SYSTEMS SUMMARY

INPUT SYSTEMS Required for Systems input

TITLE(5)
See LOADS

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

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

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

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

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

= **ZONE-CONTROL**(Z-C,50)
- **DESIGN-HEAT-T**(D-H-T)(—;0.0 to 80°F) *
  HEAT-TEMP-SCH(H-T-SCH) u-name **
- **DESIGN-COOL-T**(D-C-T)(—;0.0 to 90°F) *
  COOL-TEMP-SCH(C-T-SCH) u-name **
  BASEBOARD-CTRL(B-C)(**OUTDOOR-RESET**;OUTDOOR-RESET, THERMOSTATIC)
  THERMOSTAT-TYPE(T-TYPE)(**PROPORTIONAL**;PROPORTIONAL, REVERSE-ACTION,TWO-POSITION)
  THROTTLING-RANGE(T-R)(***;0.1 to 10.0°F)

* Required but not used in simulation of SUM system.

** If omitted, no heating or cooling, respectively, in zone.

*** Default is 2.0 if THERMOSTAT-TYPE = PROPORTIONAL or REVERSE-ACTION,
0.5 if TWO-POSITION.

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

ASSIGNED-CFM(A-CFM)(—;0.0 to 99999999.0 cfm)
or
CFM/SQFT(—;0.0 to 5.0 cfm/ft^2)
or
AIR-CHANGES/HR(A-C/HR)(—;0.0 to 10.0/hr)

OUTSIDE-AIR-CFM(O-A-CFM)(—;0.0 to 99999999.0 cfm)
or
OA-CFM/PER(O-CFM/P)(—;0.0 to 60.0 cfm/person)
or
OA-CHANGES(O-C)(—;0.0 to 10.0/hr)

EXHAUST-CFM(E-CFM)(—;0.0 to 99999999.0 cfm)
EXHAUST-STATIC(E-S)(—;0.0 to 10.0 in of WG)
EXHAUST-EFF(E-E)(**0.75**;0.1 to 1.0)
EXHAUST-KW(E-KW)(—;0.0 to 0.01)

= **ZONE**(Z,128)

ZONE-CONTROL(Z-C) u-name §
ZONE-AIR(Z-A) u-name §
MIN-CFM-RATIO(M-C-R)(—;0.0 to 1.0)
MIN-CFM-SCH(M-C-SCH) u-name
TERMINAL-TYPE(TER-TYPE)(**SVAV**;SVAV,SERIES-PIU,PARALLEL-PIU)*
INDUCED-AIR-ZONE(I-A-Z) u-name of ZONE*
REHEAT-DELTA-T(R-D-T)(—;0.0 to 100.0)*
BASEBOARD-RATING(B-R)(**0.0**;-99999999.0 to 0.0)

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

or

- ZONE-FAN-CFM(Z-F-CFM)(**;0.0 to 99999999.0 ft^3/min) ***
- ZONE-FAN-T-SCH(Z-F-SCH) u-name [Required if TERMINAL-TYPE = PARALLEL-PIU.] ***

ZONE-FAN-KW(Z-F-KW)(0.00033;0.0 to 0.01 kW/cfm) ***

* Used only for PIU system; I-A-Z required if TERMINAL-TYPE ≠ SVAV

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

*** This keyword appears under the ZONE-FANS command in the (unabridged) *BDL Summary (2.1E)*.

§ Any keyword from these subcommands may be placed in the **ZONE** command

= **SYSTEM-CONTROL**(S-C,50)

MAX-SUPPLY-T(MAX-S-T)(—;50.0 to 200.0°F)
MIN-SUPPLY-T(MIN-S-T)(—;45.0 to 70.0°F)
COOL-CONTROL(C-C)(**CONSTANT**;CONSTANT,WARMEST,
RESET,SCHEDULED)
ECONO-LIMIT-T(E-L-T)(—;45.0 to 80.0°F)
BASEBOARD-SCH(B-SCH) u-name
HEATING-SCHEDULE(H-SCH) u-name
COOLING-SCHEDULE(C-SCH) u-name
HEAT-CONTROL(H-C)(**CONSTANT**;CONSTANT,COLDEST,RESET,SCHEDULED)
HEAT-SET-T(H-S-T)(—;50.0 to 200.0°F)
HEAT-RESET-SCH(H-R-SCH) u-name of RESET-SCHEDULE
HEAT-SET-SCH(H-S-SCH) u-name
COOL-RESET-SCH(C-R-SCH) u-name of RESET-SCHEDULE
COOL-SET-SCH(C-S-SCH) u-name
MAX-HUMIDITY(MAX-H)(**100.0**;30.0 to 80.0%)
MIN-HUMIDITY(MIN-H)(**0.0**;0.0 to 70.0%)
PREHEAT-T(P-T)(**45.0**;-50.0 to 70.0°F)

= **SYSTEM-AIR**(S-A,50)

OA-CONTROL(O-CTRL)(**TEMP**;TEMP,FIXED,ENTHALPY)
SUPPLY-CFM(S-CFM)(*;10.0 to 9999999.0 cfm) [* Calculated from ZONE-AIR input and zone loads.]
MIN-OUTSIDE-AIR(M-O-A)(*;0.0 to 1.0) [* Calculated from ZONE-AIR input and zone loads.]
MIN-AIR-SCH(M-A-SCH) u-name
RECOVERY-EFF(REC-E)(**0.0**;0.2 to 0.8 Btu/Btu)
NATURAL-VENT-AC(N-V-A)(—;0.0 to 100.0 air changes/hr)**
NATURAL-VENT-SCH(N-V-SCH) u-name**
VENT-TEMP-SCH(V-T-SCH) u-name**

** Used only for SYSTEM-TYPE = RESYS.

= **SYSTEM-FANS**(S-FANS,50)

FAN-SCHEDULE(F-SCH) u-name
FAN-CONTROL(F-C)(—;CONSTANT-VOLUME,SPEED,INLET,DISCHARGE,CYCLING,
TWO-SPEED,FAN-EIR-FPLR)

SUPPLY-DELTA-T(SUP-D-T)(—;0.0 to 30.0°F)
and
SUPPLY-KW(S-KW)(—;0.0 to 0.0 kW/cfm)

RETURN-DELTA-T(RET-D-T)(—;0.0 to 30.0°F)
and
RETURN-KW(R-KW)(—;0.0 to 0.01 kW/cfm)

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

= **SYSTEM**(SYST,100)
SYSTEM-CONTROL(S-C)§
SYSTEM-AIR(S-A)§
SYSTEM-FANS(S-FANS)§
SYSTEM-FLUID(S-FLU)§
• **SYSTEM-TYPE**(S-TYPE)(—)
• **ZONE-NAMES**(Z-N) (list of zones in system,including plenum and unconditioned zones)
HEAT-SOURCE(HEAT-S)(—;HOT-WATER,ELECTRIC
FURNACE,OIL-FURNACE,HEAT-PUMP)
ZONE-HEAT-SOURCE(Z-H-S)(—;HOT-WATER,ELECTRIC
FURNACE,OIL-FURNACE)
PREHEAT-SOURCE(PREHEAT)(—;HOT-WATER,ELECTRIC
FURNACE,OIL-FURNACE)
BASEBOARD-SOURCE(BASEB-S)(—;HOT-WATER,ELECTRIC
FURNACE,OIL-FURNACE)
HUMIDIFIER-TYPE(H-TYPE)(—;HOT-WATER,ELECTRIC,FURNACE,
OIL-FURNACE)
SIZING-RATIO(S-R)(**1.0**;0.1 to 2.0)
REHEAT-DELTA-T(R-D-T)(—;0.0 to 100.0°F)*
MIN-CFM-RATIO(M-C-R)(—;0.0 to 10.0)*
HEATING-CAPACITY(H-CAP)(—;-99999999.0 to 0.0 Btu/hr)**
MAX-COND-RCVRY(M-C-R)(—;0.0 to 1.0)**

* This keyword appears under the SYSTEM-TERMINAL command in the (unabridged) BDL Summary (2.1E).

** This keyword appears under the SYSTEM-EQUIPMENT command in the (unabridged) *BDL Summary (2.1E)*.

§ Any keyword from these subcommands may be placed in the ZONE command

= PLANT-ASSIGNMENT(P-A,4)†
SYSTEM-NAMES(S-N) (list of system names in this plant)
INT-FUEL-BTU/HR(I-F-BTU) (**0.0**;0.0 to 10,000,000 Btu/hr)
INT-FUEL-SCH(I-F-SCH) (u-name)
EXT-FUEL-BTU/HR(E-F-BTU) (**0.0**;0.0 to 10,000,000 Btu/hr)
EXT-FUEL-SCH(E-F-SCH) (u-name)
INT-ELEC-KW(I-E-K) (**0.0**;0.0 to 1000 kW)
INT-ELEC-SCH(I-E-SCH) (u-name)
EXT-ELEC-KW(E-E-K) (**0.0**;0.0 to 1000 kW)
EXT-ELEC-SCH(E-E-SCH) = (u-name)
DHW-GAL/MIN (DHW-GPM)(**0.0**; 0.0 to 10,000 gal/min)
DHW-SCH (u-name)
DHW-SUPPLY-T (**140.0**; 70.0 to 200.0 F)
DHW-INLET-T-SCH (u-name)[defaults to ground temperatures from weather file]
PROCESS-HW-BTU/HR(HW-BTU) (**0.0**;0.0 to 10,000,000 Btu/hr)
PROCESS-HW-SCH(HW-SCH) (u-name)
PROCESS-CHW-BTU/HR(CHW-BTU) (**0.0**;0.0 to 10,000,000 Btu/hr)
PROCESS-CHW-SCH (u-name)

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

SYSTEMS–REPORT(S–R,1) **The total number of reports generated may not exceed 200.**
SUMMARY(S)((**SS–A**);SS–A,SS–B,...,SS–O)

END
Required at end of Systems input

COMPUTE SYSTEMS
Required to do Systems simulation

PLANT SUMMARY

INPUT PLANT Required for Plant input

TITLE(5)
See LOADS

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

- **TYPE**(—;†)
  SIZE(0.0;–1000.0 to 100.0 MBtu/hr)
  INSTALLED–NUMBER(I–N)(1;1 to 10) (all integers)
  Note: For a cooling tower, INSTALLED–NUMBER is the number of cells.

[Note: At least one PLANT–EQUIPMENT command is required; TYPE must be the first keyword listed]

† Allowed TYPE code-words are:

ABSORG–CHLR	ELEC–HW–BOILER
ABSOR1–CHLR	ELEC–STM–BOILER
ABSOR2–CHLR	ENG–CHLR
COOLING–TWR	HERM–CENT–CHLR
DBUN–CHLR	HERM–REC–CHLR
DHW–HEATER	HW–BOILER
ELEC–DHW–HEATER	STM–BOILER

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

- TYPE(—;*) [* Takes same code-words as TYPE in PLANT–EQUIPMENT.]
  ELEC–INPUT–RATIO(E–I–R)(‡;0.0 to 10.0) ‡

‡ See *Reference Manual (2.1A)*, Chap.V, Table V.4 for default values.

For

DIESEL–GEN
GTURB–GEN
STURB–GEN
ABSORG–CHLR
ENG–CHLR

see the table below for revised default values.

Revised Default Values for PART–LOAD–RATIO

Plant–Equipment	MIN	MAX	OPT
DIESEL–GEN	0.15	1.1	0.95
GTURB–GEN	0.30	1.1	1.0
STURB–GEN	0.10	1.1	1.0

u-name = PLANT-ASSIGNMENT(P-A,1)

[Note: u-name must be the u-name of the PLANT-ASSIGNMENT in SYSTEMS;
if PLANT-ASSIGNMENT is defined in SYSTEMS, then it must be defined in PLANT also.]

PLANT-PARAMETERS(P-P,1)

Boilers:
- STM-BOILER-HIR(**1.3**;0.0 to 3.0)
- HW-BOILER-HIR(**1.25**;0.0 to 3.0)

Domestic Hot Water Heaters:
- DHW-HIR(**1.39**;0.0 to 3.0)

Chillers:
- **HERM-CENT-COND-TYPE(TOWER**;TOWER,AIR)
- **HERM-REC-COND-TYPE(TOWER**;TOWER,AIR)
- ABSOR1-HIR(**1.6**;0.0 to 3.0)
- ABSOR2-HIR(**1.0**;0.0 to 3.0)
- ABSORG-HIR(**1.0**; 0.0 to 3.0)
- ABSORG-HEAT-XEFF(**0.8**; 0.1 to 1.0)
- ENG-CH-COP(**1.4**; 0.1 to 3.0)
- ENG-CH-COND-TYPE(**TOWER**;TOWER,AIR)
- **DBUN-COND-T-REC(105.0**;80.0 to 120.0°F)
- MIN-COND-AIR-T(**65.0**;0.0 to 100.0°F)
- CHILL-WTR-T(**44.0**;32.0 to 80.0°F)

Towers:
- TWR-CAP-CTRL(**ONE-SPEED-FAN**;ONE-SPEED-FAN, **FLUID-BYPASS**, TWO-SPEED-FAN VARIABLE-SPEED-FAN)
- TWR-SETPT-CTRL(**FIXED**;FIXED,WETBULB-RESET)
- TWR-SETPT-T(**80.0**; 32.0 to 100.0F)
- MIN-TWR-WTR-T(**65.0**;32.0 to 100.0°F)
- TWR-PUMP-HEAD(**60.0**;0.0 to 100.0 ft)
- **TWR-DESIGN-WETBULB(75.0**;32.0 to 100.0°F)

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

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

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

ENERGY-RESOURCE(E-R,7)
- RESOURCE(R)(—;ELECTRICITY,DIESEL-OIL,NATURAL-GAS, FUEL-OIL, STEAM,CHILLED-WATER,LPG,COAL,METHANOL)

SOURCE-SITE-EFF(S-S-E)(†;0.0 to 1.0) [† See *Supplement (2.1E)* for default values.]

Default Values for ENERGY-RESOURCE

RESOURCE	SOURCE-SITE-EFF
CHILLED-WATER	1.5*
COAL	1.0
DIESEL-OIL	1.0
ELECTRICITY	0.333***
FUEL-OIL	1.0
LPG	1.0
METHANOL	1.0
NATURAL-GAS	1.0
STEAM	0.60**

* Efficient electrically-driven chillers in a central chilled-water plant.

** Steam produced by heat-only boiler in a central steam generation plant.

*** California Energy Commission conversion factor for electricity: 10,239 Btu/kWh.

PLANT-REPORT(P-R,1)
SUMMARY(S)((**PS-A,PS-B,PS-D**);PS-A,PS-B,PS-C,PS-D,PS-G,BEPS

END
Required at end of Plant input

COMPUTE PLANT
Required to do Plant simulation

ECONOMICS SUMMARY

INPUT ECONOMICS
Required for Economics input

TITLE
See LOADS

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

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

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

= **UTILITY-RATE**(U-R)(15)
• **RESOURCE**(R)(—;ELECTRICITY,DIESEL-OIL,NATURAL-GAS,FUEL-OIL,
STEAM,CHILLED-WATER,LPG,COAL,METHANOL,OTHER-FUEL,
and for cogeneration ELEC-BUY/SELL,ELEC-NET-SALE)
MONTH-CHGS(M-CHG)(**0.0**;0.0 to $100,000/month) list of 1 to 12 values.
ENERGY-CHG(E-CHG)(**0.0**;0.0 to $100,000,000/unit)
ENERGY-CHG-SCH(E-SCH) (u-name)
DEMAND-CHGS(D-CHG)(**0.0**;0.0 to $100,000,000/unit-hr) list of 1 to 12 values
BLOCK-CHARGE(B-C)(-;list of up to ten u-names of BLOCK-CHARGEs)
MIN-MON-CHGS(M-M-CHG)(**0.0**;0.0 to $1,000,000,000/month) list of 1 to 12 values
MIN-MON-DEM-CHGS(M-D-CHG)(**0.0**;0.0 to $1,000/month) list of 1 to 12 values
RATE-LIMITATION(R-LIM)(**0.0**;0.0 to $100,000,000/UNIT)
LIKE (-;accepts u-name of another UTILITY-RATE)
BILLING-DAYS(B-D)(**31 or last day of month**;list of 12 days, one for each month; 1 to 31)

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

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

END

Required at end of Economics input

COMPUTE ECONOMICS

Required for Economics simulation

STOP

Use only if want BDL and simulation to stop here