THE DOE–2 USER NEWS

DOE-2: A COMPUTER PROGRAM FOR BUILDING ENERGY SIMULATION

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☞ ☞ HANDS ON ☜ ☜

☞ DOE-2 Basics from N.T.I.S.

It's official! The *DOE-2 Basics* Manual is now available from the National Technical Information Service. Cost of the manual is $43/US and $86/Foreign. Check the order form in this issue.

☞ DOE-Plus Now Shipping!

The DOE-Plus interactive front-end and graphical post-processor for DOE-2 is now available; see the article on p. 54 of this newsletter.

☞ Oooops!

Please note that in the last newsletter (Vol. 13, No. 1) there was an error in the article entitled *Graphical Tools to Help Calibrate the DOE-2 Simulation Program to Measured Loads.* The captions for figures 1 and 2 were inadvertently switched; the caption for figure 1 belongs to figure 2 and vice-versa. Sorry for the mix-up!

☞ Call For Papers

The International Building Performance Simulation Association (IBPSA) presents the *Building Simulation '93.* This conference, to be held in Adelaide, Australia, August 16-18, 1993, will address the following themes: Technology Transfer, Applications (practical building simulation, intelligent buildings and diagnostic routines), Simulation Approaches (environments, relational databases, expert systems, hypermedia), Fundamentals (conceptual models for building performance evaluation), and Validation. Authors are invited to submit extended abstracts in English (two pages maximum excluding tables and diagrams) no later than November 15, 1992. Three copies of the abstract should be submitted to T. Williamson, Chair, Building Simulation '93, University of Adelaide, GPO Box 498, Adelaide 5001, Australia. See p. 57 of this newsletter.

■ ■ ■ THE HEAT EXCHANGER ■ ■ ■

Daylighting with Multiple Skylights

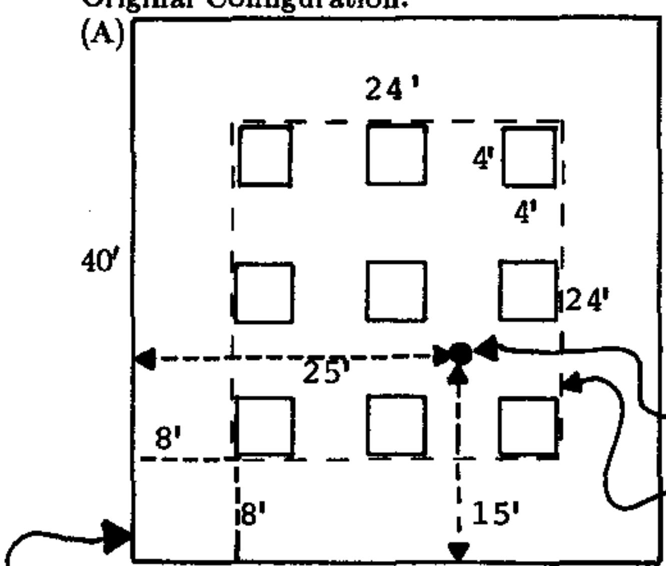
Question:
I have a question about the window multiplier and daylighting. We are modeling a building with 364 skylights, to be used for daylighting. Since it is impossible to enter all of these individually, what is a good way to enter them? If you use the window multiplier does it model one big window with equivalent area and, if so, what is the effect on daylighting calculations?

Answer:
There is no straightforward way to do daylighting calculations in DOE-2 for skylights (or windows) with multipliers. In fact, if you use a multiplier greater than 1 on a window in a daylit space, you will get a warning message saying the daylight calculation will be wrong. The problem is that the interior illuminance from a window depends on its position relative to the daylighting reference point. If you use a window multiplier, all of the windows "pile up" in one location rather than being positioned as they are in reality. This would generally greatly overestimate the daylight at the reference point. However, there is a work-around. The idea is to separate the daylighting and thermal calculations for the windows in such a way that you can combine your 364 separate skylights into (1) one large skylight that gives nearly the same daylighting as the separate skylights but no heat transfer, and (2) another large skylight that gives heat transfer but no daylighting.

Here's an example for a case with 9 skylights (sample values are shown in square brackets):

Original Configuration:

(A)



M skylights each of area = A_{win} [16 ft^2]
(total window area = MA_{win} [9 x 16 = 144 ft^2])

conductance = U_{win} [0.2]

shading coef = SC_{win} [0.4]
(or GLASS-TYPE-CODE)

visible transmittance = T_{vis} [0.3]*

reference point

fictitious rectangle enclosing all skylights, area = A' [24 x 24 = 576 ft^2]

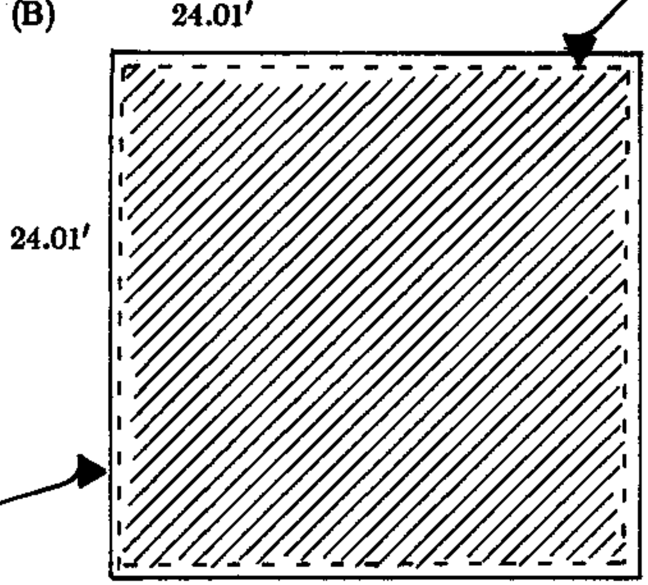
roof: total area, including windows, = A_{wall} [1600 ft^2]

* If the skylight has a well, adjust the visible transmittance as described on p.2.39ff of the *Supplement (2.1D)*.

Modified Configuration for DOE-2 input: enter *two* roof sections:

Daylighting but no heat transfer

(B)



WINDOW "W–1"

area = A′ [24 x 24 = 576 ft^2]

GLASS–CONDUCTANCE = 0.001

SHADING–COEF = 0

VIS–TRANS = $T_{vis} \dfrac{MA_{win}}{A'}$

$[\, 0.3 \, \dfrac{144}{576} = .075 \,]$

MULTIPLIER = 1

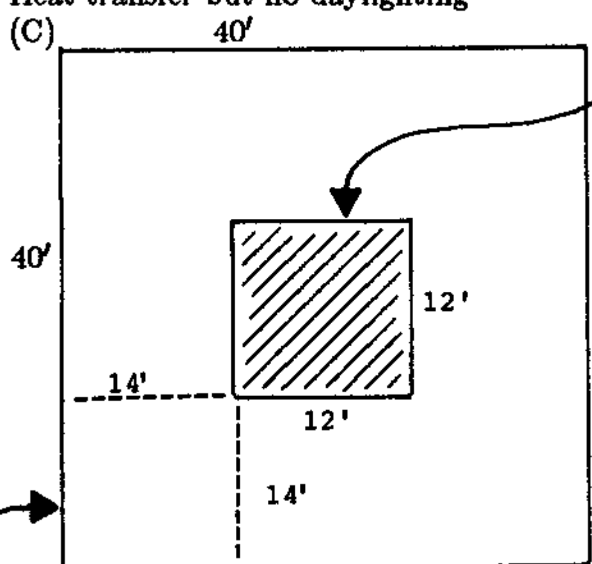
INSIDE–VIS–REFL = 0

roof: area = A′ + ϵ (just slightly larger than window; opaque roof area $\approx$ 0)

+

Heat transfer but no daylighting

(C)



WINDOW "W–2"

area = MA_{win} [9 x 16 = 144 ft^2]

GLASS–CONDUCTANCE = U_{win} [0.2]

SHADING–COEF = SC_{win} [0.4]
(or you can use GLASS–TYPE–CODE)

VIS–TRANS = 0

MULTIPLIER = 1

roof: area = A_{wall}; (including window) [1600 ft^2] other properties are same as original roof

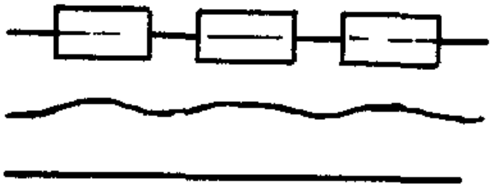
The DOE-2 input for these two roof sections might look like this:

```
   .
   .
   .
CONST-1 = CONSTRUCTION  U-VALUE = 0.3  ..

G-1 = GLASS TYPE    SHADING-COEF        = 0.0   $ No solar gain $
                    GLASS-CONDUCTANCE = 0.001 $ No conduction $
                    VIS-TRANS           = 0.075 .. $ Scaled $

G-2 = GLASS TYPE    SHADING-COEF        = 0.4
                    GLASS-CONDUCTANCE = 0.2
                    VIS-TRANS           = 0.0  ..

                 .
                 .
                 .
S-1 = SPACE         DAYLIGHTING        = YES
                    LIGHT-REF-POINT1 = (25,25,2.5)

                              .
                              .
                              .
DAYL-1 =  ROOF          $ Daylighting roof section $
          H = 24.01   W = 24.01
          TILT = 0
          X = 8   Y = 8   Z = 10
          CONS = CONST-1  ..

W-1 = WINDOW
          H = 24  W = 24  X = 0   Y = 0
          GLASS-TYPE = G-1
          INSIDE-VIS-REFL = 0  ..

THERMAL-1 = ROOF        $ Heat transfer roof section $
          H = 40  W = 40
          TILT = 0
          X = 0   Y = 0   Z = 10
          CONS = CONST-1  ..

W-2 = WINDOW
          H = 12  W = 12  X = 14  Y = 14
          GLASS-TYPE = G-2  ..

   .
   .
   .
```

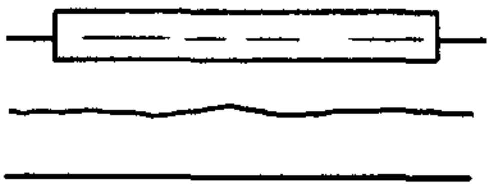
Notes:

(1) Be sure to adjust the visible transmittance of W–1 as shown in glass type G–1

(2) This approach will smooth out the illuminance distribution
from something like:

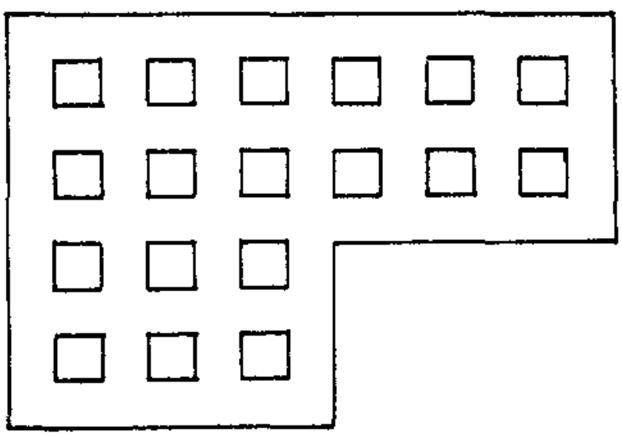


to something like: average values should be nearly the same

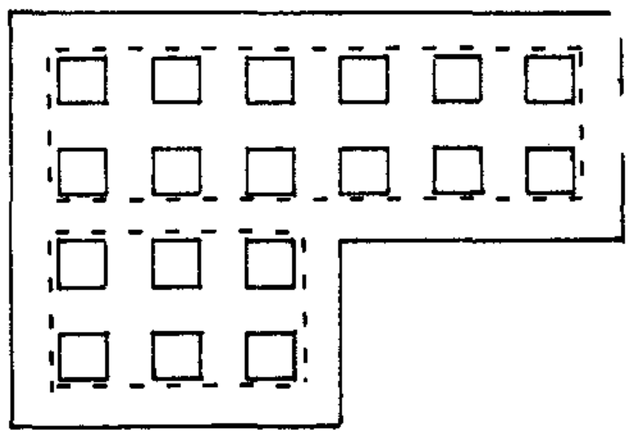


(3) If the original skylight array is not conveniently bounded by a single effective rectangle:

L-shaped roof, e.g.:



try two rectangles:



This will give *three* effective roof sections.

(4) (B) should be positioned the same as the dashed rectangle in (A).
The position of (C) is not important unless the roof is *shaded*.
In this case, (C) can overlap (B).

"Refrigerated Casework" Documentation Update for the *Engineers Manual (2.1A)*

(Put these pages at the end of the Systems section, after p.IV.173)

3.4 Refrigerated Grocery Cases (subroutines DESIGN, VARVOL, and SDSF)

This algorithm simulates the heat exchange, and energy consumption, of the refrigerated grocery cases found in supermarkets. This algorithm is intended for use with PSZ systems and is therefore embedded in subroutines VARVOL and SDSF.

Overview

Refrigerated grocery cases typically operate in the temperature range from -30°F to +40°F, and can have a significant impact on the sensible heat gain and moisture gain of the space containing them. Conversely, the actual heat and moisture exchange of the grocery case is strongly dependent on the space temperature and humidity ratios. The interdependence of the grocery case and space conditions require that this equipment be simulated in SYSTEMS where the actual space temperature and humidity ratio are determined. Grocery cases differ therefore from the other types of equipment simulated in LOADS which have heat and moisture gains independent of the actual space.

The sensible heat exchange of a grocery case is the sum of heat transferred by conduction through the walls of the case, convection of air into and out of the case, and radiation from lights and room surfaces into the case. An exact solution of this heat transfer process would be complex and beyond the scope of the program. Performance data[1] indicate that the heat exchange is essentially linear with the temperature difference between the case and the space. Consequently, the sensible heat exchange each hour can be calculated by knowing the heat exchange at design conditions and adjusting it hourly as a linear function of space and case temperatures.

The latent heat exchange is primarily a function of room air convecting into the case and coming into contact with the case evaporator or other cold surfaces not protected by anti-sweat heaters. Performance data [1] indicate that latent heat exchange is essentially a linear function of the humidity ratio difference between the room and the case evaporator. Consequently, the latent heat exchange each hour can be approximated by knowing the latent gain at design conditions and adjusting it hourly as a linear function of space and evaporator humidity ratios.

The linear dependence of the sensible and latent gains is important in the simultaneous solutions of case sensible and latent heat gain, room temperature, and room humidity ratio. Because the sensible gain is linear with temperature, conductance and heat gain factors can be included in TEMDEV when solving for the space temperature. Latent heat gains linear with the humidity ratio difference allow grocery case airflow and humidity ratio terms to be added to the moisture balance equations.

Because the sensible and latent heat gains are proportioned to the difference between the case conditions and the space conditions, the sensible and latent variation of a grocery case at -20°F will be different from a case at +40°F. The program allows up to three sets of cases to be modelled, each set having a different temperature.

[1] Reference: *ASHRAE Equipment Handbook*, Chapter 36.

With multiple sets of cases, the evaporators in the coldest cases may be wet while warmer evaporators may be dry. Dry evaporators cannot be included in the moisture balance because they will produce a false humidification effect in the system. Consequently, the program must iterate through the moisture balance equations, starting with the assumption that all evaporators are dry. If the space humidity ratio is higher than the humidity ratio of the coldest evaporator, then that evaporator must be wet. The space humidity ratio calculations are repeated taking into account this evaporator. The resultant space humidity ratio is then compared to the humidity ratio of the next coldest evaporator, and the calculations are repeated if this evaporator is found to be wet. This sequence is repeated until either a dry evaporator is found, or until all of the grocery cases are incorporated into the moisture balance.

Calculation Outline

I. Design Routine

   A. For each grocery case in a zone

      1. Calculate the sensible heat gain to the space at the rated conditions.
      2. Calculate the sensible heat gain to the space at the LOADS temperature, DESIGN-HEAT-T, and DESIGN-COOL-T.
      3. Calculate the effective conductance.
      4. Calculate the latent heat gain to the space at the rated conditions.
      5. Calculate the flow of zone air contacting the evaporator.

   B. For each zone adjust the peak heating and cooling loads calculated by the LOADS program.

   C. For each system,

      1. Calculate the required compressor capacity.
      2. Calculate the compressor nominal power consumption.
      3. Calculate the compressor nominal heat rejection.
      4. Calculate condenser fan and pump energy.
      5. Include latent cooling in the design moisture balance calculations.

II. VARVOL Routine

   1) Make scheduled adjustments.
   2) Calculate zone temperature (routine TEMDEV).
   3) Calculate system moisture balance.
   4) Calculate hourly sensible and latent zone heat gains due to the grocery cases.
   5) Calculate defrost energy.
   6) Calculate compressor loads, power consumption, recovered heat, and rejected heat.
   7) Calculate miscellaneous variables.

Calculation Algorithms

Design Calculations — For each grocery case in a particular zone

1) Calculate the sensible heat gain at the manufacturer's rated conditions. The sensible heat gain is the total heat gain multiplied by the sensible heat ratio
QSENS = <REFG-ZONE-LOAD> * <REFG-ZONE-SHR>

2) Calculate the sensible heat gain at the LOADS temperature, DESIGN-HEAT-T, and DESIGN-COOL-T. Because the variation in sensible heat gain is modelled as linear with temperature, the heat gain at the LOADS temperature is

$$<\text{REFG-QS-TLOADS}> = \text{QSENS} * \frac{<\text{TLOADS}> - <\text{REFG-DISCHARGE-T}>}{<\text{REFG-ZONE-DES-T}> - <\text{REFG-DISCHARGE-T}>}$$

Similarly for DESIGN-HEAT-T,

$$<\text{QRMIN}> = \text{QSENS} * \frac{<\text{DESIGN-HEAT-T}> - <\text{REFG-DISCHARGE-T}>}{<\text{REFG-ZONE-DES-T}> - <\text{REFG-DISCHARGE-T}>}$$

and for DESIGN-COOL-T,

$$<\text{QRMAX}> = \text{QSENS} * \frac{<\text{DESIGN-COOL-T}> - <\text{REFG-DISCHARGE-T}>}{<\text{REFG-ZONE-DES-T}> - <\text{REFG-DISCHARGE-T}>}$$

3) Calculate the effective conductance from the grocery case to the zone. This conductance is used in TEMDEV along with <REFG-QS-TLOADS> in solving for the zone temperature.

$$<\text{REFG = CONDUCTANCE}> = \frac{-<\text{REFG-QS-TLOADS}>}{<\text{TLOADS}> - <\text{REFG-DISCHARGE-T}>}$$

4) Calculate the latent heat gain to the space at the manufacturer's rated conditions. This is calculated as

<REFG-QS-DES-W> =
<REFG-ZONE-LOAD> * (1.0 – <REFG-ZONE-SHR>)

5)

A) Calculate the flow of zone air contacting the evaporator. The latent gain (loss) is caused by zone air flowing into the grocery case and losing moisture as it comes into contact with the evaporator. The airflow is needed in order to solve the moisture balance equations in SDSF. The design room humidity ratio is

<REFG-ZONE-DES-W> =
WFUNC(<REFG-ZONE-DES-T>,<REFG-ZONE-DES-RH>,BLDGP>)

where BLDGP is the design atmospheric pressure. The evaporator humidity ratio is
<REFG-EVAP-W> = WFUNC(<REFG-EVAP-T>,100.0,BLDGP>)

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The pounds of water removed per hour is $\text{LBSH2O} = \frac{-\text{<REFG-QL-DES-W>}}{1061.0}$

where 1061.0 is the heat of vaporization of water in Btu/lb.

The pounds of air required to transport the quantity of water to the evaporator is

$$\text{LBSAIR} = \frac{\text{LBSH2O}}{\text{<REFG-ZONE-DES-W>} - \text{<REFG-EVAP-W>}}$$

The flow in CFM is $\text{<REFG-CFM>} = \frac{\text{LBSAIR * SPVOL}}{60.0}$

where SPVOL is the specific volume of zone air, given by

SPVOL = V(<REFG-ZONE-DES-T>,<REFG-ZONE-DES-W,BLDGP)

C. For each zone, adjust the peak heating and cooling loads calculated by the LOADS program. This calculation is performed only when the peak loads are to be used to size the system capacities

<MAX-HEAT-RATE = <QMIN> + <QRMIN>

<MAX-COOL-RATE = <QMAX> + <QRMAX>

where <QMIN> and <QMAX> are the peak heating and cooling loads calculated by the LOADS program.

C. For each system, calculate compressor and condenser data.

1) Compressor capacity — if compressor capacity is not specified, it is calculated as the sum of the zone total heat gain, auxiliary case energy, and the part of the defrost energy that becomes a load; multiplied by the sizing ratio.

<REFG-COMP-CAP> =
[-<REFG-ZONE-LOAD> + (<REFG-AUX-KW> * 3413.) +
(-<REFG-QL-DES-W> * (1.0-<REFG-DEF-EFF>)/<REFG-DES-EFF>) +
<REFG-AUX-HEAT>] * <REFG-SIZING-RAT> * <MULTIPLIER>

<REFG-COMP-CAP> is first calculated separately for each set of cases input. If the user has specified that two or more sets of cases are to share a common set of compressors, the compressor capacities of the designated sets are summed into one value. Since in practice this common set will have to operate with a suction temperature low enough to satisfy the temperature requirements of the case with the coldest evaporator, the program will calculate the energy consumption of the common compressor using the performance data of the coldest case in the set.

2) Nominal power consumption — if not specified by the user, the nominal power consumption is calculated as a linear function of evaporator temperature.

<REFG-BTU/WATT> = 0.069 * <REFG-EVAP-T> * 5.57

This relation corresponds to 7.3 Btu/Watt at +25.0°F, and 3.5 Btu/Watt at -30.0°F. Btu/Watt is then converted to (Btu elec)/(Btu cooling) to be compatible with the EIRs used in the rest of the program.

<REFG-BTU/WATT> = 3.413/<REFG-BTU/WATT>

3) Calculate the compressor nominal heat rejection. The nominal heat rejection must be known to size the cooling tower. It is calculated as the sum of the compressor capacity and power consumption, summed over all the compressors

<REFG-HTREJ-DES> = $\sum$ (1.0 + <REFG-BTU/WATT>) * <REFG-COMP-CAP>

4) Calculate the fan and pump energy. If not input, the condenser fan and pump energy are calculated as 0.105 kW/ton and 0.025 kW/ton of compressor capacity, respectively.

<REFG-FAN-KW> = $\sum$ <REFG-COMP-CAP>*0.105/12000.

<REFG-PUMP-KW> = $\sum$ <REFG-COMP-CAP>*0.025/12000.

5) Include latent cooling in the design moisture balance equations. The moisture balance equations are derived elsewhere in this manual. The moisture balance terms applying to the refrigerated cases are:

G — the zone airflow that contacts the refrigerated case evaporators.

GW — the product of G and the evaporator humidity ratio.

G and GW are summed for all the evaporators that are wet and therefore produce latent cooling.

G = $\sum$ <REFG-CFM>
GW = $\sum$ (<REFG-CFM> * <REFG-EVAP-W>)

As discussed previously, it is not known whether an evaporator is wet until the space humidity ratio is known, but the space humidity ratio is influenced by the evaporator humidity ratio. The iterative process described previously is used to determine which evaporators are wet and the resultant space humidity ratio.

II. Hourly Calculations — Subroutine VARVOL

1) Make scheduled adjustments.
If the user has defined schedules to modify the sensible and/or latent heat gains, these adjustments must be made prior to any hourly calculation of zone temperature and humidity ratio.

a) If a <REFG-SENS-SCH> applies, both the sensible heat gain (at the LOADS temperature) and the conductance of the refrigerated case must be modified.

<QRNOW> = $\sum$ (<REFG-QS-TLOADS> * RQSSCHi)
<CRNOW> = $\sum$ (<REFG-CONDUCTANCE> * RQSSCHi)

where

RQSSCHi = the schedule value (0.0 to 1.0) for each case,

<QRNOW> = the sensible heat gain (at the LOADS temperature) modified by the schedule, summed for all refrigerated cases in the zone,

<CRNOW> = the conductance of the cases, modified by the schedule, summed for all refrigerated cases in the zone.

<QRNOW> and <CRNOW> are used in TEMDEV in solving for the zone temperature.

b) If a <REFG-LAT-SCH> applies, the airflow from the case will be modified by the schedule. The modification is taken into account in the moisture balance term for airflow through the case. The schedule value is stored for use in SDSF in the term RQLSCHi, where RQLSCHi is the schedule modification (0.0 to 1.0).

2) Calculate zone temperature (routine TEMDEV).
The sensible heat gain of the refrigerated case and the space temperature are interdependent and must be solved simultaneously. Because the sensible heat gain of a case is assumed to be linear with temperature, heat and conductance terms can be added to the equations in TEMDEV to calculate the space temperature. The terms are <QRNOW> and <CRNOW>, defined in the previous step. Since the cases can only take heat from the space, and not add heat to the space, the zone temperature calculated in TEMDEV must always be greater than <REFG-DISCHARGE-T>. An error will result otherwise. For information on the TEMDEV equations, refer to the TEMDEV write-up.

3) Calculate the system moisture balance (routine SDSF).
The terms G and GW were calculated in the design section where G was the flow of zone air that contacted wet evaporators (<REFG-CFM>), and GW was the product of G and <REFG-EVAP-W>. The same terms are used hourly in the moisture balance equations in SDSF, but modified by the user-defined schedules

G = ∑ <REFG-CFM> * RQLSCHi

GW = ∑ <REFG-CFM> * <REFG-EVAP-W> * RQLSCHi

As before, the program must iterate, adding refrigerated case airflows and humidity ratios into the moisture balance equations one case at a time in order to prevent a dry coil from contributing a false latent heat gain to the space.

Steps 4-6 are repeated for each case input.

4) Calculate the hourly sensible and latent zone heat gains due to a grocery case.

a) Sensible. Once the zone temperature is known, the zonal sensible heat gain (actually a loss) is calculated as

QSENS = <REFG-CONDUCTANCE> *
(<REFG-DISCHARGE-T> − <TNOW>) * RQSSCHi * ZMULT

where

<TNOW>	= this hour's zone temperature
ZMULT	= the zone multiplier
RQSSCHi	= the hourly schedule value

b) Latent. Once the system humidity ratio is known, the zonal latent heat gain (actually a loss) is calculated as

$$QLAT = \langle \text{REFG–QL–DES–W} \rangle * \frac{(\text{WR–}\langle \text{REFG–EVAP–W} \rangle)}{(\text{REFG–ZONE–DES–W} \rangle - \langle \text{REFG–EVAP–W} \rangle) * \text{ZMULT}}$$

where

<REFG–QL–DES–W>	is the nominal latent gain (calculated in DESIGN).
WR	is the system humidity ratio.
<REFG–EVAP–W>	is the humidity ratio of air leaving the evaporator (calculated in DESIGN).
<REFG–ZONE–DES–W>	is the system humidity ratio at the nominal conditions (calculated in DESIGN).

If WR is less than <REFG–EVAP–W>, then the evaporator is dry and QLAT is zero.

5) Calculate the defrost energy.
If the evaporator temperature is below freezing, energy must be expended to periodically melt the ice buildup. The energy expended is the sum of the phase change energy in the ice as well as energy lost in heating the evaporator, ducts, etc.

QDEF – QLAT / <REFG–DEF–EFF>

The sign of QLAT must be changed because QLAT is the latent heat gain of the *zone* and is always negative. Defrost energy is considered positive. If the timed electric defrost is used, the defrost energy will always be the nominal value
QDEF = <REFG–QL–DES–W> / <REFG–DEF–EFF>

If electric defrost is used, the electricity expended is RDEFKW = QDEF * 0.000293.

The energy lost in heating the evaporator, ducts. etc. will become a compressor load. The portion that becomes a compressor load is everything that did not directly melt ice.
QRDEF = QDEF – (–QLAT)

6) Calculate compressor load, recovered heat, and rejected heat.

a) The compressor load is the sum of sensible and latent heat taken from the zone, auxiliary energy (lights in the case, etc.), and the defrost losses.

QRi = (QSENS + QLAT) +
(<REFG–AUX–KW>*3413.0+<REFG–AUX–HEAT>) *
AUXSCHi * ZMULT + QRDEF

where AUXSCHi is the hourly value of <REFG–AUX–SCH>. If two or more cases share a compressor, QRi will be the sum of the loads of the grouped cases.

b) Power consumption. The compressor energy is a function of the compressor size, condenser temperature, and part load ratio.

i) If air cooled, the condenser temperature is TCOND = DBT or TCOND = <REFG-MIN-COND-T>, whichever is larger. DBT is the dry bulb temperature.

If water cooled, the condenser temperature is the larger of either
TCOND = WBT + <REFG-TWR-APP>
or
TCOND = <<REFG-MIN-COND-T>
WBT is the wet bulb temperature and <REFG-TWR-APP> is the cooling tower approach to the wet bulb temperature, calculated the hour before (see below).

If heat will be recovered from the compressor this hour, the condenser temperature is TCOND1 = TCOND or TCOND1 = <REFG-HTREC-T> whichever is larger.

ii) The part load ratio is calculated as PLR = QRE / <REFG-COMP-CAP>

iii) The compressor energy consumption is
COMPKW =
<REFG-COMP-CAP> * <REFG-BTU/WATT> * EIR1 * EIR2

where

COMPKW	= power consumption in Btuh,
EIR1	= the function <REFG-KW-FTCOND> with TCOND or TCOND1 as input,
EIR2	= the function <REFG-KW-FPLR> as input.

Note that <REFG-BTU/WATT> was converted to (Btu elec)/(Btu cooling) in the design routine.

c) Recovered and rejected heat. The waste heat produced by the compressor is
QREJ = QRi + CDMPKW

The demand for recovered heat is the smaller of either QNEED = -QH or QNEED = <REFG-MAX-HTREC>. QH is the heating load at the central coil. Its sign is changed because QH is always negative whereas QNEED is considered positive. The recovered heat is QREC = QREJ or QREC = QNEED whichever is smaller. The remaining heat demand and rejected heat are both diminished by the amount recovered.

QNEED = QNEED – QREC
QREJ = QREJ – QREC

The recovered and rejected heat of this compressor are summed with the heat recovered and rejected by compressors serving other cases.

QRREC = QRREC + QREC
QRREJ = QRREJ + QREJ

Steps 4-6 are repeated for each refrigerated case input. The remaining heat demand is QH = QH + QRREC. Note again that QH is always a negative quantity, whereas QRREC is positive.

7) Calculate miscellaneous variables.

a) Electrical energy

i) The compressor electrical consumption is
RCOMKW = COMPKW * 0.000293

ii) The auxiliary energy is RAUXKW = <REFG–FAN–KW>
+ <REFG–PUMP–KW> + $\sum$(<REFG–AUX–KW>)

iii) The total electrical energy consumed is RKW = RCOMKW + RAUXKW + RDEFKW

b) Cooling tower temperature. These calculations are skipped if the condenser is air cooled. (Also, the pump energy is zero in this case.)

i) The temperature drop through the tower (RANGE) is assumed to be 10° under nominal conditions. The nominal range is adjusted linearly with the hourly heat rejection load.

$$\text{RANGE} = \frac{10.0*\text{QRREJ}}{<\text{REFG-HTREJ-DES}>}$$

The RANGE is constrained to be at least 2.5°F. The tower wetbulb approach is <REFG–TWR–APP> = f′ (R1, TWET)

where

f′ is the function <TWR–APP–FRFACT>,

R1 is the value of the function <TWR–RFACT–FRT> with RANGE and TWET as input. The sign of R1 is changed, and R1 is constrained to be greater than -0.6,

TWET is the wetbulb temperature or 50.0°F, whichever is greater.

Cooling tower simulation techniques are presented in detail in the PLANT chapter.

Cross–Index of Commands and Keywords in DOE-2.1D

In an attempt to bring some order to the many volumes of DOE-2 manuals, we have compiled an alphabetical list of all commands and keywords found in the current version of the program. In the following index, commands are bold-faced and indicated with a bullet (•). To the right of each command/keyword is its abbreviation, followed by the subprogram where it resides and, for a keyword, the command with which it is associated. The subprograms have been shortened to a single letter designation (L = LOADS, S = SYSTEMS, P = PLANT, E = ECONOMICS). The next four columns list page numbers where the word can be found in DOE-2 Basics, BDL Summary, Supplement and Reference Manual. The last column shows the program version and date when the command/keyword was introduced. There are no columns for the Engineers Manual nor the Users Guide. Eventually, we hope to incorporate data from the Engineers Manual into this list; the Users Guide has been replaced by DOE-2 Basics.

Because we plan to release 2.1E in the fall, this is the last time the 2.1D cross-index will be printed. A 2.1E cross-index will be included with the revised documentation and will also be printed in the summer 1993 issue of this newsletter.

This list was last updated on August 1, 1992.

Alphabetical List of Commands and Keywords found in DOE-2.1D

In an attempt to bring some order to the many volumes of DOE-2 manuals, we have compiled an alphabetical list of all commands and keywords found in the current version of the program. Commands are bold-faced and indicated with a bullet (•). To the right of each command/keyword is its abbreviation, followed by the subprogram where it resides and, for a keyword, the command with which it is associated. The subprograms have been shortened to a single letter designation (L = LOADS, S = SYSTEMS, P = PLANT, E = ECONOMICS). The next four columns list page numbers where the word can be found. The last column shows the program version and date when the command/keyword was introduced. There are no columns for the *Engineers Manual* nor the *Users Guide*. Eventually, we hope to incorporate data from the *Engineers Manual* into this list; the *Users Guide* has been replaced by *DOE-2 Basics*.

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
•ABORT		LSPE	F.3	1,19,31,41	ii	II.19	2.0—2/15/79
ABSOR1–CAP–FT		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSOR1–HIR		P — PLANT–PARAMETERS	5.11,F.17	34		V.22	2.1—5/15/80
ABSOR1–HIR–FPLR		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSOR1–HIR–FT		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSOR2–CAP–FT		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSOR2–HIR		P — PLANT–PARAMETERS	5.11,F.17	34		V.22	2.1—5/15/80
ABSOR2–HIR–FPLR		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSOR2–HIR–FT		P — EQUIPMENT–QUAD		37		V.40,43	2.1—5/15/80
ABSORG–CAP–FT		P — EQUIPMENT–QUAD		37	4.17,4.18		2.1D—6/30/89
ABSORG–FUEL		P — PLANT–PARAMETERS	5.11,F.17	34	4.17,4.18		2.1D—6/30/89
ABSORG–FUEL–XEFF		P — PLANT–PARAMETERS	basics	bdl	supp	ref	??
ABSORG–HCAPR		P — PLANT–PARAMETERS		34	4.18		2.1D—6/30/89
ABSORG–HCAP–FQC		P — EQUIPMENT–QUAD		37	4.16,4.18		2.1D—6/30/89
ABSORG–HEAT–XEFF		P — PLANT–PARAMETERS	5.11,F.17	34	4.17,4.18		2.1D—6/30/89
ABSORG–HIR		P — PLANT–PARAMETERS	5.11,F.17	34	4.18		2.1D—6/30/89
ABSORG–HIR1–FTI		P — EQUIPMENT–QUAD		37	4.16,4.18		2.1D—6/30/89
ABSORG–HIR–FPLR		P — EQUIPMENT–QUAD		37	4.16,4.18		2.1D—6/30/89
ABSORG–HIR–FT		P — EQUIPMENT–QUAD		37	4.16,4.18		2.1D—6/30/89
ABSORPTANCE	ABS	L — CONSTRUCTION	3.11,F.6	5		III.82	2.0—2/15/79
ABSOR–TO–TWR–WTR	A–T–T–W	P — PLANT–PARAMETERS		35		V.23,V.26	2.0—2/15/79
AIR–CHANGES/HR	A–C/HR	L — SPACE–CONDITIONS	3.22,F.7	9		III.50	2.0—2/15/79

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
		S — ZONE–AIR	4.66,F.13	21	3.24	IV.189	2.0—2/15/79
AIR–FLOW–CTRL–DT	A–F–C–DT	L — WALL–PARAMETERS		5	2.8		2.1C—5/15/84
AIR–FLOW–RATE	A–F–R	L — WALL–PARAMETERS		5	2.8		2.1C—5/15/84
AIR–FLOW–TYPE	A–F–T	L — WALL–PARAMETERS		5	2.6		2.1C—5/15/84
ALTITUDE	ALT	L — BUILDING–LOCATION	3.4,F.3	2		III.30	2.0—2/15/79
ANNUAL–COST	A–C	E — COMPONENT–COST		44		VI.8	2.0—2/15/79
AREA	A	L — INTERIOR–WALL	3.32,F.10	15		III.113	2.0—2/15/79
		L — SPACE	3.24,F.8	10		III.97	2.0—2/15/79
		L — UNDERGROUND–WALL or –FLOOR	3.33,F.10	16		III.118	2.0—2/15/79
AREA/PERSON	A/P	L — SPACE–CONDITIONS	3.16F.7	7			2.1D—6/30/89
•ASSIGN		LS		17,30	1.6		2.1C—5/15/84
ASSIGNED–CFM	A–CFM	S — ZONE–AIR	4.66,F.13	21		IV.188	2.0—2/15/79
ASSIGN–CHARGE	A–C	E — ENERGY–COST	6.3,F.19	42	5.3		2.1C—5/15/84
ASSIGN–SCHEDULE	A–SCH	E — ENERGY–COST	6.4,F.19	42	5.3		2.1C—5/15/84
		P — LOAD–MANAGEMENT		39		V.60	2.0—2/15/79
ATM–MOISTURE	ATM–M	L — BUILDING–LOCATION		2	2.34,2.44		2.1B—1/15/83
ATM–TURBIDITY	ATM–T	L — BUILDING–LOCATION		2	2.34,2.44		2.1B—1/15/83
AXIS–ASSIGN	A–A	LS — HOURLY–REPORT		17		III.127	2.0A—6/15/79
AXIS–MAX	A–MAX	LS — HOURLY–REPORT		17		III.127	2.0A—6/15/79
AXIS–MIN	A–MIN	LS — HOURLY–REPORT		17		III.128	2.0A—6/15/79
AXIS–TITLES	A–T	LS — HOURLY–REPORT		17		III.127	2.0A—6/15/79
AZIMUTH	AZ	L — BUILDING–LOCATION	3.5,3.25,F.3	2		III.31	2.0—2/15/79
		L — BUILDING–SHADE		6		III.35	2.0—2/15/79
		L — EXTERIOR–WALL or ROOF	3.25,F.8	11		III.102	2.0A—6/15/79
		L — FIXED–SHADE		6			2.1B—1/15/83
		L — INTERIOR–WALL		15	2.3		2.1C—5/15/84
		L — SPACE		10		III.97	2.0—2/15/79
		L — TROMBE–WALL–V or –NV		12			2.1B—1/15/83
BASEBOARD–CTRL	B–C	S — ZONE–CONTROL	4.64,F.12	20	3.21	IV.194	2.0—2/15/79
BASEBOARD–RATING	B–R	S — ZONE	4.68,F.13	22	3.21	IV.200	2.0—2/15/79
BASEBOARD–SCH	B–SCH	S — SYSTEM–CONTROL	4.75,F.14	23	3.31	IV.209	2.0—2/15/79

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
BASEBOARD–SOURCE	BASEB–S	S — SYSTEM	4.87,F.15	27	3.31	IV.260-262	2.0—2/15/79
•BASELINE		E	44		VI.9		2.0—2/15/79
BERNOU–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
BLOCK–CHARGE	B–C	E — CHARGE–ASSIGNMENT	6.7,F.20	43	5.6		2.1C—5/15/84
BLOCK–RANGE	B–R	E — CHARGE–ASSIGNMENT	6.7,F.20	43	5.6		2.1C—5/15/84
BLOCK–UNIT	B–U	E — CHARGE–ASSIGNMENT	6.7,F.20	43	5.6		2.1C—5/15/84
BOILER–BLOW–RAT	B–B–R	P — PLANT–PARAMETERS		34		V.24,V.30	2.0—2/15/79
BOILER–CONTROL		P — PLANT–PARAMETERS		34		V.24,V.30	2.1—5/15/80
BOILER–FUEL	B–F	P — PLANT–PARAMETERS	5.13,F.17	34		V.24,V.30	2.0A—6/15/79
•BUILDING–LOCATION		L	3.4,F.3	2	1.4,2.44,2.64	III.30	2.0—2/15/79
•BUILDING–RESOURCE	B–R	L	3.34,F.10	16		III.39	2.0—2/15/79
•BUILDING–SHADE	B–S	L		6	2.44	III.35	2.0—2/15/79
C–A–LINK	C–A–L	E — CHARGE–ASSIGNMENT	6.5,F.20	43	5.4		2.1C—5/15/84
•CALCULATE		LS		18,30	1.9		2.1C—5/15/84
CAPACITY–PAYMENT	C–P	E — COST–PARAMETERS		44	5.9		2.1C—5/15/84
CCIRC–DESIGN–T–DROP		P — PLANT–PARAMETERS	5.13,F.17	35		V.25,V.33	2.1—5/15/80
CCIRC–HEAD		P — PLANT–PARAMETERS	5.13,F.17	35		V.25,V.33	2.1—5/15/80
CCIRC–IMPELLER–EFF		P — PLANT–PARAMETERS		35		V.25,V.33	2.1—5/15/80
CCIRC–LOSS		P — PLANT–PARAMETERS	5.13,F.17	35		V.25,V.33	2.1—5/15/80
CCIRC–MIN–PLR		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84
CCIRC–MOTOR–EFF		P — PLANT–PARAMETERS		35		V.25,V.33	2.1—5/15/80
CCIRC–PUMP–TYPE		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84
CCIRC–SIZE–OPT		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84
CFM/SQFT		S — ZONE–AIR	4.66,F.13	21	3.24	IV.189	2.0—2/15/79
CFMINF–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
CFMINF–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
CHANNEL–WIDTH	C–W	L — WALL–PARAMETERS		5	2.61		2.1B—1/15/83
•CHARGE–ASSIGNMENT	C–A	E	6.5,F.20	43	5.3		2.1C—5/15/84
CHILLER–CONTROL		P — PLANT–PARAMETERS		34		V.22,V.23	2.1—5/15/80
CHILL–WTR–T		P — PLANT–PARAMETERS	5.11,F.17	35		V.22,V.23	2.0—2/15/79

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
CHILL-WTR-THROTTLE		P — PLANT-PARAMETERS		35		V.22,V.23	2.1—5/15/80
CLEARNESS	CL	L — DESIGN-DAY		3		III.27	2.0—2/15/79
CLEARNESS-NUMBER	C-N	L — BUILDING-LOCATION	3.6,F.3	2		III.32	2.0—2/15/79
CLOUD-AMOUNT	C-A	L — DESIGN-DAY		3		III.27	2.0—2/15/79
CLOUD-TYPE	C-T	L — DESIGN-DAY		3		III.27	2.0—2/15/79
COEFFICIENTS	COEF	SP — CURVE-FIT		19		IV.184	2.0—2/15/79
COGEN-TRACK-MODE		P — PLANT-PARAMETERS		36	4.2		2.1C—5/15/84
COGEN-TRACK-SCH		P — PLANT-PARAMETERS		36	4.2		2.1C—5/15/84
COIL-BF	C-BF	S — SYSTEM-EQUIPMENT		26		IV.246	2.1—5/15/80
COIL-BF-FCFM	C-BF-FC	S — SYSTEM-EQUIPMENT		26		IV.242,247	2.1—5/15/80
COIL-BF-FT	C-BF-FT	S — SYSTEM-EQUIPMENT		26		IV.242,247	2.1—5/15/80
•COMPONENT-COST	C-C	E		44		VI.6	2.0—2/15/79
COMPONENT-LIFE	C-L	E — COMPONENT-COST		44		VI.6	2.0—2/15/79
COMPRESSOR-TYPE	C-TYPE	S — SYSTEM-EQUIPMENT		26		IV.249	2.1—5/15/80
•COMPUTE ECONOMICS		E	2.2,F.20	45		II.34	2.0—2/15/79
•COMPUTE LOADS		L	2.2,F.11	18		II.34	2.0—2/15/79
•COMPUTE PLANT		P	2.2,F.18	41		II.34	2.0—2/15/79
•COMPUTE SYSTEMS		S	2.2,F.15	30		II.34	2.0—2/15/79
COMP-MODE-DCHG	C-T-T-W	P — PLANT-PARAMETERS		x		x	??
COMP-KW-TON-START	C-T-T-W	P — PLANT-PARAMETERS	x	x	x	x	??
COMP-KW-TON-END	C-T-T-W	P — PLANT-PARAMETERS	x	x	x	x	??
COMP-TO-TWR-WTR	C-T-T-W	P — PLANT-PARAMETERS		35		V.22,V.23	2.0—2/15/79
CONCHN		S — SUBR-FUNCTIONS		29	1.5		2.1D—6/30/89
CONDUCTIVITY	COND	L — MATERIAL		4		III.73	2.0—2/15/79
CONDUCT-SCHEDULE	C-SCH	L — WINDOW	3.28,F.9	13		III.107	2.0—2/15/79
CONDUCT-TMIN-SCH	C-T-SCH	L — WINDOW	3.28,F.9	13	2.34,2.53		2.1B—1/15/83
•CONSTRUCTION	CONS	L	3.9,F.6	5		III.80	2.0—2/15/79
CONSTRUCTION	CONS	L — DOOR	3.31,F.10	14		III.110	2.1—5/15/80
		L — EXTERIOR-WALL or ROOF	F.8	11		III.100	2.0—2/15/79
		L — INTERIOR-WALL	3.32,F.10	15		III.113	2.0—2/15/79
		L — TROMBE-WALL-V or -NV		12			2.1B—1/15/83
		L — UNDERGROUND-WALL or -FLOOR	3.33,F.10	16		III.119	2.0—2/15/79

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
CONSUMABLES	C	P — PLANT-EQUIPMENT		32		V.13	2.0—2/15/79
CONSUMABLES-EXP	C-E	P — PLANT-COSTS		40			2.1B—1/15/83
CONSUMABLES-REF	C-R	P — REFERENCE-COSTS		40		V.94	2.0—2/15/79
COOLING-CAPACITY	C-CAP	S — SYSTEM					2.0A—6/15/79
		S — SYSTEM-EQUIPMENT		26		IV.241	2.1—5/15/80
		S — ZONE		22		IV.201	2.1—5/15/80
COOLING-EIR	C-EIR	S — SYSTEM-EQUIPMENT		26		IV.244	2.1—5/15/80
COOLING-SCHEDULE	C-SCH	S — SYSTEM-CONTROL	4.72,F.14	23	3.22,3.31	IV.18,206	2.0—2/15/79
COOL-CAP-FT	C-C-FT	S — SYSTEM-EQUIPMENT		26		IV.241,2	2.1—5/15/80
COOL-CONTROL	C-C	S — SYSTEM-CONTROL	4.73,F.14	23		IV.207	2.0—2/15/79
COOL-CTRL-RANGE	C-C-R	S — SYSTEM-EQUIPMENT		26		IV.248	2.1—5/15/80
COOL-EIR-FPLR	C-E-FP	S — SYSTEM-EQUIPMENT		26		IV.242,244	2.1—5/15/80
COOL-EIR-FT	C-E-FT	S — SYSTEM-EQUIPMENT		26		IV.242,244	2.1—5/15/80
COOL-FT-MIN	C-FT-MIN	S — SYSTEM-EQUIPMENT		26		IV.245	2.1—5/15/80
COOL-MULTIPLIER	C-M	P — LOAD-MANAGEMENT		39		V.59	2.0—2/15/79
COOL-PEAK-PERIOD	C-P-P	L — BUILDING-LOCATION		2		III.32	2.1—5/15/80
COOL-RESET-SCH	C-R-SCH	S — SYSTEM-CONTROL	4.73,F.14	23		IV.207	2.0—2/15/79
COOL-SET-SCH	C-S-SCH	S — SYSTEM-CONTROL	F.14	23		IV.207	2.0—2/15/79
COOL-SET-T	C-S-T	S — SYSTEM-CONTROL	4.73,F.14	23		IV.207	2.0—2/15/79
COOL-SH-CAP	C-S-C	S — SYSTEM-EQUIPMENT		26		IV.245	2.1—5/15/80
		S — ZONE		22		IV.201	2.1—5/15/80
COOL-SH-FT	C-S-FT	S — SYSTEM-EQUIPMENT		26		IV.242,245	2.1—5/15/80
COOL-STORE-RATE	C-ST-R	P — ENERGY-STORAGE		39		V.73	2.0—2/15/79
COOL-STORE-SCH	C-ST-SCH	P — ENERGY-STORAGE		39		V.73	2.0—2/15/79
COOL-SUPPLY-RATE	C-SU-R	P — ENERGY-STORAGE		39		V.73	2.0—2/15/79
COOL-TEMP-SCH	C-T-SCH	S — ZONE-CONTROL	4.64,F.12	20		IV.18,194	2.0—2/15/79
•COST-PARAMETERS	C-P	E	6.9,F.20	44	5.7		2.1C—5/15/84
CRANKCASE-HEAT	C-H	S — SYSTEM-EQUIPMENT		26		IV.249	2.1—5/15/80
CRANKCASE-MAX-T	C-M-T	S — SYSTEM-EQUIPMENT		26		IV.249	2.1A—5/15/81
CTANK-BASE-T	C-B-T	P — ENERGY-STORAGE		39		V.74	2.0—2/15/79
CTANK-ENV-T	C-E-T	P — ENERGY-STORAGE		39		V.76	2.0—2/15/79
CTANK-ENV-T-SCH		P — ENERGY-STORAGE	x	x	x	x	??

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
CTANK–FREEZ–T	C–F–T	P — ENERGY–STORAGE		39		V.76	2.0—2/15/79
CTANK–LOSS–COEF	C–L–C	P — ENERGY–STORAGE		39		V.74	2.0—2/15/79
CTANK–T–RANGE	C–T–R	P — ENERGY–STORAGE		39		V.74	2.0—2/15/79
•CURVE–FIT	C–F	SP			19,31	IV.180	2.1A—5/15/81
DATA		SP — CURVE–FIT		19		IV.182	2.1—5/15/80
•DAY–ASSIGN–SCH	D–A–SCH	P		31		V.97	2.0—2/15/79
•DAY–CHARGE–SCH		E	6.8,F.19	42	5.6		2.1C—5/15/84
•DAY–RESET–SCH	D–R–SCH	S	4.61,F.12	20,42		IV.176	2.0—2/15/79
•DAY–SCHEDULE	D–SCH	LSP	2.6,F.4,F.12	3,19,31		II.23,V.8	2.0—2/15/79
DAYCLS–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYCLS–2		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYCLS–3		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYCLS–4		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYCLS–5		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYCLS–6		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DAYLIGHTING	DAY	L — SPACE–CONDITIONS		9	2.34,2.45		2.1B—1/15/83
DAYLIGHT–REP–SCH	D–R–SCH	L — SPACE–CONDITIONS		9	2.34,2.48		2.1B—1/15/83
DAYLIGHT–SAVINGS	D–S	L — BUILDING–LOCATION	3.4,F.3	2		III.31	2.0—2/15/79
DAYL–FUNCTION		L — BUILDING–LOCATION		2	1.4		2.1C—5/15/84
DAYL–ILLUM–FN		L — SPACE		10	1.4		2.1C—5/15/84
DAYL–LTCTRL–FN		L — SPACE		10	1.4		2.1C—5/15/84
DAYS		LSPE — WEEK–SCHEDULE					2.0—2/15/79
DBUN–CAP–COR–REC		P — PLANT–PARAMETERS		35		V.23,27,43	2.1—5/15/80
DBUN–CAP–FT		P — EQUIPMENT–QUAD		37		V.42,3	2.1—5/15/80
DBUN–CAP–FTRISE		P — EQUIPMENT–QUAD		37		V.42	2.1—5/15/80
DBUN–COND–T–ENT		P — PLANT–PARAMETERS		35		V.23,27	2.1—5/15/80
DBUN–COND–T–REC		P — PLANT–PARAMETERS	5.12,F.17	35		V.23,V.27	2.1—5/15/80
DBUN–EIR–COR–REC		P — PLANT–PARAMETERS		35		V.23,27	2.1—5/15/80
DBUN–EIR–FPLR		P — EQUIPMENT–QUAD		37		V.42,43	2.1—5/15/80
DBUN–EIR–FT		P — EQUIPMENT–QUAD		37		V.42,43	2.1—5/15/80

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
DBUN–EIR–FTRISE		P — EQUIPMENT–QUAD		37		V.42,43	2.1—5/15/80
DBUN–HT–REC–RAT		P — PLANT–PARAMETERS		35		V.23,V.27	2.1—5/15/80
DBUN–MIN–HEAT		P — PLANT–PARAMETERS		35	4.2		2.1C—5/15/84
DBUN–TO–TWR–WTR	D–T–T–W	P — PLANT–PARAMETERS		35		V.22,V.23	2.0—2/15/79
DBUN–UNL–RAT–DES		P — PLANT–PARAMETERS		35		V.23,V.28	2.1—5/15/80
DBUN–UNL–RAT–REC		P — PLANT–PARAMETERS		35		V.23,V.28	2.1—5/15/80
DDSF–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DDSF–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DEFROST–DEGRADE	D–D	S — SYSTEM–EQUIPMENT		26	3.15	IV.243,251	2.1—5/15/80
DEFROST–T	D–T	S — SYSTEM–EQUIPMENT		26	3.15	IV.251	2.1—5/15/80
DEMAND–1	D–1	P — HEAT–RECOVERY	5.15,F.18	38		V.66	2.0—2/15/79
DEMAND–2	D–2	P — HEAT–RECOVERY		38		V.66	2.0—2/15/79
DEMAND–5	D–5	P — HEAT–RECOVERY		38		V.66	2.0—2/15/79
DEM–AVERAGE–MON1	D–A–M1	E — COST–PARAMETERS	6.9,F.20	44	5.8		2.1C—5/15/84
DEM–AVERAGE–MON2	D–A–M2	E — COST–PARAMETERS	6.10,F.20	44	5.8		2.1C—5/15/84
DEM–PERIOD–T1	D–P–T1	E — COST–PARAMETERS	6.9,F.20	44	5.7		2.1C—5/15/84
DEM–PERIOD–T2	D–P–T2	E — COST–PARAMETERS	6.9,F.20	44	5.7		2.1C—5/15/84
DEM–RATCHET–FRC1	D–R–F1	E — COST–PARAMETERS	6.10,F.20	44	5.8		2.1C—5/15/84
DEM–RATCHET–FRC2	D–R–F2	E — COST–PARAMETERS	6.10,F.20	44	5.8		2.1C—5/15/84
DEM–RATCHET–T1	D–R–T1	E — COST–PARAMETERS	6.9,F.20	44	5.7		2.1C—5/15/84
DEM–RATCHET–T2	D–R–T2	E — COST–PARAMETERS	6.9,F.20	44	5.7		2.1C—5/15/84
DEM–UNIT–NAME		P — ENERGY–RESOURCE	x	x	x	x	??
DENSITY	DENS	L — MATERIAL		4		III.73	2.0A—6/15/79
DEPTH	D	L — MATERIAL					2.0—2/15/79
		L — SPACE		10		III.97	2.0—2/15/79
DESFO–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESFO–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESIGN		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESIGN–COOL–T	D–C–T	S — ZONE–CONTROL	4.64,F.12	20		IV.18,194	2.0—2/15/79
•DESIGN–DAY	D–D	L		3		III.25	2.0—2/15/79
DESIGN–HEAT–T	D–H–T	S — ZONE–CONTROL	4.64,F.12	20		IV.18,193	2.0—2/15/79

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
DESIND–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESIND–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESPIU–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DESPIU–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DEWPT–HI	DP–H	L — DESIGN–DAY		3		III.27	2.0—2/15/79
DEWPT–LO	DP–L	L — DESIGN–DAY		3		III.27	2.0—2/15/79
DHOUR–HI	DH–H	L — DESIGN–DAY		3		III.27	2.0—2/15/79
DHOUR–LO	DH–L	L — DESIGN–DAY		3		III.27	2.0—2/15/79
DHW–HEATER–FUEL		P — PLANT–PARAMETERS	5.13,F.17	34		V.24,V.30,V.31	2.1—5/15/80
DHW–HIR		P — PLANT–PARAMETERS	5.13,F.17	34		V.24,V.30,V.31	2.1—5/15/80
DHW–HIR–FPLR		P — EQUIPMENT–QUAD		37		V.44,45	2.1—5/15/80
•DIAGNOSTIC		LSPE	F.3	1,19, 31,42		II.16	2.0—2/15/79
DIESEL–EXH–EFF		P — PLANT–PARAMETERS		38	4.8		2.1C—5/15/84
DIESEL–EXH–FPLR		P — EQUIPMENT–QUAD		38	4.9	V.46	2.1C—5/15/84
DIESEL–FUEL	D–F	P — EQUIPMENT–QUAD					2.0A—6/15/79
		P — PLANT–PARAMETERS		36		V.31	2.0—2/15/79
DIESEL–GEN–EFF		P — PLANT–PARAMETERS		36	4.8		2.1C—5/15/84
DIESEL–I/O–FPLR		P — EQUIPMENT–QUAD		38	4.9	V.46	2.1—5/15/80
DIESEL–J/L–EFF		P — PLANT–PARAMETERS		36	4.8		2.1C—5/15/84
DIESEL–JCLB–FPLR		P — EQUIPMENT–QUAD		38	4.9		2.1C—5/15/84
DIESEL–TEX–FPLR		P — EQUIPMENT–QUAD		38	4.10	V.46	2.1—5/15/80
DIESEL–TRACK–MODE		P — PLANT–PARAMETERS		36	4.2		2.1C—5/15/84
DISCOUNT–RATE	D–R	P — PLANT–COSTS		40		V.91	2.0—2/15/79
DIVIDE		LS — HOURLY–REPORT		17		III.128	2.0A—6/15/79
DKTEMP–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DKTEMP–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DKTEMP–2		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DKTEMP–3		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DOETRM–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DOETRM–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
•DOOR		L	3.31,F.10	14	2.55,2.65	III.69,III.110	2.1—5/15/80

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
DOORWAY–H	D–H	L — WALL–PARAMETERS		5	2.9		2.1C—5/15/84
DOORWAY–W	D–W	L — WALL–PARAMETERS		5	2.9		2.1C—5/15/84
DOUBLE–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DOUBLE–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
DRYBULB–HI	DB–H	L — DESIGN–DAY		3		III.26	2.0—2/15/79
DRYBULB–LO	DB–L	L — DESIGN–DAY		3		III.26	2.0—2/15/79
DUCT–AIR–LOSS	D–A–L	S — SYSTEM–AIR		23		IV.217	2.1—5/15/80
DUCT–DELTA–T	D–D–T	S — SYSTEM–AIR		23		IV.217	2.1—5/15/80
EBAL–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
EBAL–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
ECHO		LSPE — DIAGNOSTIC	F.3				2.1?—?/??/??
ECONO–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
ECONO–2		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
ECONO–3		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
ECONO–4		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
ECONO–LIMIT–T	E–L–T	S — SYSTEM–CONTROL	4.75,F.14	23		IV.210	2.0—2/15/79
ECONO–LOW–LIMIT	E–L–L	S — SYSTEM–CONTROL		23	3.23		2.1B—1/15/83
•ECONOMICS–REPORT	E–R	E	6.17,F.20	45		VI.12	2.0—2/15/79
ELEC–DHW–LOSS		P — PLANT–PARAMETERS		34		V.24,V.31	2.1—5/15/80
ELEC–INPUT–RATIO	E–I–R	P — PART–LOAD–RATIO	5.9,F.16	33	4.18,4.21	V.18,20	2.0—2/15/79
ELEC–KW	E–KW	L — BUILDING–RESOURCE	3.35,F.10	16		III.40	2.0—2/15/79
ELEC–MULTIPLIER	E–M	P — LOAD–MANAGEMENT		39		V.59	2.0—2/15/79
ELEC–SALES–ASG	E–S–A	E — COST–PARAMETERS		44	5.9		2.1C—5/15/84
ELEC–SALES–ESCL	E–S–E	E — COST–PARAMETERS		44	5.9		2.1C—5/15/84
ELEC–SALES–OPT	E–S–O	E — COST–PARAMETERS		44	5.8		2.1C—5/15/84
ELEC–SALES–SCH	E–S–SCH	E — COST–PARAMETERS		44	5.9		2.1C—5/15/84
ELEC–SCHEDULE	E–SCH	L — BUILDING–RESOURCE	3.35,F.10	16		III.40	2.0—2/15/79
EMISSIVITY	EM	L — WALL–PARAMETERS		5	2.61		2.1B—1/15/83
•END		LSPE	2.1,F.11, F.15,F.18	17,30, 41,45		II.33	2.0—2/15/79

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
			F.20				
•END-FUNCTION		LS		18,30	1.9		2.1C—5/15/84
•ENERGY-COST	E-C	E	6.2,F.19	42	5.1	V.8,83	2.0—2/15/79
ENERGY-COST	E-C	E — BASELINE		44		VI.11	2.0—2/15/79
•ENERGY-RESOURCE	E-R	P	5.16,F.18	39	4.14		2.1C—5/15/84
ENERGY-USE-SITE	E-U-SITE	E — BASELINE		44		VI.11	2.0—2/15/79
ENERGY-USE-SRC	E-U-SRC	E — BASELINE		44		VI.11	2.0—2/15/79
•ENERGY-STORAGE	E-S	P		39		V.8,73	2.0—2/15/79
ENG-CH-CAP-FT		P — EQUIPMENT-QUAD		37	4.20,4.21		2.1D—6/30/89
ENG-CH-COND-TYPE		P — PLANT-PARAMETERS	5.12,F.17	34	4.20,4.21		2.1D—6/30/89
ENG-CH-COP		P — PLANT-PARAMETERS	5.11,F.17	34	4.21		2.1D—6/30/89
ENG-CH-COP-FPLR1		P — EQUIPMENT-QUAD		37	4.19,4.21		2.1D—6/30/89
ENG-CH-COP-FPLR2		P — EQUIPMENT-QUAD		37	4.19,4.21		2.1D—6/30/89
ENG-CH-COP-FPLRS		P — EQUIPMENT-QUAD		37	4.19,4.21		2.1D—6/30/89
ENG-CH-COP-FT		P — EQUIPMENT-QUAD		37	4.19,4.21		2.1D—6/30/89
ENG-CH-COP-FTS		P — EQUIPMENT-QUAD		37	4.19,4.21		2.1D—6/30/89
ENG-CH-FUEL		P — PLANT-PARAMETERS	5.11,F.17	34	4.20,4.21		2.1D—6/30/89
ENG-CH-HREJ-FPLR		P — EQUIPMENT-QUAD		37	4.20,4.21		2.1D—6/30/89
ENG-CH-HREJ-FT		P — EQUIPMENT-QUAD		37	4.20,4.21		2.1D—6/30/89
ENG-CH-IDLE-RAT		P — PLANT-PARAMETERS		34	4.21		2.1D—6/30/89
ENG-CH-REC-EFF		P — PLANT-PARAMETERS		34	4.21		2.1D—6/30/89
EQUIPMENT-KW	E-KW	L — SPACE-CONDITIONS	3.19,F.7	7		III.46	2.0—2/15/79
EQUIPMENT-LIFE	E-L	P — PLANT-EQUIPMENT		32		V.14	2.0—2/15/79
•EQUIPMENT-QUAD	E-Q	P		37,38	4.9	V.8,38	2.1—5/15/80
EQUIPMENT-W/SQFT	E-W	L — SPACE-CONDITIONS	3.19,F.7	7		III.47	2.0—2/15/79
EQUIP-LATENT	E-L	L — SPACE-CONDITIONS	3.20,F.7	7		III.47	2.0—2/15/79
EQUIP-SCHEDULE	E-SCH	L — SPACE-CONDITIONS	3.19,F.7	7		III.46	2.0—2/15/79
EQUIP-SENSIBLE	E-S	L — SPACE-CONDITIONS	3.19,F.7	7		III.47	2.0—2/15/79
ESCALATION	E	E — ENERGY-COST	6.2,F.19	42	5.2		2.0—2/15/79
EXHAUST-CFM	E-CFM	S — ZONE-AIR	4.67,F.13	21		IV.190	2.0—2/15/79
EXHAUST-EFF	E-E	S — ZONE-AIR	4.67,F.13	21		IV.190	2.0—2/15/79

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
EXHAUST–KW	E–KW	S — ZONE–AIR	4.67,F.13	21		IV.191	2.1—5/15/80
EXHAUST–STATIC	E–S	S — ZONE–AIR	4.67,F.13	21		IV.190	2.0—2/15/79
•EXTERIOR–WALL or –ROOF	E–W	L	3.25,F.8	11	2.10,2.55	III.100	2.0—2/15/79
E–HW–BOILER–LOSS		P — PLANT–PARAMETERS		34		V.24	2.1—5/15/80
E–STM–BOILER–LOSS		P — PLANT–PARAMETERS		34		V.24	2.1—5/15/80
FANPWR		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FAN–CONTROL	F–C	S — SYSTEM–FANS	4.81,F.14	24	3.31	IV.18,221	2.0—2/15/79
FAN–EIR–FPLR	F–E–FPLR	S — SYSTEM–FANS		24		IV.228	2.1—5/15/80
FAN–KW	F–KW	L — WALL–PARAMETERS		5	2.9		2.1B—1/15/83
FAN–PLACEMENT	F–P	S — SYSTEM–FANS		24		IV.226	2.0—2/15/79
FAN–SCHEDULE	F–SCH	S — SYSTEM–FANS	4.81,F.14	24	3.17,3.31	IV.221	2.0—2/15/79
FCOIL–0		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FCOIL–1Z		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FCOIL–2Z		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FCOIL–3=		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FIRST–COST	F–C	E — BASELINE		44		VI.9,11	2.0—2/15/79
		E — COMPONENT–COST		44		VI.6	2.0—2/15/79
		P — PLANT–EQUIPMENT		32		V.13	2.0—2/15/79
FIRST–COST–EXP	F–C–E	P — PLANT–COSTS		40			2.1B—1/15/83
FIRST–COST–REF	F–C–R	P — REFERENCE–COSTS		40		V.94	2.0—2/15/79
FIXED–MONTH–CHG1	F–M–C1	E — ENERGY–COST	6.3,F.19	42	5.3		2.1C—5/15/84
FIXED–MONTH–CHG2	F–M–C2	E — ENERGY–COST	6.3,F.19	42	5.3		2.1C—5/15/84
•FIXED–SHADE	F–S	L		6	2.44,2.63		2.1C—5/15/84
FLOOR–MULTIPLIER	F–M	L — SPACE	3.24,F.8	10	2.81		2.1B—1/15/83
		S — ZONE		22			2.1B—1/15/83
FLOOR–WEIGHT	F–W	L — SPACE–CONDITIONS	3.23,F.7	7		III.51	2.0—2/15/79
FLUID–HEAT–CAP	F–H–C	S — SYSTEM–FLUID	4.85,F.15	25		IV.235	2.0—2/15/79
FOR		L — SET–DEFAULT		2			2.0—2.15.79
		L — WALL–PARAMETERS		5	2.6,2.61		2.1B—1/15/83

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
FNSYS1–1		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FNSYS1–2Z		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FNSYS1–3Z		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FNSYS1–4Z		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FNSYS1–5		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FRAC–LEAK–AREA	F–L–A	L — SPACE–CONDITIONS		9	2.74		2.1B—1/15/83
FRAC–VENT–AREA	F–V–A	S — SYSTEM–AIR		23	3.33,3.34		2.1D—6/30/89
FTDEV		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
•FUNCTION		LS	F.10	17,30	1.3		2.1D—6/30/89
FUNCTION		L — BUILDING–LOCATION		2	1.3		2.1C—5/15/84
		L — DOOR	F.10	14	1.3		2.1C—5/15/84
		L — EXTERIOR–WALL or ROOF		11	1.3		2.1C—5/15/84
		S — PLANT–ASSIGNMENT		29	1.3		2.1D—6/30/89
		L — SPACE		10	1.3		2.1C—5/15/84
		S — SYSTEM		27	1.3		2.1D—6/30/89
		L — UNDERGROUND–WALL or –FLOOR		16	1.3		2.1C—5/15/84
		L — WINDOW		13	1.3		2.1C—5/15/84
		S — ZONE		22	1.3		2.1D—6/30/89
FURNAC		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
FURNACE–AUX	F–A	P — PLANT–PARAMETERS		34		V.24,V.31	2.1—5/15/80
		S — SYSTEM–EQUIPMENT		26		IV.252	2.1—5/15/80
FURNACE–FUEL		P — PLANT–PARAMETERS		34		V.24,V.31	2.1—5/15/80
FURNACE–HIR	F–HIR	P — PLANT–PARAMETERS		34		V.24,V.31	2.1—5/15/80
		S — SYSTEM–EQUIPMENT		26		IV.252	2.1—5/15/80
FURNACE–HIR–FPLR	F–H–FP	P — EQUIPMENT–QUAD		37		V.44,45	2.1—5/15/80
		S — SYSTEM–EQUIPMENT		26		IV.243,252	2.1—5/15/80
FURNACE–OFF–LOSS	F–O–L	S — SYSTEM–EQUIPMENT		26		IV.252	2.1—5/15/80
FURNITURE–TYPE	F–TYPE	L — SPACE–CONDITIONS		7		III.53	2.1—5/15/80
FURN–FRACTION	F–F	L — SPACE–CONDITIONS		7		III.53	2.1—5/15/80
FURN–WEIGHT	F–WGT	L — SPACE–CONDITIONS		7		III.53	2.1—5/15/80
GAS–SCHEDULE	G–SCH	L — BUILDING–RESOURCE	3.34,F.10	16		III.39	2.0—2/15/79

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
GAS–THERMS	G–T	L — BUILDING–RESOURCE	3.34,F.10	16		III.39	2.0—2/15/79
GLARE–CTRL–PROB	G–C–P	L — WINDOW		13	2.34,2.53		2.1B—1/15/83
GLASS–CONDUCTANCE	G–C	L — GLASS–TYPE	3.13F.6	6		III.88	2.0—2/15/79
•GLASS–TYPE	G–T	L	3.13F.6	6	2.6,2.45,2.77	III.87	2.0—2/15/79
GLASS–TYPE	G–T	L — WINDOW	3.27,F.9	13		III.107	2.0—2/15/79
GLASS–TYPE–CODE	G–T–C	L — GLASS–TYPE		6	2.77	III.87	2.0—2/15/79
GND–FORM–FACTOR	G–F–F	L — DOOR		14		III.110	2.1—5/15/80
		L — EXTERIOR WALL or ROOF		11		III.100	2.0—2/15/79
		L — TROMBE–WALL–V or –NV		12			2.1B—1/15/83
		L — WINDOW		13		III.107	2.0—2/15/79
GND–REFLECTANCE	G–R	L — EXTERIOR WALL or ROOF	3.25F.8	11		III.10	2.0—2/15/79
		L — TROMBE–WALL–V or –NV		12			2.1B—1/15/83
GROSS–AREA	G–A	L — BUILDING–LOCATION	3.6,F.3	2		III.32	2.0—2/15/79
GROUND–T	G–T	L — BUILDING–LOCATION	3.6,F.3	2		III.32	2.0—2/15/79
		L — DESIGN–DAY		3		III.27	2.0—2/15/79
GTURB–CAP–FT		P — EQUIPMENT–QUAD		38	4.10		2.1C—5/15/84
GTURB–EXH–EFF		P — PLANT–PARAMETERS		36	4.8		2.1C—5/15/84
GTURB–EXH–FPLR		P — EQUIPMENT–QUAD		38	4.10		2.1C—5/15/84
GTURB–FUEL	G–F	P — PLANT–PARAMETERS		36		V.24,V.31	2.0A—6/15/79
GTURB–GEN–EFF		P — PLANT–PARAMETERS		36	4.8		2.1C—5/15/84
GTURB–I/O–FPLR		P — EQUIPMENT–QUAD		38	4.10	V.44,46	2.1—5/15/80
GTURB–TEX–FPLR		P — EQUIPMENT–QUAD		38	4.10	V.44,47	2.1—5/15/80
HCIRC–DESIGN–T–DROP		P — PLANT–PARAMETERS	5.13,F.17	35		V.25	2.1—5/15/80
HCIRC–HEAD		P — PLANT–PARAMETERS	5.13,F.17	35		V.25	2.1—5/15/80
HCIRC–IMPELLER–EFF		P — PLANT–PARAMETERS		35		V.25	2.1—5/15/80
HCIRC–LOSS		P — PLANT–PARAMETERS	5.14,F.17	35		V.25	2.1—5/15/80
HCIRC–MIN–PLR		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84
HCIRC–MOTOR–EFF		P — PLANT–PARAMETERS		35		V.25	2.1—5/15/80
HCIRC–PUMP–TYPE		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84
HCIRC–SIZE–OPT		P — PLANT–PARAMETERS	5.14,F.17	35	4.13		2.1C—5/15/84

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•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
HCOIL–WIPE–FCFM	H–W–FC	S — SYSTEM					2.1—5/15/80
		S — SYSTEM–EQUIPMENT		26		IV.251	2.1A—5/15/81
HE		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
HEATING–CAPACITY	H–CAP	S — SYSTEM	4.89,F.15		3.31		2.0A—6/15/79
		S — SYSTEM–EQUIPMENT		26	3.31	IV.249	2.1—5/15/80
		S — ZONE		22		IV.201	2.1—5/15/80
HEATING–EIR	H–EIR	S — SYSTEM–EQUIPMENT		26	3.15	IV.250	2.1—5/15/80
HEATING–SCHEDULE	H–SCH	S — SYSTEM–CONTROL	4.71,F.14	23	3.22,3.31	IV.18,203	2.0—2/15/79
HEAT–CAP–FT	H–C–FT	S — SYSTEM–EQUIPMENT		26	3.15	IV.242-3,249	2.1—5/15/80
HEAT–CONTROL	H–C	S — SYSTEM–CONTROL	4.71,F.14	23		IV.204	2.0—2/15/79
HEAT–EIR–FPLR	H–E–FP	S — SYSTEM–EQUIPMENT		26	3.15	IV.243,250	2.1—5/15/80
HEAT–EIR–FT	H–E–FT	S — SYSTEM–EQUIPMENT		26	3.15	IV.250	2.1—5/15/80
HEAT–MULTIPLIER	H–M	P — LOAD–MANAGEMENT		39		V.59	2.0—2/15/79
HEAT–PEAK–PERIOD	H–P–P	L — BUILDING–LOCATION		2		III.32	2.1—5/15/80
•HEAT–RECOVERY	HEAT–R	P	5.15,F.18	38	44	V.8,66	2.0—2/15/79
HEAT–RESET–SCH	H–R–SCH	S — SYSTEM–CONTROL	4.72,F.14	23		IV.205	2.0—2/15/79
HEAT–SET–SCH	H–S–SCH	S — SYSTEM–CONTROL	4.71,F.14	23		IV.205	2.0—2/15/79
HEAT–SET–T	H–S–T	S — SYSTEM–CONTROL	4.72,F.14	23		IV.205	2.0—2/15/79
HEAT–SOURCE	HEAT–S	S — SYSTEM	4.87,F.13	27	3.31	IV.259,261	2.0—2/15/79
HEAT–STORE–RATE	H–ST–R	P — ENERGY–STORAGE		39		V.73	2.0—2/15/79
HEAT–STORE–SCH	H–ST–SCH	P — ENERGY–STORAGE		39		V.74	2.0—2/15/79
HEAT–SUPPLY–RATE	H–SU–R	P — ENERGY–STORAGE		39		V.73	2.0—2/15/79
HEAT–TEMP–SCH	H–T–SCH	S — ZONE–CONTROL	4.64,F.12	20	3.21	IV.18,193	2.0—2/15/79
HEIGHT	H	L — BUILDING–SHADE		6		III.35	2.0—2/15/79
		L — DOOR	3.31,F.10	14		III.110	2.1—5/15/80
		L — EXTERIOR–WALL or ROOF	3.25,F.8	11		III.102	2.0—2/15/79
		L — FIXED–SHADE		6			2.1B—1/15/83
		L — INTERIOR–WALL		15		III.113	2.1—5/15/80
		L — SPACE		10		III.97	2.0—2/15/79
		L — TROMBE–WALL–V or –NV		12			2.1B—1/15/83
		L — UNDERGROUND–WALL or –FLOOR		16		III.118	2.1—5/15/80
		L — WINDOW	3.27,F.9	13		III.108	2.0—2/15/79
HERM–CENT–CAP–FT		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80

•COMMAND or Keyword	Abbrev	Subprogram — Command	DOE-2 Basics (2.1D)	BDL Summary (2.1D)	Supp (2.1D)	Ref Man (2.1A)	Program — year Version — added
HERM–CENT–COND–PWR		P — PLANT–PARAMETERS		34		V.23,V.26	2.1—5/15/80
HERM–CENT–COND–TYPE		P — PLANT–PARAMETERS	5.12,F.7	34		V.23,V.26	2.1—5/15/80
HERM–CENT–EIR–FPLR		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80
HERM–CENT–EIR–FT		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80
HERM–CENT–UNL–RAT		P — PLANT–PARAMETERS		34		V.23,V.26	2.1—5/15/80
HERM–REC–CAP–FT		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80
HERM–REC–COND–PWR		P — PLANT–PARAMETERS		34		V.23,V.26	2.1—5/15/80
HERM–REC–COND–TYPE		P — PLANT–PARAMETERS	5.12,F.17	34		V.23,V.26	2.1—5/15/80
HERM–REC–EIR–FPLR		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80
HERM–REC–EIR–FT		P — EQUIPMENT–QUAD		37		V.41,43	2.1—5/15/80
HERM–REC–UNL–RAT		P — PLANT–PARAMETERS		34		V.23	2.1—5/15/80
HOLIDAY	HOL	L — BUILDING–LOCATION	3.5,F.3	2		III.31	2.0—2/15/79
HOR–LEAK–FRAC	H–L–F	L — SPACE–CONDITIONS		9	2.74		2.1B—1/15/83
HOR–VENT–FRAC	H–V–F	S — SYSTEM–AIR		23	3.33,3.34		2.1D—6/30/89
HOT–WATER	H–W	L — BUILDING–RESOURCE	3.34,F.10	16		III.39	2.0—2/15/79
HOURIN		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
HOUR–HI	H–H	L — DESIGN–DAY		3		III.26	2.0—2/15/79
HOUR–LO	H–L	L — DESIGN–DAY		3		III.26	2.0—2/15/79
HOURLY–DATA–SAVE	H–D–S	L — LOADS–REPORT		17	1.26		2.1D—6/30/89
		P — PLANT–REPORT		40	1.26		2.1D—6/30/89
		S — SYSTEMS–REPORT		29	1.26		2.1D—6/30/89
•HOURLY–REPORT	H–R	LS		17,30,41		II.32,III.127, IV.273, IV.8,103	2.0—2/15/79
HOURS		LSP — DAY–SCHEDULE			1.28		2.0—2/15/79
HOURS–USED	H–U	P — PLANT–EQUIPMENT		32		V.4	2.0—2/15/79
HPUNIT		S — SUBR–FUNCTIONS		29	1.5		2.1D—6/30/89
HP–SUPP–HT–CAP	S–H–C	S — SYSTEM–EQUIPMENT		26	3.15		2.1C—5/15/84
HP–SUPP–SOURCE	SUPP–S	S — SYSTEM–EQUIPMENT		26	3.15		2.1C—5/15/84
HR8PL–FWB1WB6	HRPL–FWB	S — SYSTEM–EQUIPMENT		27	3.31		2.1D—6/30/89
HR8–FWB1WB6	HR–FWB	S — SYSTEM–EQUIPMENT		27	3.31		2.1D—6/30/89
HTANK–BASE–T	H–B–T	P — ENERGY–STORAGE		39		V.74	2.0—2/15/79
HTANK–ENV–T	H–E–T	P — ENERGY–STORAGE		39		V.76	2.0—2/15/79

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