Replacing Defective Feedwater Heaters With Spares From A Steam To Combined Cycle Repowering

Michael J. Barrios, P.E.

Florida Power & Light Company

REPLACING DEFECTIVE FEEDWATER HEATERS WITH

SPARES FROM A STEAM TO COMBINED CYCLE REPOWERING

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The Fort Lauderdale Plant is scheduled to be repowered to a combined cycle unit starting in the Fall of 1992. The existing unit is a gas/oil-fired 137 MW, 1450 psig reheat unit with a Westinghouse turbine and a Babcox & Wilcox (B & W) boiler. The unit became commercial in 1957. The existing unit has six feedwater heaters, two high pressure and four low pressure. The repowered unit will use the existing steam turbine and the two LP neck feedwater heaters. Attachment 1 is a heat balance of the existing unit and Attachment 2 is a heat balance of the repowered unit. The number 6 feedwater heater or 13th stage heater on Unit 4 was replaced in 1978. FPL has plans to use this heater to replace an out-of-service feedwater heater at the Cutler Plant Unit 5 (PCU5).

The Cutler Unit 5 is a 67 MW gas-fired 1350 psig non-reheat unit with a Westinghouse turbine and a Combustion Engineering (CE) boiler. The unit became commercial in 1954. A heat balance for the Cutler 5 unit can be seen in Attachment 3. The number 5 feedwater heater or 11th stage heater has been bypassed and removed from service due to excessive plugging and a high failure rate.

A PEPSE study was performed to determine how the Fort Lauderdale Unit 4 (PFL4), number 5 feedwater heater would perform on the Cutler unit. The Engineering Department determined that PFL4 heater physically would fit on the PCU5 unit.

The first step in the study was to build a feedwater heater submodel to match the feedwater manufacturer's design specification sheet. A simplified feedwater heater design model was build for the heater. The heat transfer coefficient (u) of the sections and the baffle spacings were varied to meet the design conditions for the heater. This was necessary since there were no drawings of the heater's internal configuration. The feedwater outlet and the drain outlet pressure and temperature were used to validate the model against the manufacturer's specification sheet. The PFL4 acceptance data also was entered into the feedwater heater submodel for further validation. The model's results using the acceptance test data did not agree as closely as the data from the manufacturer's specification sheet, but at acceptance the unit had a different heater. The feedwater heater outlets were within 1°F of the acceptance data so we felt that the submodel was an accurate model of the existing feedwater heater.

The next step was to build the turbine cycle model for the Cutler 5 unit. This unit is a peaking unit that only operates during periods of high demand. The PEPSE turbine cycle model was built and verified against the unit's VWO heat balance. The number 5 feedwater heater was modeled in the performance mode to match the VWO heat balance. The simplified design mode submodel was incorporated into the turbine cycle model to perform the sensitivity studies. The inlet drain of the submodel had to be eliminated since this heater would be the last heater in the train at PCU5.

There were four operating scenarios that FPL wanted to analyze. They were (1) Installing the heater with no modification to the feedwater heater, (2) Plugging tubes to match the feedwater design tube velocity, (3) Throttling extraction flow to match original heat balance generation, and (4) Installing a flow restricting orifice in the extraction line to maintain the original extraction flow.

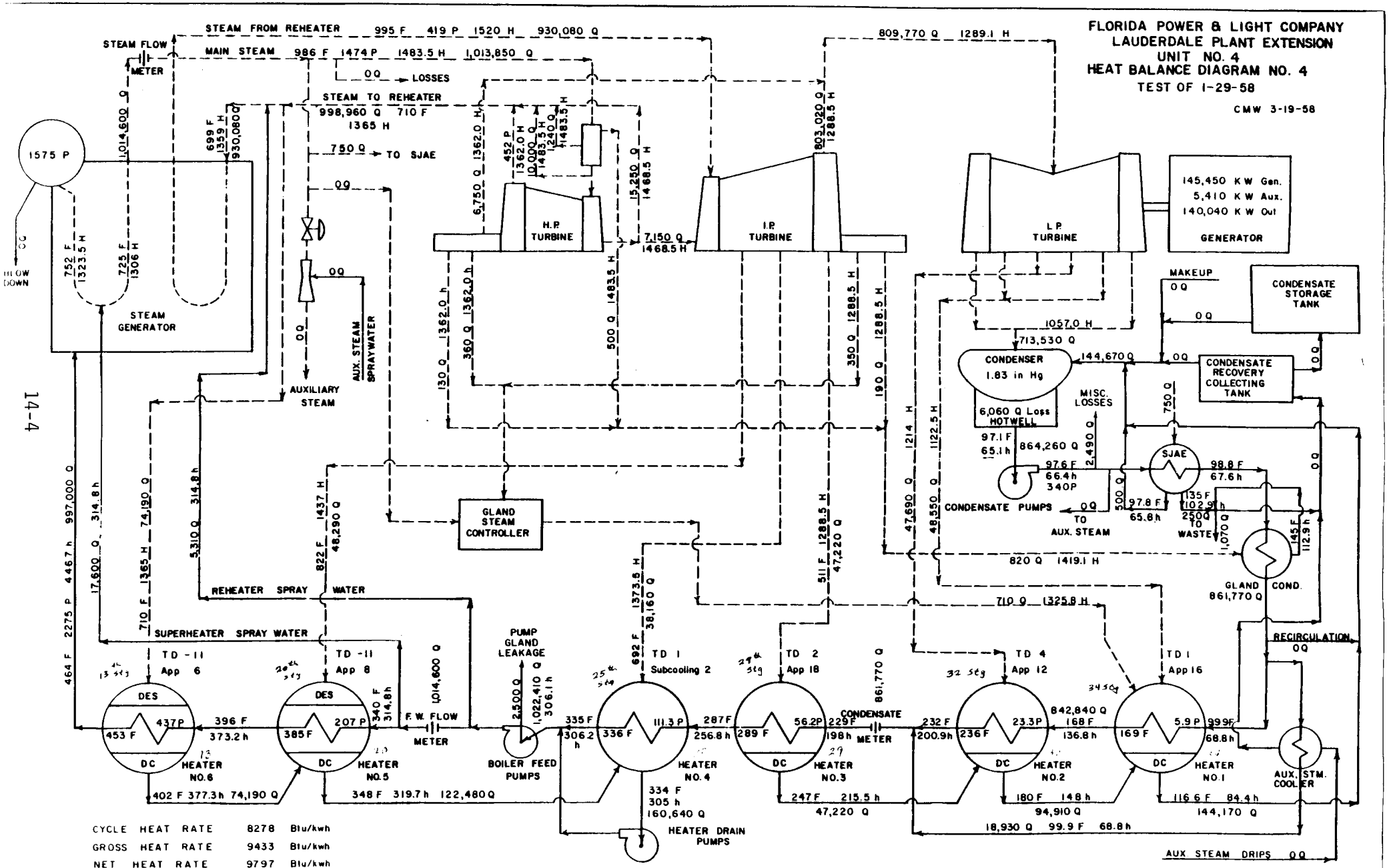
Table 1 is a summary of the first three scenarios. The flow restricting orifice was ruled out because the critical orifice ID would have been 1.6 inches and we did not

want to risk plugging the throat during long reserve shutdown periods. The extraction pipe is six inch schedule 40.

In conclusion, we determined that throttling the extraction flow to regain lost generation would be the best operating mode. The Cutler Plant will save about $300,000 by using the feedwater heater from the Fort Lauderdale Unit 4 instead of purchasing a new heater.

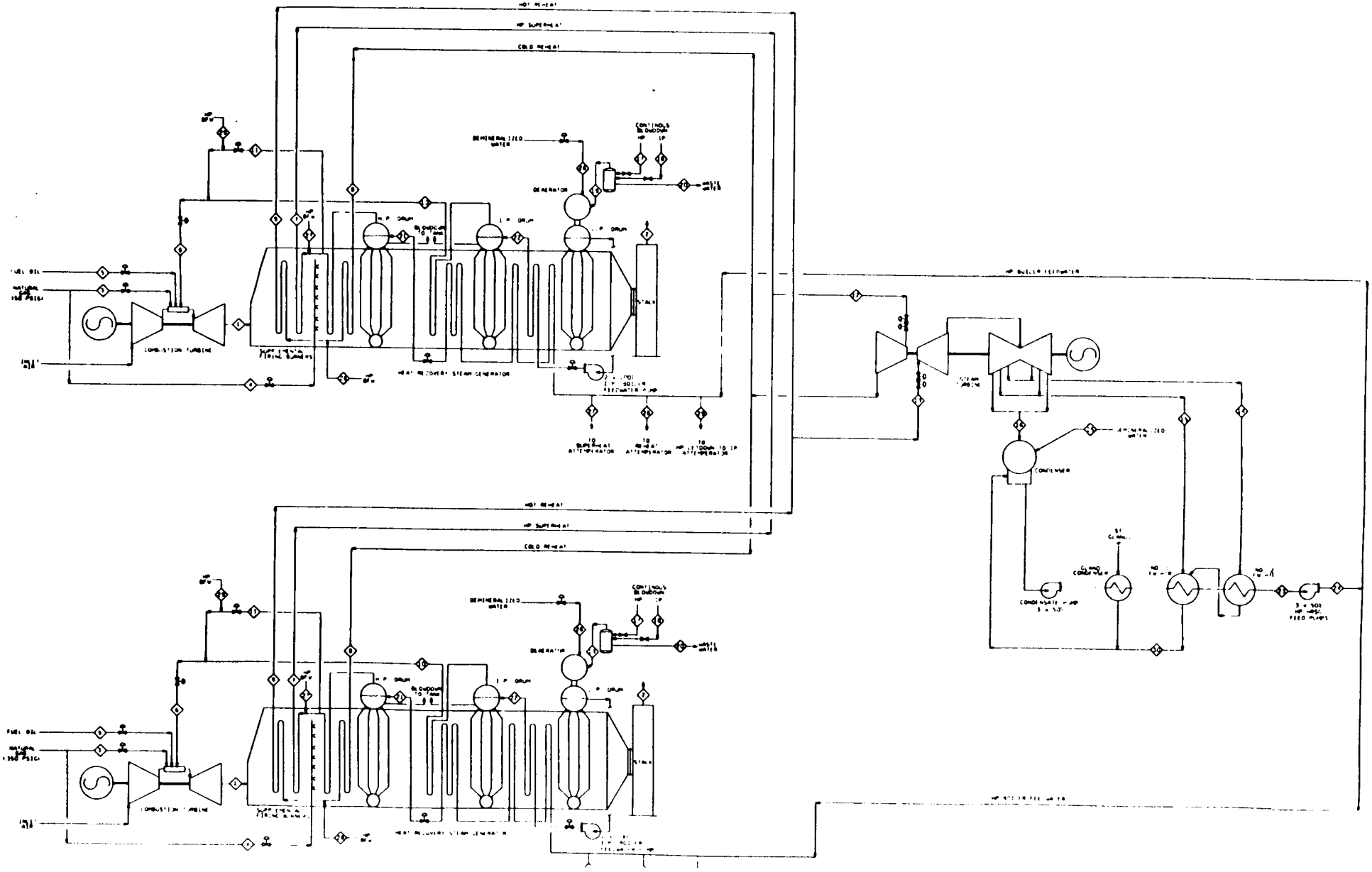
TABLE 1

SCENARIO	FW IN °F	FW OUT °F	STEAM IN °F	DRAIN OUT°F	GROSS GEN MW	TCHR BTU/KWH
PCU 5 Original Heat Balance	355	423.5	654.8	375.0	74.6	9102
PCU5 with PFL4 Heater w/no Modification	355	442.1	654.8	359.3	73.6	9059
117 Plugged Tubes to Match Design FWH Tube Velocity (Design Velocity = 7.4 ft/sec)	355	439.7	654.8	364.4	73.7	9065
PCU5 with PFL4 Heater and Throttling of Extraction Flow to Match Original Heat Balance Generation	355	423.8	647.2	356.4	74.6	

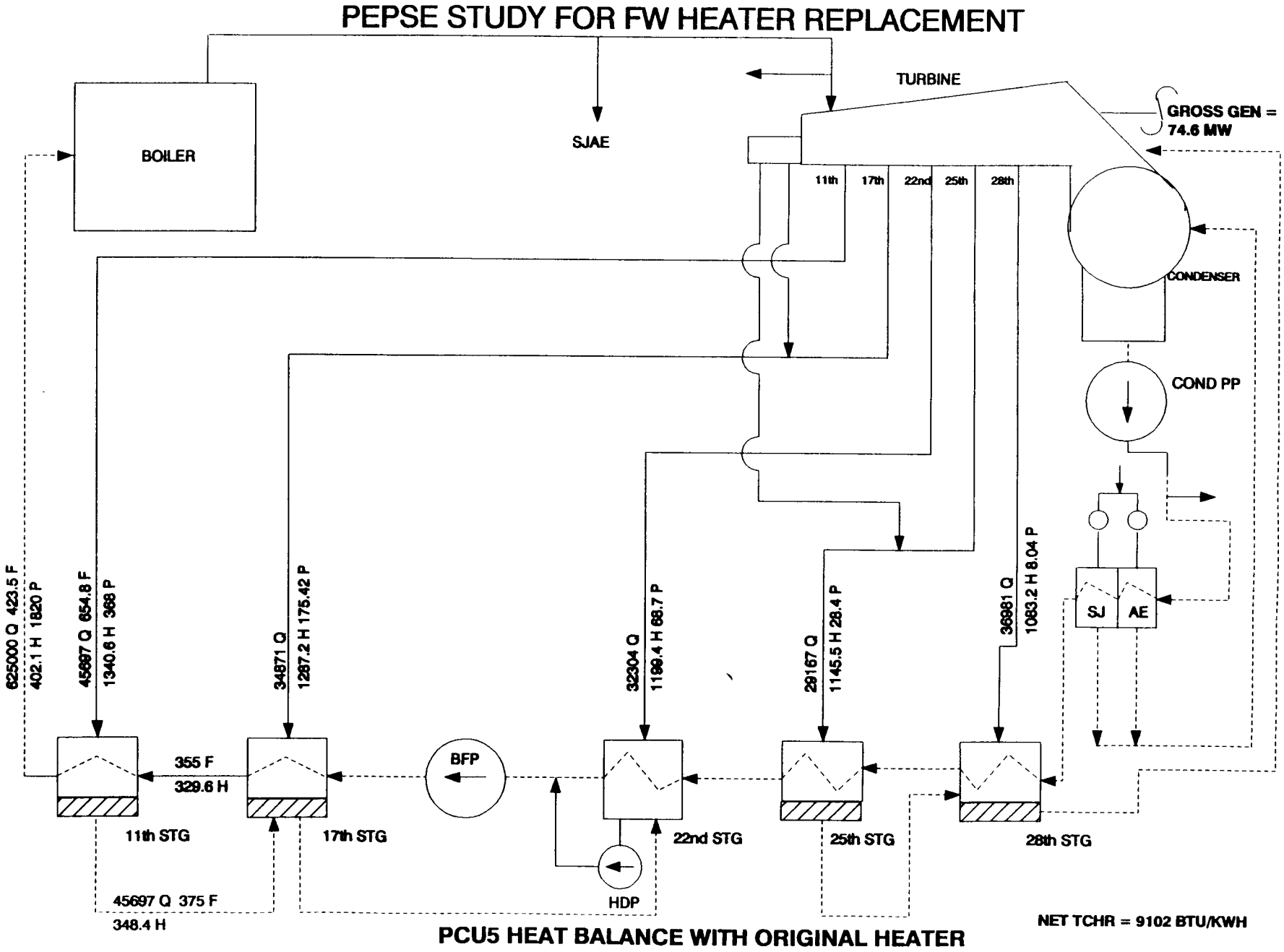

FLORIDA POWER & LIGHT COMPANY
LAUDERDALE PLANT EXTENSION
UNIT NO. 4
HEAT BALANCE DIAGRAM NO. 4
TEST OF 1-29-58
CMW 3-19-58
STEAM FROM REHEATER 995 F 419 P 1520 H 930,080 Q
MAIN STEAM 986 F 1474 P 1483.5 H 1,013,850 Q
STEAM FLOW METER
LOSSES
STEAM TO REHEATER 998,960 Q 710 F 1365 H
750 Q TO SJAE
809,770 Q 1289.1 H
1575 P
BLOW DOWN
STEAM GENERATOR
AUXILIARY STEAM
AUX. STEAM SPRAYWATER
H.P. TURBINE
I.P. TURBINE
L.P. TURBINE
145,450 KW Gen.
5,410 KW Aux.
140,040 KW Out
GENERATOR
MAKEUP
CONDENSATE STORAGE TANK
CONDENSER 1.83 in Hg
6,060 Q Loss HOTWELL
MISC. LOSSES
CONDENSATE RECOVERY COLLECTING TANK
CONDENSATE PUMPS
SJAE
TO AUX. STEAM
TO WASTE
GLAND STEAM CONTROLLER
GLAND COND.
861,770 Q
REHEATER SPRAY WATER
SUPERHEATER SPRAY WATER
PUMP GLAND LEAKAGE
TD -11 App 6
TD -11 App 8
TD 1 Subcooling 2
TD 2 App 18
TD 4 App 12
TD 1 App 16
DES
DC
HEATER NO.6
HEATER NO.5
HEATER NO.4
HEATER NO.3
HEATER NO.2
HEATER NO.1
F.W. FLOW METER
CONDENSATE METER
BOILER FEED PUMPS
HEATER DRAIN PUMPS
AUX. STM. COOLER
RECIRCULATION
AUX STEAM DRIPS
CYCLE HEAT RATE 8278 Btu/kwh
GROSS HEAT RATE 9433 Btu/kwh
NET HEAT RATE 9797 Btu/kwh
BOILER EFFICIENCY 87.75 %

ATTACMENT 1

FLORIDA POWER & LIGHT
LAUDERDAL PLANT UNITS 4 & 5
COMBUSTION TURBINE REPOWERING

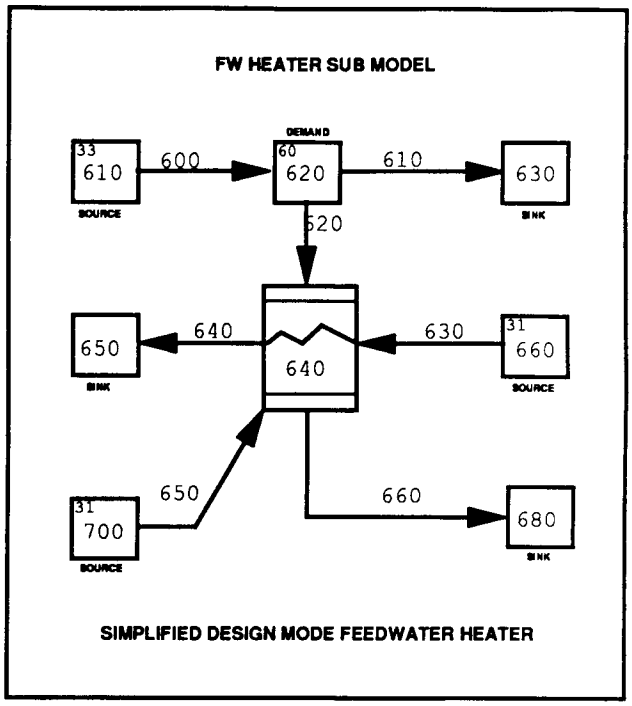


ATTACHMENT 2



ATTACHMENT 3

```
=      DESIGN MODE HEATER FOR PCU5 STUDY
*
*     THIS IS A FW HTR SUB MODEL FOR PFL 4  HTR 5 TO GO
*        TO PCU 5 HTR 5.
*                                BY M.J. BARRIOS 2/4/91
*                             DEBUG
010200   3   0   0   0   0   0     0.0   * DEBUGOFF=0 WORD 6
01200010  0  0  0  0  0  2    * SET ITERMIN TO 2
506000   610,   U,   620,   I
506100   620,   U,   630,   I
506200   620,   B,   640,   S
506300   660,   U,   640,   T
506400   640,   T,   650,   I
506600   640,   D,   680,   I
*
*       DRAIN STREAM
506500   700,   U,   640,   D
*
*
*              TEMP    PRESS     FLOW
*706100   33,   795.9   218.0   1.0E07  *HEATER DESING SPEC SHEET
*706100   33,   822.0   207.0   1.0E07  *PFL4 ACC TEST DATA
706100   33,   656.0   368.0   1.0E07  * PCU 5 HEAT BALANCE
706200   60      0.0             44400.0
706300   32
706500   30
706800   30
*              TEMP    PRESS   FEEDWATER FLOW
*706600   31   333.0   2260.0   1010750.   * DESIGN SPEC DATA
*706600   31   340.0   2260.0   997000.0  * PFL 4 ACC TEST DATA
706600   31   357.0   1815.0   625000.  * PCU 5 HEAT BALANCE
*
*                               DRAIN INLET FLOW
*707000   31   408.1   437.    79920.0   *DESIGN SPEC SHEET
*707000   31   402.0   437.    74190.0   * PFL 4 ACC TESTET
707000   31   402.0   437.    0.0       * PCU 5 HEAT BALANCE
*
*    DESIGN MODE HEATER DATA
*
*
*         1       !2!      3         4         5
*       CTYPE   IDRAIN   IDXTGE   NMODFW   FRFWUT
706400    18       1      -620       4        0.0
*
*         6       7        8         9        10
*       IGFLC   IFFLC   IFLDFC   IFLGCR   HTRORT
*706400    2       2        0         0        1
*
*
*         11      12       13        14
*       IGFLDS  IFFLDS   IGFLDC   IFFLDC
*706400    2       2        2         2
*                                        THERM
*           CONDENSING SECTION DATA       COND.
*         1       2        3         4      5        6
*       DIDC    DODC     XLC      XNC    !XKTC!    SLC
706401   .527    .625     720.     402.     45.    .8125
*
*         7       8        !9!      10
*       DNZFWI  DNZFWO   DNZI     DNZO
706402   10.0    10.0     11.66    6.0
*                                 U VALU    PITCH    LEVEL
706403   0.0     0.0      0.0      795.     .8125    5.0
*           DESUPERHEATING SECTION
*         1       2        3
*       XLDS    ?SBFLDS?  XBFLDS
706404   87.0     200.       4.
*                         BAFFLE #
*
706405   0.0    1.0    1.0   0.0   0.0   113. * U VALUE
*
*           DRAIN COOLER SECTION
*         1       2        3
*       XLDC    ?SBFLDC?  XBFLDC
706406   72.0     200.       7.
*                         BAFFLE #
*
706407   0.0    1.0    1.0   0.0   0.0  489.   * U VALUE
*
*      END OF DECK
```



SIMPLIFIED DESIGN MODE FEEDWATER HEATER

Southwestern Engineering
Subsidiary of
Tyler Corporation
6111 E. Bandini Blvd., P.O. Box 54940, Terminal Annex Los Angeles, Cal. 90054, Tel: 213/685-98

FEEDWATER HEATER SPECIFICATION SHEET

Rev. 2: 3-10-78
Rev. 1: 2-23-78

CUSTOMER	Florida Power & Light Company	JOB NO.	6056-10
STATION	Ft. Lauderdale Plant UNIT NO. 4	FILE NO.	30010
PLANT LOCATION	Florida	INQUIRY NO.	TWS 241805
SERVICE OF UNIT	H. P. Heater #5	DATE	9/16/77
SIZE	37.5 - 357 TYPE: Horizontal U-Tube	ITEM NO.	2
SURFACE/SHELL	3938 EFF. SQ. FT. 3999 GROSS SQ. FT.	NO. OF UNITS	1 SHELLS/UNIT 1
SURFACE/UNIT	3938 EFF. SQ. FT. 3999 GROSS SQ. FT.		

PERFORMANCE OF ONE UNIT

		SHELL SIDE		TUBE SIDE
FLUID CIRCULATED		STEAM	DRAINS	FEED WATER
TOTAL FLUID ENTERING	#/HR.	52,355	79,920	1,010,750
INLET ENTHALPY	BTU/#	1422	383.9	307.0
OUTLET ENTHALPY	BTU/#	319.8	319.8	369.2
INLET TEMPERATURE	°F	795.9 (389.1 SAT.)	408.1	333
OUTLET TEMPERATURE	°F	348.2		392.6
OPERATING PRESSURE	PSIA	218		2000
NUMBER OF PASSES PER SHELL		3 zones		2
VELOCITY	FT./SEC.			7.4 AT 60°F.
PRESSURE DROP	PSI	(A) 1.7	(C) 3.9	12.3

	HEAT EXCHANGED BTU/HR.	MTD °F	TRANSFER RATE BTU/HR/SQ FT/°F	SURFACE EFF SQ FT	BAFFLE SPACING	THK.	NUMBER
(A) DESUPERHEATING SECTION	9,750,000	182.9	113	473	17.4	.625	5
(B) CONDENSING SECTION	47,430,000	19.4	795	3068	34.6	.625	8
(C) DRAIN COOLING SECTION	5,670,000	29.2	489	397	6.9	.375	9

CONSTRUCTION OF EACH SHELL

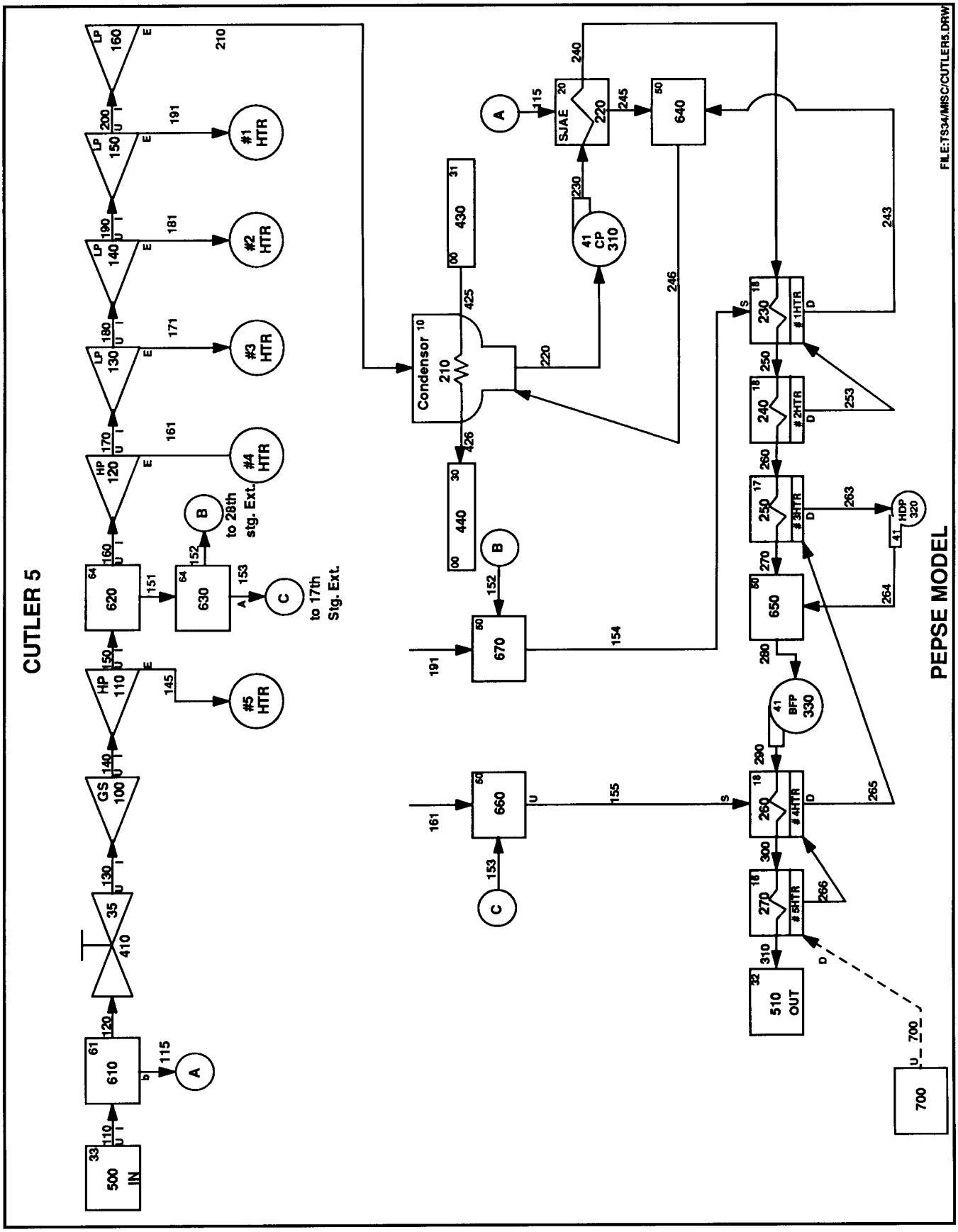
DESIGN PRESSURE	PSIG	300	2600
TEST PRESSURE	PSIG	450	3900
DESIGN TEMPERATURE	°F	STM BOX 850 SKIRT 650 SHELL 650	450
CONNECTIONS: SIZE		IN 10 6 OUT 6	IN 10 OUT 10
TYPE		BW ; 300# Flg. BW	BW Sch. 160

TUBES: NO. 402U O.D. 5/8" BWG 18 MIN/AVG. LENGTH 357 * STR. PITCH 13/16" TRI.
DESUP SHROUD LENGTH 87" DR CLG SHROUD TYPE Full Pass LENGTH 73"
CONSTRUCTION—ASME SECTION VIII DIVISION 1 1974 HEI STDS. Yes CUST. SPEC.
WEIGHTS: EMPTY 27,100 FULL OF WATER 41,000 REMOVABLE SHELL/BUNDLE 6600
STRESS RELIEVED PARTS MARKED (SR) — RADIOGRAPHED PARTS MARKED (XR)

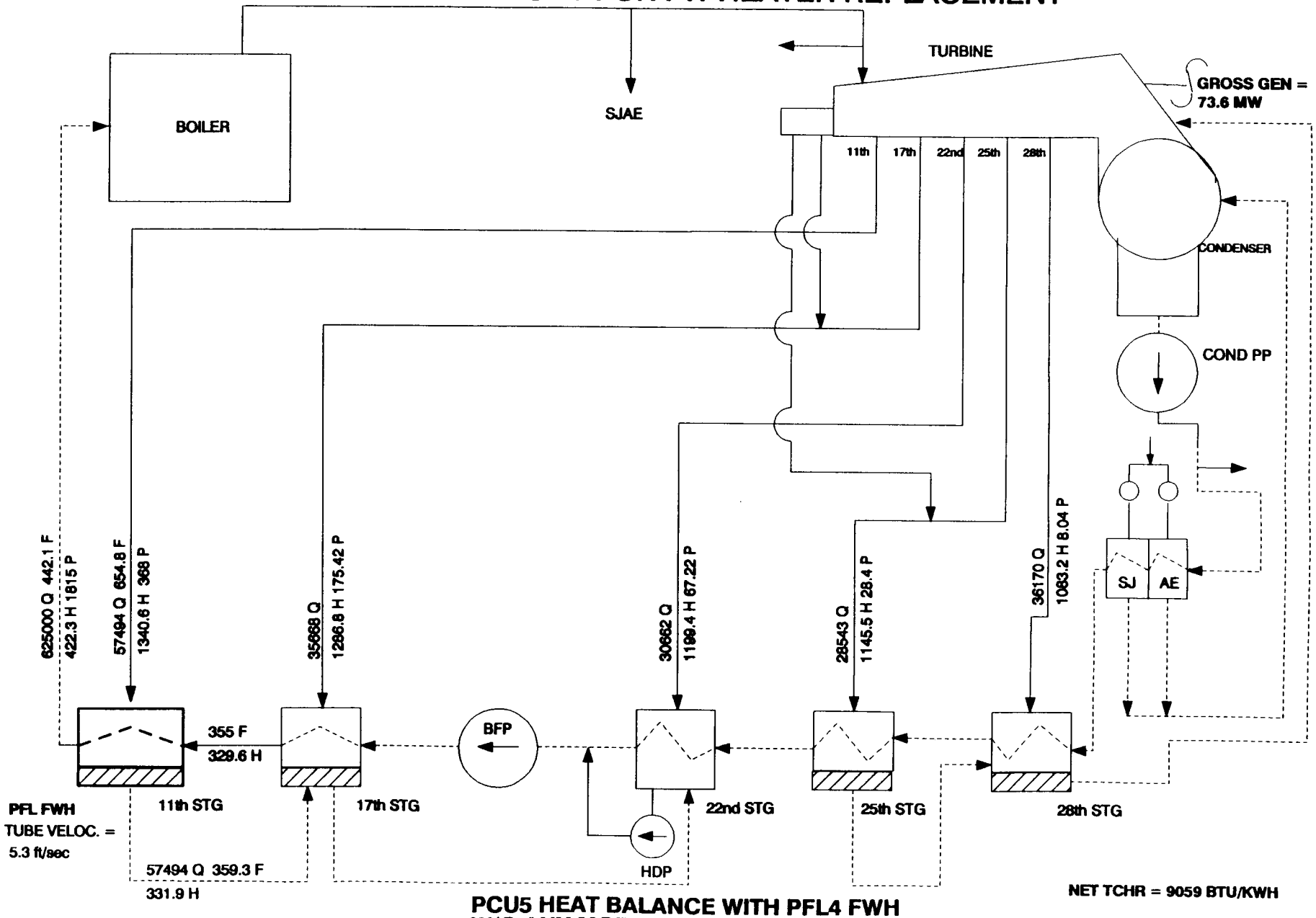
PART	MATERIAL	THK.	CORR. ALLOW.	GASKETS	MATERIAL
TUBES NI-CU	SB163 DSR	.049	-	Shell - Skirt	Flexitallic A
FIXED T.S.	SA266-II	5.5			
SHELL 37½"ID	SA515-70	7/16		TUBE TO TUBE SHEET JOINT	Welded & Rolled
SHELL COVER F-D	SA515-70	.563		TUBE SHEET OVERLAY	Monel
TUBE SUPPORTS 8	SA283-C	5/8		TYPE OF SHELL SUPPORTS	Fixed
CROSS BAFFLES 5, 9	SA283-C	5/8&3/8		SHELL TO SKIRT JOINT	Flanged
CHANNEL	SA266-II	5.1875		TYPE OF CHAN. AND CLOSURE	Breechlock
CHANNEL COVER	SA266-II	8.5			
SHROUD	SA-283-C	1/4		INTERIOR CORR. CONTROL PROCEDURE	
IMPINGEMENT BAFFLE	SA240Tp304	1/4		NUMBER OF TUBES (LINE 27) INCLUDES 2 INSTALLED SPARES	
Steam Box	SA387-11 CL.1	1/4			

SHELL SAFETY VALVE: MANUF. -- MODEL NO.
TUBESIDE RELIEF VALVE: MANUF. -- MODEL NO.
OTHER ACCESSORIES: Insulation Clips

A REV. 5/71


CUTLER 5
PEPSE MODEL
FILE:TS34/MISC/CUTLER5.DRW
500 IN
610
620
630
660
670
700
510 OUT
640
440
430
Condensor 210
SJAE
41 CP 310
41 BFP 330
HDP 320
#1 HTR
#2 HTR
#3 HTR
#4 HTR
#5 HTR
#1HTR
#2HTR
#3HTR
#4HTR
#5HTR
to 28th stg. Ext.
to 17th Stg. Ext.

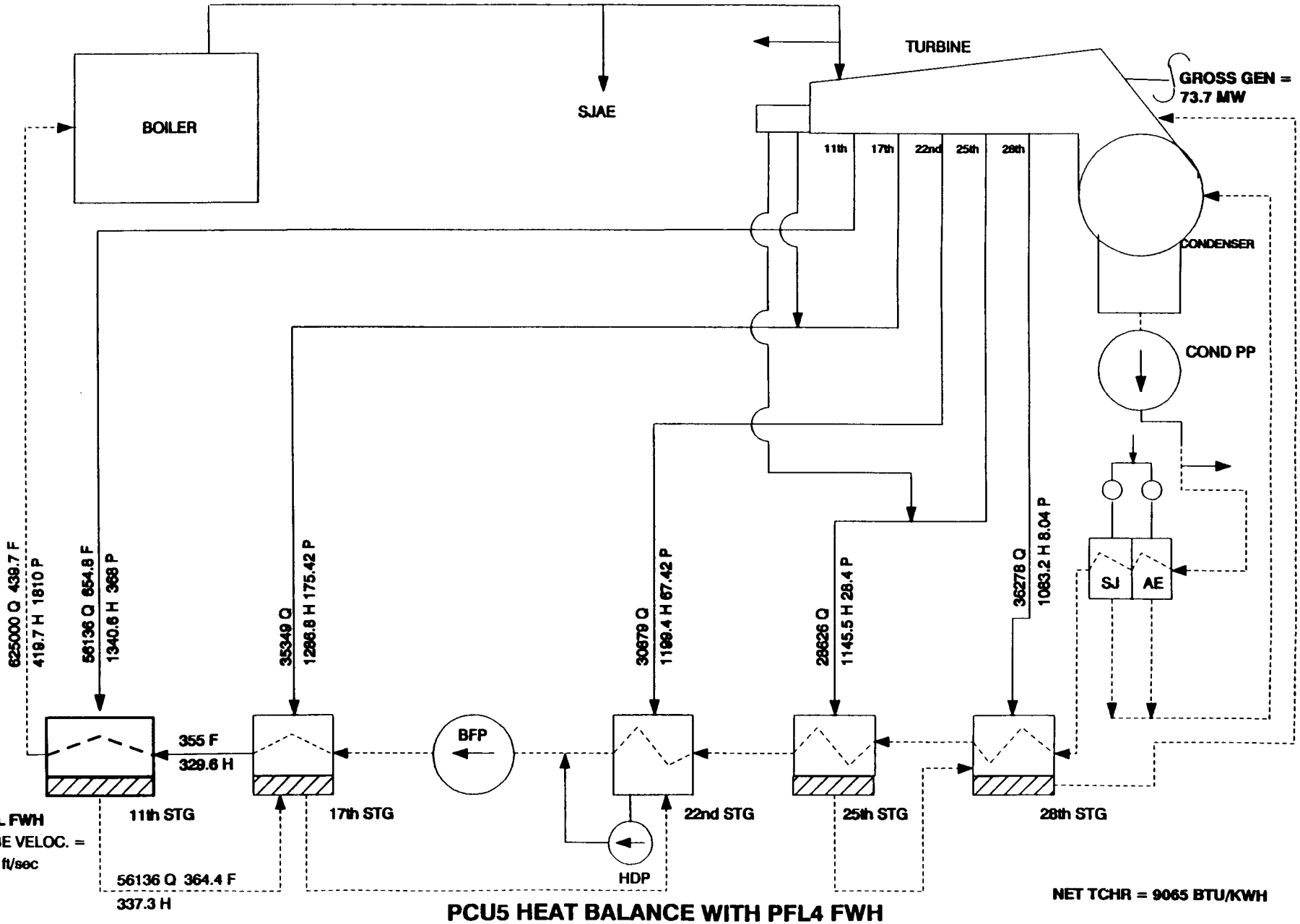
PEPSE STUDY FOR FW HEATER REPLACEMENT



PCU5 HEAT BALANCE WITH PFL4 FWH
W/O ANY MODIFICATIONS

PRS/TS/MJB

PEPSE STUDY FOR FW HEATER REPLACEMENT

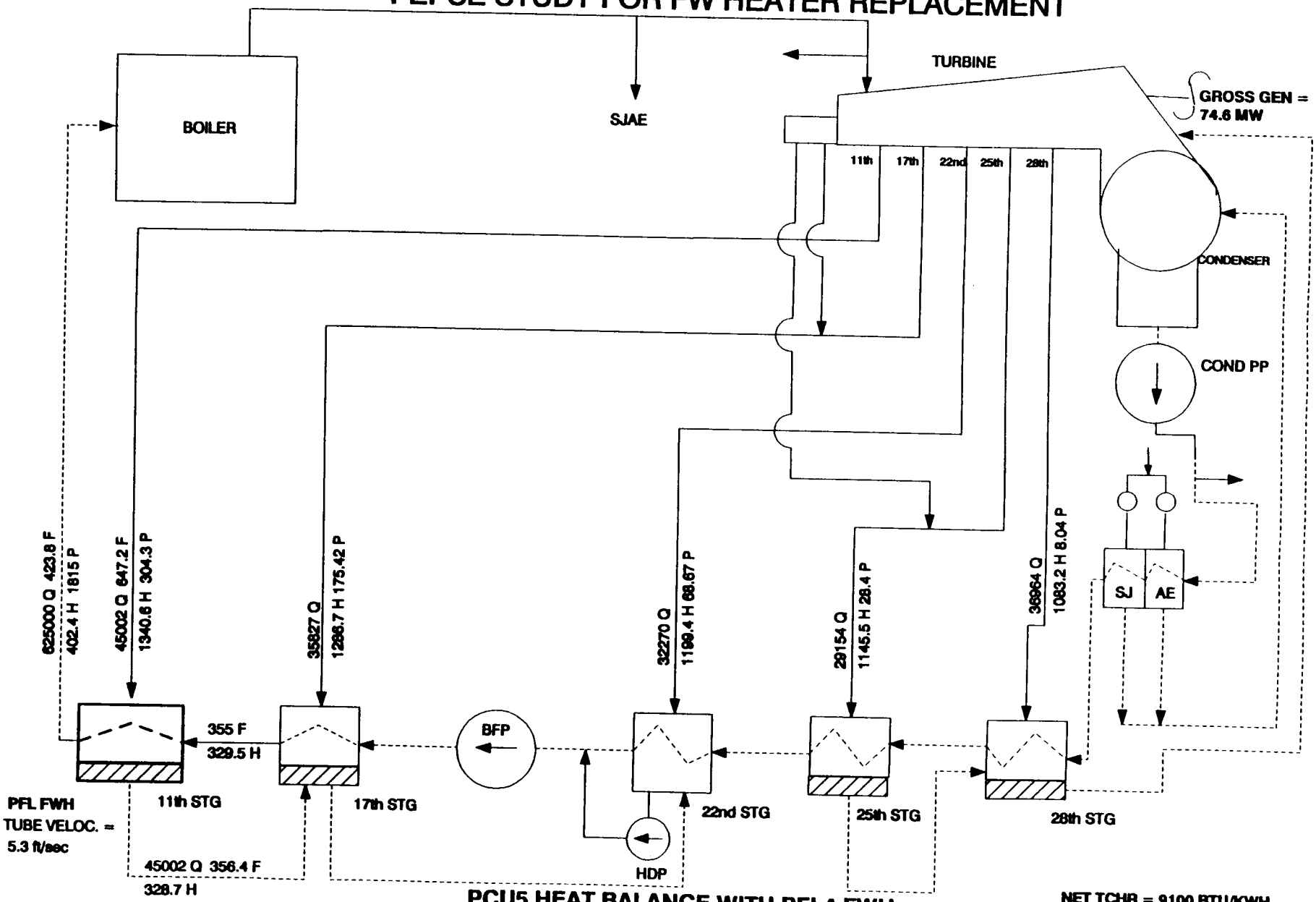


NET TCHR = 9065 BTU/KWH

PCU5 HEAT BALANCE WITH PFL4 FWH AND 117 TUBES PLUGGED.

PRS/TS/MJB

PEPSE STUDY FOR FW HEATER REPLACEMENT



PCU5 HEAT BALANCE WITH PFL4 FWH THROTTLING OF EXTRACTION FLOW TO MATCH ORIGINAL HEAT BAL. GENERATION

NET TCHR = 9100 BTU/KWH

PRS/TS/MJB

```
=      DESIGN MODE HEATER FOR PCU5 STUDY
*
*     THIS IS A FW HTR SUB MODEL FOR PFL 4  HTR 5 TO GO
*        TO PCU 5 HTR 5.
*                                   BY M.J. BARRIOS 2/4/91
*                                DEBUG
010200   3   0   0   0   0   0     0.0   * DEBUGOFF=0 WORD 6
01200010  0  0  0  0  0  2    * SET ITERMIN TO 2
506000   610,   U,   620,   I
506100   620,   U,   630,   I
506200   620,   B,   640,   S
506300   660,   U,   640,   I
506400   640,   T,   650,   I
506600   640,   D,   680,   I
*
*       DRAIN STREAM
506500   700,   U,   640,   D
*
*
*              TEMP    PRESS     FLOW
*706100   33,   795.9   218.0   1.0E07  *HEATER DESING SPEC SHEET
*706100   33,   822.0   207.0   1.0E07  *PFL4 ACC TEST DATA
706100   33,   656.0   368.0   1.0E07  * PCU 5 HEAT BALANCE
706200   60      0.0           44400.0
706300   32
706500   30
706800   30
*              TEMP    PRESS   FEEDWATER FLOW
*706600   31   333.0   2260.0   1010750.   * DESIGN SPEC DATA
*706600   31   340.0   2260.0   997000.0  * PFL 4 ACC TEST DATA
706600   31   357.0   1815.0   625000.  * PCU 5 HEAT BALANCE
*
*                                DRAIN INLET FLOW
*707000   31   408.1   437.    79920.0   *DESIGN SPEC SHEET
*707000   31   402.0   437.    74190.0   * PFL 4 ACC TESTET
707000   31   402.0   437.    0.0       * PCU 5 HEAT BALANCE
*
*    DESIGN MODE HEATER DATA
*
*
*         1       !2!      3         4         5
*        CTYPE   IDRAIN   IDXTGE    NMODFW   FRFWUT
706400    18       1       -620       4        0.0
*
*         6       7        8         9         10
*        IGFLC   IFFLC    IFLDFC    IFLGCR   HTRORT
*706400    2       2        0         0         1
*
*
*         11      12       13        14
*        IGFLDS  IFFLDS   IGFLDC    IFFLDC
*706400     2       2        2         2
*                                          THERM
*           CONDENSING SECTION DATA        COND.
*         1       2        3         4      5        6
*        DIDC    DODC      XLC      XNC    !XKTC!    SLC
706401   .527    .625      720.     402.     45.    .8125
*
*         7       8        !9!       10
*       DNZFWI  DNZFWO   DNZI      DNZO
706402   10.0     10.0    11.66     6.0
*                                  U VALU     PITCH    LEVEL
706403   0.0      0.0      0.0      795.     .8125     5.0
*           DESUPERHEATING SECTION
*         1       2        3
*        XLDS    ?SBFLDS?  XBFLDS
706404   87.0     200.        4.
*                          BAFFLE #
*
706405   0.0    1.0    1.0   0.0   0.0   113. * U VALUE
*
*           DRAIN COOLER SECTION
*         1       2        3
*        XLDC    ?SBFLDC?  XBFLDC
706406   72.0     200.        7.
*                          BAFFLE #
*
706407   0.0    1.0   1.0   0.0   0.0  489.   * U VALUE
*
*      END OF DECK
```

```
= 80 MW WESTINGHOUSE UNIT
**************************************************************************
*       DATA TAKEN FROM WESTINGHOUSE HEAT BAL.  TEST #5, 4/18/55         *
*       CUTLER PLANT UNIT # 5                                            *
*                                                                        *
*    CREATED: 02/08/91     REV.  0      BY: CNA                         *
*                                                                        *
*    REV #: 1         DATE:           BY:                                *
*                                                                        *
*    DESCRIPTION:                                                        *
**************************************************************************
*
*010200  NTGCYC NGEPRO NHOKUP NTURB NRHEAT NDEBUG BKAUXR PPBEND
010200      2      3      1      2      0      0     0.0   -2.5
*
*
*        ITRSPC  ITRSCH  ITRCON  ITROPS  ITRSTR  ITREUP
012001     5       2       5       2       5       1       * ITERATION
*                                                          UPDATE CARD
*
*011010 IGENUM  NGNTYP NGENER NGNCOL ISPEED BKGRAT  POWFAC PPGNH2 PPGNHR
011010  1       2      2      0      3600   81176.   0.850   19.6  15.0
*
*
*011021  BKMCLI     BKELEI
011011      0.0       0.0

*
*      # OF ITERATIONS
* 012000   35
*
010001     1
****************************
**** TABLE SUPPRESION   ****
****************************
* SUPPRESS ALL 132-COLUMN TABLES
020000  NOPRNT
* 80 COLUMN TABLE SUPPRESSION CONTROL
020101  NOPRNT
020103  PRINT
020105  NOPRNT
020106  PRINT
020107  PRINT
020120  PRINT
020128  NOPRNT
020135  NOPRNT
020136  NOPRNT
020139  NOPRNT
020142  PRINT
020146  NOPRNT
020147  NOPRNT
020149  NOPRNT
020150  NOPRNT
020174  PRINT
****************************
```

```
020002          NOPRNT
020004          NOPRNT
020005          NOPRNT
020021          NOPRNT
020022          NOPRNT
020023          NOPRNT
*012000  ITRMAX
*012000   1
*
*
*                              EXTRACTION LINES
*
*               FROM        PORT ID           TO        PORT ID
501450          110,        E,                270,      S
501610          120,        E,                660,      IA
501710          130,        E,                250,      S
501810          140,        E,                240,      S
501910          150,        E,                670,      IA
*
*                            END EXTRACTION LINES
*
*                            STREAM DISCRIPTIONS
*
*
*          FROM    PORT ID   TO     PORT ID
501100     500,     U,       610,     I
501150     610,     B,       220,     S
501200     610,     U,       410,     I
501300     410,     U,       100,     I
501400     100,     U,       110,     I
501500     110,     U,       620,     I
501510     620,     B,       630,     I
501520     630,     B,       670,     IB
501530     630,     U,       660,     IB
501540     670,     U,       230,     S
501550     660,     U,       260,     S
501600     620,     U,       120,     I
501700     120,     U,       130,     I
501800     130,     U,       140,     I
501900     140,     U,       150,     I
502000     150,     U,       160,     I
502100     160,     U,       210,     S
502200     210,     D,       310,     I
502300     310,     U,       220,     T
502400     220,     T,       230,     T
502430     230,     D,       640,     IA
502450     220,     D,       640,     IB
502460     640,     U,       210,     D
502500     230,     T,       240,     T
502530     240,     D,       230,     D
502600     240,     T,       250,     T
502630     250,     D,       320,     I
502640     320,     U,       650,     IB
502650     260,     D,       250,     D
502660     270,     D,       260,     D
```

```
502700      250,     T,       650,    IA
502800      650,     U,       330,    I
502900      330,     U,       260,    T
503000      260,     T,       270,    T
503100      270,     T,       510,    I
504250      430,     U,       210,    T
504260      210,     T,       440,    I
*     HTR INLET SOURCE
507000      700,     U,       270,    D
*
*   HTR SOURCE
707000 31 402. 437. 0.0
*
****************** SPECIAL STREAM **********************
*
*           STYPE     PFAC1          * EXTRACTION LINE PRESSURE DROP
601450        2       0.173          * FWH #5 EXTRAC. PRESS. DROP
*
*
*
*                          TURBINE GROUPS:   GS,HP,IP,LP
*              USED GENERIC TYPE TURBINE (CTYPE=8)
*
*                          GOVERNING STAGE
*
*      CTYP NGEN NIPEN GEXT TYP MOIS NREND CASE DELPX
701000  8   1     0     0    1   0     1     5   0.0
*
*
*      CTYP NGEN NXPEN GEXT TYPE MOIS NREND CASE DELXP
*
701100  8   1     0     1    2   0     1     5   0.0  *HP
701200  8   1     1     1    2   0     1     5   0.02 *HP
701300  8   1     3     1    2   0     1     5   0.02 *HP
701400  8   1     0     1    4   0     2     5   0.02 *LP
701500  8   1     1     1    4   0     2     5   0.02 *LP
*                                                   WEXT  ANAREA
701600  8   1     3     0    4   0     2     5   0.0  0.0   26.2
*
*
*                             DESIGN DATA
*
*         SHELL P  SHELL H
701005    1017.0   1467.8  *1ST STG
701105    368.0    1340.6  *HP
701205    179.0    1271.0  *HP
701305     70.0    1199.4  *HP
701405     29.0    1145.5  *LP
701505      8.2    1076.0  *LP
701605    0.900     996.0  *LP
*
*
*         PBIV     HBIV      WBIPV
701009    1271.0   1467.8    625000.
701109    1017.0   1467.8    615900.
```

```
701409     70.00  1199.4     509500.
*
*                          END TURBINE GROUP
*
*     FEEDWATER HEATERS-----HEAT EXCHANGERS-----CONDENSER
*
*                          FEEDWATER HEATERS
*        CTYPE   IDRAIN   IDXTGE   NMODFW   FRFWUT   TTD   DCA     *HTR #
*
702300   16      1        150      2        0.0      6.5   10.5     * 1
702400   16      0        140      2        0.0     14.5    9.5     * 2
702500   17      1        130      2        0.0     10.5            * 3
702600   18      1        120      2        0.0     16.0   11.5     * 4
*
*    DESIGN MODE HEATER DATA
*
*
*          1       !2!      3         4         5
*        CTYPE   IDRAIN   IDXTGE    NMODFW   FRFWUT
702700    18       1      -110       4        0.0
*
*          6       7        8         9        10
*        IGFLC   IFFLC    IFLDFC    IFLGCR   HTRORT
*702700    2       2        0         0        1
*
*
*          11      12       13        14
*        IGFLDS  IFFLDS   IGFLDC    IFFLDC
*702700     2       2        2         2
*                                          THERM
*           CONDENSING SECTION DATA        COND.
*          1       2        3         4        5        6
*        DIDC    DODC      XLC      XNC     !XKTC!    SLC
702701   .527    .625     600.      402.     14.5    .8125
*
*          7       8       !9!       10
*        DNZFWI  DNZFWO   DNZI      DNZO
702702   10.0    10.0     11.66     6.0
*                                  U VALU     PITCH     LEVEL
702703   0.0     0.0      0.0       795.      .8125     5.0
*           DESUPERHEATING SECTION
*          1       2        3
*        XLDS    ?SBFLDS?  XBFLDS
702704   87.0     200.       4.
*                          BAFFLE #
*
702705   0.0    1.0    1.0   0.0   0.0   113. * U VALUE
*
*           DRAIN COOLER SECTION
*          1       2        3
*        XLDC    ?SBFLDC?  XBFLDC
702706   72.0     200.       7.
*                          BAFFLE #
*
702707   0.0    1.0   1.0   0.0   0.0  489.   * U VALUE
```

```
*                          HEAT EXCHANGERS
*       CTYPE   TTHXDN   FRHXUT
*
702200   20      0.0      0.0       * SJAE
*
*                          CONDENSER
*       CTYPE   IDRAIN   NMODFW   FRFWUT   PPSH
*
702100   10      1        2        0.0      0.890
*
*
*     END FEEDWATER HEATERS----HEATEXCHANGERS----CONDENSER
*
*
*                      PUMPS:     COND.----HDP---BFP
*
*       CTYPE     PMPDIS
703100   41        308.0     * COND.
703200   41        280.0     * HDP
703300   41        1820.0    * BFP
*
*                      END PUMPS
*
*
*                              VALVES
*      CTYPE   PDRPL   PDRFP  PDRPV  TFRIST  PTHV   HTHV     WTHV
*
704100  35     -2.0    -2.0   -2.0    0.30  1271.0 1467.8    624100.
*      CTYPE   PDVS
*
*
*                               END VALVES
*
*
*
*                               SOURCES / SINKS
*
*         CTYPE     TTVSC    PPVSC     WWVSC     THERM
*
704400    30
704300    31         70.0    20.0      1.30E7     0.0   * CIRC H2O FLOW
705100    32
*                  ********************************************
705000    33         950.0   1271.0      625000.   * MS FLOW
*                  ********************************************
*
*                           END SOURCES / SINKS
*
*
*                           MIXER DISCRIPTION
*
*              CTYPE       IFLPRU     PPMIXU
*
706400          50           1
706600          50           1
```

```
706700          50          1
706500          50          1
*
*                           END MIXER DISCRIPTION
*
*
*                           SPLITTER DESCRIPTION
*
*         CTYPE       HHFIXB      WWFIXB
706100     61            0.0       900.0
*
*                            -MIN DATA
*         CTYPE       PACLEK      WWFIXB      PPREC
706200     64          5111.1      8100.0      1017.0  * LO TO 17TH STG HTR
706300     64           631.1      1000.0      1017.0  * LO TO 28TH STG HTR
*
*
*                           END SPLITTER DESCRIPTION
*
*                           CALC. OF LO CONSTANT   ' C '
*
*         CXVAR   NXUIDC    VALYC     YCNVRG  CYFLTR  CYVAR  NYUIDC
*
840100    PACLEK,   620,    8100.0,  1.0E-3,   1.0,    WW,  153
840200    PACLEK,   630,    1000.0,  1.0E-3,   1.0,    WW,  152
*     END OF INPUT DATA
*
.
```