Powered Induction Unit (PIU)

The basic PIU consists of a central air-handling unit with filter (not shown), cooling and optional heating coils, and a draw-through type supply air fan. A return air fan is also usually used. Exhaust fans are optional for any or all zones.

The powered induction boxes are available in two configurations: *series* and *parallel*.

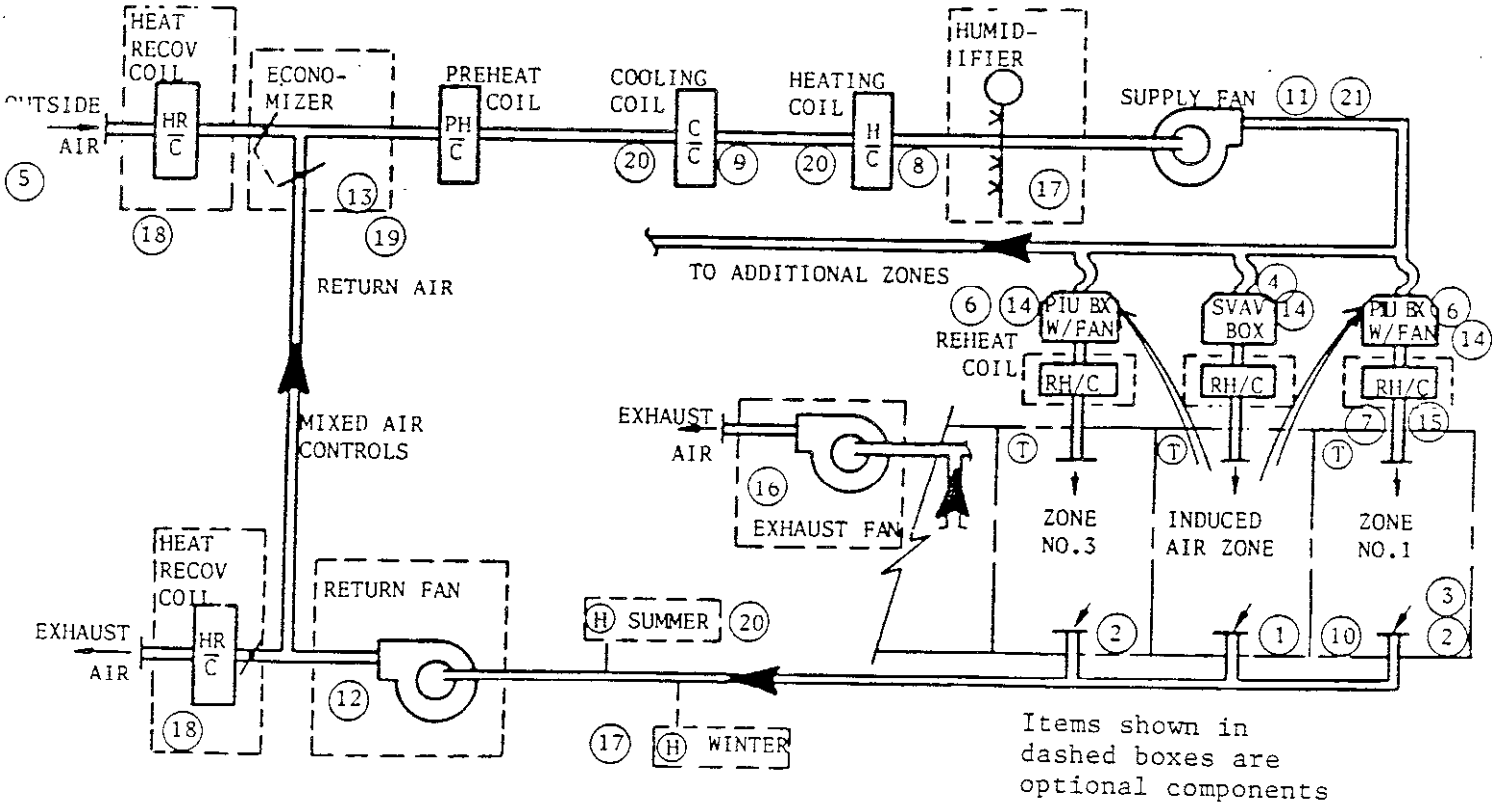

Figure 4.10: Powered Induction Unit System with Optional Reheat

Following is suggested minimal input for PIU system with economizer is shown for *series* type units configured like the sketch below. There must be more than one zone.

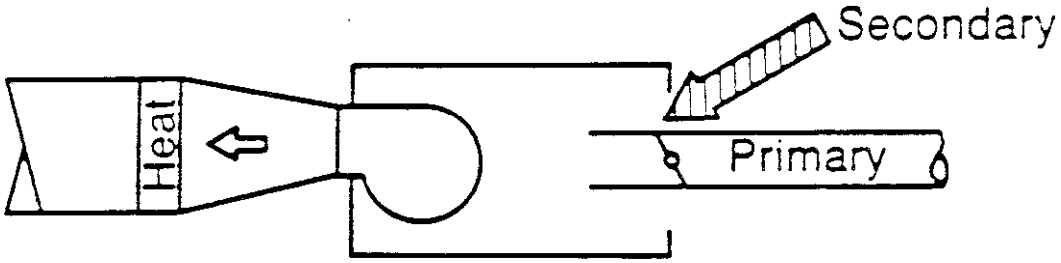

Figure 4.11: Series PIU

```
INPUT SYSTEMS ..

SYSTEMS-REPORT  SUMMARY=(SS-A,SS-O) ..

                        $ SYSTEMS SCHEDULES

FANS-ON =  SCHEDULE THRU DEC 31     (WD)    (1,7)(0) (8,18)(1)
                                            (19,24)(0)
                                    (WEH)   (1,24)(0) ..

COOLSETPT = SCHEDULE THRU DEC 31    (WD)    (1,7)(99) (8,18)(76)
                                            (19,24)(99)
                                    (WEH)   (1,24)(99) ..

HEATSETPT = SCHEDULE THRU DEC 31    (WD)    (1,7)(55) (8,18)(72)
                                            (19,24)(55)
                                    (WEH)   (1,24)(55) ..

CORE = ZONE         DESIGN-HEAT-T   =   72
   (1)              DESIGN-COOL-T   =   74
                    HEAT-TEMP-SCH   =   HEATSETPT (3)
                    COOL-TEMP-SCH   =   COOLSETPT (3)
                    TERMINAL-TYPE   =   SVAV (4)
                    CFM/SQFT        =   .7
                    OA-CFM/PER      =   15 .. (5)
OFFICE = ZONE       LIKE CORE
   (2)              TERMINAL-TYPE   =   SERIES-PIU
                    ZONE-FAN-RATIO  =   1 (6)
                    ZONE-FAN-KW     =   .00033 (6)
                    INDUCED-AIR-ZONE =  CORE (1)
                    REHEAT-DELTA-T  =   55 .. (15)
```

Following is suggested minimal input for *parallel* type PIU units like the sketch below:

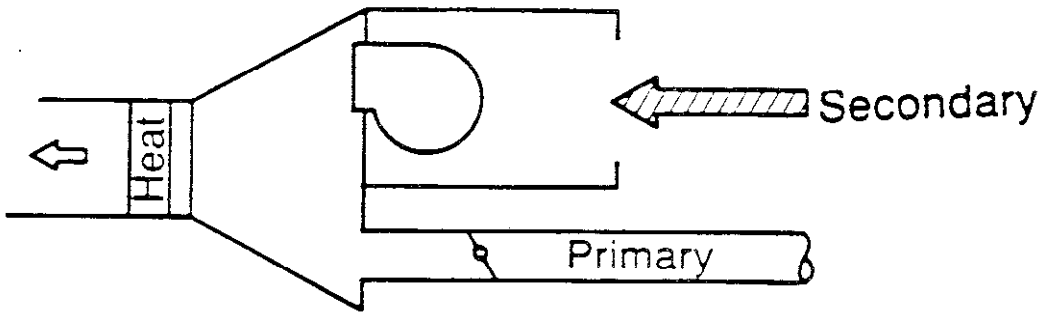

Figure 4.12: Parallel PIU

```
INPUT SYSTEMS ..

SYSTEMS-REPORT  SUMMARY=(SS-A,SS-O) ..

                        $ SYSTEMS SCHEDULES

FANS-ON =  SCHEDULE THRU DEC 31      (WD)    (1,7)(0) (8,18)(1)
                                             (19,24)(0)
                                     (WEH)   (1,24)(0) ..

COOLSETPT = SCHEDULE THRU DEC 31     (WD)    (1,7)(99) (8,18)(76)
                                             (19,24)(99)
                                     (WEH)   (1,24)(99) ..

HEATSETPT = SCHEDULE THRU DEC 31     (WD)    (1,7)(55) (8,18)(72)
                                             (19,24)(55)
                                     (WEH)   (1,24)(55) ..


START-Z=FAN = SCHEDULE THRU DEC 31   (WD) (1,7) (55) (8,18) (73) (19,24) (55)
                                     (WEH) (1,24) (55) ..


CORE = ZONE                DESIGN-HEAT-T     =   72
  (1)                      DESIGN-COOL-T     =   74
                           HEAT-TEMP-SCH     =   HEATSETPT (3)
                           COOL-TEMP-SCH     =   COOLSETPT (3)
                           TERMINAL-TYPE     =   SVAV (4)
                           OA-CFM/PER        =   15 .. (5)
```

```
OFFICE = ZONE          LIKE CORE
  (2)                  TERMINAL-TYPE          =   PARALLEL-PIU
                       ZONE-FAN-RATIO         =   .8 (6)
                       ZONE-FAN-KW            =   .00033 (6)
                       ZONE-FAN-T-SCH         =   START-Z-FAN (3)
                       INDUCED-AIR-ZONE       =   CORE (1)
                       REHEAT-DELTA-T         =   55 ..  (15)

AC-SYST = SYSTEM       SYSTEM-TYPE            =   PIU
                       MAX-SUPPLY-T           =   110 (7)
                       HEAT-SET-T             =   70 (8)
                       MIN-SUPPLY-T           =   55 (9)
                       NIGHT-CYCLE-CTRL       =   ZONE-FANS-ONLY (10)
                       FAN-SCHEDULE           =   FANS-ON (11)
                       RETURN-STATIC          =   1.0 (12)
                       RETURN-EFF             =   .55 (12)
                       OA-CONTROL             =   TEMP (13)
                       ECONO-LIMIT-T          =   68 (13)
                       MIN-CFM-RATIO          =   .3 (4)
                       ZONE-NAMES             =   (OFFICE) .. (2)

END ..
COMPUTE SYSTEMS ..
INPUT PLANT ..
PLANT-REPORT SUMMARY = (BEPS) ..

SHW = PLANT-EQUIPMENT   TYPE = DHW-HEATER       SIZE = -999 ..
HWG = PLANT-EQUIPMENT   TYPE = HW-BOILER        SIZE = -999 ..
CHR = PLANT-EQUIPMENT   TYPE = HERM-REC-CHLR    SIZE = -999 ..

PLANT-PARAMETERS   BOILER-FUEL = NATURAL-GAS
                   HERM-REC-COND-TYPE = AIR ..

END ..
COMPUTE PLANT ..
```

Additional capabilities for this system:

1) To enable an exhaust fan add the keywords EXHAUST-CFM = Value (CFM) and EXHAUST-KW = Value (.0001 is typical) to the ZONE keyword list. (16)

2) To enable a humidifier which requires heat to evaporate water into the air add MIN-HUMIDITY = Value (25% is typical) to the SYSTEM keyword list. (17)

3) To enable heat recovery to exchange relief air heat with outside air heat add RECOVERY-EFF = Value (0.6 is typical) to the SYSTEM keyword list. (18)

4) To disable the economizer change OA-CONTROL = TEMP to OA-CONTROL = FIXED. (19)

5) To reset the supply air as a function of outside air temperature see an example of this control in the *Sample Run Book (2.1E)*, 31-Story Office Building, Run 1.

6) To enable control of maximum humidity whenever the supply air temperature is reset, insert MAXIMUM-HUMIDITY = Value (60% is allowed in the new ASHRAE 90.1P Standard) in the SYSTEM keyword list. (20)

7) Simulating baseboard heat in lieu of or in addition to reheat coils is demonstrated in the *Sample Run Book (2.1E)*, 31-Story Office Building, Runs 2 and 3.

8) To enable variable speed control of the fan motor, insert FAN-CONTROL = SPEED in the SYSTEM keyword list. (21)