
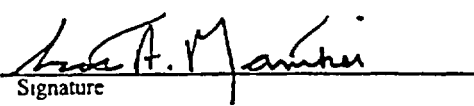

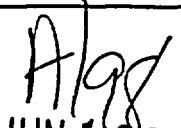


Nuclear Power Business Unit
CALCULATION DOCUMENT FORM

Calculation/Addendum Number: N-91-069-00-A	Title of Calculation/Addendum: Impact of Higher Capacity Recirculation System for the Electric Motor Driven AFW Pumps.					
<input checked="" type="checkbox"/> Original Calculation/Addendum <input type="checkbox"/> Supersedes Calculation/Addendum <input type="checkbox"/> Revised Calculation/Addendum Revision # _____						
<input checked="" type="checkbox"/> QA Scope <input type="checkbox"/> Non-QA Scope	Associated Documents: _____ _____					
	Superseded By Calculation/Addendum # _____ _____					
<p>This Calculation has been reviewed in accordance with NP 7.2.4. The review was accomplished by one or a combination of the following (as checked):</p> <table style="width:100%;"> <tr> <td style="width:50%;"><input type="checkbox"/> A review of a representative sample of repetitive calculations.</td> <td style="width:50%;"><input checked="" type="checkbox"/> A detailed review of the original calculation.</td> </tr> <tr> <td><input type="checkbox"/> A review of the calculation against a similar calculation previously performed.</td> <td><input type="checkbox"/> A review by an alternate, simplified, or approximate method of calculation.</td> </tr> </table>			<input type="checkbox"/> A review of a representative sample of repetitive calculations.	<input checked="" type="checkbox"/> A detailed review of the original calculation.	<input type="checkbox"/> A review of the calculation against a similar calculation previously performed.	<input type="checkbox"/> A review by an alternate, simplified, or approximate method of calculation.
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<input type="checkbox"/> A review of the calculation against a similar calculation previously performed.	<input type="checkbox"/> A review by an alternate, simplified, or approximate method of calculation.					
Page Inventory: Page 1 – 4 Form PBF-1608 Page 5 – 7 See Table of Contents (Page 5)						
Attachments: Attachment A, Sheet 1 of 1, "Flowserve Control Valve Specification Serial No. 0D981A.004", attached.						
Prepared By: <u>A. Foltynowicz</u> Print Name	 Signature	Date: 6-14-00				
Reviewed By: <u>S. Manthei</u> Print Name	 Signature	Date: 6-14-2000				
Approved By: <u>R. HORNAK</u> Print Name	 Signature	Date: 6-15-00				


REC'D JUN 16 2000

Calculation Checklist (Optional for Non-QA Scope)

Item No.	Attribute Description	N/A	Author	Reviewer
1.	Purpose			
a.	Is the purpose clearly stated indicating issue to be resolved or information to be determined?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
2.	Methodology and Acceptance Criteria			
a.	Has the method/approach been described?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
b.	Have appropriate acceptance criteria and their sources been identified?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
3.	Assumptions			
a.	Are the assumptions provided with sufficient rationale to permit verification?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
b.	Have assumptions associated with pending plant or procedure changes that require verification been identified?	N/A	<input type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
c.	Have the requirements to revise governing calculations or verify pending assumptions been documented in a modification or an EWR?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
4.	References			
a.	Have all the appropriate references, including revisions and/or dates, been identified?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
b.	Are all references readily available in the PBNP Records System, as public documents, or attached?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
5.	Inputs			
a.	Have the applicable inputs and sources been identified?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
6.	Calculation			
a.	Have formulae and inputs been provided consistent with the source document, including engineering units?		<input checked="" type="checkbox"/> N/A	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
7.	Computer-Aided Design Calculations (NP 7.2.4 Attachment A)	N/A		
a.	Has the computer program been validated per the requirements of Attachment A?		<input type="checkbox"/>	<input type="checkbox"/> yes <input type="checkbox"/> no
b.	Have the program version and revision been identified on the computer run and in the calculation?		<input type="checkbox"/>	<input type="checkbox"/> yes <input type="checkbox"/> no
c.	Is the input to the computer program adequately documented?		<input type="checkbox"/>	<input type="checkbox"/> yes <input type="checkbox"/> no
d.	If spreadsheet or other simple computer aided tools are used in the calculation, have the formulae been documented in the calculation?		<input type="checkbox"/>	<input type="checkbox"/> yes <input type="checkbox"/> no
e.	Have the attributes been documented in the calculation for any input or output data files supporting the calculation, including file name, date stamp, time stamp (hour and minute only), and file size?		<input type="checkbox"/>	<input type="checkbox"/> yes <input type="checkbox"/> no
8.	Summary of Results and Conclusions			
a.	Do the summary of results and conclusions clearly state the calculation results and respond to the purpose?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
b.	Do the conclusions address the acceptability/unacceptability of the results?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
c.	Has a CR been initiated to identify any unsatisfactory conditions?	N/A	<input type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

Item No.	Attribute Description	N/A	Author	Reviewer
	d. Have all engineering judgments been provided with sufficient rationale?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
9.	Administrative			
	a. Have calculation format and content as noted in NP 7.2.4 been followed?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	b. Have all required attachments been included in the document and numbered appropriately?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	c. Has the calculation been prepared neatly and legibly with sufficient contrast to allow satisfactory record copies to be produced?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	d. Are the calculation number, preparer's initials, preparation date, and page number provided on each page?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	e. Have revisions been clearly identified by revision bars or other appropriate means (for revised calculations only)?	N/A	<input type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	f. If the calculation supersedes a previous calculation, is this noted on the cover sheet?	N/A	<input type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	g. Has the calculation been appropriately identified as QA or Non-QA scope?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	h. Has the review method been clearly identified on the cover page?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
	i. Is all information requested by PBF-1620 entered on the form?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no

COMMENTS AND RESOLUTION

Reviewer Comments:	Resolution:
✓	

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Purpose

This addendum documents the installation of the replacement pressure reducing orifices RO-04008 and RO-04015 by Modification Requests 99-029*A & 99-029*B, respectively. Condition Report CR 99-1391 raised concern regarding the noise and vibration in the AF piping attributed to the ROs cavitation. Therefore, the existing ROs were replaced with new ROs.

The existing ROs are addressed in Calculation N-91-069. This addendum documents that the results of Calculation N-91-069 are not significantly altered by the above replacement and remain valid.

Methodology & Acceptance Criteria

No calculations are performed under this addendum. The comparison of pressure drop across old vs. replacement components was performed.

The methodology and acceptance criteria outlined in Calculation N-91-069 shall apply and are used appropriately.

Assumptions

No new assumptions are made in this addendum.

References

1. Wisconsin Electric Calculation N-91-063, "P38A & B Recirc. Line System Characteristics, Rev. 0, approved 07/02/91.
2. Wisconsin Electric Calculation N-91-069, "Impact of Higher Capacity Recirculation System for the Electric Motor Driven AFW Pumps, Rev. 0, approved 07/09/91.
3. Crane Technical Paper 410, "Flow of Fluids through Valves, Fittings and Pipe", 1988.
4. Condition Report 99-1391, "Potential Common Mode Failure Mechanism Affecting Welds in AFW Pump Recirc. Line".
5. Purchase Order No. 4500291375.
6. Addendum No. N-91-063-00-A, "P38A & B Recirc Line System Characteristics".

Inputs

1. Wisconsin Electric Calculation N-91-063, "P38A & B Recirc. Line System Characteristics, Rev. 0, approved 07/02/91.
2. Addendum No. N-91-063-00-A, "P38A & B Recirc Line System Characteristics.

Calculation

Not Applicable.

Results & Conclusions

The existing ROs' resistance coefficient "KRC", utilized to calculate the AF pumps P-38A and P-38B recirculation line flow, was compared to the new ROs resistance coefficient.
The existing ROs' information is from the Calculation N-91-069. The replacement ROs' information is as referenced.

EXISTING RO-4008 & 4015

Page 3 of 12 KRC = 1892

REPLACEMENT ROs

$$KRC = (\Delta P_{KC} \times d^4) / (0.00259 \times Q^2)$$

per Ref.3, Eq 3-14

where; ΔP_{KC} = 965.542 psi (Input 2)
Q = 80 gpm (Input 1)
d = 1.939 in. (Input 1)

$$KRC = \frac{965.542 \times 2.3 \times 1.939^4}{0.00259 \times 80^2}$$

$$KRC = 1893.78 = 1894$$

Page 6 of 12 KRC = 1892

KRC = 1894

The slightly higher resistance coefficient KRC value of new ROs is negligible.

In conclusion, this addendum determines that replacement ROs installed by MR 99-029*A and MR 99-029*B, do not affect the results of the calculation N-91-069, that is, to maintain AF system pump P-38A and P-38B recirculating flow as follows:

- Recirculation line open: Total flow rate = 93gpm
- Recirculation line open and the pump discharge flow maintained at 200 gpm:
Total flow rate = 89 gpm.

ATTACHMENT A
WISCONSIN ELECTRIC
CALCULATION ADDENDUM N-91-069-00-A
PAGE 1 OF 1

FLOWERVE CONTROL VALVE
SPECIFICATION SERIAL NO. 0D981A.004

Process Data For Control Valve Selection		Condition				Actuator	None
		Cond 1	Cond 2	Cond 3	Cond 4		
1	Pipe Size, Up/Down	2.000 / 2.000				51	
2	Pipe Sch, Up/Down	80 / 80				52	
3	Allow Noise/Add Attn/Type	90 / 0 /				53	1.50
4	Process Fluid	Water				54	
5	Critical Pressure	3207.40 psi(a)				55	
6		Cond 1	Cond 2	Cond 3	Cond 4	56	
7	Temperature (°F)	120.000	100.000	100.000	100.000	57	
8	Inlet Press (psi (g))	1440.000	1180.000	1300.000	1190.000	58	
9	Outlet Press (psi (g))	50.000	15.000	15.000	15.000	59	
10	Liq Flow Rate (galUS/min)	84.680	77.085	80.958	77.415	60	
11	Gas Flow Rate (1000 SCFH)	0	0	0	0	61	
12	Viscosity (cP)	0.000	0.000	0.000	0.000	62	
13	Vapor Press (psi (a))	1.703	0.955	0.955	0.955	63	
14	SG-MW	0.970	0.980	0.980	0.980	64	
15	Max Shutoff / Shutoff Class	100.000 psi / N/A - No Plug				65	
16	Available Air Supply	80.000 psi (g)				66	
17	Fail Position / Valve Function	/ Throttling				67	
18		Cond 1	Cond 2	Cond 3	Cond 4	68	
19	Flow Coeff (Cv)	2.260	2.260	2.260	2.260	69	
20	Est Stroke (Percent)	N/A	N/A	N/A	N/A	70	
21	Pressure Drop (psi)	1390.000	1165.000	1285.000	1175.000	71	
22	Choke Drop (psi)	1453.077	1193.788	1313.788	1203.788	72	
23	Noise (Phwrt) (dBA)	<70	<70	<70	<70	73	
24	Valve Vel (ft/s)	61.528	56.010	58.824	56.249	74	
25	Pipe Vel (ft/s)	9.205				75	
26	Valve Model / Body Type	ChannelStream / Globe				76	
27	Size/Pressure Rating/Type	2.00 / CL 600 /				77	
28	Trim # - Cv / Characteristic	.75 Cv:2.300 / Linear				78	
29	Number of Stages/Teeth	6 Stage				79	
30	Flow Direction	Flow Over				80	
31	Body Matl / Bonnet Matl	316 SS / 316 SS				81	
32	End Conn/Sch/Face to Face	Socket Weld / / ISA S75.03				82	
33	Flange Finish					83	
34	Bonnet Type	Blind Flange				84	
35	Trim Type	Unbalanced				85	
36	Plug Matl / Facing	None /				86	
37	Plug Stem Facing					87	
38	Seat Ring Matl / Facing	316 SS /				88	
39	Soft Seat Material					89	
40	Retainer Matl/Steeve Matl	316 SS /				90	
41	Guides Upper/Lower	None/None				91	
42	Packing Matl / Style / Vac / Fire	None/N/A//				92	Radio, Exam
43	Body Drain					93	Drawings
44	Bonnet Port Type					94	Assem Hydro
45	Bellows Type					95	Seat Leak Test
46	Bellows Material					96	Documentation
47	Body Bolting/Bonnet Flange Matl	B7-2H / 316 SS				97	Cert of Conf.
48	Gaskets	Spiral Graphite				98	PO or Spec.
49	Gland Flange Material	None				99	Cleaning
50	Gland Flange Bolting	None				100	CMTR
						99	Special Paint
						100	Pressure Boundry and Trm
							ValStat Test

Line #	Remarks
	ASME B16.34 Special Class with 10CFR50 App B and 10CFR21.
	No plug, packing parts, actuator or associated parts.
	Non-adjustable Pressure Reducing Device
95	Prepared & <i>Mark D. Cowell</i> 4/11/00 -- Reviewed By: <i>M. K. Dunkelberger</i> 4/11/00
95	Certified By: <i>Mark D. Cowell, Sr.</i> Project Engineer Mike K. Dunkelberger, Project Engineer