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PUB-439

DOE-2 USER NEWS

: A COMPUTER PROGRAM FOR BUILDING ENERGY USE ANALYSIS

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BULLETIN BOARD

Item: We are creating at LBL a computer library of DOE-2 input decks describing existing buildings, particularly those with sub-meters, to be used in our ongoing verification efforts. If you have any (clean) input decks that you would like to contribute to this depository, please call the DOE-2 User Coordination Office to make transport arrangements.

Item: The DOE-2 User Coordination Office is offering a new service to owners of the new DOE-2.1A version of the code that will assist them in correcting bugs prior to the release of the next official version. Upon receipt of a stamped ($1.56), self-addressed envelope, we will send out a paper copy of the bug fixes (the UPDATE modification file). DOE-2.1A owners can then modify their own tapes to eradicate any particularly bothersome bugs.

Item: Seminars, workshops, and training courses in the use of DOE-2 are conducted from time to time at the various computer service bureaus around the country. Although this office cannot recommend one over another, we can provide individual listings of all known local offices of the various service bureaus and independent consultants in a requester's area. Inquiries concerning DOE-2 courses can then be made directly to the local offices.

AVAILABILITY OF DOE-2.1A

At long last, the National Energy Software Center has released the DOE-2.1A version of the code. The tapes, both CDC- and IBM-compatible, may be ordered now through the:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

The back page of this issue is a tear-out sheet containing an order form.

The IBM tape is being offered in the form of an update to the DOE-2.1 base tape. For CDC purchasers, a new base tape has been prepared. Also for CDC purchasers, NTIS is offering upon special request a supplementary 77-file weather data tape to replace that which was supplied as part of the earlier CDC package. Please note that the weather data is no longer an integral part of the DOE-2 package.

The update to the documentation is in the process of being printed. Purchasers of the DOE-2.1 manuals will be notified by NTIS when it becomes available. The update package will take the following form:

The BDL Summary and the Reference Manual, Part 1 will be reprinted in their entireties. The DOE-2.1A Reference Manual, in particular, has been substantially upgraded, and a new section, "SYSTEM Control Strategy", has been added that should provide valuable information to new as well as experienced users.

The Users Guide and the Reference Manual, Part 2 will be updated by replacement sheets and Errata and Addenda instructions.

The Sample Run Book is not being updated. Interested users may acquire hard-copy DOE-2.1A runs of the Sample Buildings by applying to their service bureau or computer center.

New users should order the complete set of DOE-2.1A Manuals, a package containing the three basic volumes plus the update package.

All inquiries pertaining to cost and date of availability should be directed to NTIS.

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DIRECT COOLING IN PLANT

In DOE-2.1A, it is possible to model "free" cooling with the following new keywords which have been added to the PLANT-PARAMETERS and EQUIPMENT-QUAD commands in PLANT.

Keyword	Codewords/ Min. Max.	Default
In PLANT-PARAMETERS:		
DIRECT-COOL-MODE	NOT-AVAILABLE, STRAINER-CYCLE, THERMO-CYCLE	NOT-AVAILABLE
DIRECT-COOL-KW	0.0 to 1.0 kW/ton	0.0 for STRAINER-CYCLE, 0.02 for THERMO-CYCLE
DIRECT-COOL-SCH	u-name	Always available
DIRECT-CHILL-WTR-T	30.0 to 60.0 °F	50.0
DC-MAX-T	35.0 to 65.0 °F	55.0
In EQUIPMENT-QUAD:		
TC-CHLR-CAP-FT	u-name of bi-linear or bi-quadratic	CCAPT5

DIRECT-COOL-MODE indicates whether or not direct cooling will be available during the simulation. The default is that it is not. The codeword STRAINER-CYCLE indicates that the controls exist (see DC-MAX-T, DC-CHILL-WTR-T, DIRECT-COOL-T) to allow the cooling tower water to be passed directly into the chilled water loop. The codeword THERMO-CYCLE indicates that the controls exist to allow the centrifugal chillers to act as a heat exchanger without the electric input to the compressor. For either of these direct cooling modes to be used, the following must be satisfied:

1. The outside drybulb temperature must be less than or equal to DC-MAX-T (°F).

2. The value for DIRECT-COOL-SCH for this hour must be non-zero.

3. The chilled water temperature when using direct cooling must not exceed DC-CHILL-WTR-T (°F).

Auxillary electric input for direct cooling can be specified by DIRECT-COOL-KW. For the THERMO-CYCLE, this represents a kW/ton of operating capacity for the period during which the compression chillers are operating in this mode. For the STRAINER-CYCLE, this represents the electrical input to the condenser water pumps (and other added equipment) calculated as a kW/ton of SYSTEMS peak cooling load.

When in the THERMO-CYCLE mode, the compression chiller capacity as a function of condenser and chilled water temperatures is calculated using the curve CCAPT5. The user may enter his own curve with the keyword TC-CHLR-CAP-FT in the EQUIPMENT-QUAD command. The default coefficients for CCAPT5 are:

1)	-0.351443	4)	-0.045625
2)	0.056583	5)	-0.000043
3)	-0.600054	6)	-0.000012

For both modes of direct cooling, the chilled water pumps are assumed to run as usual. For the STRAINER-CYCLE mode, the condenser water pumping energy is calculated using only the value of DIRECT-COOL-KW as the kW/ton (using peak SYSTEM load for the tonnage) and the flow-rate is assumed equal to the chilled water loop. In the THERMO-CYCLE mode, the chiller electrical input is assumed to be DIRECT-COOL-KW times the operating capacity times the part load ratio (kW/ton of chiller capacity).

ECONOMIC EVALUATION METHODS

DOE-2 can be used in three different ways to perform an economic analysis. In Method I, the total life cycle cost of different design alternatives is compared. Investment statistics such as payback period and savings-to-investment ratio do not apply. This method may be used to rank new building or retrofit alternatives. In Method II, retrofit alternatives are ranked on the basis of investment statistics. The building before retrofit is defined as the baseline. The investment is the cost of energy-saving modifications to the baseline building. The savings are given by the difference in life-cycle energy and operation cost of the modified building relative to the baseline. A DOE-2 run is made on the baseline and on each of the alternatives. Method III is similar to Method II except that new-building alternatives (rather than retrofit alternatives) are compared using investment statistics. In this case, the alternative with the smallest investment is used as a baseline.

1. Method I: Ranking by life-cycle costs

A separate DOE-2 run is made on each building design according to the following procedure.

a. Procedure

(1) Enter cost data for each building design.

(a) Enter central plant costs using the keywords FIRST-COST, INSTALLATION, CONSUMABLES, MAINTENANCE, EQUIPMENT-LIFE, MINOR-OVHL-INT, MINOR-OVHL-COST, MAJOR-OVHL-INT, and MAJOR-OVHL-COST in the PLANT-EQUIPMENT command in the PLANT program. For existing buildings, specify also HOURS-USED for each piece of plant equipment. If HOURS-USED is not specified, the equipment will be considered to be new, and the first cost of the equipment will be included in the life-cycle cost calculation. Note that a solar collector system is not costed in PLANT and, therefore, must be entered by using the COMPONENT-COST instruction in the Economics program.

(b) In the PLANT input, enter fuel cost and escalation rate, using an ENERGY-COST command for each energy type.

(c) In the PLANT input, enter project lifetime, discount rate, etc., using the PLANT-COSTS command.

(d) Enter all other costs in the Economics program input using COMPONENT-COST commands. These costs include the building envelope, secondary systems, solar collectors, control systems, etc. If the overall life-cycle cost of the building is desired, all relevant costs must be entered. If only the difference in life-cycle cost between alternatives is desired, only the cost items which differ between the alternatives need be entered.

(2) Run DOE-2 on each building design.

(3) Compare total life-cycle costs as given in Economics Report ES-B.

Note: For this method, baseline data need not be specified; furthermore, the cost savings, investment, savings-to-investment ratio, etc., given in Economics Report ES-C, do not apply.

Caution: Life-cycle cost is usually very sensitive to discount rate and fuel escalation rates. These values should therefore be chosen with care.

b. Example:

An example of Method I is given in the Users Guide, Section 8.B.1, in which the life-cycle cost of a building with a packaged variable air volume system is compared with the life cycle cost of the same building with a heat pump system.

c. Cost Minimization by parametric runs

Method I may be used to evaluate any parameter of the design by plotting the total life-cycle costs for several different values of the parameter. Sufficient runs should be made to produce a smooth curve in the neighborhood of the minimum total life-cycle cost. The optimum value for the parameter corresponds to this minimum.

2. Method II: Ranking retrofit alternatives using investment statistics

This method applies to an existing building which is being modified to make it energy efficient. The primary concern is whether the investment to modify the building is cost-effective. In other words, are the energy and operations cost savings over the project lifetime greater than the investment; or is the payback period — the number of years to recover the investment — short enough to be financially attractive. When this method is used, DOE-2 is first run on the baseline building; i.e., on the building before modifications are made. The program is then run a second time on the modified building. Selected numbers from the first run are input in the Economics BASELINE command in the second run. Economics Report ES-C of the second run gives the investment statistics.

a. Procedure

(1) For the baseline run enter plant equipment costs, energy costs, nonplant costs, project lifetime, etc., as in Method I. Be sure to specify HOURS-USED for each plant component since this is an existing building. Also, be sure to get Economics Reports ES-A, ES-B, and ES-C.

(2) Repeat step (1) for the modified building, with one exception: some numbers from Economics Reports ES-A, ES-B, and ES-C of the baseline run must be entered in the BASELINE command in the Economics input for the modified building. The BASELINE keywords and the corresponding ES-A, ES-B, and ES-C quantities are listed in Table VI.2 of the Reference Manual.

(3) The investment statistics which determine whether the modification is cost-beneficial are given in Economics Report ES-C.

Note: The Economics program need not be run for the baseline if the user does not wish to specify non-plant costs. In this case, the BASELINE input for subsequent runs can be obtained from PLANT Report PS-J of the baseline run.

b. Examples

Examples of Method II are given in the Users Guide, Section 8.B.2, and in the Sample Run Book, Simple Structure Run 3 (baseline) and Simple Structure Run 3A (modification).

c. Special Case

If the modification involves adding or replacing central plant equipment, that equipment must be entered under COMPONENT-COST in the Economics input of the modified building run. It is important that the cost of the alternative plant equipment not also be entered in the PLANT input. To avoid double counting it is therefore necessary to set these costs to zero in the PLANT input, as shown in the following example.

Caution: When doing retrofit studies, it is important not to let SYSTEMS or PLANT size the equipment, unless resizing equipment is part of the retrofit. If the equipment is sized by SYSTEMS in the baseline run, the user should explicitly enter values for ASSIGNED-CFM in each conditioned zone in each retrofit run. The values may be derived from the SV-A report of the baseline run by dividing the cfm shown for the zone by the ALTITUDE MULTIPLIER. Similarly, the size of PLANT equipment may be taken from the PS-H report.

Example:

Building modification consists of installing an additional boiler, of 160,000 Btu/hr capacity, to a plant with an existing boiler of 450,000 Btu/hr capacity.

In PLANT

```
INPUT PLANT ..

EXISTING-BOILER          =PLANT-EQUIPMENT   TYPE=STM-BOILER
                                            SIZE=0.45
                                            FIRST-COST=5000
                                            INSTALLATION=1.2
                                            EQUIPMENT-LIFE=200000
                                            HOURS-USED=50000 ..

ADD-BOILER               =PLANT-EQUIPMENT   TYPE=STM-BOILER
                                            SIZE=0.16
                                            FIRST-COST=0
                                            CONSUMABLES=0
                                            MAINTENANCE=0
                                            MINOR-OVHL-COST=0
                                            MAJOR-OVHL-COST=0 ..
END ..
COMPUTE PLANT ..
```

In ECONOMICS

```
INPUT ECONOMICS ..

                         ECONOMICS-REPORT   SUMMARY=(ALL-SUMMARY) ..

ADD-BOILER              =COMPONENT-COST     FIRST-COST=3000
                                            INSTALL-COST=600
                                            ANNUAL-COST=300
                                            COMPONENT-LIFE=10 ..

                        BASELINE            FIRST-COST= ....
                                                etc.
END ..
COMPUTE ECONOMICS ..
STOP ..
```

3. Method III: Comparison of new building designs using investment statistics

a. Procedure

(1) Run DOE-2, including ECONOMICS, on the alternative with the smallest investment. This is the baseline run.

(2) Run DOE-2 on each of the remaining alternatives using the results of (1), above, to obtain the appropriate input for the BASELINE command (see Table VI.2 of the Reference Manual).

(3) The investment statistics which determine whether the alternative is cost-beneficial relative to the design with the smallest investment are given in Economics Report ES-C.

FILE STRUCTURE FOR INTERMEDIATE FILES

LDSOUT, SYSOUT and DSNFIL

Internal to the operation of DOE-2 are three files that the user seldom sees or knows about unless the SAVE-FILES command is used. These files are DSNFIL, LDSOUT and SYSOUT. The first two are created by LOADS and are sent to SYSTEMS. SYSTEMS, in turn, adds information to DSNFIL and creates a new file, SYSOUT, to be sent to PLANT. Ordinarily, the user need have no idea about the contents of these files beyond knowing that they contain the design and hourly information that pass from one sub-program to the next. Occasionally, however, the user may want to do data analyses of a different sort than DOE-2 performs. For example, it may be desired to make a scatter plot of heating load versus heating degree days. For this purpose it would be necessary to know the file structure on these intermediate files so that a post-processor program could be written to generate the plot. The following is a terse description of the file structures in terms of the FORTRAN variable names used in DOE-2:

DSNFIL - This file has two records passed from LOADS to SYSTEMS, two records passed from SYSTEMS to PLANT, and one record passed from PLANT to ECONOMICS. The records are as follows:

Record 1: LOADS to SYSTEMS
NRUNPR,IRUNPR(6,12),NSPACE,DBUF(32,NSPACE),
NATTCH,BUF(NATTACH),BLDGQH,BLDGQC,BLDGQL,BLDGP
IHLFLG,IDSFLG,DBTMIN,DBTMAX,WMIN,WMAX,NDSDY,DESHRQ(3,24,3)

Record 2: LOADS to SYSTEMS
BEPS(40),GTEMP(12),CLR(12),LOCALD(10)

NRUNPR The number of RUN-PERIODs
IRUNPR Month, day, year of start and end of RUN-PERIODs
NSPACE The number of LOADS SPACEs
DBUF for each SPACE defined in LOADS

1-4	Name of SPACE
5-10	Air temperature weighting factors
11	LOADS calculation temperature
20	Internal wall U*A*ΔT
21	Peak cooling load
22	Peak heating load
23	Area
24	Volume
25	Maximum number of people
26	Latent gain at heating peak
27	Latent gain at cooling peak
28	Infiltration cfm at heating peak
29	Infiltration cfm at cooling peak
30	Plenum heat at heating peak
31	Plenum heat at cooling peak

NATTCH Length of the INTERIOR-WALL block
BUF Two integers plus one real number for each INTERIOR-WALL defined in LOADS, first the SPACE it is in, then the SPACE it is NEXT-TO, and last the U*A for the wall
BLDGQH The building peak block load
BLDGQC The building peak block cooling load
BLDGQL The latent gain at time of building block cooling peak
BLDGP The design atmospheric pressure
IHLFLG Holiday flag (1,0; use, do not use holidays)
IDSFLG Daylight savings flag (1,0; use, do not use daylight savings)
DBTMIN OA temperature at block heating peak
DBTMAX OA temperature at block cooling peak
WMIN OA humidity at block heating peak

WMAX OA humidity at block cooling peak
NDSDY Number of DESIGN-DAYs (0 if none)
DESHRQ The OA dry and wetbulb temperatures and humidity ratio for up to three days of hourly profiles for the DESIGN-DAY simulation
BEPS Array containing BEPS report quantities

1	Total equipment electrical in LOADS
2	Total equipment gas in LOADS
3	Total light electrical in LOADS
4	Total hot water Btu in LOADS
5	Total elevator electrical in LOADS
6	Gross area
7	Net area
8-12	Heating gas for each PLANT-ASSIGNMENT in SYSTEMS
12-15	Heating electrical in kW for each PLANT-ASSIGNMENT in SYSTEMS
16-19	Cooling electrical in kW for each PLANT-ASSIGNMENT in SYSTEMS
20-23	Fan electrical in kW for each PLANT-ASSIGNMENT in SYSTEMS
24-27	Fraction hours load not met for each PLANT-ASSIGNMENT in SYSTEMS
28-31	Heating oil for each PLANT-ASSIGNMENT in SYSTEMS
32-40	For future use

GTEMP GROUND-Ts
CLR CLEARNESS-NUMBERs
LOCALD Data from the BUILDING-LOCATION command

1	LATITUDE
2	LONGITUDE
3	TIME-ZONE (integer)
4	AZIMUTH
5	ALTITUDE
6	Sin(lat)
7	Cos(lat)
8	Tan(lat)
9	Sin(azim)
10	Cos(azim)

Record 3: From SYSTEMS to PLANT

NDSDY,NRUNPR,IRUNPR,IHLFLG,IDSFLG,LEN,BUF(LEN)

NDSDY Through IDSFLG as in Record 1
LEN Number of PLANT-ASSIGNMENTs times 10
BUF for each PLANT-ASSIGNMENT

1-4	The name of the PLANT-ASSIGNMENT
5	The peak heating load
6	The peak cooling load
7	The peak electrical load in kW
8	Peak hot water load from LOADS
9	
10	SYSTEM-TYPEs in PLANT-ASSIGNMENT

Record 4: From SYSTEMS to PLANT

Same as Record 2

Record 5: From PLANT to ECONOMICS

This Record is unused; it may contain random noise

LDSOUT - This file contains one record for each day in the DESIGN-DAY RUN-PERIOD as well as weather file RUN-PERIOD plus three initialization days for each RUN-PERIOD. Each record contains the following:

BLDGLD(3,24),AA(LEN)

BLDGLD The following for each hour in the day:

1 Total BUILDING-RESOURCE electrical
2 Total building gas
3 Total domestic hot-water

LEN Number of LOADS SPACEs times N, where N is 6 if weather file was packed with 30-bit option and N is 4 if 60-bit option

AA(M+I) where M=(IHOUR-1)*(NSPACE*N); where IHOUR = hour, NSPACE = number of SPACEs and I is:

1 QS The sensible load in SPACE (Btu)
2 QL The latent gain in SPACE (Btu)
3 ZKW The total zone electrical load (Btu)
4 QP Plenum load from lights (Btu)
5 CFMINF The infiltration cfm
6 CONDUCHR The zone conductance less INTERIOR-WALLs

The above if for N=6 or 30-bit files. For 60-bit files only four words are used.

1 Sensible space load
2 Top 30 bits INT(ZKW) bottom 30 bits INT(QL)
3 Top 30 bits INT(CFMINF) bottom 30 bits INT(QP)
4 CONDUCHR

SYSOUT - This file contains one record for each day in the RUN-PERIOD. Each record contains the following:

HOTWATER(24),BUF(16,24,NPLANT)

HOTWATER The hot water load in Btus for each hour from LOADS

BUF For each hour for each of the NPLANT PLANT-ASSIGNMENTs

1 Total heating load
2 Total cooling load
3 Total electrical load (in kW)
4 Total gas load
5 Total oil load
6 128*HON + CON where HON = 0,1 if heating is off,on
CON = 0,1 if cooling is off,on
7 INT(DBT+128.1)*256 + INT(WBT+128.1)

8-16 For use by the Solar Simulator only
8 The main heating coil load
9 The air temperature entering main heating coil
10 Flow-rate in cfm through the main heating coil
11 Preheat coil load
12 OA flow-rate
13 Total zone coil heating load
14 Average zone coil entering temperature
15 Total zone coil flow-rate
16 Total baseboard heating energy

BUGS DISCOVERED IN DOE-2.1A AND INTERIM SOLUTIONS

CLASSIFIED INDEX

This index is intended to cross-reference bugs by 1) abort routine, 2) system-type affected (except those which affect all systems), 3) report affected, and 4) subject matter, command, and/or keyword.

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SUPPLY-CFM: 14
THERMO-CYCLE: 26
VENT-TEMP-SCH: 22
Weighting factors: 2

BDL

[1] The END command should be a legal command in PARAMETRIC-INPUT ECONOMICS, but BDL does not recognize it. An error message, ILLEGAL COMMAND IN PARAMETRIC RUN, is issued. Since it cannot find an END command, the program may keep reading end-of-files until it hits the job's time limit.

Interim solution: Insert all of ECONOMICS input with PARAMETERs changed.

[2] Weighting factors depend on LIGHTING-TYPE. However, if ASHRAE weighting factors are being used (through the use the keyword FLOOR-WEIGHT) in two SPACEs, and the second SPACE is LIKE'd to the first, with the exception of a different LIGHTING-TYPE, the program incorrectly uses the same set of weighting factors for both SPACEs.

Interim solution: Do not use LIKE for SPACEs for which you want different weighting factors.

[3] When a user LIKE's a command to another command which is not of the same type (an EXTERIOR-WALL LIKE'd to an INTERIOR-WALL, for example), the correct error message is printed out, followed by the extraneous message:

ERROR *** CANNOT LIKE SOMETHING TO ITSELF

Interim solution: Ignore the extra error message; correct the input and it will disappear.

[4] When one SPACE is LIKE'd to another, and the first SPACE uses SHAPE=BOX, two erroneous caution messages are printed for the second SPACE:

CAUTION --- IF SHAPE=BOX IS INPUT, VOLUME IS NOT USED
CAUTION --- IF SHAPE=BOX IS INPUT, AREA IS NOT USED

Interim solution: Ignore the two caution messages.

[5] Whenever SHAPE=BOX is input in the SPACE command, the keyword VOLUME is not used. However, the program always issues the following erroneous caution message:

CAUTION --- IF SHAPE=BOX IS INPUT, VOLUME IS NOT USED

Interim solution: Ignore the caution message.

LOADS

[6] 1) In the LV-C Report, the TASK LIGHTING KW and the W/SQFT are switched in position. 2) When the zone outside air specified is less than exhaust, the program increases the outside air rate for the zone to be equal to the exhaust rate. The SV-A report, however, still lists the specified outside air at the zone level. 3) In PV-D, the last eight characters of the utility name are incorrect.

Interim solution: None.

[7] If, in SPACE-CONDITIONS, the TEMPERATURE is set outside the range of 70 to 80°F, and if PEOPLE-HEAT-GAIN is specified, then the value calculated by the program for the latent load due to people will be negative.

Interim solution: Do not use PEOPLE-HEAT-GAIN under these conditions. Instead, specify both PEOPLE-HG-LAT and PEOPLE-HG-SENS.

[8] When SKY-FORM-FACTOR is specified, but GND-FORM-FACTOR is not, or vice versa, for quick walls, the unset form factor does not get reset. It remains at its flag value of -66666, resulting in strange loads.

Interim solution: For quick walls, input both SKY-FORM-FACTOR and GND-FORM-FACTOR, or neither, as the documentation indicates.

[9] If INTERIOR-WALLs are used in a SPACE NEXT-TO a SPACE with a MULTIPLIER, the heat exchange across that wall is not calculated correctly. The program currently will incorrectly place only one wall between the spaces rather than the MULTIPLIER number of walls.

Interim solution: None; define all spaces separately if INTERIOR-WALLs are important.

[10] When DESIGN-DAYs are input, the solar calculations are be based on the keywords CLOUD-TYPE, CLOUD-AMOUNT, and CLEARNESS. However, if the job is run with a packed weather file containing solar data (e.g., a TMY tape), the program ignores these keywords and their values and the DESIGN-DAYs receive zero solar data. The regular RUN-PERIOD reports are unaffected by this bug.

Interim solution: Run the DESIGN-DAY input deck with any packed weather file with no solar information on it (a TRY file, for instance). Then run the regular RUN-PERIOD input deck with the desired solar file.

SYSTEMS

[11] When a zone for which SIZING-OPTION=ADJUST-LOADS is specified and multiple internal walls exist attached to this zone, the program will sometimes terminate without performing the simulation or issuing any message.

Interim solution: None; remove the SIZING-OPTION keyword from the ZONE command.

[12] The program will abort in routine PTAC if, in a PTAC system, the following conditions occur simultaneously: MAX-ELEC-T is greater than the outside air drybulb temperature and the heat pump is running.

Interim solution: Use the default (40) or a sufficiently low value for MAX-ELEC-T.

[13] This is a minor or possibly severe bug, depending on compiler type. There is a typographical error in the code that always causes an incorrect calculation of the design cooling mixed air temperature. Depending upon the machine, the program may abort in routine DESIGN.

Interim solution: None.

[14] When SUPPLY-CFM has been specified and is being distributed in a variable air volume system, the heating and cooling flow rates are not always correct relative to the THERMOSTAT-TYPE and MIN-CFM-RATIOs.

Interim solution: Specify the zonal ASSIGNED-CFMs and let the program sum them into SUPPLY-CFM.

[15] 1) In a unit with HEAT-SOURCE=HEAT-PUMP, (RESYS or PTAC), the design calculations for the zone maximum heating addition rate do not correctly use MIN-HP-T and MAX-ELEC-T. 2) When HEATING-CAPACITY is specified in a central system with reheat coils, the sign of the reheat coil capacity is wrong.

Interim solutions: For 1), ignore the SV-A report's maximum heat addition. For 2), reverse the sign on the value given for the zonal heating capacity in SV-A.

[16] When a user specifies exhaust air for a zone in a system not allowing exhaust air, the program converts the exhaust air to an outside airflow. When this conversion is done, however, there is no check to see whether outside air has already been specified. Thus the exhaust overrides the outside air even if the former is smaller. This will be changed in DOE-2.1B to take the larger of the two.

Interim solution: Input outside air rather than exhaust.

[17] The SS-J report is accurate only for the systems in the first PLANT-ASSIGNMENT.

Interim solution: None.

[18] In the design calculations for zonal heating capacities, the fan heat is incorrectly subtracted rather than added. This causes slight oversizing equal to twice the fan heat.

Interim solution: None; reduce fan heat to minimum.

[19] If a system is sized based upon the cooling peak load or upon MAX-COOL-RATE, the heat addition rate reported in the SV-A Report should be calculated based upon the fan size. At present, the SV-A reports instead the peak heating load or MAX-HEAT-RATE. A similar problem exists when the sizing is based upon the peak heating load.

Interim solution: None; insignificant bug, ignore this figure.

[20] When using DUCT-DELTA-T in a RESYS system, the value is added to the MAX-SUPPLY-T rather than subtracted from it, so the answer moves in the wrong direction.

Interim solution: None; do not use DUCT-DELTA-T in a RESYS system.

[21] In the zonal systems, HP and PTAC, the electrical input to heating and cooling (DX heating and cooling only) is calculated incorrectly when the heating and/or cooling capacity is specified but the CFM is not. This usually results in a small error, but can result in a very large error; the error is proportional to the ratio of specified capacity and the capacity the program would use if automatic sizing were allowed. In the case of the larger error, this can result in negative electrical input to heating and/or cooling.

Interim solution: Specify the CFM when specifying the capacity.

[22] These are two interrelated bugs in the RESYS system: 1) If VENT-TEMP-SCH is not specified, it should default to the top of the heating throttling range. Thus, ventilation should occur, if the outside temperature is below the cooling setpoint, until the temperature drops into the heating throttling range. The bug does not permit ventilation unless the zone temperature would rise into the cooling throttling range without the ventilation. 2) If VENT-TEMP-SCH is set equal to the COOL-TEMP-SCH, an ambiguous temperature band is created between the VENT-TEMP-SCH and the bottom of the cooling throttling range. Natural ventilation will not occur until the zone temperature reaches the cooling setpoint, while mechanical cooling will begin at one-half the throttling range below this temperature. In the simulation this anomaly shows up as a small but erroneous heating effect.

Interim solutions: For 1), specify VENT-TEMP-SCH. For 2), set VENT-TEMP-SCH to be less than COOL-TEMP-SCH - one-half the throttling range.

[23] When the load on a PTAC or HP system is low and no outside air has been specified, sometimes a negative fan electrical will be reported. This will cause the peak fan electrical to be significantly off in most cases. Other numbers are not usually significantly affected.

Interim solution: None.

[24] When the HEAT-SOURCE=HEAT-PUMP option is used in the PTAC system, the auxilary electric heat capacity (ELEC-HEAT-CAP) is not automatically sized. Thus, the total electric input to heating can be drastically underestimated and the zones will have many hours underheated.

Interim solution: Specify ELEC-HEAT-CAP.

PLANT

[25] In the ENERGY-COST command, the keywords BLOCK and MULTIPLIER are alternate ways of specifying load blocks in which energy will be priced differently. The bug is that BLOCK is treated like MULTIPLIER and MULTIPLIER is treated like BLOCK.

Interim solution: Use BLOCK when you want MULTIPLIER and vice versa.

[26] When the THERMO-CYCLE option is used with the DIRECT-COOL-MODE keyword but no centrifugal chiller is specified, as required, multiple error messages reading

ERROR **** THERMOCYCLE REQUIRES AT LEAST ONE COMPRESSION CHILLER.

are printed, but the program does not stop in BDL as it should.

Interim solution: Correct input.

THE HEAT EXCHANGER

This section is devoted to common questions from users and responses from the DOE-2 User Coordination Office. Your questions and comments are most welcome.

* * * * *

Question: We have put the IBM version of DOE-2.1 up on our computer and cannot get the PARAMETRIC-INPUT command to operate. Do you know what our problem is?

Answer: I can only guess, but it may be due to the following. When BDL encounters the PARAMETRIC-INPUT command, it looks for a file called INCOPY. This file should contain a copy of your entire input deck. At LBL we create this file automatically just before calling the BDL program. If your job control stream fails to create INCOPY and you are using the PARAMETRIC-INPUT command, the program will abort.

* * * * *

Question: I have a building that I am running on DOE-2.1A which has a dual duct, constant volume, system (DDS). Using the HEAT-TEMP-SCH and the COOL-TEMP-SCH keywords in the ZONE-CONTROL command, I have established a daytime heating set-point at 68°F and the daytime cooling set-point to be 75°F in all the zones. In the SS-F report for one of the zones (which is admittedly not adequately conditioned!) the minimum temperature for the zone is 83°F and the maximum temperature is 95°F and the report shows many hours undercooled. The BEPS report in PLANT, however, says that the percent of hours any system zone outside of the throttling range is 0.0. How do you explain this?

Answer: In the configuration as you describe it the COOL-TEMP-SCH is not used. In DOE-2.1A the COOL-TEMP-SCH and its associated throttling range establish the temperature band for controlling the variable volume boxes and the cooling coil temperature. Since you have constant volume and, I presume, have let COOL-CONTROL default to CONSTANT, there is nothing for COOL-TEMP-SCH to control. The SS-F report, nevertheless and probably inappropriately, uses COOL-TEMP-SCH to determine whether the zone is undercooled. The BEPS report, on the other hand, knows that only HEAT-TEMP-SCH matters and reports that no zoned was ever underheated.

* * * * *

The DOE-2 User Coordination Office encourages user response to this section. Please send questions and comments to:

The Heat Exchanger
DOE-2 User Coordination Office
Building 90, Room 3147
Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

Information Sheet and Order Form:

DOE-2 Building Energy Use Analysis Program

Version 2.1A

The following may be ordered by telephone, (703) 487-4650 or FTS 737-4650, or by mail. The current costs may be obtained by writing or calling NTIS. Please refer to the PB order numbers when ordering by telephone.

_____ copies CDC DOE-2.1A Program Tapes PB82-141458†

_____ copies IBM DOE-2.1A Update Tapes PB82-141466†

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† There is no update tape for the CDC. A new DOE-2.1A Program Tape has been prepared for CDC purchasers. Current owners of the IBM DOE-2.1 tape need only order the update tape.

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