AMERICAN ELECTRIC POWER SERVICE CORPORATION
MECHANICAL ENGINEERING DIVISION
HEAT EXCHANGERS & PUMPS SECTION

ENGINEERING EVALUATION AND/OR CALCULATION CONTROL SHEET

SUBJECT: Verification of The Nov 21, 1979 Auxiliary feed pump's net positive suction head available.

E/C IDENTIFICATION NO: *HXP791121AF REVISION NO. 1

SUBJECT FILE NO: 10.4.4.2.3 PAGE 1 OF 4 PAGES

OTHER: ORIGINAL 11/21/79 CALC. ATTACHMENTS: 6

PLANT D.C. COOK	PERFORMED	REVIEWER	MED No. 8 Check Method Used	APPROVED
NAME	[signature]	[signature]	4.3.1	[signature]
DATE	1/12/88	1/13/88		1/13/88
All work to be in compliance with provisions of MED Procedure No. 8				

NOTES: Revision 1 verifies the 11/21/79 NPSH calculation. The original calculation was reviewed to improve on the traceability of the assumptions/method used in the calculation. Traceability was a generic issue identified during the SSFI audit of the AFW system. The 11/21/79 calculation has been microfilmed.

FORM: HXP801104 REV.11/8/84

*Log in File 13.18
File cc of pg 1 in 13.18

January 12, 1988

Net Positive Suction Head

Introduction : The auxiliary feedpump's (afp) net positive suction head available (NPSHa) was determined in a calculation dated Nov. 21,1979. This calculation will verify the acceptability of the previous calculation's results.

Problem : In order to use the Nov. 21, 1979 NPSH results it is necessary to determine the acceptability of those results. This calculation will verify the Nov. 21,79 results by calculating the afps NPSHa at the design conditions.

Assumptions :

1) The three afps are operating as designed -
   2 MDAFPs @ 450 gpm 2714 ft tdh
   1 TDAFP @ 900 gpm 2714 ft tdh
   pump centerline @ el. 593'

2) Afps supplied from the condensate storage tank with condensate at 100 deg f.

3) a: NPSHa will be calculated based on the high and low level alarms :
   high level set at el. 638'- 4" (XPS-112,-113)
   low level set at el. 625'- 9" (XPS-110,111)

   b: NPSHa will be calculated on the basis of constant flow (design) to 2 pumps while varying the flow to the remaining pump.

4) The afps suction line losses are taken from calculation HXP87113AF. This calculation has been checked and approved using MED 8.

5) NPSH required is obtained from the afp's performance curves.

Calculation : The NPSHa is calculated as follows -

$$NPSHa = Ha + Hst - Hfs - Hvpa \quad *$$

where: Ha - absolute pressure on surface of fluid supplied to the pump (ft).

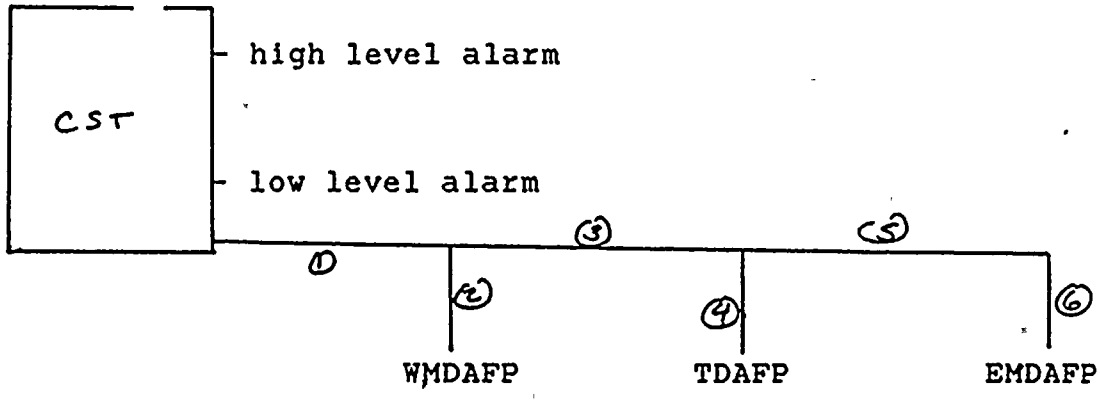
Hst- static elevation difference of liquid level above pump centerline (ft). Note: positive for level above pump and negative for level below pump.

January 12, 1988

Calculation : Hfs- line losses in suction piping (ft).

(con't) Hvpa-absolute vapor pressure of fluid at the pumping temperature (ft).

* from Cameron Hydraulic Data
16th edition 2nd printing
pg 1-10 thru 1-15



AFW system suction piping

Segment no.	Flow (gpm)	Suction line loss unit 1	unit 2 (ft)
1	1800	5.64	5.78
2	450	1.52	1.67
3	1350	.16	.33
4	900	2.78	2.01
5	450	.03	.05
6	450	1.6	1.61

NPSH WMDAFP -TDAFP & EMDAFP @ design flow

WMDAFP's Hfs is sum of seg 1 + 2

unit 1 NPSHa = Ha + Hst - Hfs - Hvpa
high level alarm @ 638'-4"

Ha = 34.1' @ 100 deg f water
Hst = 638'- 4" minus 593' = 45'-4"
Hvpa = 2.21' @ 100 deg f
Hfs = seg 1 + 2
= 5.64 + 1.52 = 7.16'

January 12, 1988

Calculation : (con't)

NPSHa = 34.1 + 45.33 - 7.16 - 2.21
= 70.06'

low level alarm @ 625'-9"

Hst = 625'-9" minus 593' = 32'-9"

NPSHa = 34.1 + 32.75 - 7.16 - 2.21
= 57.48'

Note : The NPSHa for the other 2 pumps is calculated in the same manner.

Results : The NPSH results are tabulated below -

PUMP	NPSH (required)	NPSH (avilable) unit 1 low	unit 1 high	unit 2 low	unit 2 high
WMDAFP	12'	57'	70'	57'	70'
TDAFP	34'	56'	68'	56'	69'
EMDAFP	12'	57'	70'	57'	69'

NPSHa from Nov. 21, 1979 calculation

	low	high
MDAFPs	57'	69'
TDAFP	56'	68'

Conclusions : The results of this calculation verifies the acceptability of the Nov. 21, 1979 calculation results.

Note : The minor difference in the calculated NPSHa is due to the new system resistance calculation. This calculation determined that the minor system resistance losses (the old vs the new) are negligible.

FORM GE-8-[illegible]

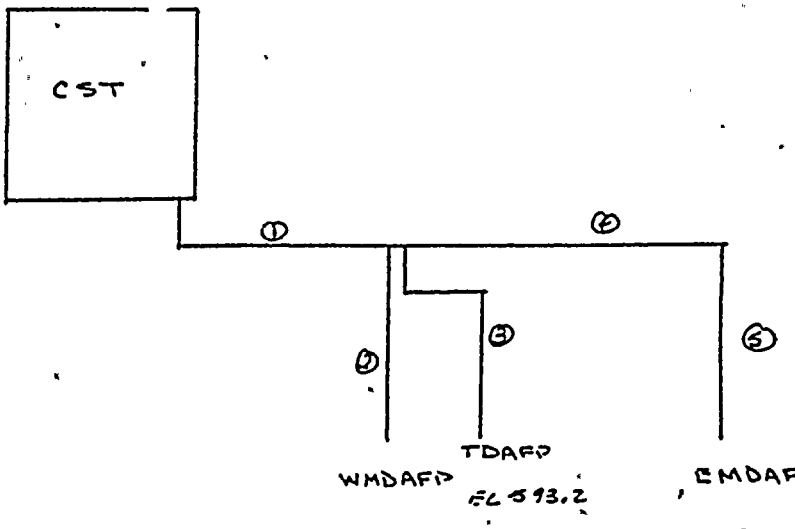
ENGINEERING DEPT.
AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY
NEW YORK

0 0 2 0 0 1 6 0 0 2 6

SHEET 1 OF 6
DATE 11/[illegible]/79 BY AF CK JR
COMPANY I&M POWER G.O.
PLANT D.C. COOK 1&2

FILE 10.4.4

SUBJECT MDAFP & TDAFP NPSHA CALCULATION



h_s - STATIC EL. DIFF.
h_{PA} - ATM. PRESS.
h_{VP} - LIQ. VAPOR PRESS.
h_f - LINE LOSS.

COOK PLANT
MED RECORD - MED COPY
SECTION HEEP
ENGINEER AF
DATE 5/13/84
☑ PLANT LIFETIME
DATE TO PLANT
☐ NON PERMANENT
MINIMUM RETENTION YRS.

$NPSH = h_s + h_{PA} - h_{VP} - h_f$

CST LEVEL @ EL 640-0
$h_s = 640 - 593.2 = 46.8'$
$h_{PA} = 33.9'$
$h_{VP} = 2.19'$ @ 100°F
h_f - SEE ATTACHED NFLCS OUTPUT
$NPSH_A = 46.8 + 33.9 - 2.19 - h_f$
$= 78.51 - h_f$

CST LEVEL @ 611-3 h_{VP} @ 100°F = .9 psi.
$h_s = 611.25 - 593.2 = 18.05'$
$NPSH_A = 49.76 - h_f$

IN ACC

26

SUBJECT

2. ASSUMPTIONS.

3 PP OPERATION
100° F CONDENSATE TEMP.
NPSHA CURVES DRAWN ON THE BASIS OF CONSTANT FLOW (DESIGN) TO 2 PPS VARYING FLOW TO 3RD PP.

3. RESULTS.

AT LOW CST LEVEL (611-3)
MDAFP NPSHA @ DESIGN FLOW OF 450 GPM IS 42' (18.2 PSI) VS A REQUIRED NPSH. OF 12' (5.2 PSI).
TDAFP NPSHA @ DESIGN FLOW OF 900 GPM IS 41' (17.7 PSI) VS A REQUIRED NPSH OF 34' (14.7 PSI)

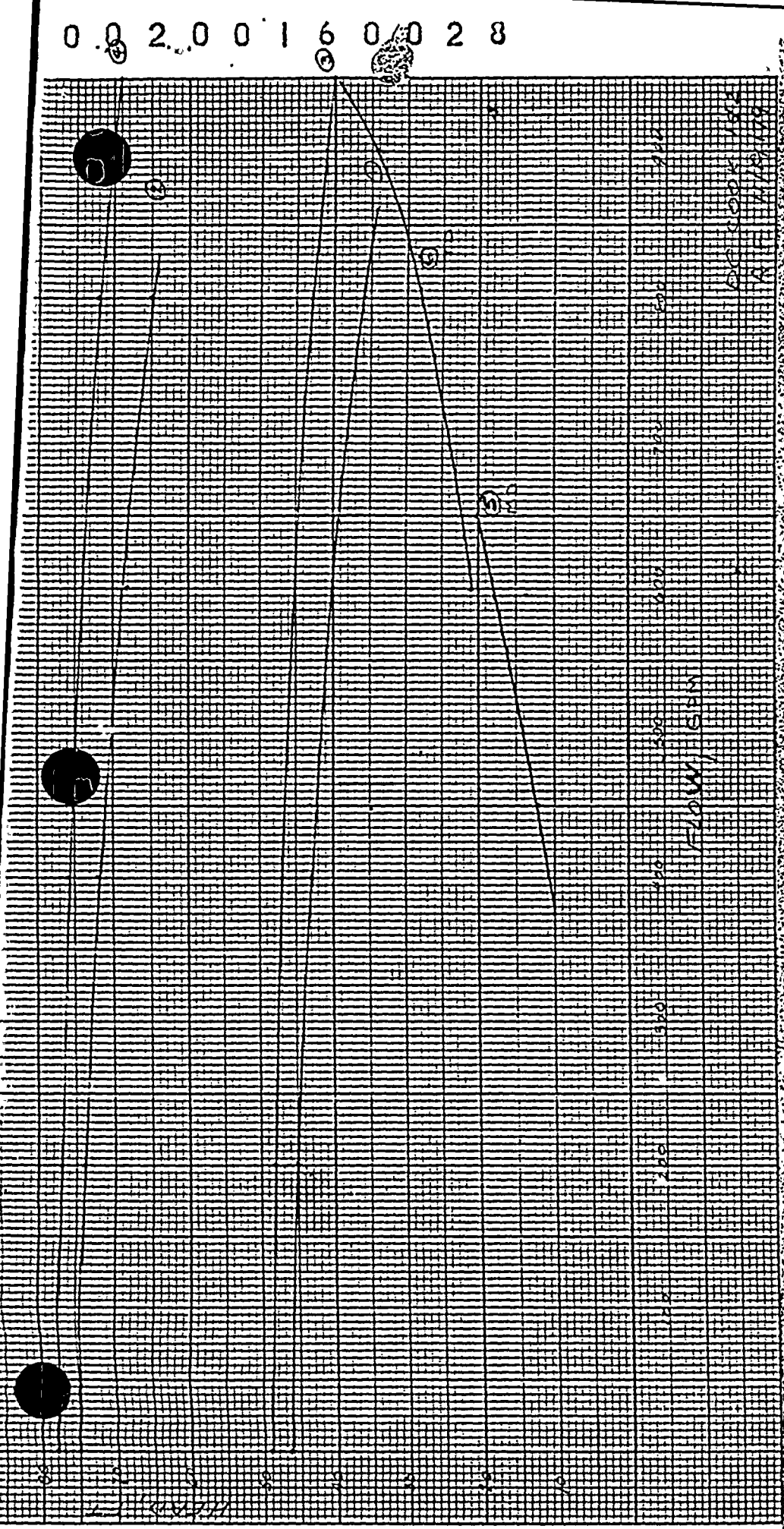
AT HIGH CST LEVEL (640-0)
MDAFP IS 71' (30.7 PSI)
TDAFP IS 70' (30.3 PSI).

POSSIBLE PROBLEM IN SETTING LOW NPSH ALARMS ON THE TDAFP WITH LOW CST LEVEL.

IN ACCORDANCE WITH TELEPHONE CONVERSATION OF TODAY WITH E. NIELD SET POINTS ARE AS FOLLOWS: HI LEVEL 638-4 (XPS-112, 113)
LOW LEVEL 625-9 (XPS-110, 111)
∴ TO LOW CST LEVEL CURVES ADD 14.5'
TO HI CST LEVEL CURVES ADD -1.7'
@ LOW LEVEL TDAFP NPSHA IS 55.5' (24 PSI).

AF 11/20/79

0 0 2 0 0 1 6 0 0 2 8



AMERICAN ELECTRIC POWER SERVICE CORPORATION

File 10.4.4.2
11/19/79

DATE _____ 4 OF 6

MEMO TO: _____

TEMP @ 100°F

SEG ① 12.0, 444.95, .5, 486

② 10.02, 53.5, 6.43, 743 T.DAFP

③ 12.0, 10.0, 0.0, 7.9

④ 7.98, 186.0, 4.602, 611 E.M.DAFP

ABOVE DATA FROM EFF. CALC.
DATED 2/15/74.

From: A. F. ELICIANO

FORM OM-14
(AD-16)

FORM MED-31
REV. 4/73

0 0 2 0 0 1 6 0 0 3 0

PIPE FRICTION CALCULATION

DATA SHEET

SHEET 5 OF 6
PLANT D.C. COOK 1&2
BY SB DATE 11/14/79

SYSTEM New Aux. Feedpump Suction Line to Flange

DWG. REF. 12-5299A-3

FLUID TEMP.(F) 100° PIPE ABS. ROUGHNESS (FT) .00015 PIPE SEGMENT NUMBER 1

①FLUID FLOW (GPM) 0-2000 ②PIPE I.D. (IN) 8" (7.981") PIPE EL. 603-? TO EL. 593-0

STRAIGHT PIPE LENGTHS	FITTINGS	NUMBER	*K OR L/D	ΣK	ΣL/D
14'-6"	GATE VALVE		13		
	GLOBE VALVE		340		
2'-3"	BUTTERFLY VALVE	1	40		40
	SWING CHECK	1	135		135
2'-6"	90° STD. ELBOW		30		
3'-3"	90° S.R. ELBOW	1	50		50
25'-0"	90° L.R. ELBOW	IIII ~~IIII~~	20		160
	45° STD. ELBOW	III	16		48
19'-6"	45° S.R. ELBOW		26		
	180° CLOSE RETURN		50		
3'-0"	STD. TEE RUN	1	20		20
2'-9"	STD. TEE BRANCH		60		
	* MITRE BENDS		1.2(1-COSθ)		
4'-6"	* LATERAL ◁ OUTLET		1.0		
	* LATERAL ◁ INLET		0.5		
1'-6"	* STRAIGHT RUN LATERAL		0.15		
	* PIPE ENTR PROJ. INWD.		0.78		
1'-0"	* " " SHARP EDGE		0.50		
	* " " WELL ROUND		0.04		
6'-0"	* PIPE EXIT SHARP EDGED		1.0		
	* ORIFICE (C_D = .61)		2.69 RF/β^4		
	* SUDDEN CONTRACTION †	$(\frac{5}{8})$ II	.5(1-β^2) $\frac{8}{12}$	.278	
	* SUDDEN INCREASE †		(1-β^2)^2	.219	
	* VALVE, MISCELLANEOUS		891.4 d^4/C_v^2		
	MISC				
	Piping			3.91	
TOTALS	⑤ 85'-9"			④ 4.397	⑤ 453

* ITEMS ARE "K" VALUES ONLY
β = d/D
† BASED ON SMALLER PIPE DIAMETER
RF = RECOVERY FACTOR

FK-9-1-72

AMERICAN ELECTRIC POWER SERVICE CORPORATION

4 OF 6

DATE _____

MEMO TO: _____

_____

TEMP @ 100°F

SEG ①	12.0, 444.95, .5, 486	
③	10.02, 53.5, 6.43, 783	TDAFP
④	1200, 0.0, 0.0, 791	
⑤	7.981, 86.0, 4.602, 611	EMDAFP

ABOVE DATA FROM EFF CALC.
DATED 2/15/74.

From A. FELICIANO

FORM OM-14
(AD-16)

AMERICAN ELECTRIC POWER SERVICE CORPORATION

4 OF 6

DATE _____

MEMO TO: _____

_____

TEMP @ 100°F

SEG ① 12.0, 444.95, .5, 486

② 10.02, 53.5, 6.43, 783 TDAFP

④ 1200, 0.0, 0.0, 791

⑤ 7.981, 86.0, 4.602, 611 EMDAFP

ABOVE DATA FROM EFF CALC.
DATED 2/15/74.

FROM A. FELICIANO

FORM OH-14
(AD-16)

```
READY
10 [illegible]00,.00015,1,5
11[illegible]0 _
110  .07.0,0.0,2000,200,12.0,444.95,.5,□486
120  0.0,0.0,2000,200,7.981,85.75,4.397,453
130  0.0,0.0,2000,200 X_
130  0.0,0.0,2000,200,10.02,53.5,6.43,743
□140  0.0,0.0,2000,200,12.00,0.0,0.0,79
150  0.0,0.0,2000,200,7.981,86.0,4.602,611
SAVE

READY
RUN HFLC5


HFLC5       UTI/EASY      14:02 NOV 19,'79

 PIPE FRICTION CALCULATIONS-COLEBROOK EQUATION

 INPUT DATAFILE
?STY

 WATER TEMP.(F)                  = 100.00
 DENSITY(LBM/CUFT)               =  62.00
 ABS.VISCOSITY(LBM/SEC/FT        = .460533E-03
 PIPE ABS.ROUGHNESS(FT)          =  .150000E-03
```

PIPE SEG NO. 1 PIPE DIA= 12.000

FLOW-GPM	VEL [illegible]	LHD(FT	KHD(FT)	LOAD(FT)	TOT.HD.
.0	[illegible]	.00	.00	.0[illegible]	.00
200.0	.57	.04	.00	.0[illegible]	.05
400.0	1.1[illegible]	.16	.01	.17	.34
[illegible]	[illegible]	[illegible]	.02	[illegible]	.71
[illegible]	[illegible]	[illegible]	.04	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.06	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.09	[illegible]	[illegible]
14[illegible]	[illegible]	[illegible]	.12	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.16	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.20	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.25	[illegible]	[illegible]

PIPE SEG NO. 2 PIPE DIA= [illegible]

FLOW-GPM	VEL(FPS)	LHD(FT	KHD(FT)	LOAD(FT)	TOT.HD.(FT)
.0	[illegible]	[illegible]	.0[illegible]	.00	.00
200.0	1.[illegible]	[illegible]	.1[illegible]	.22	.3[illegible]
400.0	2.57	[illegible]	.4[illegible]	.7[illegible]	1.4[illegible]
600.0	3.85	.48	1.01	[illegible]	[illegible]
800.0	5.1[illegible]	.8[illegible]	1.80	2.[illegible]1	[illegible]
1000.0	6.4[illegible]	1.2[illegible]	2.81	[illegible]	[illegible]
1200.0	7.70	1.81	4.05	[illegible]	12.27
1400.0	8.98	2.46	5.51	8.[illegible]	16.59
1600.0	10.26	3.18	7.19	11.1[illegible]	21.56
1800.0	11.54	4.00	9.11	14.07	27.18
2000.0	12.83	4.92	11.24	17.[illegible]	33.44

WMDAFP

4.0 MAJOR COMPONENT DESIGN BASES

4.1 Safety Related Components

4.1.1 ESW Pumps (PP-7E, PP-7W)

The ESW pumps are 2-stage vertical turbine pumps manufactured by Johnston Pumps (Model 30CC-2 Stage). These pumps have enclosed shafts and grease lubricated bearings. [7.2.2(4)] [7.8.2(1)] The pumps are located in the center portion of the screenhouse in separate missile-protected rooms. [7.2.2(4)] [7.1.5(2)] [7.1.5(6)] The pump inlet pipe and shaft extend approximately 44 feet below the screenhouse floor into the suction well which is approximately 45 feet deep. [7.1.1(2)] [7.1.1(8)]

The pumps were originally provided with bronze impellers. However, erosion due to heavy lake water sand and silt loading resulted in replacement of the impellers every 3 to 4 years. As a result, the impellers are being upgraded to stainless steel (ASTM A351-CF3M; type 316 SS) as the pumps are repaired. This design change is expected to at least double the life of the impellers. [7.6.3(2)] [7.1.4(2)]

4.1.1.1 Basic Functions

As discussed in Sections 2 and 3, the ESW pumps are designed to provide cooling water to various interfacing systems. Each of the four pumps has the following design parameters. [7.1.1(2)] [7.1.1(8)] [7.8.2(1)] [7.8.2(5)] [7.8.2(4)] [7.8.2(3)] [7.8.2(6)]

Design Flow Rate	10,000 gpm
Design Total Dynamic Head	145 ft
Shutoff Head	Approximately 240 ft
Rated Speed	880 rpm
Efficiency (at design point)	Approximately 84%
Brake Horsepower (at design point) - Based on a fluid specific gravity of 1.0.	Approximately 440 hp

Refer to Figure 6-1 for pump head flow requirements.

4.1.1.1.1 Pump NPSH

At the minimum lake level of 565 feet 11 inches, the inlet to the first stage of the pump impeller will have a submergence of 18 to 19 feet. The pump is capable of a suction lift of 8 feet of water (at 70 F) at the design flow rate of 10,000 gpm. Therefore, at the above lake level the pump has a margin of 26 feet above the required NPSH of 25 feet. As a result, pump performance is not limited by NPSH considerations. [7.8.2(1)] [7.1.1(2)] [7.1.1(8)]

JOHNSTON PUMP COMPANY

Nuclear Service Division

January 15, 1998

Indiana Michigan & Electric
D.C. Cook Plant
Bridgeman, MI 49106

Subject: Johnston Service Water Pumps Model 30 CC

Attention: Walt McCrory

Per our phone conversation please see enclosed curve on our 30CC model pump which shows the minimum submergence required over the suction bell as 56". Also shown on this curve is the NPSHR which shows 18 feet at 10,000 GPM. I hope this information will be helpful and should you have any questions please do not hesitate to call.

Sincerely,

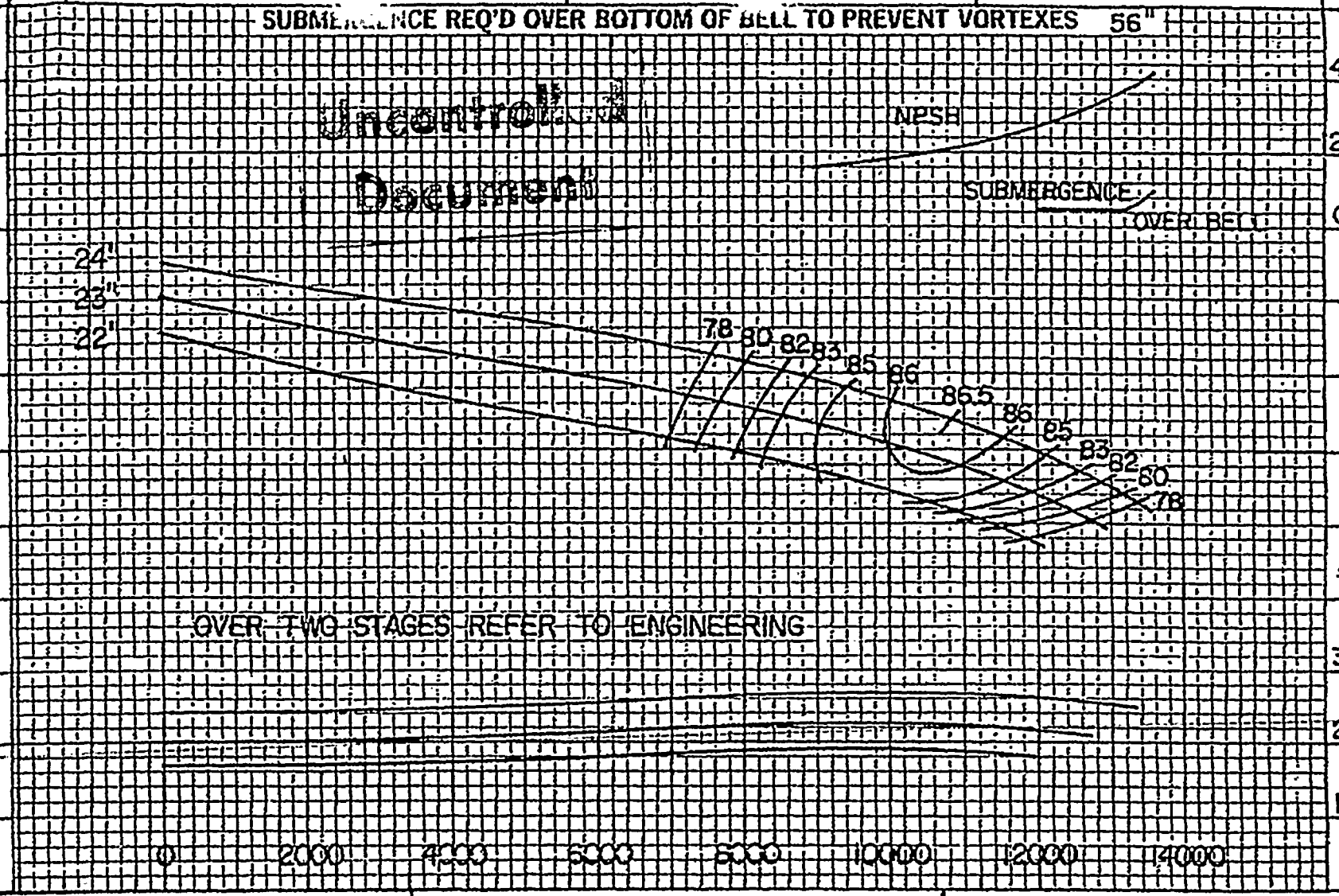
Ray Clark

Ray Clark

2601 East 34th Street ☐ Chattanooga, Tennessee 37407
FAX 423/698-1447 Telephone: 423/629-1415 HOTLINE 1-800-227-2601

PER STAGE	IMP. DIAM. EXIT	IMPELLER PART NO. 6005 IMPELLER PATTERN NO. 5003	THRUST CONSTANT 95.5 WR² 159 LB/STAGE	PUMP SHAFT DIAM. 3 1/4" INCHES

SUBMERGENCE REQ'D OVER BOTTOM OF BELL TO PREVENT VORTEXES 56"



PERFORMANCE BASED ON MULTISTAGE TESTS
PUMPING CLEAR COLD WATER SP. GR. 1.0
FOR 1 STAGE MULTIPLY HEAD & EFF. BY 1.00
FOR 2 STAGES MULTIPLY HD. & EFF. BY 1.00
DATE 2-23-78

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

30 CC TURBINE PUMP 880 RPM
IMPELLER — BRONZE
BOWL — CASTIRON COATED
CURVE SHEET NO. EC-2558

JP-341A

HXP791121AF - Verification of the Nov 21, 1979 Auxiliary Feed Pumps Net Positive Suction Head Available

Most Significant Technical Rating: T1

Most Significant Administrative Rating: A2

Calc. Date: 1/13/88 Discipline: Mechanical System: AFW

Summary Observation

GENERAL COMMENTS

* replacement for HXP740226FK

* Joe Lula to revise the review to indicate that the calculation should show that pump operation is limited by flow retention and operation will not occur in the extrapolated portion of the NPSHr curve. Additionally, the extrapolated curve should be deleted from the calculation. Resolved - Calculation does not use extrapolated data. (JL 3/20/98)

SL Reviewer: Mark Idell Date: 3/16/98

SL Approver: Joe Lula Date: 3/17/98

AEP Approver: Gordon C. Allen Date: 3/24/98

Pages in the Calculation: 10 Priority: Inventory

1a Purpose and Objective: Are the purpose and objective clearly stated?

Is this attribute acceptable as is? Yes

Comment Rating	Comment Text
	Verifies results of a previous calculation which was attached. (origininal calculation had no identification ID other than date and title summary)

1b Purpose and Objective: If the calculation is for a modification, is this noted in the purpose and on the cover sheet?

Is this attribute acceptable as is? n/a

2a Methodology and Acceptance Criteria: Has the method/approach been described?

Is this attribute acceptable as is? Yes

2b Methodology and Acceptance Criteria: Is the method/approach appropriate for the calculation?

Is this attribute acceptable as is? Yes

2c Methodology and Acceptance Criteria: Are the steps in the analysis method clearly defined?

Is this attribute acceptable as is? Yes

Comment Rating	Comment Text
	A sample of the calculations have been illustrated in the calculations, the remainder of the similar computations have been performed in with only the results appearing in the calculation.

2d Methodology and Acceptance Criteria: Have the sources of the acceptance criteria been identified?

Is this attribute acceptable as is? Yes

Comment Rating	Comment Text
	The acceptance criteria has not been specifically provided but are understood by the problem description

2e Methodology and Acceptance Criteria: Are the acceptance criteria appropriate for the calculation?

Is this attribute acceptable as is? Yes

3a Assumptions: Are the assumptions provided with sufficient rationale to permit verification?
Is this attribute acceptable as is? Yes

3b Assumptions: Have the assumptions that require verification been identified?
Is this attribute acceptable as is? n/a

3c Assumptions: Have assumptions that require verification been tracked to assure closure, if applicable?
Is this attribute acceptable as is? n/a

4a Design Inputs: Have the applicable design inputs been identified, including second party verification?
Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	Design inputs have not been identified within the calculation. No clear reference was provided for the NPSHr curves.

4b Design Inputs: Has a statement as to whether the source inputs to the calc. may impact the design bases been included?
Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	No statement has been provided

5a References: Have all the appropriate references been identified and cross references provided?
Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	References for design data have not been provided with appropriate references and or sources.

5b References: Have all the references been provided with sufficient information to permit verification?
Is this attribute acceptable as is? Yes

5c References: Have the revision numbers and/or dates been provided?
Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	Reference dates and or revision indications have not been provided.

6a Calculations: Have formulae been provided consistent with the source document, including engineering units?

Is this attribute acceptable as is? Yes

6b Calculations: Have the correct formulae/methods been selected to support the problem statement and objective in agreement with established client and/or industry requirements?

Is this attribute acceptable as is? Yes

6c Calculations: Have all engineering judgements been provided with sufficient rationale?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
T1	NPSHr calculation uses generic 14.7 psia as the site atmospheric pressure. Calculation does not indicate that this is the most limiting committed atmospheric pressure in licensing basis if in fact it is. Minimum CST level should reference the suction pipe nozzle elevation not the referenced lo-level alarm. (Top of 12" AFP suction pipe nozzle is 610'-9", lo level alarm is 625'-9" difference of 15'-0") The lo-level alarm represents a potential maximum level available at the onset of an accident. Reference to instrument alarm levels did not include instrument error or inaccuracies. Impact on calculation is minimal, with no change to conclusion, adequate NPSH is available. Additional margin is available because flow retention is used Available NPSH margin: Motor Driven AFP Low 45', High 57' (margin at AFP suction pipe nozzle = 30') Turbine Driven AFP Low 22', High 34' (margin at AFP suction pipe nozzle = 7' ')

6d Calculations: Have the calculations been performed in accordance with the methodology?

Is this attribute acceptable as is? Yes

6e Calculations: Are the calculation results accurate and free of computational errors?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	Source of head loss input data for line segment 3 not described in reference document.

6f Calculations: Have the arithmetic results been transposed correctly from references or equation results?

Is this attribute acceptable as is? Yes

6g Calculations: Are the analytical models consistent with the input data, assumptions, or design methods?
Is this attribute acceptable as is? Yes

7a Computer-Aided Design Calculations: Has the computer program been validated?
Is this attribute acceptable as is? n/a

7b Computer-Aided Design Calculations: Is the program consistent with the design approach, methodology, and acceptance criteria?
Is this attribute acceptable as is? n/a

7c Computer-Aided Design Calculations: Have the program title, revision, computer hardware and date and time of run been identified?
Is this attribute acceptable as is? n/a

7d Computer-Aided Design Calculations: Does the input data conform with design inputs and are the results consistent with the assumptions and input data?
Is this attribute acceptable as is? n/a

7e Computer-Aided Design Calculations: If spreadsheet or other simple computer aided tools are used in the calculation, have the formulae been documented in the calculation and independently verified to be correct?
Is this attribute acceptable as is? n/a

7f Computer-Aided Design Calculations: Have data files from last revision been verified and documented?
Is this attribute acceptable as is? n/a

7g Computer-Aided Design Calculations: Have the following attributes been documented for any data files which were created or revised...
Is this attribute acceptable as is? n/a

8a Summary of Results and Conclusions: Does the summary of the results and conclusions clearly state the calculation results and respond to the purpose and objective?
Is this attribute acceptable as is? Yes

8b Summary of Results and Conclusions: Do the conclusions address the acceptability / unacceptability of the results?

Is this attribute acceptable as is? n/a

8c Summary of Results and Conclusions: Have limitations or requirements imposed by the calculation necessary to maintain the validity of the results been identified?

Is this attribute acceptable as is? n/a

8d Summary of Results and Conclusions: Are justifications provided for conclusions based on "engineering judgement"?

Is this attribute acceptable as is? n/a

9a Recommendations: Are the recommendations consistent with the purpose/objective, acceptance criteria, and results?

Is this attribute acceptable as is? n/a

9b Recommendations: Do any recommendations require corrective actions? Are these corrective actions being communicated to the affected organization?

Is this attribute acceptable as is? n/a

10a Appearance: Have calculation format and content requirements been met?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	See below

10b Appearance: Have all required attachments been included in the document and numbered appropriately?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	Attachment pages are not numbered to indicate the either the parent or the calculation to which it is attached

10c Appearance: Has the calculation been prepared neat and legible with sufficient contrast to all satisfactory record copies to be produced?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	Page 6 of 6 of the attachment is not completely legible.

10d Appearance: Are the calculation number and the sheet number provided on each page?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	Only page numbers provided on calculation and attachment no documents numbers appear except on title sheets.

10e Appearance: Have revision bars been provided as appropriate (for revised calculations only)?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	No revision bars have been provided to indicate the revised information.

10f Appearance: If the calculation indicates that it supersedes a previous calculation, is this noted on the cover sheet?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A2	The calculations intent is to verify the results of a previous calculation, it would have been more appropriate to revise the original calculation rather than have two or more design calculations on the same subject.

10g Appearance: Is the calculation review checklist attached?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	No checklist was provided, but a reviewer signature is.

11a Review Methods: Has the review method been performed using one or more of the following methods...

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	No review method has been identified.

11b Review Methods: Has the review method been clearly identified on the cover page?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	No method has been provided.

11c Review Methods: Is the verification checklist attached?

Is this attribute acceptable as is? No

Comment Rating	Comment Text
A1	No checklist has been provided.

References

Code Legend

TECHNICAL

TS	Superceded
T0	No comment, calculation is acceptable as presented.
T1	Negligible effect on results and item resolved by documented engineering judgement. Calculation of record may require revision.
T2	Minor effect on results and item resolved by simple/manual calculation. Calculation of record may require revision.
T3	Significant effect on results or item resolved by detailed analysis. Calculation of record will require revision.
T4	Results in inoperability or design basis or licensing basis limits are exceeded. Calculation of record will require revision.

ADMINISTRATIVE

A0	No comment, calculation is acceptable as presented.
A1	Minor editorial item (spelling, grammar, typographical errors, page numbers, etc.). Calculation does not require revision.
A2	Poor organization, poor legibility, confused layout. Calculation may require revision.
A3	Documentation of assumptions, scope, design inputs, methodology, references or engineering judgement is not complete or clear. Calculation may require revision.
A4	Did not follow procedure.

STATUS

IP	Performing independent review.
IR	Resolving review comments.
R	Replaced (Superceded, Voided, Vendor Calc).
RC	Independent review complete.
FM	Ready for Functional Manager review.
TOC	Reviewed by management (Approved).
TOCR	Reviewed by management - Additional action required.
TOCR/RC	Reviewed by management- Add. actions taken, again ready for FM.