT–SET–SCH	•(only if HEAT–CONTROL=SCHEDULED)
	COOL–CONTROL	CONSTANT
	COOL–SET–T	MIN–SUPPLY–T
	COOL–RESET–SCH	•(only if COOL–CONTROL=RESET)
	COOL–SET–SCH	•(only if COOL–CONTROL=SCHEDULED)
	PREHEAT–T	45°F
	MAX–HUMIDITY	No dehumidification control
	MIN–HUMIDITY	No humidification
	ECONO–LIMIT–T	Return air temperature ■ changed in 2.1E
	ECONO–LOW–LIMIT	No lower limit
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08×ΔT
	RETURN–CFM	SUPPLY–CFM minus EXHAUST–CFM or 0
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	RECOVERY–EFF	No heat recovery simulated
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	3.37°F
	SUPPLY–KW	0.00109 kW/cfm
	FAN–SCHEDULE	Always on
	FAN–CONTROL	CONSTANT–VOLUME
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	MAX–FAN–RATIO	1.1
	MIN–FAN–RATIO	0.3
	RETURN–STATIC	If neither pair, (RETURN–STATIC,
	RETURN–EFF	RETURN–EFF) or (RETURN–DELTA–T,
	RETURN–DELTA–T	RETURN–KW), is specified,
	RETURN–KW	no return fan is simulated.
	NIGHT–CYCLE–CTRL	STAY–OFF
	FAN–EIR–FPLR	•(only if FAN–CONTROL=FAN–EIR–FPLR)

Continued on next page.

Continuation of

DDS–System Type: Dual Duct Fan System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	MIN–CFM–RATIO	Constant volume system (therefore is required for DDVAV simulation)
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=DDS	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)

apply to this system.

SZCI–System Type: Ceiling Induction System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-SET-T	From MAX-SUPPLY-T (for design only)
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■ changed in 2.1E
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	3.11°F
	SUPPLY-KW	0.00101 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	INLET
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
		Continued on next page.

Continuation of

SZCI–System Type: Ceiling Induction System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	REHEAT–DELTA–T	No reheat simulated
SYSTEM–EQUIPMENT	See page 114-115	
SYSTEM	SYSTEM–TYPE=SZCI	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

UHT–System Type: Unit Heater		
Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	HEATING–SCHEDULE	Always available
	BASEBOARD–SCH	Always off
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	0.218°F
	SUPPLY–KW	0.00007 kW/cfm
	FAN–SCHEDULE	Always on
	NIGHT–CYCLE–CTRL	STAY–OFF
SYSTEM–EQUIPMENT	HEATING–CAPACITY	Dependent on peak loads
	FURNACE–AUX	800.0 Btu/hr
	FURNACE–HIR	1.35 Btu/Btu
	FURNACE–AUX–KW	0.0 kW
	FURNACE–HIR–FPLR	Standard curve SDL–C111
	FURNACE–OFF–LOSS	No loss accounted for
SYSTEM	SYSTEM–TYPE=UHT	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–FANS	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	SIZING–RATIO	1.0
PLANT–ASSIGNMENT	See page 43	
§ Any keyword from this subcommand may be placed in the SYSTEM command.		

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

UVT–System Type: Unit Ventilator

Command	Keyword	Default Value or Consequence
ZONE-level command	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	HEATING-SCHEDULE	Always available
	BASEBOARD-SCH	Always off
SYSTEM-AIR	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	MAX-OA-FRACTION	1.0
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	0.182°F
	SUPPLY-KW	0.000059 kW/cfm
	FAN-SCHEDULE	Always on
	NIGHT-CYCLE-CTRL	CYCLE-ON-ANY (no outside air)
SYSTEM-EQUIPMENT	HEATING-CAPACITY	Dependent on peak loads
	FURNACE-AUX	800.0 Btu/hr
	FURNACE-HIR	1.35 Btu/Btu
	FURNACE-AUX-KW	0.0 kW
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	No loss accounted for
SYSTEM	SYSTEM-TYPE=UVT	•
	ZONE-NAMES	•
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	HOT-WATER
	BASEBOARD-SOURCE	HOT-WATER
	SIZING-RATIO	1.0
PLANT-ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM-FANS command)
Add-On Evaporative Cooling (SYSTEM-EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT-ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT-ASSIGNMENT commands)
Building Resources (PLANT-ASSIGNMENT commands)

apply to this system.

FPH–System Type: Floor Panel Heating System		
Command	Keyword	Default Value or Consequence
ZONE–CONTROL	DESIGN–HEAT–T	70°F
	HEAT–TEMP–SCH	No active heating control
	DESIGN–COOL–T	76°F
	THERMOSTAT–TYPE	PROPORTIONAL
	THROTTLING–RANGE	2°F
ZONE	ZONE–CONTROL	§
	ZONE–TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR–MULTIPLIER	Taken from SPACE in LOADS
	MAX–HEAT–RATE	Peak load or 1.08×ΔT×CFM
	PANEL–LOSS–RATIO	0.0
	SIZING–OPTION	FROM–LOADS
	TROM–VENT–SCH	•(only if TROMBE–WALL–V specified)
SYSTEM–CONTROL	HEATING–SCHEDULE	Always available
SYSTEM	SYSTEM–TYPE=FPH	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	HEAT–SOURCE	HOT–WATER
	SIZING–RATIO	1.0
PLANT–ASSIGNMENT	See page 43	
§ Any keyword from this subcommand may be placed in the SYSTEM command.		

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

TPFC–System Type: Two Pipe Fan Coil System		
Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	MIN-HUMIDITY	No humidification
	BASEBOARD-SCH	Always off
SYSTEM-AIR	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	0.218°F
	SUPPLY-KW	0.00007 kW/cfm
	FAN-SCHEDULE	Always on
	NIGHT-CYCLE-CTRL	STAY-OFF
SYSTEM-EQUIPMENT	See page 114-115	
SYSTEM	SYSTEM-TYPE=TPFC	•
	ZONE-NAMES	•
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	HOT-WATER
	BASEBOARD-SOURCE	HOT-WATER
	SIZING-RATIO	1.0
PLANT-ASSIGNMENT	See page 43	
§ Any keyword from this subcommand may be placed in the SYSTEM command.		

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM-FANS command)
Add-On Evaporative Cooling (SYSTEM-EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT-ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT-ASSIGNMENT commands)
Building Resources (PLANT-ASSIGNMENT commands)

apply to this system.

FPFC–System Type: Four Pipe Fan Coil System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	BASEBOARD-SCH	Always off
SYSTEM-AIR	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	0.218°F
	SUPPLY-KW	0.00007 kW/cfm
	FAN-SCHEDULE	Always on
	NIGHT-CYCLE-CTRL	STAY-OFF
SYSTEM-EQUIPMENT	See page 114-115	
SYSTEM	SYSTEM-TYPE=FPFC	●
	ZONE-NAMES	●
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	HOT-WATER
	BASEBOARD-SOURCE	HOT-WATER
	SIZING-RATIO	1.0
PLANT-ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

TPIU–System Type: Two Pipe Induction Unit System		
Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	COOL–CONTROL	CONSTANT (RESET is NORMAL)
	COOL–SET–T	MIN–SUPPLY–T
	COOL–RESET–SCH	•(only if COOL–CONTROL=RESET)
	COOL–SET–SCH	•(only if COOL–CONTROL=SCHEDULED)
	HEAT–SET–T	From MIN–SUPPLY–T (SET=SUPPLY–HI)
	PREHEAT–T	45°F
	MAX–HUMIDITY	No dehumidification control
	MIN–HUMIDITY	No humidification
	ECONO–LIMIT–T	Return air temperature ■ changed in 2.1E
	ECONO–LOW–LIMIT	No lower limit
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08×ΔT
	RETURN–CFM	SUPPLY–CFM minus EXHAUST–CFM or 0
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	RECOVERY–EFF	No heat recovery simulated
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	4.467°F
	SUPPLY–KW	0.001445 kW/cfm
	FAN–SCHEDULE	Always on
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	RETURN–STATIC	No return fan is simulated if neither pair
	RETURN–EFF	(RETURN–STATIC, RETURN–EFF)
	RETURN–DELTA–T	or (RETURN–DELTA–T, RETURN–KW)
	RETURN–KW	is specified.
	NIGHT–CYCLE–CTRL	STAY–OFF
		Continued on next page.

Continuation of

TPIU–System Type: Two Pipe Induction Unit System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	INDUCTION–RATIO	3
SYSTEM–FLUID	INDUC–MODE–SCH	•
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=TPIU	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–FLUID	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

FPIU–System Type: Four Pipe Induction Unit System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	50°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	HEAT-SET-T	From MIN-SUPPLY-T
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■ changed in 2.1E
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	4.467°F
	SUPPLY-KW	0.001445 kW/cfm
	FAN-SCHEDULE	Always on
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	RETURN-STATIC RETURN-EFF RETURN-DELTA-T RETURN-KW	No return fan is simulated if neither pair (RETURN-STATIC, RETURN-EFF) or (RETURN-DELTA-T, RETURN-KW) is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
		Continued on next page.

Continuation of

FPIU–System Type: Four Pipe Induction Unit System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	INDUCTION–RATIO	3
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=FPIU	●
	ZONE–NAMES	●
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM-EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

VAVS–System Type: Variable Volume Fan System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	MIN-SUPPLY-T + REHEAT-DELTA-T
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-SET-T	No capability to hold SAT reset or "warmest"
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	3.37°F
	SUPPLY-KW	0.00109 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	INLET
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)

Continued on next page.

§ Any keyword from this subcommand may be placed in the SYSTEM command.

Continuation of

VAVS–System Type: Variable Volume Fan System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	REHEAT–DELTA–T	No reheat simulated
	MIN–CFM–RATIO	From outside air or heating load
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=VAVS	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

PIU–System Type: Powered Induction Unit System

Command	Keyword	Default Value or Consequence
ZONE–CONTROL	DESIGN–HEAT–T	70°F
	HEAT–TEMP–SCH	No active heating control
	DESIGN–COOL–T	76°F
	COOL–TEMP–SCH	No active cooling control
	THERMOSTAT–TYPE	PROPORTIONAL
	THROTTLING–RANGE	2°F
	BASEBOARD–CTRL	OUTDOOR–RESET
ZONE–AIR	ASSIGNED–CFM	Based on heating/cooling loads,supply air,ΔT,and sizing ratio
	CFM/SQFT	
	AIR–CHANGES/HR	
	OUTSIDE–AIR–CFM	Based on MIN–OUTSIDE–AIR
	OA–CFM/PER	
	OA–CHANGES	
	EXHAUST–CFM	0.0
	EXHAUST–EFF	0.75
	EXHAUST–STATIC	0.0
	EXHAUST–KW	From EXHAUST–EFF and EXHAUST–STATIC
ZONE–FANS	ZONE–FAN–CFM	•
	or	• PARALLEL–PIU, defaulting not allowed
	ZONE–FAN–RATIO	1.0 for SERIES–PIU
	ZONE–FAN–KW	0.00033
	ZONE–FAN–T–SCH	• (only for PARALLEL–PIU)
ZONE	ZONE–CONTROL	§
	ZONE–AIR	§
	ZONE–FANS	§
	ZONE–TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR–MULTIPLIER	Taken from SPACE in LOADS
	MAX–HEAT–RATE	Peak load or 1.08×ΔT×CFM
	MAX–COOL–RATE	Peak load or 1.08×ΔT×CFM
	BASEBOARD–RATING	No baseboard heating
	MIN–CFM–RATIO	From SYSTEM–TERMINAL
	MIN–CFM–SCH	MIN–CFM–RATIO
	SIZING–OPTION	FROM–LOADS
	TROM–VENT–SCH	•(only if TROMBE–WALL–V specified)
	TERMINAL–TYPE	SVAV †
	INDUCED–AIR–ZONE	•(only if TERMINAL–TYPE ≠ SVAV)
	REHEAT–DELTA–T	No reheat to zone simulated
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08×ΔT
	RETURN–CFM	SUPPLY–CFM minus EXHAUST–CFM or 0
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	RECOVERY–EFF	No heat recovery simulated
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None

† Because TERMINAL–TYPE defaults to SVAV, the zones with either Series–PIU or Parallel–PIU must be identified.
§ Any keyword from this subcommand may be placed in the SYSTEM command.

Continued on next page.

Continuation of

PIU–System Type: Powered Induction Unit System

Command	Keyword	Default Value or Consequence
SYSTEM–CONTROL	MAX–SUPPLY–T	MIN–SUPPLY–T + REHEAT–DELTA–T
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	HEAT–SET–T	No main heating coil capacity
	COOL–CONTROL	CONSTANT
	COOL–SET–T	MIN–SUPPLY–T
	COOL–RESET–SCH	•(only if COOL–CONTROL=RESET)
	COOL–SET–SCH	•(only if COOL–CONTROL=SCHEDULED)
	PREHEAT–T	45°F
	MAX–HUMIDITY	No dehumidification control
	MIN–HUMIDITY	No humidification
	ECONO–LIMIT–T	Return air temperature ■ changed in 2.1E
	ECONO–LOW–LIMIT	No lower limit
	BASEBOARD–SCH	Always off
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	3.37°F
	SUPPLY–KW	0.00109 kW/cfm
	FAN–SCHEDULE	Always on
	FAN–CONTROL	INLET
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	MAX–FAN–RATIO	1.1
	MIN–FAN–RATIO	0.3
	RETURN–STATIC	No return fan is simulated if neither pair
	RETURN–EFF	(RETURN–STATIC, RETURN–EFF)
	RETURN–DELTA–T	or (RETURN–DELTA–T, RETURN–KW)
	RETURN–KW	is specified.
	NIGHT–CYCLE–CTRL	STAY–OFF
	FAN–EIR–FPLR	•(only if FAN–CONTROL=FAN–EIR–FPLR)

§ Any keyword from this subcommand may be placed in the SYSTEM command.

Continued on next page.

Continuation of

PIU–System Type: Powered Induction Unit System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	REHEAT–DELTA–T	No reheat simulated
	MIN–CFM–RATIO	From outside air or heating load
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=PIU	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

RHFS–System Type: Constant Volume Reheat Fan System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	MIN-SUPPLY-T + REHEAT-DELTA-T
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-SET-T	From MAX-SUPPLY-T (SET=SUPPLY-HI if COOL-CONTROL=WARMEST or =RESET)
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	PREHEAT-T	45°F
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■ changed in 2.1E
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	3.11°F
	SUPPLY-KW	0.00101 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	CONSTANT-VOLUME
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
		Continued on next page.

Continuation of

RHFS–System Type: Constant Volume Reheat Fan System

Command	Keyword	Default Value or Consequence
SYSTEM–TERMINAL	REHEAT–DELTA–T	50°F
SYSTEM–EQUIPMENT	See page 36	
SYSTEM	SYSTEM–TYPE=RHFS	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

ZONE–level Commands and Keywords

HP–System Type: Water Loop Heat Pump System		
Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105.0
	MIN–SUPPLY–T	55.0
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	BASEBOARD–SCH	Always off
	ECONO–LIMIT–T	■ Return air temperature
	DRYBULB–LIMIT	■ Return air temperature
	ENTHALPY–LIMIT	■ None
	ECONO–LOW–LIMIT	■ None
SYSTEM–AIR	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	RATED–CFM	No performance adjustment
	VENT–TEMP–SCH	HEAT–TEMP–SCH + .5 * THROTTLING–RANGE
	OA–CONTROL	■ Fixed
	RECOVERY–EFF	■ 0.0 no recovery
	MAX–OA–FRACTION	■ 1.0
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	0.218°F
	SUPPLY–KW	0.00007 kW/cfm
	FAN–SCHEDULE	Always on
	FAN–CONTROL	CYCLING if OA–CONTROL=FIXED, else CONSTANT–VOLUME
	NIGHT–CYCLE–CTRL	STAY–OFF
	NIGHT–VENT–CTRL	NOT–AVAILABLE
	NIGHT–VENT–SCH	Required keyword (only if N–V–C=WHEN–SCHEDULED or SCHEDULED+DEMAND; otherwise, unused)
	NIGHT–VENT–DT	5.0°F
	NIGHT–VENT–RATIOS	• (only if N–V–C ≠ NOT–AVAILABLE)
SYSTEM–FLUID	MIN–FLUID–T	default to PLANT–ASSIGNMENT values
	MAX–FLUID–T	default to PLANT–ASSIGNMENT values
	FLUID–VOLUME	default to PLANT–ASSIGNMENT values
	COND–FLOW–TYPE	■ FIXED–FLOW
	COND–WTR–FLOW	■ 3.0 gpm
		Continued on next page.

Continuation of

HP–System Type: Water Loop Heat Pump System

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	COOLING–CAPACITY	Dependent on peak loads
	COOL–CAP–FT	Standard curve SDL–C5
	COOLING–EIR	0.382 Btu/Btu
	COOL–EIR–FT	Standard curve SDL–C15
	COOL–EIR–FPLR	Standard curve SDL–C20
	COOL–SH–CAP	From loads
	COOL–SH–FT	Standard curve SDL–C25
	COIL–BF	0.241
	COIL–BF–FCFM	Standard curve SDL–C35
	COIL–BF–FT	Standard curve SDL–C45
	RATED–CCAP–FCFM	Standard curve SDL–C79
	RATED–CEIR–FCFM	Standard curve SDL–C94
	RATED–SH–FCFM	Standard curve SDL–C86
	RATED–HCAP–FCFM	Standard curve SDL–C101
	RATED–HEIR–FCFM	Standard curve SDL–C109
	HEATING–CAPACITY	Dependent on peak loads
	HEAT–CAP–FT	Standard curve SDL–C55
	HEATING–EIR	0.357 Btu/Btu
	HEAT–EIR–FT	Standard curve SDL–C60
	HEAT–EIR–FPLR	Standard curve SDL–C65
SYSTEM	SYSTEM–TYPE=HP	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–FLUID	§
	SYSTEM–EQUIPMENT	§
	BASEBOARD–SOURCE	HOT–WATER
	SIZING–RATIO	1.0
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

HVSYS–System Type: Heating and Ventilating System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	HEATING-SCHEDULE	Always available
	HEAT-CONTROL	CONSTANT (RESET is LIKELY OPTION)
	HEAT-SET-T	From MAX-SUPPLY-T, or if HEAT-CONTROL=CONSTANT, then weighted average DESIGN-HEAT-T
	HEAT-RESET-SCH	•(only if HEAT-CONTROL=RESET)
	HEAT-SET-SCH	•(only if HEAT-CONTROL=SCHEDULED)
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	2.42°F
	SUPPLY-KW	0.000783 kW/cfm
	FAN-SCHEDULE	Always on
	MOTOR-PLACEMENT	IN-AIRFLOW
	RETURN-STATIC	No return fan is simulated if neither pair (RETURN-STATIC, RETURN-EFF) or (RETURN-DELTA-T, RETURN-KW) is specified.
	RETURN-EFF	
	RETURN-DELTA-T	
	RETURN-KW	
	NIGHT-CYCLE-CTRL	STAY-OFF
	NIGHT-VENT-CTRL	NOT-AVAILABLE
	NIGHT-VENT-SCH	• (only if N-V-C=WHEN-SCHEDULED or SCHEDULED+DEMAND; otherwise, unused)
	NIGHT-VENT-DT	5.0°F
	NIGHT-VENT-RATIOS	• (only if N-V-C ≠ NOT-AVAILABLE)
SYSTEM-TERMINAL	REHEAT-DELTA-T	No reheat simulated
SYSTEM-EQUIPMENT	HEATING-CAPACITY	Dependent on peak loads
	FURNACE-AUX	800.0 Btu/hr
	FURNACE-AUX-KW	0.0 kW
	FURNACE-HIR	1.35 Btu/Btu
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	No loss accounted for
		Continued on next page.

Continuation of

HVSYS–System Type: Heating and Ventilating System

Command	Keyword	Default Value or Consequence
SYSTEM	SYSTEM-TYPE=HVSYS	•
	ZONE-NAMES	•
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-TERMINAL	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	HOT-WATER
	ZONE-HEAT-SOURCE	HOT-WATER
	BASEBOARD-SOURCE	HOT-WATER
	HUMIDIFIER-TYPE	HOT-WATER
	SIZING-RATIO	1.0
	RETURN-AIR-PATH	DIRECT
	PLENUM-NAMES	No return air plenum
PLANT-ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM-FANS command)
Add-On Evaporative Cooling (SYSTEM-EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT-ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT-ASSIGNMENT commands)
Building Resources (PLANT-ASSIGNMENT commands)

apply to this system.

CBVAV–System Type: Ceiling Bypass System		
Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	MIN–SUPPLY–T+REHEAT–DELTA–T
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	HEAT–SET–T	No main heating coil capacity
	COOL–CONTROL	CONSTANT
	COOL–SET–T	MIN–SUPPLY–T
	COOL–RESET–SCH	• (only if COOL–CONTROL=RESET)
	COOL–SET–SCH	• (only if COOL–CONTROL=SCHEDULED)
	PREHEAT–T	45°F
	MAX–HUMIDITY	No dehumidification control
	MIN–HUMIDITY	No humidification
	ECONO–LIMIT–T	■ Return air temperature
	ECONO–LOW–LIMIT	No lower limit
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08×ΔT
	RETURN–CFM	SUPPLY–CFM minus EXHAUST–CFM or 0
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	RECOVERY–EFF	No heat recovery simulated
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
		Continued on next page.

Continuation of

CBVAV–System Type: Ceiling Bypass System

Command	Keyword	Default Value or Consequence
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	2.42°F
	SUPPLY–KW	0.000783 kW/cfm
	FAN–SCHEDULE	Always on
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	RETURN–STATIC RETURN–EFF RETURN–DELTA–T RETURN–KW	No return fan is simulated if neither pair (RETURN–STATIC, RETURN–EFF) or (RETURN–DELTA–T, RETURN–KW) is specified.
	NIGHT–CYCLE–CTRL	STAY–OFF
SYSTEM–TERMINAL	REHEAT–DELTA–T	No reheat simulated
	MIN–CFM–RATIO	From outside air or heating load
SYSTEM	SYSTEM–TYPE=CBVAV	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	PREHEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	HUMIDIFIER–TYPE	HOT–WATER
	SIZING–RATIO	1.0
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

RESYS–System Type: Residential System

Command	Keyword	Default Value or Consequence
ZONE–CONTROL	DESIGN–HEAT–T	• but not used
	HEAT–TEMP–SCH	•
	DESIGN–COOL–T	• but not used
	COOL–TEMP–SCH	•
	THERMOSTAT–TYPE	PROPORTIONAL
	THROTTLING–RANGE	2°F
	BASEBOARD–CTRL	OUTDOOR–RESET
ZONE–AIR	ASSIGNED–CFM	Based on heating/cooling
	CFM/SQFT	loads,supply air,ΔT,and
	AIR–CHANGES/HR	sizing ratio
	SS–VENT–SCH	No venting of sunspace
	SS–VENT–T–SCH	No variation in venting
	SS–VENT–CST	5.0 ach
	SS–VENT–WND	0.0 1/knot
	SS–VENT–TEMP	0.0 1/°F
	SS–VENT–LIMIT–T	120.0°F
	SS–VENT–KW	0.0
	SS–FLOW–SCH	No multiplied air flow effect
ZONE	ZONE–CONTROL	§
	ZONE–AIR	§
	ZONE–TYPE	CONDITIONED
	BASEBOARD–RATING	No baseboard heating
	SIZING–OPTION	FROM–LOADS
	TROM–VENT–SCH	• (only if TROMBE–WALL–V specified)
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From loads or capacities
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
	VENT–METHOD	AIR–CHANGE
	MAX–VENT–RATE	20
	HOR–VENT–FRAC	None
	FRAC–FRAC–AREA	0.5
	OPER–FRAC–SCH	u-name
	NATURAL–VENT–AC	No natural ventilation
	NATURAL–VENT–SCH	No natural ventilation
	VENT–TEMP–SCH	HEAT–TEMP–SCH
SYSTEM	SYSTEM–TYPE=RESYS	•
	ZONE–NAMES	• (First listed must be control zone)
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	GAS–FURNACE (HEAT–PUMP is OPTION)
	BASEBOARD–SOURCE	ELECTRIC
	SIZING–RATIO	1.0
	EVAP–PCC–EFF	.8
	EVAP–PCC–SCH	(see u-name)

Continued next page

§ Any keyword from this subcommand may be placed in the ZONE command.

Continuation of

RESYS–System Type: Residential System

Command	Keyword	Default Value or Consequence
SYSTEM-EQUIPMENT	COOLING-CAPACITY	Dependent on peak loads (input if CAPACITY is known)
	COOL-SH-CAP	From loads
	COOL-CAP-FT	Standard curve SDL-C1
	COOLING-EIR	0.438 Btu/Btu
	COOL-EIR-FT	Standard curve SDL-C11
	COOL-EIR-FPLR	Standard curve SDL-C16
	COOL-SH-FT	Standard curve SDL-C21
	COIL-BF	0.241
	COIL-BF-FCFM	Standard curve SDL-C31
	COIL-BF-FPLR	Standard curve SDL-C120
	COIL-BF-FT	Standard curve SDL-C41
	COOL-FT-MIN	70.0°F
	CRANKCASE-HEAT	0.05 kW
	CRANKCASE-MAX-T	50.0°F
	OUTSIDE-FAN-KW	No explicit fan energy
	OUTSIDE-FAN-T	Fan always on
	OUTSIDE-FAN-MODE	INTERMITTENT
	COMPRESSOR-TYPE	SINGLE-SPEED
	CONDENSER-TYPE	air cooled
	RATED-CCAP-FCFM	Standard curve SDL-C76
	RATED-SH-FCFM	Standard curve SDL-C83
	RATED-CEIR-FCFM	Standard curve SDL-C91
	RATED-HCAP-FCFM	Standard curve SDL-C98
	RATED-HEIR-FCFM	Standard curve SDL-C105
	HEATING-CAPACITY	From loads
	HEAT-CAP-FT	Standard curve SDL-C51
	HEATING-EIR	0.37 Btu/Btu
	HEAT-EIR-FT	Standard curve SDL-C56
	HEAT-EIR-FPLR	Standard curve SDL-C61
	HP-SUPP-HT-CAP	From heating loads
	MIN-HP-T	10.0°F
	MAX-HP-SUPP-T	17.0°F
	HP-SUPP-SOURCE	ELECTRIC
	FURNACE-AUX	800.0 Btu/hr
	FURNACE-AUX-KW	0.0 kW
	FURNACE-HIR	1.35 Btu/Btu
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	No loss accounted for
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	0.396°F
	SUPPLY-KW	0.000128 kW/cfm
	FAN-SCHEDULE	Always on
	LOW-SPEED-RATIOS	• if COMPRESSOR-TYPE=DUAL-SPEED
PLANT-ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the above, all keywords that apply to the following, also apply to RESYS.

Night Ventilation (SYSTEM-FANS command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT-ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT-ASSIGNMENT commands)
Building Resources (PLANT-ASSIGNMENT commands)

PSZ–System Type: Packaged Single Zone System		
Command	Keyword	Default Value or Consequence
ZONE–CONTROL	DESIGN–HEAT–T	•
	HEAT–TEMP–SCH	No active heating control
	DESIGN–COOL–T	•
	COOL–TEMP–SCH	No active cooling control
	THERMOSTAT–TYPE	PROPORTIONAL
	THROTTLING–RANGE	2°F
	BASEBOARD–CTRL	OUTDOOR–RESET
ZONE–AIR	ASSIGNED–CFM	Based on heating/cooling
	CFM/SQFT	loads, supply air, ΔT,
	AIR–CHANGES/HR	and sizing ratio
	OUTSIDE–AIR–CFM	
	OA–CFM/PER	Based on MIN–OUTSIDE–AIR
	OA–CHANGES	
	EXHAUST–CFM	0.0
	EXHAUST–EFF	0.75
	EXHAUST–STATIC	0.0
	EXHAUST–KW	From EXHAUST–EFF and EXHAUST–STATIC
ZONE	ZONE–CONTROL	§
	ZONE–AIR	§
	ZONE–TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR–MULTIPLIER	Taken from SPACE in LOADS
	MAX–HEAT–RATE	Peak load or 1.08×ΔT×CFM
	MAX–COOL–RATE	Peak load or 1.08×ΔT×CFM
	BASEBOARD–RATING	No baseboard heating
	HEATING–CAPACITY	
	COOLING–CAPACITY	From SYSTEM–EQUIPMENT
	COOL–SH–CAP	
	MIN–CFM–RATIO	From SYSTEM–TERMINAL
	MIN–CFM–SCH	MIN–CFM–RATIO
	SIZING–OPTION	FROM–LOADS
	TROM–VENT–SCH	•(only if TROMBE–WALL–V specified)
SYSTEM–CONTROL	MAX–SUPPLY–T	•
	MIN–SUPPLY–T	•
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	MAX–HUMIDITY	No dehumidification control
	MIN–HUMIDITY	No humidification
	ECONO–LIMIT–T	Return air temperature ■
	ECONO–LOCKOUT	■ YES – Compressor off w/OA dampers open
	ECONO–LOW–LIMIT	No lower limit
	WS–ECONO	■ NO
	WS–ECONO–MIN–DT	■ 5°F
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08×ΔT
	RETURN–CFM	SUPPLY–CFM minus EXHAUST–CFM or 0
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	RECOVERY–EFF	No heat recovery simulated
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None

§ Any keyword from this subcommand may be placed in the ZONE command.

Continued on next page.

Continuation of

PSZ–System Type: Packaged Single Zone System

Command	Keyword	Default Value or Consequence
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	1.815°F
	SUPPLY-KW	0.000587 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	CONSTANT-VOLUME
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
	INDOOR-FAN-MODE	Continuous
SYSTEM-TERMINAL	REHEAT-DELTA-T	No reheat simulated
	MIN-CFM-RATIO	Constant volume system
SYSTEM	SYSTEM-TYPE=PSZ	•
	ZONE-NAMES	•(First listed must be control zone)
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-TERMINAL	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	GAS-FURNACE (HEAT-PUMP, ELECTRIC, and GAS-HEAT-PUMP are OPTIONs)
	ZONE-HEAT-SOURCE	ELECTRIC
	BASEBOARD-SOURCE	ELECTRIC
	HUMIDIFIER-TYPE	ELECTRIC
	SIZING-RATIO	1.0
	SIZING-OPTION	NON-COINCIDENT
	RETURN-AIR-PATH	DIRECT
	PLENUM-NAMES	No return air plenum
SYSTEM-EQUIPMENT	MIN-HP-T	15.0°F
	MAX-HP-SUPP-T	40.0°F
	HP-SUPP-SOURCE	ELECTRIC
	FURNACE-AUX	800.0 Btu/hr
	FURNACE-AUX-KW	0.0 kW
	FURNACE-HIR	1.35 Btu/Btu
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	No loss accounted for
	REFG-KW-FTCOND	Standard curve SDL-C112
	REFG-KW-FPLR	Standard curve SDL-C113
	TWR-RFACT-FRT	Standard curve SDL-C114
	TWR-APP-FRFACT	Standard curve SDL-C115

Continued on next page.

Continuation of

PSZ–System Type: Packaged Single Zone System

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	COOLING–CAPACITY	Dependent on peak loads †
	COOL–SH–CAP	From loads †
	COOL–CAP–FT	Standard curve SDL–C3
	COOLING–EIR	0.360 Btu/Btu
	COOL–EIR–FT	Standard curve SDL–C13
	COOL–EIR–FPLR	Standard curve SDL–C18
	COOL–SH–FT	Standard curve SDL–C23
	COIL–BF	0.190
	COIL–BF–FCFM	Standard curve SDL–C33
	COIL–BF–FT	Standard curve SDL–C43
	COIL–BF–FPLR	Standard curve SDL–C120
	COOL–FT–MIN	70.0°F
	MIN–SUPPLY–SCH	uses MIN–SUPPLY–T
	MIN–UNLOAD–RATIO	0.25
	MIN–HGB–RATIO	0.25
	MAX–COND–RCVRY	No heat recovery from condenser
	CONDENSER–TYPE	■ Air-cooled
	WS–ECONO–XEFF	■ 0.6
	CRANKCASE–HEAT	.05 kW
	CRANKCASE–MAX–T	50°F
	OUTSIDE–FAN–KW	No explicit condenser fan electric
	OUTSIDE–FAN–T	45.0°F
	OUTSIDE–FAN–MODE	INTERMITTENT
	RATED–CCAP–FCFM	Standard curve SDL–C78
	RATED–SH–FCFM	Standard curve SDL–C85
	RATED–CEIR–FCFM	Standard curve SDL–C93
	RATED–HCAP–FCFM	Standard curve SDL–C100
	HEATING–CAPACITY	Dependent on peak loads
	HEAT–CAP–FT	Standard curve SDL–C52
	HEATING–EIR	0.370 Btu/Btu
	HEAT–EIR–FT	Standard curve SDL–C57
	HEAT–EIR–FPLR	Standard curve SDL–C62
	HP–SUPP–HT–CAP	From heating loads
PLANT–ASSIGNMENT	See page 43	

† Input if CAPACITY is known
§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords above, all keywords that apply to the following, also apply to this system. For water-cooled condensers that apply to PSZ systems, see the PLANT–ASSIGNMENT keywords that control the size of both tower and circulating pumps; see SYSTEM–FLUID for condenser flow variables.

Refrigerated Casework
Defrost Controls
Air and Water Side Economizers
Air and Water Cooled Condensers
Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

PMZS–System Type: Packaged Multi-Zone System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	(Input HEATING and COOLING capacity when known)
SYSTEM-CONTROL	MAX-SUPPLY-T	•
	MIN-SUPPLY-T	•
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-CONTROL	CONSTANT
	HEAT-SET-T	From MAX-SUPPLY-T
	HEAT-RESET-SCH	•(only if HEAT-CONTROL=RESET)
	HEAT-SET-SCH	•(only if HEAT-CONTROL=SCHEDULED)
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■
	ECONO-LOCKOUT	■ NO – Compressor runs w/OA dampers open
	ECONO-LOW-LIMIT	No lower limit
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	2.117°F
	SUPPLY-KW	0.000685 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	CONSTANT-VOLUME
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
SYSTEM-TERMINAL	MIN-CFM-RATIO	Constant volume system
		Continued on next page.

Continuation of

PMZS–System Type: Packaged Multi-Zone System

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	See page 36	
	CONDENSER–TYPE	■ Air-cooled
SYSTEM	SYSTEM–TYPE=PMZS	●
	ZONE–NAMES	●
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	GAS–FURNACE
	BASEBOARD–SOURCE	ELECTRIC
	HUMIDIFIER–TYPE	ELECTRIC
	SIZING–RATIO	1.0
	SIZING–OPTION	NON-COINCIDENT
	RETURN–AIR–PATH	DUCT
	EVAP–PCC–EFF	.8
	EVAP–PCC–SCH	(see u-name)
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

PVAVS–System Type: Packaged Variable Air Volume System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM-CONTROL	MAX-SUPPLY-T	MIN-SUPPLY-T + REHEAT-DELTA-T
	MIN-SUPPLY-T	•
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	HEAT-SET-T	No main heating coil capacity
	COOL-CONTROL	CONSTANT
	COOL-SET-T	MIN-SUPPLY-T
	COOL-RESET-SCH	•(only if COOL-CONTROL=RESET)
	COOL-SET-SCH	•(only if COOL-CONTROL=SCHEDULED)
	MAX-HUMIDITY	No dehumidification control
	MIN-HUMIDITY	No humidification
	ECONO-LIMIT-T	Return air temperature ■
	ECONO-LOCKOUT	■ NO – Compressor runs w/OA dampers open
	ECONO-LOW-LIMIT	No lower limit
	WS-ECONO	■ NO
	WS-ECONO-MIN-DT	■ 5.0°F
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From ZONE-AIR or load/1.08×ΔT
	RETURN-CFM	SUPPLY-CFM minus EXHAUST-CFM or 0
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
	OA-CONTROL	TEMP
	MAX-OA-FRACTION	1.0
	RECOVERY-EFF	No heat recovery simulated
	DUCT-AIR-LOSS	None
	DUCT-DELTA-T	None
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	2.117°F
	SUPPLY-KW	0.000685 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	INLET
	SUPPLY-MECH-EFF	From SUPPLY-EFF
	MOTOR-PLACEMENT	IN-AIRFLOW
	FAN-PLACEMENT	DRAW-THROUGH
	MAX-FAN-RATIO	1.1
	MIN-FAN-RATIO	0.3
	RETURN-STATIC	No return fan is simulated if neither pair
	RETURN-EFF	(RETURN-STATIC, RETURN-EFF)
	RETURN-DELTA-T	or (RETURN-DELTA-T, RETURN-KW)
	RETURN-KW	is specified.
	NIGHT-CYCLE-CTRL	STAY-OFF
	FAN-EIR-FPLR	•(only if FAN-CONTROL=FAN-EIR-FPLR)
	INDOOR-FAN-MODE	Continuous
SYSTEM-TERMINAL	REHEAT-DELTA-T	No reheat simulated
	MIN-CFM-RATIO	From outside air or heating load
SYSTEM-EQUIPMENT	CONDENSER-TYPE	■ Air-cooled
	WS-ECONO-XEFF	■ 0.6

Continued on next page.

• = Required keyword

■ = Added/changed in 2.1E

Continuation of

PVAVS–System Type: Packaged Variable Air Volume System

Command	Keyword	Default Value or Consequence
SYSTEM	SYSTEM–TYPE=PVAVS	•
	ZONE–NAMES	•
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	EVAP–PCC–EFF	.8
	EVAP–PCC–SCH	(see u-name)
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	ELECTRIC
	HUMIDIFIER–TYPE	ELECTRIC
	SIZING–RATIO	1.0
	SIZING–OPTION	NON-COINCIDENT
	RETURN–AIR–PATH	DUCT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Gas Heat Pump

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

For water cooled condensers that apply to PVAVS, see the PLANT–ASSIGNMENT keywords that control the size of both tower and circulating pumps; see SYSTEM–FLUID for condenser flow variables.

PTAC–System Type: Packaged Terminal Air Conditioner System

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	(Input HEATING and COOLING capacity when known)
SYSTEM-CONTROL	MAX-SUPPLY-T	105°F
	MIN-SUPPLY-T	55°F
	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
	BASEBOARD-SCH	Always off
SYSTEM-AIR	SUPPLY-CFM	From loads or capacities
	MIN-OUTSIDE-AIR	From ZONE-AIR or none
	MIN-AIR-SCH	No scheduling of outside air
SYSTEM-FANS	SUPPLY-STATIC	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-EFF	From SUPPLY-DELTA-T & SUPPLY-KW
	SUPPLY-DELTA-T	0.218°F
	SUPPLY-KW	0.00007 kW/cfm
	FAN-SCHEDULE	Always on
	FAN-CONTROL	TWO-SPEED
	NIGHT-CYCLE-CTRL	STAY-OFF
	LOW-SPEED-RATIOS	(1.0, 1.0, 1.0, 1.0)
SYSTEM-EQUIPMENT	COOLING-CAPACITY	Dependent on peak loads
	COOL-CAP-FT	Standard curve SDL-C2
	COOLING-EIR	0.438 Btu/Btu
	COOL-EIR-FT	Standard curve SDL-C12
	COOL-EIR-FPLR	Standard curve SDL-C17
	COOL-SH-CAP	From loads
	COOL-SH-FT	Standard curve SDL-C22
	COIL-BF	0.241
	COIL-BF-FCFM	Standard curve SDL-C32
	COIL-BF-FT	Standard curve SDL-C42
	COIL-BF-FPLR	Standard curve SDL-C120
	MIN-SUPPLY-SCH	uses MIN-SUPPLY-T
	CONDENSER-TYPE	■ Air-cooled
	COOL-FT-MIN	70.0°F
	RATED-CCAP-FCFM	Standard curve SDL-C77
	RATED-SH-FCFM	Standard curve SDL-C84
	RATED-CEIR-FCFM	Standard curve SDL-C92
	RATED-HCAP-FCFM	Standard curve SDL-C99
	RATED-HEIR-FCFM	Standard curve SDL-C106
	HEATING-CAPACITY	Dependent on peak loads
	HEAT-CAP-FT	Standard curve SDL-C52
	HEATING-EIR	0.370 Btu/Btu
	HEAT-EIR-FT	Standard curve SDL-C57
	HEAT-EIR-FPLR	Standard curve SDL-C62
	HP-SUPP-HT-CAP	From heating loads
	CRANKCASE-HEAT	.025 kW
	CRANKCASE-MAX-T	50°F
	MIN-HP-T	40°F
	MAX-HP-SUPP-T	40.0°F
	HP-SUPP-SOURCE	ELECTRIC
		Continued on next page.

Continuation of

PTAC–System Type: Packaged Terminal Air Conditioner System

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	FURNACE–AUX	800.0 Btu/hr
	FURNACE–AUX–KW	0.0 kW
	FURNACE–HIR	1.35 Btu/Btu
	FURNACE–HIR–FPLR	Standard curve SDL–C111
	FURNACE–OFF–LOSS	No loss accounted for
	EVAP–CL–TYPE	■ INDIRECT–DIRECT
	EVAP–CL–KW	■ .0005 kW/cfm
	EVAP–CL+REC–RA	■ NO (recirculation)
	DIRECT–EFF	■ .85
	INDIR–EFF	■ .80
SYSTEM	SYSTEM–TYPE=PTAC	●
	ZONE–NAMES	●
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	ELECTRIC (HEAT–PUMP is OPTION)
	EVAP–PCC–EFF	.8
	EVAP–PCC–SCH	(see u-name)
	BASEBOARD–SOURCE	ELECTRIC
	SIZING–RATIO	1.0
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Gas Heat Pump

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

PTGSD–System Type: Packaged Total Gas Solid Desiccant

Command	Keyword	Default Value or Consequence
ZONE–CONTROL	HEAT–TEMP–SCH	No active heating
	COOL–TEMP–SCH	No active heating
	THROTTLING–RANGE	2°F
	BASEBOARD–CTRL	Outdoor-reset
ZONE–AIR	ASSIGNED–CFM	Based on heating/cooling loads, supply air, ΔT, and sizing ratio
	CFM–SQFT	
	AIR–CHANGES/HR	
	OUTSIDE–AIR–CFM	Based on MIN–OUTSIDE–AIR
	OA–CFM/PER	
	OA–CHANGES	
	EXHAUST–CFM	0.0
	EXHAUST–EFF	0.75
	EXHAUST–STATIC	0.0
	EXHAUST–KW	From EXHAUST–EFF and EXHAUST–STATIC
	SS–VENT–SCH	No venting of sunspace
	SS–VENT–T–SCH	No variation in venting
	SS–VENT–CST	5.0 ach
	SS–VENT–WND	0.0 1/knot
	SS–VENT–TEMP	0.0 1/°F
	SS–VENT–LIMIT–T	120.0°F
	SS–VENT–KW	0.0
	SS–FLOW–SCH	No multiplied air flow effect
ZONE	ZONE–CONTROL	§
	ZONE–AIR	§
	ZONE–TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR–MULTIPLIER	Taken from SPACE in LOADS
	BASEBOARD–RATING	No baseboard heating
	TROM–VENT–SCH	• (only if TROMBE–WALL–V specified)
SYSTEM–CONTROL	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	MAX–HUMIDITY	No dehumidification control
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	REQUIRED
	MIN–OUTSIDE–AIR	From ZONE–AIR or none
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	1.2
	SUPPLY–KW	.0004
	FAN–SCHEDULE	Always on
	FAN–CONTROL	SPEED
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	MIN–FAN–RATIO	.3
	MAX–FAN–RATIO	1.1
	NIGHT–CYCLE–CTRL	STAY–OFF
	FAN–EIR–FPLR	• (only if FAN–CONTROL=FAN–EIR–FPLR)
	SYSTEM–TERMINAL	■ MIN–CFM–RATIO .3

§ Any keyword from this subcommand may be placed in the ZONE command.

Continued on next page.

Continuation of

PTGSD–System Type: Packaged Total Gas Solid Desiccant

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	HEATING–CAPACITY	Required
SYSTEM–TERMINAL	MIN–CFM–RATIO	■ .3
SYSTEM	SYSTEM–TYPE=PTGSD	•
	ZONE–NAMES	• (first listed must be control zone)
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–TERMINAL	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	GAS–HYDRONIC
	BASEBOARD–SOURCE	GAS–HYDRONIC
	ZONE–HEAT–SOURCE	GAS–HYDRONIC
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM–FANS command)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

apply to this system.

EVAP–COOL System Type: Stand Alone Evaporative Cooling Unit

Command	Keyword	Default Value or Consequence
ZONE-level commands	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	
	MIN–SUPPLY–T	
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	ECONO–LIMIT–T	100°F ■
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	Must be precalculated by user
	MIN–OUTSIDE–AIR	From ZONE–AIR or none during heating ■
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
SYSTEM–FANS	SUPPLY–STATIC	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–EFF	From SUPPLY–DELTA–T & SUPPLY–KW
	SUPPLY–DELTA–T	2.42°F
	SUPPLY–KW	0.000783 kW/cfm
	FAN–SCHEDULE	Always on
	FAN–CONTROL	CONSTANT–VOLUME
	SUPPLY–MECH–EFF	From SUPPLY–EFF
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	MAX–FAN–RATIO	1.1
	NIGHT–CYCLE–CTRL	STAY–OFF
	FAN–EIR–FPLR	• (only if FAN–CONTROL=FAN–EIR–FPLR)
SYSTEM–EQUIPMENT	EVAP–CL–TYPE	■ INDIRECT–DIRECT
	EVAP–CL–KW	■ .0005 kW/cfm
	EVAP–CL+REC–RA	■ NO (recirculation)
	DIRECT–EFF	■ .85
	INDIR–EFF	■ .80
SYSTEM	SYSTEM–TYPE=EVAP–COOL	• ■
	ZONE–NAMES	• (First listed must be control zone)
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HOT–WATER
	ZONE–HEAT–SOURCE	HOT–WATER
	BASEBOARD–SOURCE	HOT–WATER
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT
	RETURN–AIR–PATH	DIRECT
	PLENUM–NAMES	No return air plenum
PLANT–ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the SYSTEM command.

In addition to the keywords listed above, all keywords that apply to the following also apply to this system.

Night Ventilation (SYSTEM–FANS command)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT commands)
Building Resources (PLANT–ASSIGNMENT commands)

■ PVVT–System Type:

Packaged Single Zone Fan System - Variable Volume - Variable Temperature

Command	Keyword	Default Value or Consequence
ZONE–level	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	MAXIMUM–HUMIDITY	No dehumidification control
	MINIMUM–HUMIDITY	No humidification
	DRYBULB–LIMIT	Return air temperature
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08*DT
	RETURN–AIR	SUPPLY–CFM minus EXHAUST-CFM or 0.0
	MIN–OUTSIDE–AIR	From ZONE-AIR or none
	MIN–AIR–SCH	No scheduling of outside air
	OA–CONTROL	TEMP
	MAX–OA–FRACTION	1.0
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
	VENT–TEMP–SCH	HEAT–TEMP–SCH + .5 * THROTTLING–RANGE
SYSTEM–FANS	SUPPLY–STATIC	None
	SUPPLY–EFF	None
	SUPPLY–DELTA–T	2.117
	SUPPLY–KW	.0007
	FAN–SCHEDULE	Always on
	SUPPLY–MECH–EFF	From SUPPLY–STATIC
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	MAX–FAN–RATIO	1.0
	MIN–FAN–RATIO	0.3
	INDOOR–FAN–MODE	Continuous
	NIGHT–CYCLE–CTRL	STAY–OFF
SYSTEM–EQUIPMENT	COMPRESSOR–TYPE	VARIABLE–SPEED
	CONDENSER–TYPE	AIR–COOLED
	HP–SUPP–SOURCE	ELECTRIC
	DEFROST–TYPE	RESISTIVE
	DEFROST–CTRL	TIMED

§ Any keyword from this subcommand may be placed in the ZONE command.

Continued on next page.

Continuation of

■ PVVT–System Type:

Packaged Single Zone Fan System - Variable Volume - Variable Temperature

Command	Keyword	Default Value or Consequence
SYSTEM	SYSTEM-TYPE=PVVT	
	ZONE-NAMES	(First listed must be control zone)
	SYSTEM-CONTROL	§
	SYSTEM-AIR	§
	SYSTEM-FANS	§
	SYSTEM-EQUIPMENT	§
	HEAT-SOURCE	HEAT-PUMP
	ZONE-HEAT-SOURCE	ELECTRIC
	BASEBOARD-SOURCE	ELECTRIC
	HUMIDIFIER-TYPE	ELECTRIC
	SIZING-RATIO	1.0
	SIZING-OPTION	NON-COINCIDENT
	RETURN-AIR-PATH	DIRECT
	PLENUM-NAMES	No return air plenum
PLANT-ASSIGNMENT	See page 43	

In addition to the keywords listed above, all keywords that apply to

Night Ventilation (SYSTEM-FANS command)
Add-On Evaporative Cooling (SYSTEM-EQUIPMENT command)
Add-On (Integrated) Desiccant Cooling (SYSTEM command)
Service Hot Water Heat Pump (SYSTEM and PLANT-ASSIGNMENT commands)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT-ASSIGNMENT commands)
Building Resources (PLANT-ASSIGNMENT commands)
Gas Heat Pumps

apply to this system.

■ RESVVT–System Type:

Single Zone Fan System - Variable Volume - Variable Temperature

Command	Keyword	Default Value or Consequence
ZONE–level	See pages 63,88	
SYSTEM–CONTROL	MAX–SUPPLY–T	105°F
	MIN–SUPPLY–T	55°F
	HEATING–SCHEDULE	Always available
	COOLING–SCHEDULE	Always available
	MAXIMUM–HUMIDITY	No dehumidification control
	MINIMUM–HUMIDITY	No humidification
	BASEBOARD–SCH	Always off
SYSTEM–AIR	SUPPLY–CFM	From ZONE–AIR or load/1.08*DT
	DUCT–AIR–LOSS	None
	DUCT–DELTA–T	None
SYSTEM–FANS	SUPPLY–STATIC	None
	SUPPLY–EFF	None
	SUPPLY–DELTA–T	0.4
	SUPPLY–KW	.00016
	FAN–SCHEDULE	Always on
	FAN–CONTROL	Speed
	SUPPLY–MECH–EFF	From SUPPLY–STATIC
	MOTOR–PLACEMENT	IN–AIRFLOW
	FAN–PLACEMENT	DRAW–THROUGH
	MAX–FAN–RATIO	1.0
	MIN–FAN–RATIO	0.3
SYSTEM	SYSTEM–TYPE=RESVVT	
	ZONE–NAMES	
	SYSTEM–CONTROL	§
	SYSTEM–AIR	§
	SYSTEM–FANS	§
	SYSTEM–EQUIPMENT	§
	HEAT–SOURCE	HEAT–PUMP
	ZONE–HEAT–SOURCE	ELECTRIC
	BASEBOARD–SOURCE	ELECTRIC
	HUMIDIFIER–TYPE	ELECTRIC
	SIZING–RATIO	1.0
	SIZING–OPTION	NON–COINCIDENT

Continued on next page.

Continuation of

■ RESVVT–System Type:

Single Zone Fan System - Variable Volume - Variable Temperature

Command	Keyword	Default Value or Consequence
SYSTEM-EQUIPMENT	MIN-HP-T	10°F
	MAX-HP-SUPP-T	40°F
	HP-SUPP-SOURCE	Electric
	COOLING-CAPACITY	from peak loads (user should enter a value)
	COOL-SH-CAP	from peak loads (user should enter a value)
	COOLING-EIR	.343
	COOL-CAP-FT	Standard curve SDL-C4
	COOL-SH-FT	Standard curve SDL-C24
	COOL-CAP-FRPM	Standard curve SDL-C151
	COOL-EIR-FT	Standard curve SDL-C82
	COOL-EIR-LS-FT	Standard curve SDL-C132
	COOL-RPM-LIMITS	3500,1000 rpm
	COIL-BF	.14
	COIL-BF-FCFM	Standard curve SDL-C34
	COIL-BF-FT	Standard curve SDL-C44
	COIL-BF-FPLR	Standard curve SDL-C131
	COOL-FT-MIN	70°F
	COOL-CTRL-RANGE	4°F
	COOL-CLOSS-FPLR	Standard curve SDL-C147
	COOL-CLOSS-MIN	0.8
	HEATING-CAPACITY	from peak loads
	HEATING-EIR	.306
	HEAT-CAP-FT	Standard curve SDL-C95
	HEAT-CAP-FRPM	Standard curve SDL-C152
	HEAT-EIR-FT	Standard curve SDL-C104
	HEAT-EIR-LS-FT	Standard curve SDL-C133
	HEAT-RPM-LIMITS	3500,1000 rpm
	HEAT-CLOSS-FPLR	Standard curve SDL-C146
	HEAT-CLOSS-MIN	0.8
	HP-SUPP-HT-CAP	from peak loads
	FURNACE-AUX	800 btu/hr
	FURNACE-HIR	1.35
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	0.
	FURNACE-AUX-KW	0.
	CRANKCASE-HEAT	.05 kW
	CRANKCASE-MAX-T	50°F
	COMPRESSION-TYPE	variable-speed
	OUTSIDE-FAN-ELEC	no explicit elec
	OUTSIDE-FAN-T	user must enter value

Continued on next page.

Continuation of

■ RESVVT–System Type:

Single Zone Fan System - Variable Volume - Variable Temperature

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	OUTSIDE–FAN–MODE	intermittent
	OUTSIDE–FAN–CFLT	Standard curve SDL-C139
	OUTSIDE–FAN–HFLT	Standard curve SDL-C145
	DEFROST–TYPE	reverse cycle
	DEFROST–CTRL	on-demand
	DEFROST–FRAC–FT	Standard curve SDL-C188
	DEFROST–T	40°F
	COOL–WASTE–HEAT	0.23
	HEAT–WASTE–HEAT	0.25
	WASTE–HEAT–USE	space-heat
	COOL–WH–FT	Standard curve SDL-C136
	COOL–WH–FRPM	Standard curve SDL-C137
	HEAT–WH–FT	Standard curve SDL-C142
	HEAT–WH–FRPM	Standard curve SDL-C143
	CONDENSER–TYPE	air-cooled
	EVAP–PCC–ELEC	.0017 watts/btu
	EVAP–PCC–EFF	0.8
	EVAP–PCC–SCH	see *Supplement (2.1E)*
	RATED–CCAP–FCFM	Standard curve SDL-C78
	RATED–SH–FCFM	Standard curve SDL-C85
	RATED–CEIR–FCFM	Standard curve SDL-C93
	RATED–HCAP–FCFM	Standard curve SDL-C100
	RATED–HEIR–FCFM	Standard curve SDL-C105
PLANT–ASSIGNMENT	See page 43	

In addition to the keywords listed above, all keywords that apply to the following also apply to this system.

Night Ventilation (SYSTEM–FANS)
Add-On Evaporative Cooling (SYSTEM–EQUIPMENT)
Add-On (Integrated) Desiccant Cooling (SYSTEM)
Service Hot Water Heat Pump (SYSTEM and PLANT–ASSIGNMENT)
Electric and Fuel Meters (SYSTEM, ZONE, and PLANT–ASSIGNMENT)
and Building Resources (PLANT–ASSIGNMENT)

SUM–System Type

Command	Keyword	Default Value or Consequence
ZONE-CONTROL	DESIGN-HEAT-T	70°F
	HEAT-TEMP-SCH	•
	DESIGN-COOL-T	76°F
	COOL-TEMP-SCH	•
	THERMOSTAT-TYPE	PROPORTIONAL
	THROTTLING-RANGE	2°F
ZONE	ZONE-CONTROL	§
	ZONE-TYPE	CONDITIONED
	MULTIPLIER	Taken from SPACE in LOADS
	FLOOR-MULTIPLIER	Taken from SPACE in LOADS
	MAX-HEAT-RATE	Peak load
	MAX-COOL-RATE	Peak load
	SIZING-OPTION	FROM-LOADS
SYSTEM-CONTROL	HEATING-SCHEDULE	Always available
	COOLING-SCHEDULE	Always available
SYSTEM-FANS	FAN-SCHEDULE	Always on
	NIGHT-CYCLE-CTRL	STAY-OFF
SYSTEM	SYSTEM-TYPE=SUM	•
	ZONE-NAMES	•
	SYSTEM-CONTROL	§
	SYSTEM-FANS	§
	SIZING-RATIO	1.0
PLANT-ASSIGNMENT	See page 43	

§ Any keyword from this subcommand may be placed in the command.

FNSYS1–System Type

FNSYS1 is for use with SYSTEMS Functions. It is identical to the system type SUM, except that it has all of the SYSTEM keywords enabled. By using the FNSYS1–1, FNSYS1–2Z, FNSYS1–3Z, FNSYS1–4Z, FNSYS1–5 keywords of the SUBR–FUNCTIONS command (p. 29) you can change the computation algorithm of the basic FNSYS1 system and thereby build a custom system type.

SYSTEM–EQUIPMENT keywords

For Central Systems

System Types **SZRH, MZS, DDS, SZCI, TPIU, FPIU, VAVS, PIU, RHFS,** and **CBVAV**

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	COOLING–CAPACITY	Dependent on peak loads
	COOL–CAP–FT	Standard curve SDL–C7
	COOL–SH–CAP	From loads
	COOL–SH–FT	Standard curve SDL–C27
	COIL–BF	0.037 (0.078 for MZS)
	COIL–BF–FCFM	Standard curve SDL–C38
	COIL–BF–FT	Standard curve SDL–C48
	COIL–BF–FPLR	Standard curve SDL–C161
	MIN–SUPPLY–SCH	uses MIN–SUPPLY–T
	COOL–CTRL–RANGE	4.0°F
	COOL–FT–MIN	70.0°F
	HEATING–CAPACITY	Dependent on peak loads
	HCOIL–WIPE–FCFM	No effect (Used only for MZS and DDS)
	FURNACE–AUX	800.0 Btu/hr
	FURNACE–AUX–KW	0.0 kW
	FURNACE–HIR	1.35 Btu/Btu
	FURNACE–HIR–FPLR	Standard curve SDL–C111
	FURNACE–OFF–LOSS	No loss accounted for

SYSTEM–EQUIPMENT keywords

For Zonal Systems

System Types **TPFC** and **FPFC**

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	COOLING–CAPACITY	Dependent on peak loads
	COOL–CAP–FT	Standard curve SDL–C10
	COOL–SH–CAP	From loads
	COOL–SH–FT	Standard curve SDL–C30
	COIL–BF	0.14
	COIL–BF–FCFM	Standard curve SDL–C40
	COIL–BF–FT	Standard curve SDL–C50
	COIL–BF–FPLR	Standard curve SDL–C161
	MIN–SUPPLY–SCH	uses MIN–SUPPLY–T
	COOL–FT–MIN	70.0°F
	HEATING–CAPACITY	Dependent on peak loads
	FURNACE–AUX	800.0 Btu/hr
	FURNACE–AUX–KW	0.0 kW
	FURNACE–HIR	1.35 Btu/Btu
	FURNACE–HIR–FPLR	Standard curve SDL–C111
	FURNACE–OFF–LOSS	No loss accounted for

SYSTEM–EQUIPMENT keywords

For Packaged Systems

System Types PMZS and PVAVS

Command	Keyword	Default Value or Consequence
SYSTEM-EQUIPMENT	COOLING-CAPACITY	Dependent on peak loads
	COOL-CAP-FT	Standard curve SDL-C3
	COOLING-EIR	0.360 Btu/Btu
	COOL-EIR-FT	Standard curve SDL-C13
	COOL-EIR-FPLR	Standard curve SDL-C18
	COOL-SH-CAP	Dependent on peak loads
	COOL-SH-FT	Standard curve SDL-C23
	COIL-BF	0.19
	COIL-BF-FCFM	Standard curve SDL-C33
	COIL-BF-FT	Standard curve SDL-C43
	COIL-BF-FPLR	Standard curve SDL-C120
	MIN-SUPPLY-SCH	uses MIN-SUPPLY-T
	COOL-CTRL-RANGE	4.0°F
	COOL-FT-MIN	70.0°F
	MIN-UNLOAD-RATIO	0.25
	MIN-HGB-RATIO	0.25
	MAX-COND-RCVRY	No heat recovery from condenser
	CRANKCASE-HEAT	.05 kW
	CRANKCASE-MAX-T	50°F
	OUTSIDE-FAN-ELEC	No explicit condenser fan electric
	OUTSIDE-FAN-T	45.0°F
	OUTSIDE-FAN-MODE	INTERMITTENT
	HEATING-CAPACITY	Dependent on peak loads
	HCOIL-WIPE-FCFM	No effect (Used only for PMZS)
	FURNACE-AUX	800.0 Btu/hr
	FURNACE-AUX-KW	0.0 kW
	FURNACE-HIR	1.35 Btu/Btu
	FURNACE-HIR-FPLR	Standard curve SDL-C111
	FURNACE-OFF-LOSS	No loss accounted for
	CONDENSER-TYPE	■ Air-cooled

SYSTEM–EQUIPMENT keywords

For Packaged Systems

System Type PVVT

Command	Keyword	Default Value or Consequence
SYSTEM–EQUIPMENT	COIL–BF	0.1900
	COIL–BF–FFLOW	Standard curve SDL–C38
	COIL–BF–FPLR	■ Standard curve SDL–C120
	COIL–BF–FT	Standard curve SDL–C48
	COMPRESSOR–TYPE	■ VARIABLE–SPEED
	CONDENSER–TYPE	■ Air-cooled
	COOL–CAP–FT	Standard curve SDL–C8
	COOL–CTRL–RANGE	4.0000
	COOL–EIR–FPLR	Standard curve SDL–C129
	COOL–EIR–FT	Standard curve SDL–C89
	COOL–FT–MIN	70.0000
	COOL–SH–FT	Standard curve SDL–C28
	COOLING–EIR	0.360 Btu/Btu
	CRANKCASE–HEAT	■ 0.0500
	CRANKCASE–MAX–T	■ 50.0000°F
	DEFROST–CTRL	■ TIMED
	DEFROST–T	40.0000
	DEFROST–TYPE	■ RESISTIVE
	DIRECT–EFF	■ 0.8500
	DIRECT–EFF–FFLOW	■ Standard curve SDL–C58
	EVAP–CL+M–SUP	■ TOGETHER
	EVAP–CL+REC–RA	■ NO
	EVAP–CL–AIR	■ No evap cooler
	EVAP–CL–KW/FLOW	■ 0.0010
	EVAP–CL–LIMIT–T	■ 199.
	EVAP–CL–TYPE	■ NONE
	EVAP–PCC–EFF	■ 0.8000
	EVAP–PCC–ELEC	■ 0.0017
	EVAP–PCC–SCH	■ No evap precooler
	FURNACE–AUX	800.
	FURNACE–HIR	1.3500
	FURNACE–HIR–FPLR	Standard curve SDL–C111
	HEAT–CAP–FT	Standard curve SDL–C96
	HEAT–EIR–FPLR	Standard curve SDL–C116
	HEAT–EIR–FT	Standard curve SDL–C107
	HEATING–EIR	0.3700
	HP–SUPP–HT–CAP	Sized for heating load
	HP–SUPP–SOURCE	ELECTRIC
	INDIR–EFF	■ 0.8000
	INDIR–EFF–FFLOW	■ Standard curve SDL–C59
	MAX–HP–SUPP–T	40.0000
	MIN–HGB–RATIO	■ 0.0
	MIN–HP–T	10.0000
	MIN–SUPPLY–SCH	■ Not scheduled
	MIN–UNLOAD–RATIO	0.2500
	OUTSIDE–FAN–CFLT	■ Standard curve SDL–C169
	OUTSIDE–FAN–ELEC	Included in EIR
	OUTSIDE–FAN–MODE	INTERMITTENT
	OUTSIDE–FAN–T	45.0°F
	RESIST–CAP–RATIO	■ 0.7000
	WS–ECONO–XEFF	■ 0.6000

● = Required keyword

■ = Added/changed in 2.1E

VERIFICATION AND SUMMARY REPORTS

LOADS Verification Reports

Code-word	*Title/description*
LV-A	GENERAL PROJECT AND BUILDING INPUT
LV-B	SUMMARY OF SPACES OCCURRING IN THE PROJECT
LV-C	DETAILS OF SPACE
LV-D	DETAILS OF EXTERIOR SURFACES IN THE PROJECT
LV-E	DETAILS OF UNDERGROUND SURFACES IN THE PROJECT
LV-F	DETAILS OF INTERIOR SURFACES IN THE PROJECT
LV-G	DETAILS OF SCHEDULES OCCURRING IN THE PROJECT
LV-H	DETAILS OF WINDOWS OCCURRING IN THE PROJECT
LV-I	DETAILS OF CONSTRUCTIONS OCCURRING IN THE PROJECT
LV-J	DETAILS OF BUILDING SHADES IN THE PROJECT
LV-K	WEIGHTING FACTOR SUMMARY
LV-L	DAYLIGHT FACTOR SUMMARY
LV-M	DOE-2 UNITS TABLE (English/Metric Conversion Table)
ALL-VERIFICATION	All verification reports

LOADS Summary Reports

LS-A	SPACE PEAK LOADS SUMMARY
LS-B	SPACE PEAK LOAD COMPONENTS
LS-C	BUILDING PEAK LOAD COMPONENTS
LS-D	BUILDING MONTHLY LOADS SUMMARY
LS-E	SPACE MONTHLY LOAD COMPONENTS IN MBtu
LS-F	BUILDING MONTHLY LOAD COMPONENTS IN MBtu
LS-G	SPACE DAYLIGHTING SUMMARY
LS-H	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT, <space>
LS-I	PERCENT LIGHTING ENERGY REDUCTION BY DAYLIGHT, BUILDING
LS-J	DAYLIGHT ILLUMINANCE FREQUENCY OF OCCURRENCE
LS-K	SPACE INPUT FUELS SUMMARY
LS-L	MANAGEMENT AND SOLAR SUMMARY FOR SPACE
ALL-SUMMARY	All summary reports

SYSTEMS Verification Reports

SV-A	SYSTEM DESIGN PARAMETERS
SV-A	SYSTEM DESIGN PARAMETERS (Refrigerated Equipment in <space>)
SV-B	ZONE FAN DATA for <system>
REPORT-ONLY	Requested report printed; no simulation of SYSTEMS or PLANT performed.

SYSTEMS Summary Reports

SS-A	SYSTEM MONTHLY LOADS SUMMARY
SS-B	SYSTEM MONTHLY LOADS SUMMARY
SS-C	SYSTEM MONTHLY LOAD HOURS
SS-D	PLANT MONTHLY LOADS SUMMARY
SS-E	PLANT MONTHLY LOAD HOURS
SS-F	ZONE DEMAND SUMMARY
SS-G	ZONE LOADS SUMMARY
SS-H	SYSTEM MONTHLY LOADS SUMMARY
SS-I	SYSTEM MONTHLY SENSIBLE-LATENT SUMMARY
SS-J ■	SYSTEM PEAK HEATING AND COOLING DAYS
SS-K	SPACE TEMPERATURE SUMMARY
SS-L	FAN ELECTRIC ENERGY FOR <system>
SS-M	FAN ELECTRIC ENERGY FOR PLANT
SS-N	RELATIVE HUMIDITY SCATTER PLOT
SS-O	TEMPERATURE SCATTER PLOT

SS–P ■	LOAD, ENERGY and PART LOAD HEATING IN [u-name of SYSTEM], or LOAD, ENERGY and PART LOAD COOLING IN [u-name of SYSTEM] LOAD, ENERGY and PART LOAD PUMP OPERATION FOR [u-name of PLANT–ASSIGNMENT] LOAD, ENERGY and PART LOAD BOILER OPERATION FOR [u-name of PLANT–ASSIGNMENT] LOAD, ENERGY and PART LOAD COOLING TOWER OPERATION FOR [u-name of PLANT–ASSIGNMENT] LOAD, ENERGY and PART LOAD WATER-SIDE ECONO OPERATION FOR [u-name of PLANT–ASSIGNMENT] LOAD, ENERGY and PART LOAD DHW TANK OPERATION FOR [u-name of PLANT–ASSIGNMENT]
SS–Q ■	HEAT PUMP COOLING AND HEATING SUMMARY FOR [u-name of SYSTEM or PLANT–ASSIGNMENT]
SUPL ■	SYSTEM SUPPLEMENTAL EVAPORATIVE OR DESICCANT COOLING
REFG	REFRIGERATION EQUIPMENT SUMMARY
ALL–SUMMARY	All summary reports

PLANT Verification Reports

PV–A	EQUIPMENT SIZES
PV–B	COST REFERENCE DATA (USED FOR DEFAULT COSTS)
PV–C	EQUIPMENT COSTS
PV–E	EQUIPMENT LOAD RATIOS
PV–G	EQUIPMENT QUADRATICS
ALL–VERIFICATION	All verification reports

PLANT Summary Reports

PS–A	PLANT ENERGY UTILIZATION SUMMARY
PS–B	MONTHLY PEAK AND TOTAL ENERGY USE
PS–C	EQUIPMENT PART LOAD OPERATION
PS–D	PLANT LOADS SATISFIED
PS–E ■	MONTHLY ENERGY END USE SUMMARY
PS–F ■	ENERGY RESOURCE PEAK BREAKDOWN BY END USE
PS–G	ELECTRICAL LOAD SCATTER PLOT
PS–H	EQUIPMENT USE STATISTICS
PS–I	EQUIPMENT LIFE CYCLE COSTS
BEPS ■	BUILDING ENERGY PERFORMANCE SUMMARY
BEPU ■	BUILDING ENERGY PERFORMANCE SUMMARY (UTILITY UNITS)
ALL–SUMMARY	All summary reports

ECONOMICS Verification Reports

EV–A	LIFE-CYCLE COSTING PARAMETERS AND BUILDING COMPONENT COST INPUT DATA

ECONOMICS Summary Reports

ES–A	ANNUAL ENERGY AND OPERATIONS COSTS AND SAVINGS
ES–B	LIFE-CYCLE BUILDING AND PLANT NON-ENERGY COSTS
ES–C	ENERGY SAVINGS, INVESTMENT STATISTICS, OVERALL LIFE-CYCLE COSTS
ES–D	ENERGY COST SUMMARY
ES–E	SUMMARY OF UTILITY-RATE: U–NAME
ES–F	BLOCK–CHARGES AND RATCHET SUMMARY FOR [u-name of UTILITY–RATE]
ALL–SUMMARY	All summary reports

MATERIALS LIBRARY

1. Thermal Properties of Building Materials

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-^{o}F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-^{o}F	Resistance Hr-Ft^2-^{o}F/ Btu
	Acoustic Tile					
AC01	3/8 inch	0.0313	0.0330	18.0	0.32	0.95
AC02	1/2 inch	0.0417	0.0330	18.0	0.32	1.26
AC03	3/4 inch	0.0625	0.0330	18.0	0.32	1.89
AS01	**Aluminum or Steel Siding**	0.0050	26.000	480.0	0.10	
	Asbestos-Cement					
AB01	1/8 inch Board	0.0104	0.3450	120.0	0.2	0.03
AB02	1/4 inch Board	0.0208	0.3450	120.0	0.2	0.06
AB03	Shingle					0.21
AB04	1/4 inch Lapped Siding					0.21
AV01	**Asbestos-Vinyl Tile**				0.3	0.05
	Asphalt					
AR01	Roofing Roll			70.0	0.35	0.15
AR02	Shingle and Siding			70.0	0.35	0.44
AR03	Tile				0.30	0.05
	Brick					
BK01	4 inch Common	0.3333	0.4167	120.0	0.20	0.80
BK02	8 inch Common	0.6667	0.4167	120.0	0.20	1.60
BK03	12 inch Common	1.0000	0.4167	120.0	0.20	2.40
BK04	3 inch Face	0.2500	0.7576	130.0	0.22	0.33
BK05	4 inch Face	0.3333	0.7576	130.0	0.22	0.44
	Building Paper					
BP01	Permeable Felt					0.06
BP02	2-Layer Seal					0.12
BP03	Plastic Film Seal					0.01
BR01	**Built-up Roofing 3/8 inch**	0.0313	0.0939	70.0	0.35	0.33
	Carpet					
CP01	With Fibrous Pad				0.34	2.08
CP02	With Rubber Pad				0.34	1.23

1. Thermal Properties of Building Materials -- Continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-°F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-°F	Resistance Hr-Ft^2-°F/ Btu
	Cement					
CM01	1 inch Mortar	0.0833	0.4167	116.0	0.2	0.20
CM02	1.75 inch Mortar	0.1458	0.4167	116.0	0.2	0.35
CM03	1 inch Plaster with Sand Aggregate	0.0833	0.4167	116.0	0.2	0.20
	Clay Tile, Hollow					
CT01	3 inch 1 Cell	0.2500	0.3125	70.0	0.2	0.80
CT02	4 inch 1 Cell	0.3333	0.2999	70.0	0.2	1.11
CT03	6 inch 2 Cells	0.5000	0.3300	70.0	0.2	1.52
CT04	8 inch 2 Cells	0.6667	0.3600	70.0	0.2	1.85
CT05	10 inch 2 Cells	0.8333	0.3749	70.0	0.2	2.22
CT06	12 inch 3 Cells	1.0000	0.4000	70.0	0.2	2.50
	Clay Tile, Paver					
CT11	3/8 inch	0.0313	1.0416	120.0	0.2	0.03
	Concrete, Heavy Weight Dried Aggregate, 140 lbs.					
CC01	1.25 inch	0.1042	0.7576	140.0	0.2	0.14
CC02	2 inch	0.1667	0.7576	140.0	0.2	0.22
CC03	4 inch	0.3333	0.7576	140.0	0.2	0.44
CC04	6 inch	0.5000	0.7576	140.0	0.2	0.66
CC05	8 inch	0.6667	0.7576	140.0	0.2	0.88
CC06	10 inch	0.8333	0.7576	140.0	0.2	1.10
CC07	12 inch	1.0000	0.7576	140.0	0.2	1.32
	Concrete, Heavy Weight Undried Aggregate, 140 lbs.					
CC11	3/4 inch	0.0625	1.0417	140.0	0.2	0.06
CC12	1 3/8 inch	0.1146	1.0417	140.0	0.2	0.11
CC13	3 1/4 inch	0.2708	1.0417	140.0	0.2	0.26
CC14	4 inch	0.3333	1.0417	140.0	0.2	0.32
CC15	6 inch	0.5000	1.0417	140.0	0.2	0.48
CC16	8 inch	0.6667	1.0417	140.0	0.2	0.64
	Concrete, Light Weight, 80 lb.					
CC21	3/4 inch	0.0625	0.2083	80.0	0.2	0.30
CC22	1.25 inch	0.1042	0.2083	80.0	0.2	0.50
CC23	2 inch	0.1667	0.2083	80.0	0.2	0.80
CC24	4 inch	0.3333	0.2083	80.0	0.2	1.60
CC25	6 inch	0.5000	0.2083	80.0	0.2	2.40
CC26	8 inch	0.6667	0.2083	80.0	0.2	3.20

1. Thermal Properties of Building Materials -- Continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-^{o}F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-^{o}F	Resistance Hr-Ft^2-^{o}F/ Btu
	Concrete, Light Weight, 30 lb.					
CC31	3/4 inch	0.0625	0.0751	30.0	0.2	0.83
CC32	1.25 inch	0.1042	0.0751	30.0	0.2	1.39
CC33	2 inch	0.1667	0.0751	30.0	0.2	2.22
CC34	4 inch	0.3333	0.0751	30.0	0.2	4.44
CC35	6 inch	0.5000	0.0751	30.0	0.2	6.66
CC36	8 inch	0.6667	0.0751	30.0	0.2	8.88
	Concrete Block, 4 inch Heavy Weight					
CB01	Hollow	0.3333	0.4694	101.0	0.2	0.71
CB02	Concrete Filled	0.3333	0.7575	140.0	0.2	0.44
CB03	Perlite Filled	0.3333	0.3001	103.0	0.2	1.11
CB04	Partially Filled Concrete†	0.3333	0.5844	114.0	0.2	0.57
CB05	Concrete and Perlite††	0.3333	0.4772	115.0	0.2	0.70
	Concrete Block, 6 inch Heavy Weight					
CB06	Hollow	0.5000	0.5555	85.0	0.2	0.90
CB07	Concrete Filled	0.5000	0.7575	140.0	0.2	0.66
CB08	Perlite Filled	0.5000	0.2222	88.0	0.2	2.25
CB09	Partially Filled Concrete†	0.5000	0.6119	104.0	0.2	0.82
CB10	Concrete and Perlite††	0.5000	0.4238	104.0	0.2	1.18
	Concrete Block, 8 inch Heavy Weight					
CB11	Hollow	0.6667	0.6060	69.0	0.2	1.10
CB12	Concrete Filled	0.6667	0.7575	140.0	0.2	0.88
CB13	Perlite Filled	0.6667	0.2272	70.0	0.2	2.93
CB14	Partially Filled Concrete†	0.6667	0.6746	93.0	0.2	0.99
CB15	Concrete and Perlite††	0.6667	0.4160	93.0	0.2	1.60
	Concrete Block, 12 inch Heavy Weight					
CB16	Hollow	1.0000	0.7813	76.0	0.2	1.28
CB17	Concrete Filled	1.0000	0.7575	140.0	0.2	1.32
CB18	Partially Filled Concrete†	1.0000	0.7773	98.0	0.2	1.29
	Concrete Block, 4 inch Medium Weight					
CB21	Hollow	0.3333	0.3003	76.0	0.2	1.11
CB22	Concrete Filled	0.3333	0.4456	115.0	0.2	0.75
CB23	Perlite Filled	0.3333	0.1512	78.0	0.2	2.20
CB24	Partially Filled Concrete†	0.3333	0.3306	89.0	0.2	1.01
CB25	Concrete and Perlite††	0.3333	0.2493	90.0	0.2	1.34

† One filled and reinforced concrete core every 24 inches of wall length.

†† One filled and reinforced concrete core every 24 inches of wall length with the remaining cores filled with Perlite insulation.

1. Thermal Properties of Building Materials -- Continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-°F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-°F	Resistance Hr-Ft^2-°F/ Btu
	Concrete Block, 6 inch Medium Weight					
CB26	Hollow	0.5000	0.3571	65.0	0.2	1.40
CB27	Concrete Filled	0.5000	0.4443	119.0	0.2	1.13
CB28	Perlite Filled	0.5000	0.1166	67.0	0.2	4.29
CB29	Partially Filled Concrete†	0.5000	0.3686	83.0	0.2	1.36
CB30	Concrete and Perlite††	0.5000	0.2259	84.0	0.2	2.21
	Concrete Block, 8 inch Medium Weight					
CB31	Hollow	0.6667	0.3876	53.0	0.2	1.72
CB32	Concrete Filled	0.6667	0.4957	123.0	0.2	1.34
CB33	Perlite Filled	0.6667	0.1141	56.0	0.2	5.84
CB34	Partially Filled Concrete†	0.6667	0.4348	76.0	0.2	1.53
CB35	Concrete and Perlite††	0.6667	0.2413	77.0	0.2	2.76
	Concrete Block, 12 inch Medium Weight					
CB36	Hollow	1.0000	0.4959	58.0	0.2	2.02
CB37	Concrete Filled	1.0000	0.4814	121.0	0.2	2.08
CB38	Partially Filled Concrete†	1.0000	0.4919	79.0	0.2	2.03
	Concrete Block, 4 inch Light Weight					
CB41	Hollow	0.3333	0.2222	65.0	0.2	1.50
CB42	Concrete Filled	0.3333	0.3695	104.0	0.2	0.90
CB43	Perlite Filled	0.3333	0.1271	67.0	0.2	2.62
CB44	Partially Filled Concrete†	0.3333	0.2808	78.0	0.2	1.19
CB45	Concrete and Perlite††	0.3333	0.2079	79.0	0.2	1.60
	Concrete Block, 6 inch Light Weight					
CB46	Hollow	0.5000	0.2777	55.0	0.2	1.80
CB47	Concrete Filled	0.5000	0.3819	110.0	0.2	1.31
CB48	Perlite Filled	0.5000	0.0985	57.0	0.2	5.08
CB49	Partially Filled Concrete†	0.5000	0.3189	73.0	0.2	1.57
CB50	Concrete and Perlite††	0.5000	0.1929	74.0	0.2	2.59
	Concrete Block, 8 inch Light Weight					
CB51	Hollow	0.6667	0.3333	45.0	0.2	2.00
CB52	Concrete Filled	0.6667	0.4359	115.0	0.2	1.53
CB53	Perlite Filled	0.6667	0.0963	48.0	0.2	6.92
CB54	Partially Filled Concrete†	0.6667	0.3846	68.0	0.2	1.73
CB55	Concrete and Perlite††	0.6667	0.2095	69.0	0.2	3.18

† One filled and reinforced concrete core every 24 inches of wall length.

†† One filled and reinforced concrete core every 24 inches of wall length with the remaining cores filled with Perlite insulation.

1. Thermal Properties of Building Materials -- Continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-°F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-°F	Resistance Hr-Ft^2-°F/ Btu
	Concrete Block, 12 inch Light Weight					
CB56	Hollow	1.0000	0.4405	49.0	0.2	2.27
CB57	Concrete Filled	1.0000	0.4194	113.0	0.2	2.38
CB58	Partially Filled Concrete†	1.0000	0.4274	70.0	0.2	2.34
	Gypsum or Plaster Board					
GP01	1/2 inch	0.0417	0.0926	50.0	0.2	0.45
GP02	5/8 inch	0.0521	0.0926	50.0	0.2	0.56
GP03	3/4 inch	0.0625	0.0926	50.0	0.2	0.67
	Gypsum Plaster					
GP04	3/4 inch Light Weight Aggregate	0.0625	0.1330	45.0	0.2	0.47
GP05	1 inch Light Weight Aggregate	0.0833	0.1330	45.0	0.2	0.63
GP06	3/4 inch Sand Aggregate	0.0625	0.4736	105.0	0.2	0.13
GP07	1 inch Sand Aggregate	0.0833	0.4736	105.0	0.2	0.18
	Hard Board, 3/4 inch					
HB01	Medium Density Siding	0.0625	0.0544	40.0	0.28	1.15
HB02	Medium Density Others	0.0625	0.0608	50.0	0.31	1.03
HB03	High Density Standard Tempered	0.0625	0.0683	55.0	0.33	0.92
HB04	High Density Service Tempered	0.0625	0.0833	63.0	0.33	0.75
LT01	**Linoleum Tile**				0.30	0.05
	Particle Board					
PB01	Low Density 3/4 inch	0.0625	0.0450	75.0	0.31	1.39
PB02	Medium Density 3/4 inch	0.0625	0.7833	75.0	0.31	0.08
PB03	High Density 3/4 inch	0.0625	0.9833	75.0	0.31	0.06
PB04	Underlayment 5/8 inch	0.0521	0.1796	75.0	0.29	0.29

† One filled and reinforced concrete core every 24 inches of wall length.

1. Thermal Properties of Building Materials -- Continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-^{o}F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-^{o}F	Resistance Hr-Ft^2-^{o}F/ Btu
	Plywood					
PW01	1/4 inch	0.0209	0.0667	34.0	0.29	0.31
PW02	3/8 inch	0.0313	0.0667	34.0	0.29	0.47
PW03	1/2 inch	0.0417	0.0667	34.0	0.29	0.63
PW04	5/8 inch	0.0521	0.0667	34.0	0.29	0.78
PW05	3/4 inch	0.0625	0.0667	34.0	0.29	0.94
PW06	1 inch	0.0833	0.0667	34.0	0.29	1.25
	Roof Gravel or Slag					
RG01	1/2 inch	0.0417	0.8340	55.0	0.4	0.05
RG02	1 inch	0.0833	0.8340	55.0	0.4	0.10
RT01	**Rubber Tile**					0.05
SL01	Slate, 1/2 inch	0.0417	0.8340	100.0	0.35	0.05
ST01	Stone, 1 inch	0.0833	1.0416	140.0	0.2	0.08
SC01	Stucco, 1 inch	0.0833	0.4167	166.0	0.2	0.20
TZ01	Terrazzo, 1 inch	0.0833	1.0416	140.0	0.2	0.08
	Wood, Soft					
WD01	3/4 inch	0.0625	0.0667	32.0	0.33	0.94
WD02	1.5 inch	0.1250	0.0667	32.0	0.33	1.87
WD03	2.5 inch	0.2083	0.0667	32.0	0.33	3.12
WD04	3.5 inch	0.2917	0.0667	32.0	0.33	4.37
WD05	4 inch	0.3333	0.0667	32.0	0.33	5.00
	Wood, Hard					
WD11	3/4 inch	0.0625	0.0916	45.0	0.30	0.68
WD12	1 inch	0.0833	0.0916	45.0	0.30	0.91
	Wood, Shingle					
WS01	For Wall	0.0583	0.0667	32.0	0.30	0.87
WS02	For Roof	0.0583	0.0667	32.0	0.30	0.94

2. Thermal Properties of Insulating Materials

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-°F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-°F	Resistance Hr-Ft^2-°F/ Btu
	Mineral Wool/Fiber					
IN01	Batt, R-7‡	0.1882	0.0250	0.60	0.2	7.53
IN02	Batt, R-11	0.2957	0.0250	0.60	0.2	11.83
IN03	Batt, R-19	0.5108	0.0250	0.60	0.2	20.43
IN04	Batt, R-24	0.6969	0.0250	0.60	0.2	27.88
IN05	Batt, R-30	0.8065	0.0250	0.60	0.2	32.26
IN11	Fill, 3.5 inch, R-11	0.2917	0.0270	0.60	0.2	10.80
IN12	Fill, 5.5 inch, R-19	0.4583	0.0270	0.63	0.2	16.97
	Cellulose					
IN13	Fill, 3.5 inch, R-13	0.2917	0.0225	3.0	0.33	12.96
IN14	Fill, 5.5 inch, R-20	0.4583	0.0225	3.0	0.33	20.37
	Preformed Mineral Board					
IN21	7/8 inch, R-3	0.0729	0.0240	15.0	0.17	3.04
IN22	1 inch, R-3.5	0.0833	0.0240	15.0	0.17	3.47
IN23	2 inch, R-6.9	0.1667	0.0240	15.0	0.17	6.95
IN24	3 inch, R-10.3	0.2500	0.0240	15.0	0.17	10.42
	Polystyrene, Expanded					
IN31	1/2 inch	0.0417	0.0200	1.8	0.29	2.08
IN32	3/4 inch	0.0625	0.0200	1.8	0.29	3.12
IN33	1 inch	0.0833	0.0200	1.8	0.29	4.16
IN34	1.25 inch	0.1042	0.0200	1.8	0.29	5.21
IN35	2 inch	0.1667	0.0200	1.8	0.29	8.33
IN36	3 inch	0.2500	0.0200	1.8	0.29	12.50
IN37	4 inch	0.3333	0.0200	1.8	0.29	16.66
	Polyurethane, Expanded					
IN41	1/2 inch	0.0417	0.0133	1.5	0.38	3.14
IN42	3/4 inch	0.0625	0.0133	1.5	0.38	4.67
IN43	1 inch	0.0833	0.0133	1.5	0.38	6.26
IN44	1.25 inch	0.1042	0.0133	1.5	0.38	7.83
IN45	2 inch	0.1667	0.0133	1.5	0.38	12.53
IN46	3 inch	0.2500	0.0133	1.5	0.38	18.80
IN47	4 inch	0.3333	0.0133	1.5	0.38	25.06

‡ Nominal thickness is 2 inches to 2 3/4 inches. Resistance value is based on a thickness of 2.26 inches.

2. Thermal Properties of Insulating Materials -- continued

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-^{o}F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-^{o}F	Resistance Hr-Ft^2-^{o}F/ Btu
	Urea Formaldehyde					
IN51	3.5 inch, R-19	0.2910	0.0200	0.7	0.3	14.55
IN52	5.5 inch, R-30	0.4580	0.0200	0.7	0.3	22.90
	Insulation Board					
IN61	Sheathing, 1/2 inch	0.0417	0.0316	18.0	0.31	1.32
IN62	Sheathing, 3/4 inch	0.0625	0.0316	18.0	0.31	1.98
IN63	Shingle Backer, 3/8 inch	0.0313	0.0331	18.0	0.31	0.95
IN64	Nail Base Sheathing, 1/2 inch	0.0417	0.0366	25.0	0.31	1.14
	Roof Insulation, Preformed					
IN71	1/2 inch	0.0417	0.0300	16.0	0.2	1.39
IN72	1 inch	0.0833	0.0300	16.0	0.2	2.78
IN73	1.5 inch	0.1250	0.0300	16.0	0.2	4.17
IN74	2 inch	0.1667	0.0300	16.0	0.2	5.56
IN75	2.5 inch	0.2083	0.0300	16.0	0.2	6.94
IN76	3 inch	0.2500	0.0300	16.0	0.2	8.33

3. Thermal Properties of Air Spaces

DOE-2 Code-word	Description	Thickness Feet	Thermal Properties: Conductivity Btu-Ft/ Hr-Ft^2-^{o}F	Density Lb/ Ft^3	Specific Heat Btu/ Lb-^{o}F	Resistance Hr-Ft^2-^{o}F/ Btu
	Air Layer, 3/4 inch or less					
AL11	Vertical Walls					0.90
AL12	Slope 45°					0.84
AL13	Horizontal Roofs					0.82
	Air Layer, 3/4 inch to 4 inches					
AL21	Vertical Walls					0.89
AL22	Slope 45°					0.87
AL23	Horizontal Roofs					0.87
	Air Layer, 4 inches or more					
AL31	Vertical Walls					0.92
AL32	Slope 45°					0.89
AL33	Horizontal Roofs					0.92

Note: A more extensive list of data can be found in the 1989 ASHRAE Handbook of Fundamentals, Chap. 22, Table 2.

Index to the Window Library

G-T-C	WINDOW	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID
SINGLE CLEAR											
1000	CLEAR	6.31	1.11	1.00	.86	.84	.08	.90	.08	2	3.0
1001	CLEAR	6.17	1.09	.95	.81	.77	.07	.88	.08	3	6.0
1002	LOW IRON	6.31	1.11	1.05	.90	.90	.08	.91	.08	14	3.0
1003	LOW IRON	6.22	1.10	1.04	.90	.89	.08	.91	.08	16	5.0
SINGLE TINT											
1200	BRONZE	6.31	1.11	.84	.73	.64	.06	.69	.06	5	3.0
1201	BRONZE	6.17	1.09	.71	.61	.48	.05	.53	.06	6	6.0
1202	GREEN	6.31	1.11	.83	.72	.63	.06	.82	.08	11	3.0
1203	GREEN	6.17	1.09	.71	.61	.49	.06	.75	.07	12	6.0
1204	GREY	6.31	1.11	.83	.71	.63	.06	.61	.06	8	3.0
1205	GREY	6.17	1.09	.69	.59	.46	.05	.43	.05	9	6.0
1206	BLUE	6.17	1.09	.71	.61	.48	.05	.57	.06	17	6.0
SINGLE REF A											
1400	CLEAR-L	4.90	.86	.23	.19	.07	.34	.08	.41	200	6.0
1401	CLEAR-M	5.11	.90	.29	.25	.11	.27	.14	.31	201	6.0
1402	CLEAR-H	5.41	.95	.36	.31	.16	.22	.20	.25	202	6.0
1403	TINT-L	4.93	.87	.26	.22	.04	.15	.05	.17	210	6.0
1404	TINT-M	5.11	.90	.29	.25	.06	.13	.09	.14	211	6.0
1405	TINT-H	5.29	.93	.34	.29	.10	.11	.10	.11	212	6.0
SINGLE REF B											
1406	CLEAR-L	5.44	.96	.35	.31	.15	.22	.20	.23	220	6.0
1407	CLEAR-H	5.50	.97	.45	.39	.24	.16	.30	.16	221	6.0
1408	TINT-L	4.93	.87	.26	.23	.04	.13	.05	.09	230	6.0
1409	TINT-M	5.05	.89	.33	.28	.10	.11	.13	.10	231	6.0
1410	TINT-H	5.50	.97	.40	.34	.15	.09	.18	.08	232	6.0
SINGLE REF C											
1411	CLEAR-L	4.99	.88	.29	.25	.11	.25	.13	.28	240	6.0
1412	CLEAR-M	5.23	.92	.37	.32	.17	.20	.19	.21	241	6.0
1413	CLEAR-H	5.35	.94	.41	.35	.20	.16	.22	.17	242	6.0
1414	TINT-L	4.99	.88	.29	.25	.07	.13	.08	.13	250	6.0
1415	TINT-M	5.23	.92	.34	.29	.10	.10	.11	.10	251	6.0
1416	TINT-H	5.35	.94	.37	.31	.12	.09	.13	.09	252	6.0
SINGLE REF D											
1417	CLEAR	6.12	1.08	.58	.50	.43	.31	.33	.45	260	6.0
1418	TINT	6.12	1.08	.53	.46	.30	.14	.25	.18	270	6.0
SINGLE LOW-E CLEAR											
1600	(e2=.4)	4.99	.88	.91	.78	.75	.10	.85	.12	300	3.0
1601	(e2=.2)	4.34	.76	.89	.77	.74	.09	.82	.11	350	3.0
1602	(e2=.2)	4.27	.75	.84	.72	.68	.09	.81	.11	351	6.0
SINGLE ELECTROCHROMIC ABSORBING BLEACHED/COLORED											
1800		6.17	1.09	.98	.84	.81	.09	.85	.10	700	6.0
1801		6.17	1.09	.36	.31	.11	.18	.13	.08	701	6.0
SINGLE ELECTROCHROMIC REFLECTING BLEACHED/COLORED											
1802		6.17	1.09	.85	.73	.69	.17	.82	.11	702	6.0
1803		6.17	1.09	.34	.29	.10	.22	.16	.07	703	6.0

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID
DOUBLE CLEAR IG														
2000	3.23	.57	.88	.76	.70	.13	.81	.15	2	3.0	Air	6.3	2	3.0
2001	2.79	.49	.89	.76	.70	.13	.81	.15	2	3.0	Air	12.7	2	3.0
2002	2.61	.46	.89	.76	.70	.13	.81	.15	2	3.0	Arg	12.7	2	3.0
2003	3.16	.56	.81	.69	.60	.11	.78	.14	3	6.0	Air	6.3	3	6.0
2004	2.74	.48	.81	.70	.60	.11	.78	.14	3	6.0	Air	12.7	3	6.0
2005	2.56	.45	.81	.70	.60	.11	.78	.14	3	6.0	Arg	12.7	3	6.0
DOUBLE LOW IRON IG														
2006	3.23	.57	.96	.83	.81	.14	.84	.15	14	3.0	Air	6.3	14	3.0
2007	2.79	.49	.96	.83	.81	.14	.84	.15	14	3.0	Air	12.7	14	3.0
2008	2.61	.46	.96	.83	.81	.14	.84	.15	14	3.0	Arg	12.7	14	3.0
2009	3.18	.56	.95	.82	.80	.14	.83	.15	16	5	Air	6.3	16	5.0
2010	2.76	.49	.95	.82	.80	.14	.83	.15	16	5	Air	12.7	16	5.0
2011	2.58	.45	.95	.82	.80	.14	.83	.15	16	5	Arg	12.7	16	5.0
DOUBLE TINT BRONZE IG														
2200	3.23	.57	.72	.62	.54	.09	.62	.10	5	3.0	Air	6.3	2	3.0
2201	2.79	.49	.72	.62	.54	.09	.62	.10	5	3.0	Air	12.7	2	3.0
2202	2.61	.46	.72	.62	.54	.09	.62	.10	5	3.0	Arg	12.7	2	3.0
2203	3.16	.56	.57	.49	.38	.07	.47	.08	6	6.0	Air	6.3	3	6.0
2204	2.74	.48	.57	.49	.38	.07	.47	.08	6	6.0	Air	12.7	3	6.0
2205	2.56	.45	.56	.49	.38	.07	.47	.08	6	6.0	Arg	12.7	3	6.0
DOUBLE TINT GREEN IG														
2206	3.23	.57	.72	.62	.53	.09	.74	.13	11	3.0	Air	6.3	2	3.0
2207	2.79	.49	.71	.61	.53	.09	.74	.13	11	3.0	Air	12.7	2	3.0
2208	2.61	.46	.71	.61	.53	.09	.74	.13	11	3.0	Arg	12.7	2	3.0
2209	3.16	.56	.58	.50	.38	.07	.66	.12	12	6.0	Air	6.3	3	6.0
2210	2.74	.48	.57	.49	.38	.07	.66	.12	12	6.0	Air	12.7	3	6.0
2211	2.56	.45	.57	.49	.38	.07	.66	.12	12	6.0	Arg	12.7	3	6.0
DOUBLE TINT GREY IG														
2212	3.23	.57	.71	.61	.53	.09	.55	.09	8	3.0	Air	6.3	2	3.0
2213	2.79	.49	.71	.61	.53	.09	.55	.09	8	3.0	Air	12.7	2	3.0
2214	2.61	.46	.70	.61	.53	.09	.55	.09	8	3.0	Arg	12.7	2	3.0
2215	3.16	.56	.55	.47	.35	.07	.38	.07	9	6.0	Air	6.3	3	6.0
2216	2.74	.48	.54	.47	.35	.07	.38	.07	9	6.0	Air	12.7	3	6.0
2217	2.56	.45	.54	.47	.35	.07	.38	.07	9	6.0	Arg	12.7	3	6.0
DOUBLE TINT BLUE IG														
2218	3.16	.56	.57	.49	.37	.07	.50	.09	17	6.0	Air	6.3	3	6.0
2219	2.74	.48	.57	.49	.37	.07	.50	.09	17	6.0	Air	12.7	3	6.0
2220	2.56	.45	.56	.49	.37	.07	.50	.09	17	6.0	Arg	12.7	3	6.0
DOUBLE REF A CLEAR-L IG														
2400	2.79	.49	.17	.14	.05	.34	.07	.41	200	6.0	Air	6.3	3	6.0
2401	2.26	.40	.15	.13	.05	.34	.07	.41	200	6.0	Air	12.7	3	6.0
2402	2.02	.36	.14	.12	.05	.34	.07	.41	200	6.0	Arg	12.7	3	6.0
DOUBLE REF A CLEAR-M IG														
2403	2.86	.50	.22	.19	.09	.27	.13	.31	201	6.0	Air	6.3	3	6.0
2404	2.35	.41	.20	.17	.09	.27	.13	.31	201	6.0	Air	12.7	3	6.0
2405	2.13	.38	.20	.17	.09	.27	.13	.31	201	6.0	Arg	12.7	3	6.0

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID
DOUBLE REF A CLEAR-H IG														
2406	2.95	.52	.27	.23	.13	.22	.18	.25	202	6.0	Air	6.3	3	6.0
2407	2.47	.44	.26	.22	.13	.22	.18	.25	202	6.0	Air	12.7	3	6.0
2408	2.26	.40	.25	.22	.13	.22	.18	.25	202	6.0	Arg	12.7	3	6.0
DOUBLE REF A TINT-L IG														
2410	2.80	.49	.18	.15	.03	.15	.05	.17	210	6.0	Air	6.3	3	6.0
2411	2.27	.40	.15	.13	.03	.15	.05	.17	210	6.0	Air	12.7	3	6.0
2412	2.04	.36	.15	.13	.03	.15	.05	.17	210	6.0	Arg	12.7	3	6.0
DOUBLE REF A TINT-M IG														
2413	2.86	.50	.20	.17	.05	.13	.08	.14	211	6.0	Air	6.3	3	6.0
2414	2.35	.41	.18	.15	.05	.13	.08	.14	211	6.0	Air	12.7	3	6.0
2415	2.13	.38	.17	.15	.05	.13	.08	.14	211	6.0	Arg	12.7	3	6.0
DOUBLE REF A TINT-H IG														
2416	2.92	.51	.24	.21	.08	.11	.09	.11	212	6.0	Air	6.3	3	6.0
2417	2.42	.43	.22	.19	.08	.11	.09	.11	212	6.0	Air	12.7	3	6.0
2418	2.21	.39	.21	.19	.08	.11	.09	.11	212	6.0	Arg	12.7	3	6.0
DOUBLE REF B CLR-L IG														
2420	2.96	.52	.27	.23	.12	.22	.18	.23	220	6.0	Air	6.3	3	6.0
2421	2.48	.44	.25	.22	.12	.22	.18	.23	220	6.0	Air	12.7	3	6.0
2422	2.27	.40	.25	.21	.12	.22	.18	.23	220	6.0	Arg	12.7	3	6.0
DOUBLE REF B CLR-H IG														
2426	2.98	.53	.35	.30	.19	.16	.27	.17	221	6.0	Air	6.3	3	6.0
2427	2.50	.44	.34	.29	.19	.16	.27	.17	221	6.0	Air	12.7	3	6.0
2428	2.30	.41	.34	.29	.19	.16	.27	.17	221	6.0	Arg	12.7	3	6.0
DOUBLE REF B TINT-L IG														
2430	2.80	.49	.18	.15	.03	.13	.05	.09	230	6.0	Air	6.3	3	6.0
2431	2.27	.40	.16	.14	.03	.13	.05	.09	230	6.0	Air	12.7	3	6.0
2432	2.04	.36	.15	.13	.03	.13	.05	.09	230	6.0	Arg	12.7	3	6.0
DOUBLE REF B TINT-M IG														
2433	2.84	.50	.24	.20	.08	.11	.12	.10	231	6.0	Air	6.3	3	6.0
2434	2.33	.41	.22	.19	.08	.11	.12	.10	231	6.0	Air	12.7	3	6.0
2435	2.10	.37	.21	.18	.08	.11	.12	.10	231	6.0	Arg	12.7	3	6.0
DOUBLE REF B TINT-H IG														
2436	2.98	.53	.29	.25	.12	.09	.16	.08	232	6.0	Air	6.3	3	6.0
2437	2.50	.44	.27	.23	.12	.09	.16	.08	232	6.0	Air	12.7	3	6.0
2438	2.30	.41	.27	.23	.12	.09	.16	.08	232	6.0	Arg	12.7	3	6.0
DOUBLE REF C CLEAR-L IG														
2440	2.82	.50	.22	.19	.09	.25	.12	.28	240	6.0	Air	6.3	3	6.0
2441	2.30	.41	.20	.18	.09	.25	.12	.28	240	6.0	Air	12.7	3	6.0
2442	2.07	.36	.20	.17	.09	.25	.12	.28	240	6.0	Arg	12.7	3	6.0
DOUBLE REF C CLEAR-M IG														
2443	2.90	.51	.28	.24	.14	.20	.17	.21	241	6.0	Air	6.3	3	6.0
2444	2.40	.42	.27	.23	.14	.20	.17	.21	241	6.0	Air	12.7	3	6.0
2445	2.18	.38	.26	.23	.14	.20	.17	.21	241	6.0	Arg	12.7	3	6.0

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID
DOUBLE REF C CLEAR-H IG														
2446	2.94	.52	.32	.27	.16	.16	.20	.17	242	6.0	Air	6.3	3	6.0
2447	2.45	.43	.30	.26	.16	.16	.20	.17	242	6.0	Air	12.7	3	6.0
2448	2.23	.39	.30	.26	.16	.16	.20	.17	242	6.0	Arg	12.7	3	6.0
DOUBLE REF C TINT-L IG														
2450	2.82	.50	.21	.18	.06	.13	.07	.13	250	6.0	Air	6.3	3	6.0
2451	2.30	.41	.19	.16	.06	.13	.07	.13	250	6.0	Air	12.7	3	6.0
2452	2.07	.36	.18	.15	.06	.13	.07	.13	250	6.0	Arg	12.7	3	6.0
DOUBLE REF C TINT-M IG														
2453	2.90	.51	.24	.21	.08	.10	.10	.10	251	6.0	Air	6.3	3	6.0
2454	2.40	.42	.22	.19	.08	.10	.10	.10	251	6.0	Air	12.7	3	6.0
2455	2.18	.38	.21	.19	.08	.10	.10	.10	251	6.0	Arg	12.7	3	6.0
DOUBLE REF C TINT-H IG														
2456	2.94	.52	.26	.23	.10	.09	.12	.09	252	6.0	Air	6.3	3	6.0
2457	2.45	.43	.24	.21	.10	.09	.12	.09	252	6.0	Air	12.7	3	6.0
2458	2.23	.39	.24	.20	.10	.09	.12	.09	252	6.0	Arg	12.7	3	6.0
DOUBLE REF D CLEAR IG														
2460	3.15	.56	.49	.42	.34	.32	.31	.46	260	6.0	Air	6.3	3	6.0
2461	2.72	.48	.49	.42	.34	.32	.31	.46	260	6.0	Air	12.7	3	6.0
2462	2.54	.45	.49	.42	.34	.32	.31	.46	260	6.0	Arg	12.7	3	6.0
DOUBLE REF D TINT IG														
2470	3.15	.56	.41	.35	.24	.15	.23	.19	270	6.0	Air	6.3	3	6.0
2471	2.72	.48	.40	.35	.24	.15	.23	.19	270	6.0	Air	12.7	3	6.0
2472	2.54	.45	.40	.34	.24	.15	.23	.19	270	6.0	Arg	12.7	3	6.0
DOUBLE LOW-E (e3=.4) CLEAR IG														
2600	2.85	.50	.84	.72	.63	.15	.77	.18	2	3.0	Air	6.3	300	3.0
2601	2.30	.41	.85	.73	.63	.15	.77	.18	2	3.0	Air	12.7	300	3.0
2602	2.05	.36	.85	.73	.63	.15	.77	.18	2	3.0	Arg	12.7	300	3.0
DOUBLE LOW-E (e3=.2) CLEAR IG														
2610	2.61	.46	.84	.72	.62	.15	.74	.18	2	3.0	Air	6.3	350	3.0
2611	1.99	.35	.85	.73	.62	.15	.74	.18	2	3.0	Air	12.7	350	3.0
2612	1.70	.30	.86	.74	.62	.15	.74	.18	2	3.0	Arg	12.7	350	3.0
2613	2.57	.45	.77	.66	.53	.13	.72	.17	3	6.0	Air	6.3	351	6.0
2614	1.96	.35	.78	.67	.53	.13	.72	.17	3	6.0	Air	12.7	351	6.0
2615	1.67	.29	.79	.68	.53	.13	.72	.17	3	6.0	Arg	12.7	351	6.0
DOUBLE LOW-E (e2=.1) CLEAR IG														
2630	2.47	.44	.69	.60	.54	.22	.77	.14	400	3.0	Air	6.3	2	3.0
2631	1.81	.32	.69	.60	.54	.22	.77	.14	400	3.0	Air	12.7	2	3.0
2632	1.48	.26	.69	.59	.54	.22	.77	.14	400	3.0	Arg	12.7	2	3.0
2633	2.43	.43	.65	.56	.47	.20	.75	.11	401	6.0	Air	6.3	3	6.0
2634	1.78	.31	.65	.56	.47	.20	.75	.11	401	6.0	Air	12.7	3	6.0
2635	1.46	.26	.66	.56	.47	.20	.75	.11	401	6.0	Arg	12.7	3	6.0

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID
DOUBLE LOW-E (e2=.1) TINT IG														
2636	2.43	.43	.45	.39	.28	.10	.44	.05	451	6.0	Air	6.3	3	6.0
2637	1.78	.31	.43	.37	.28	.10	.44	.05	451	6.0	Air	12.7	3	6.0
2638	1.46	.26	.43	.37	.28	.10	.44	.05	451	6.0	Arg	12.7	3	6.0
DOUBLE LOW-E (e3=.1) CLEAR IG														
2640	2.47	.44	.74	.63	.54	.23	.77	.13	2	3.0	Air	6.3	400	3.0
2641	1.81	.32	.75	.64	.54	.23	.77	.13	2	3.0	Air	12.7	400	3.0
2642	1.48	.26	.75	.65	.54	.23	.77	.13	2	3.0	Arg	12.7	400	3.0
DOUBLE LOW-E (e2=.04) CLEAR IG														
2660	2.38	.42	.51	.44	.39	.36	.70	.12	500	3.0	Air	6.3	2	3.0
2661	1.68	.30	.51	.44	.39	.36	.70	.12	500	3.0	Air	12.7	2	3.0
2662	1.34	.24	.50	.43	.39	.36	.70	.12	500	3.0	Arg	12.7	2	3.0
DOUBLE LOW-E (e2=.04) CLEAR IG														
2663	2.41	.42	.49	.42	.34	.31	.68	.12	501	6.0	Air	6.3	3	6.0
2664	1.67	.29	.48	.42	.34	.31	.68	.12	501	6.0	Air	12.7	3	6.0
2665	1.32	.23	.48	.42	.34	.31	.68	.12	501	6.0	Arg	12.7	3	6.0
DOUBLE LOW-E (e2=.04) TINT IG														
2666	2.41	.42	.35	.31	.21	.14	.41	.08	550	6.0	Air	6.3	3	6.0
2667	1.67	.29	.33	.29	.21	.14	.41	.08	550	6.0	Air	12.7	3	6.0
2668	1.32	.23	.32	.28	.21	.14	.41	.08	550	6.0	Arg	12.7	3	6.0
DOUBLE ELECTROCHROMIC ABSORBING IG BLEACHED/COLORED AIR														
2800	2.43	0.43	.85	.73	.64	.14	.76	.16	704F	6.0	Air	6.3	709	6.0
2801	2.43	0.43	.21	.18	.09	.18	.12	.08	705F	6.0	Air	6.3	709	6.0
DOUBLE ELECTROCHROMIC ABSORBING IG BLEACHED/COLORED AIR														
2802	1.78	0.31	.86	.74	.64	.14	.76	.16	704F	6.0	Air	12.7	709	6.0
2803	1.78	0.31	.19	.20	.16	.18	.12	.08	705F	6.0	Air	12.7	709	6.0
DOUBLE ELECTROCHROMIC ABSORBING IG BLEACHED/COLORED ARGON														
2804	1.49	0.26	.86	.74	.64	.14	.76	.16	704F	6.0	Arg	12.7	709	6.0
2805	1.49	0.26	.18	.15	.09	.18	.12	.08	705F	6.0	Arg	12.7	709	6.0
DOUBLE ELECTROCHROMIC REFLECTING IG BLEACHED/COLORED AIR														
2820	2.43	0.43	.73	.63	.55	.21	.73	.17	706F	6.0	Air	6.3	709	6.0
2821	2.43	0.43	.20	.17	.09	.22	.14	.08	707F	6.0	Air	6.3	709	6.0
DOUBLE ELECTROCHROMIC REFLECTING IG BLEACHED/COLORED AIR														
2822	1.78	0.31	.74	.64	.55	.21	.73	.17	706F	6.0	Air	12.7	709	6.0
2823	1.78	0.31	.17	.15	.09	.22	.14	.08	707F	6.0	Air	12.7	709	6.0
DOUBLE ELECTROCHROMIC REFLECTING IG BLEACHED/COLORED ARGON														
2824	1.49	0.26	.74	.64	.55	.21	.73	.17	706F	6.0	Arg	12.7	709	6.0
2825	1.49	0.26	.16	.15	.09	.22	.14	.08	707F	6.0	Arg	12.7	709	6.0
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC ABS IG BLEACHED/COLORED AIR														
2840	2.33	0.41	.51	.44	.34	.33	.66	.14	704F	6.0	Air	6.3	708F	5.7
2841	2.33	0.41	.18	.16	.06	.19	.10	.08	705F	6.0	Air	6.3	708F	5.7
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC ABS IG BLEACHED/COLORED AIR														
2842	1.64	0.29	.59	.51	.34	.33	.66	.14	704F	6.0	Air	12.7	708F	5.7
2843	1.64	0.29	.15	.13	.06	.19	.10	.08	705F	6.0	Air	12.7	708F	5.7
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC ABS IG BLEACHED/COLORED ARGON														
2844	1.33	0.23	.60	.52	.34	.33	.66	.14	704F	6.0	Arg	12.7	708F	5.7
2845	1.33	0.23	.14	.12	.06	.19	.10	.08	705F	6.0	Arg	12.7	708F	5.7

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC REF IG BLEACHED/COLORED AIR														
2860	2.33	0.41	.54	.46	.32	.32	.64	.14	706F	6.0	Air	6.3	708F	5.7
2861	2.33	0.41	.18	.16	.07	.22	.12	.08	707F	6.0	Air	6.3	708F	5.7
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC REF IG BLEACHED/COLORED AIR														
2862	1.64	0.29	.55	.47	.32	.32	.64	.14	706F	6.0	Air	12.7	708F	5.7
2863	1.64	0.29	.16	.14	.07	.22	.12	.08	707F	6.0	Air	12.7	708F	5.7
DOUBLE LOW-E (e2=.029) ELECTROCHROMIC REF IG BLEACHED/COLORED ARGON														
2864	1.33	0.23	.56	.48	.32	.32	.64	.14	706F	6.0	Arg	12.7	708F	5.7
2865	1.33	0.23	.15	.13	.07	.22	.12	.08	707F	6.0	Arg	12.7	708F	5.7

Index to the Window Library (continued)

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID	GAP2 GAS	GAP2 WID
TRIPLE CLEAR IG																
3001	2.19	.39	.79	.68	.60	.17	.74	.20	2	3.0	Air	6.3	2	3.0	Air	6.3
3002	1.79	.32	.79	.68	.60	.17	.74	.20	2	3.0	Air	12.7	2	3.0	Air	12.7
3002	1.64	.29	.79	.68	.60	.17	.74	.20	2	3.0	Arg	12.7	2	3.0	Arg	12.7
TRIPLE LOW-E (e5=.1) CLEAR IG																
3601	1.81	.32	.67	.57	.46	.24	.70	.18	2	3.0	Air	6.3	2	3.0	Air	6.3
3602	1.28	.23	.67	.58	.46	.24	.70	.18	2	3.0	Air	12.7	2	3.0	Air	12.7
3603	1.06	.19	.67	.58	.46	.24	.70	.18	2	3.0	Arg	12.7	2	3.0	Arg	12.7
TRIPLE LOW-E (e2=e5=.1) CLEAR IG																
3621	1.55	.27	.54	.47	.36	.29	.66	.17	400	3.0	Air	6.3	2	3.0	Air	6.3
3622	.99	.17	.55	.47	.36	.29	.66	.17	400	3.0	Air	12.7	2	3.0	Air	12.7
3623	.77	.14	.55	.47	.36	.29	.66	.17	400	3.0	Arg	12.7	2	3.0	Arg	12.7
TRIPLE LOW-E FILM (88) CLEAR IG																
3641	1.83	.32	.66	.57	.48	.28	.71	.18	2	3.0	Air	6.3	600	0.1	Air	6.3
3642	1.32	.23	.67	.57	.48	.28	.71	.18	2	3.0	Air	12.7	600	0.1	Air	12.7
TRIPLE LOW-E FILM (77) CLEAR IG																
3651	1.79	.32	.53	.46	.38	.38	.64	.24	2	3.0	Air	6.3	601	0.1	Air	6.3
3652	1.26	.22	.54	.47	.38	.38	.64	.24	2	3.0	Air	12.7	601	0.1	Air	12.7
TRIPLE LOW-E FILM (66) CLEAR IG																
3661	1.75	.31	.41	.35	.26	.40	.54	.31	3	6.0	Air	6.3	602	0.1	Air	6.3
3662	1.23	.22	.42	.36	.26	.40	.54	.31	3	6.0	Air	12.7	602	0.1	Air	12.7
TRIPLE LOW-E FILM (66) TINT IG																
3663	1.75	.31	.30	.26	.16	.18	.32	.14	6	6.0	Air	6.3	602	0.1	Air	6.3
3664	1.23	.22	.29	.25	.16	.18	.32	.14	6	6.0	Air	12.7	602	0.1	Air	12.7
TRIPLE LOW-E FILM (55) CLEAR IG																
3671	1.74	.31	.35	.30	.21	.44	.45	.37	3	6.0	Air	6.3	603	0.1	Air	6.3
3672	1.22	.22	.36	.31	.21	.44	.45	.37	3	6.0	Air	12.7	603	0.1	Air	12.7
TRIPLE LOW-E FILM (55) TINT IG																
3673	1.74	.31	.26	.23	.13	.19	.27	.16	6	6.0	Air	6.3	603	0.1	Air	6.3
3674	1.22	.22	.25	.22	.13	.19	.27	.16	6	6.0	Air	12.7	603	0.1	Air	12.7
TRIPLE LOW-E FILM (44) TINT IG																
3681	1.74	.31	.23	.20	.10	.21	.22	.18	6	6.0	Air	6.3	604	0.1	Air	6.3
3682	1.21	.21	.22	.19	.10	.21	.22	.18	6	6.0	Air	12.7	604	0.1	Air	12.7
TRIPLE LOW-E FILM (33) TINT IG																
3691	1.74	.31	.19	.16	.07	.23	.17	.23	6	6.0	Air	6.3	605	0.1	Air	6.3
3692	1.20	.21	.17	.15	.07	.23	.17	.23	6	6.0	Air	12.7	605	0.1	Air	12.7

G-T-C	U-SI	U-IP	SC	SHGC	Tsol	Rfsol	Tvis	Rfvis	LAY1 ID	LAY1 WID	GAP1 GAS	GAP1 WID	LAY2 ID	LAY2 WID	GAP2 GAS	GAP2 WID
QUAD LOW-E GLAZING / LOW-E FILMS CLEAR IG																
4651	.66	.12	.52	.45	.34	.34	.62	.21	2	3.0	Kry	7.9	600	0.1	Kry	3.2

LAY3 ID	LAY3 WID	GAP3 GAS	GAP3 WID	LAY4 ID	LAY4 WID
600	0.1	Kry	7.9	2	3.0

Geographical Data for the 50 Largest U.S. Cities

State	City	Lat.	Long.	Time Zone
Arizona	Phoenix	33.45	112.07	7
	Tucson	32.13	110.58	7
California	Fresno	36.43	119.47	8
	Long Beach	33.78	118.18	8
	Los Angeles	34.07	118.25	8
	Oakland	37.82	122.27	8
	Sacramento	38.35	121.29	8
	San Diego	32.72	117.15	8
	San Francisco	37.78	122.42	8
	San Jose	37.33	121.88	8
Colorado	Denver	39.73	104.98	7
Florida	Jacksonville	30.33	81.65	5
	Miami	25.78	80.18	5
Georgia	Atlanta	33.75	84.38	5
Hawaii	Honolulu	21.32	157.87	10
Illinois	Chicago	41.88	87.63	6
Indiana	Indianapolis	39.77	86.15	5
Louisiana	New Orleans	29.97	90.07	6
Maryland	Baltimore	39.28	76.62	5
Massachusetts	Boston	42.37	71.07	5
Michigan	Detroit	42.33	83.00	5
Minnesota	Minneapolis	44.98	93.27	6
Missouri	Kansas City	39.10	94.58	6
	Saint Louis	38.62	90.20	6
Nebraska	Omaha	41.28	96.02	6
New Mexico	Albuquerque	35.05	106.39	6
New York	Buffalo	42.88	78.88	5
	New York	40.72	74.00	5
North Carolina	Charlotte	35.13	80.5	5
Ohio	Cincinnati	39.10	84.52	5
	Cleveland	41.50	81.70	5
	Columbus	39.97	83.00	5
	Toledo	41.65	83.55	5
Oklahoma	Oklahoma City	35.50	97.50	6
	Tulsa	36.17	95.92	6

Oregon	Portland	45.53	122.62	8
Pennsylvania	Philadelphia	39.95	75.17	5
	Pittsburgh	40.43	80.02	5
Tennessee	Memphis	35.13	90.05	6
	Nashville	36.17	86.78	6
Texas	Austin	30.16	97.44	6
	Dallas	32.78	96.82	6
	El Paso	31.75	106.48	7
	Fort Worth	32.75	97.30	6
	Houston	29.77	95.37	6
	San Antonio	29.42	98.50	6
Virginia	Virginia Beach	36.5	75.58	5
Washington	Seattle	47.60	122.33	8
Wisconsin	Milwaukee	43.03	87.92	6
D.C.	Washington	38.90	77.03	5

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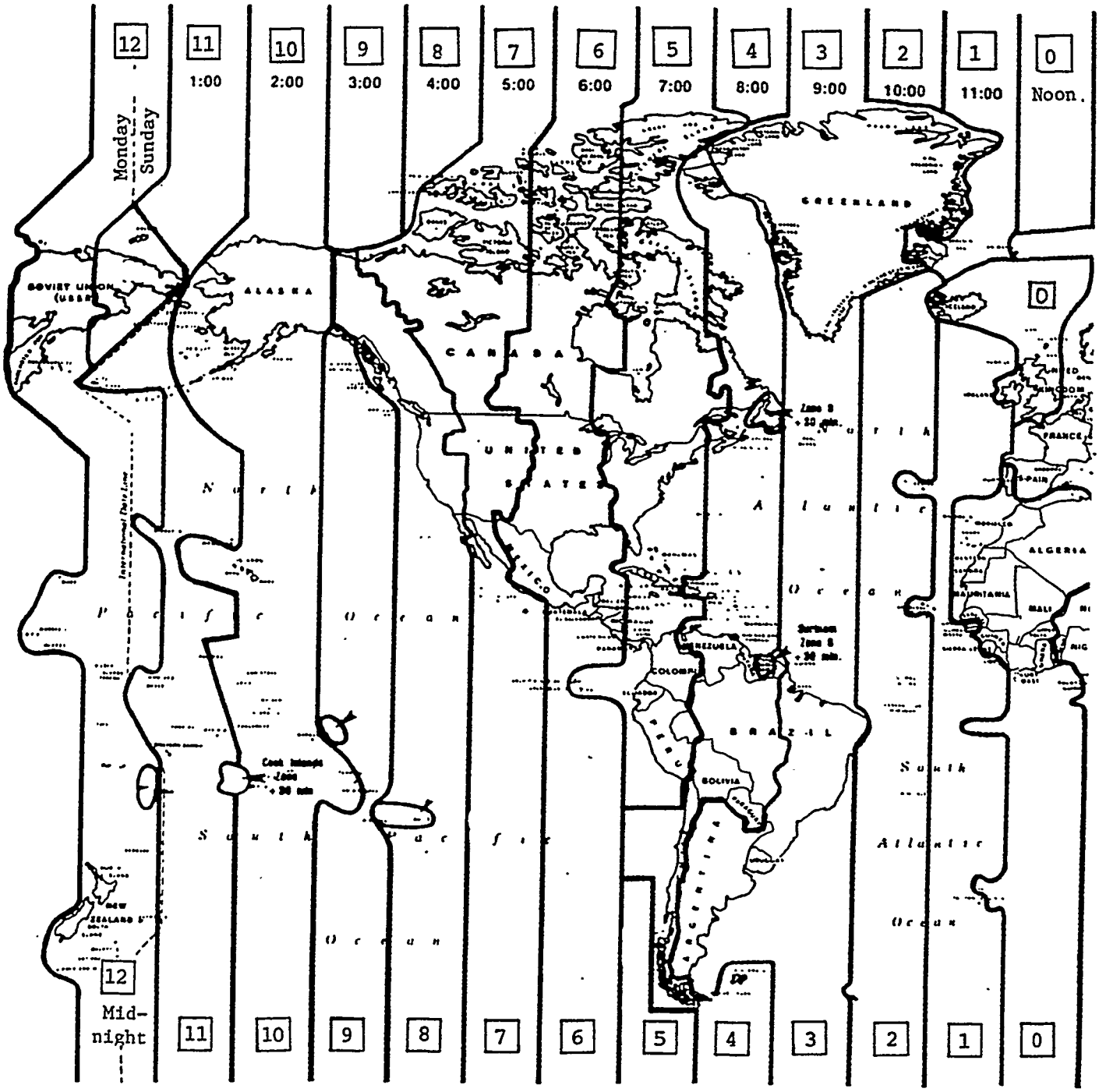
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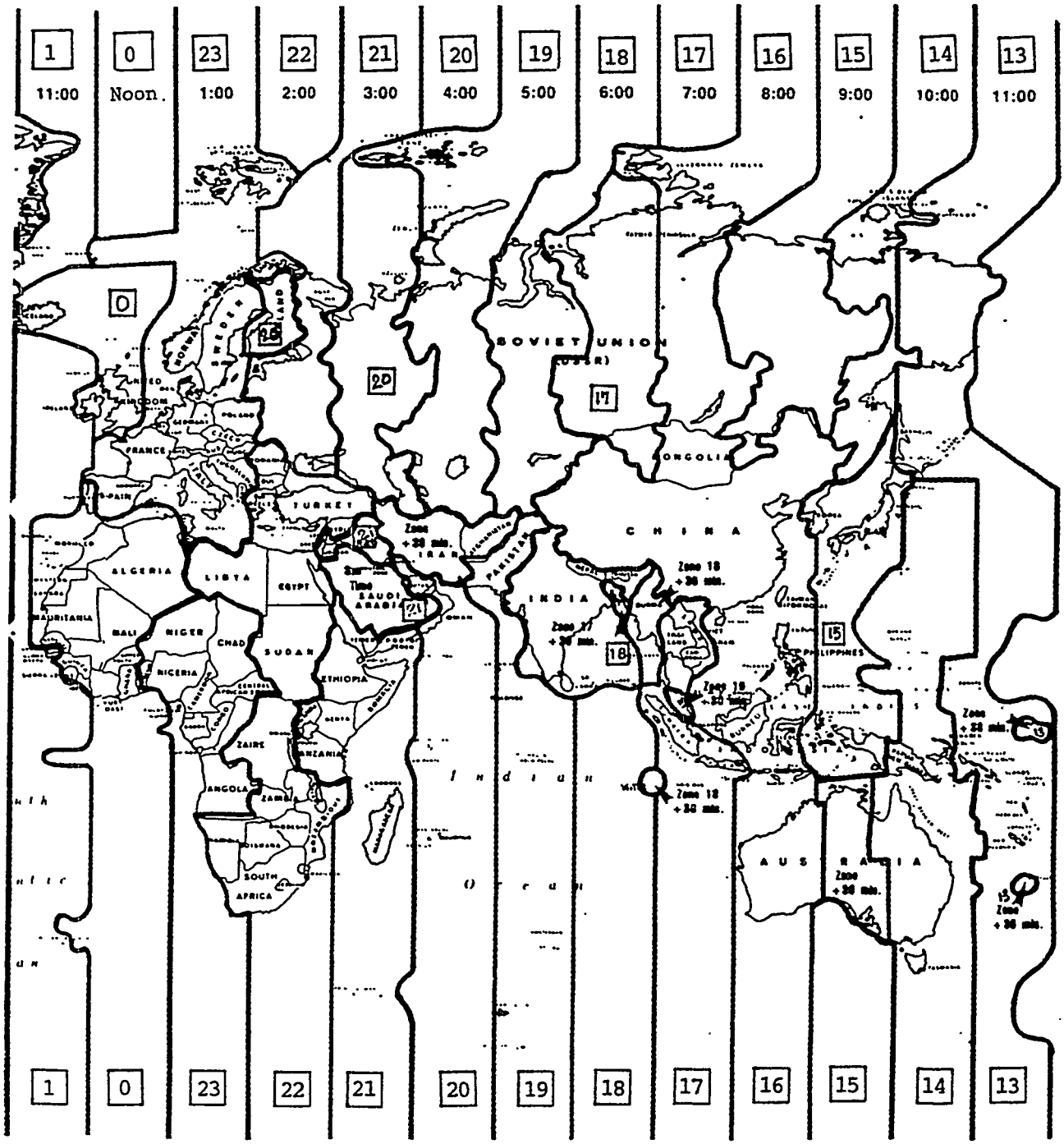
10:00
11:00
Noon.
Monday
Sunday
GREENLAND
SOVIET UNION (USSR)
ALASKA
CANADA
UNITED STATES
MEXICO
COLOMBIA
VENEZUELA
BRAZIL
BOLIVIA
PERU
ARGENTINA
FRANCE
SPAIN
ALGERIA
MAURITANIA
MALI
NEW ZEALAND
Pacific Ocean
North Pacific Ocean
South Pacific Ocean
Atlantic Ocean
North Atlantic Ocean
South Atlantic Ocean
International Date Line
Midnight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SOVIET UNION
(USSR)
MONGOLIA
CHINA
INDIA
PAKISTAN
IRAN
TURKEY
SAUDI ARABIA
ALGERIA
LIBYA
EGYPT
MAURITANIA
MALI
NIGER
CHAD
SUDAN
NIGERIA
ETHIOPIA
ZAIRE
TANZANIA
ANGOLA
ZAMBIA
SOUTH AFRICA
PHILIPPINES
AUSTRALIA
FRANCE
SPAIN
POLAND
Zone +30 min.
Zone 18 +30 min.
Zone 17 +30 min.
Zone 19 +30 min.

INDEX

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1793	3	1818	5	1843	1	1868	11	1893	1	1918	3	1943	6	1968	9	1993	6
1794	4	1819	6	1844	9	1869	6	1894	2	1919	4	1944	14	1969	4	1994	7
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1797	1	1822	3	1847	6	1872	9	1897	6	1922	1	1947	4	1972	14	1997	4
1798	2	1823	4	1848	14	1873	4	1898	7	1923	2	1948	12	1973	2	1998	5
1799	3	1824	12	1849	2	1874	5	1899	1	1924	10	1949	7	1974	3	1999	6
1800	4	1825	7	1850	3	1875	6	1900	2	1925	5	1950	1	1975	4	2000	14

Year 1

S	M	Tu	W	Th	F	S
JANUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
FEBRUARY						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				
MARCH						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
APRIL						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						
MAY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
JUNE						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	
JULY						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
AUGUST						
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
SEPTEMBER						
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17	18	19	20	21	22	23
24	25	26	27	28	29	30
OCTOBER						
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
NOVEMBER						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		
DECEMBER						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Year 2

S	M	Tu	W	Th	F	S
JANUARY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
FEBRUARY						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			
MARCH						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
APRIL						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
MAY						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
JUNE						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
JULY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
AUGUST						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
SEPTEMBER						
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
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OCTOBER						
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7	8	9	10	11	12	13
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NOVEMBER						
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DECEMBER						
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Note: The program and the weather files use a 365 day year even for leap years. Therefore, in leap years, the calendar and the program get one day out of step with regard to days of the week after February 29. When using the perpetual calendar for leap years, shift back one day of the week for dates after February 29.

Year 3

S	M	Tu	W	Th	F	S
JANUARY						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
FEBRUARY						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		
MARCH						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
APRIL						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				
MAY						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
JUNE						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						
JULY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
AUGUST						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
SEPTEMBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
OCTOBER						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
NOVEMBER						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
DECEMBER						
1	2	3	4	5	6	7
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Year 4

S	M	Tu	W	Th	F	S
JANUARY						
		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
FEBRUARY						
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	
MARCH						
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
APRIL						
	1	2	3	4	5	
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			
MAY						
			1	2	3	
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
JUNE						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
JULY						
	1	2	3	4	5	
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
AUGUST						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
SEPTEMBER						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				
OCTOBER						
		1	2	3	4	
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
NOVEMBER						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						
DECEMBER						
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Year 5

S	M	Tu	W	Th	F	S
JANUARY						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
FEBRUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
MARCH						
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
APRIL						
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12	13	14	15	16	17	18
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26	27	28	29	30		
MAY						
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28	29	30				
JULY						
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19	20	21	22	23	24	25
26	27	28	29	30	31	
AUGUST						
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SEPTEMBER						
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27	28	29	30			
OCTOBER						
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NOVEMBER						
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DECEMBER						
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Year 6

S	M	Tu	W	Th	F	S
JANUARY						
					1	2
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
FEBRUARY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						
MARCH						
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21	22	23	24	25	26	27
28	29	30	31			
APRIL						
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25	26	27	28	29	30	
MAY						
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
JUNE						
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27	28	29	30			
JULY						
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AUGUST						
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22	23	24	25	26	27	28
29	30	31				
SEPTEMBER						
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		
OCTOBER						
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3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
NOVEMBER						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				
DECEMBER						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Year 7

S	M	Tu	W	Th	F	S
JANUARY						
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
FEBRUARY						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					
MARCH						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
APRIL						
				1	2	
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
MAY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
JUNE						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		
JULY						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
AUGUST						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
SEPTEMBER						
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24	25	26	27	28	29	30
OCTOBER						
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25	26	27	28	29	30	31

Year 8

S	M	Tu	W	Th	F	S
JANUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
FEBRUARY						
		1	2	3	4	
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29			
MARCH						
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
APRIL						
1	2	3	4	5	6	7
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
MAY						
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
JUNE						
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17	18	19	20	21	22	23
24	25	26	27	28	29	30
JULY						
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
AUGUST						
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
SEPTEMBER						
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						
OCTOBER						
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21	22	23	24	25	26	27
28	29	30	31			
NOVEMBER						
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18	19	20	21	22	23	24
25	26	27	28	29	30	
DECEMBER						
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Year 9

S	M	Tu	W	Th	F	S
JANUARY						
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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
FEBRUARY						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		
MARCH						
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
APRIL						
	1	2	3	4	5	6
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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				
MAY						
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5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	
JUNE						
						1
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						
JULY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			
AUGUST						
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
SEPTEMBER						
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
OCTOBER						
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27	28	29	30	31		
NOVEMBER						
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17	18	19	20	21	22	23
24	25	26	27	28	29	30
DECEMBER						
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Year 10

S	M	Tu	W	Th	F	S
JANUARY						
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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		
FEBRUARY						
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3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	
MARCH						
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					
APRIL						
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20	21	22	23	24	25	26
27	28	29	30			
MAY						
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18	19	20	21	22	23	24
25	26	27	28	29	30	31
JUNE						
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
JULY						
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27	28	29	30	31		
AUGUST						
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						
SEPTEMBER						
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OCTOBER						
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NOVEMBER						
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DECEMBER						
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Year 11

S	M	Tu	W	Th	F	S
JANUARY						
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19	20	21	22	23	24	25
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FEBRUARY						
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23	24	25	26	27	28	29
MARCH						
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29	30	31				
APRIL						
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MAY						
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31						
JUNE						
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28	29	30				
JULY						
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AUGUST						
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30	31					
SEPTEMBER						
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OCTOBER						
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NOVEMBER						
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DECEMBER						
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Year 12

S	M	Tu	W	Th	F	S
JANUARY						
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FEBRUARY						
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MARCH						
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APRIL						
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MAY						
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30	31					
JUNE						
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27	28	29	30			
JULY						
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AUGUST						
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29	30	31				
SEPTEMBER						
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OCTOBER						
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31						
NOVEMBER						
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DECEMBER						
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Year 13

S	M	Tu	W	Th	F	S
JANUARY						
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24	25	26	27	28	29	30
31						
FEBRUARY						
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28	29					
MARCH						
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APRIL						
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24	25	26	27	28	29	30
MAY						
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29	30	31				
JUNE						
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JULY						
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31						
AUGUST						
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SEPTEMBER						
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OCTOBER						
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30	31					
NOVEMBER						
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DECEMBER						
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Year 14

S	M	Tu	W	Th	F	S
JANUARY						
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30	31					
FEBRUARY						
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27	28					
MARCH						
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APRIL						
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MAY						
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JUNE						
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JULY						
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30	31					
AUGUST						
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SEPTEMBER						
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OCTOBER						
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NOVEMBER						
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DECEMBER						
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31						