

<u>Calculation/Addendum Number:</u> N-91-063-00-A		<u>Title of Calculation/Addendum:</u> P38A & B Recirc Line System Characteristics					
<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	Superseded By Calculation/Addendum # _____						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 border="0"> <tr> <td>_____ A review of a representative sample of repetitive calculations.</td> <td><input checked="" type="checkbox"/> A detailed review of the original calculation.</td> </tr> <tr> <td>_____ A review of the calculation against a similar calculation previously performed.</td> <td>_____ A review by an alternate, simplified, or approximate method of calculation.</td> </tr> </table>				_____ A review of a representative sample of repetitive calculations.	<input checked="" type="checkbox"/> A detailed review of the original calculation.	_____ A review of the calculation against a similar calculation previously performed.	_____ A review by an alternate, simplified, or approximate method of calculation.
_____ A review of a representative sample of repetitive calculations.	<input checked="" type="checkbox"/> A detailed review of the original calculation.						
_____ A review of the calculation against a similar calculation previously performed.	_____ A review by an alternate, simplified, or approximate method of calculation.						
<u>Page Inventory:</u>		<u>Attachments:</u>					
Page 1 - 4 Form PBF-1608		Attachment A, Sheet 1 of 1, "Flowserve Control Valve Specification Serial No. 0D981A.004", attached.					
Page 5 - 7 See Table of Contents (Page 5)							
Prepared By: A. Foltynowicz Print Name	<i>A. Foltynowicz</i> Signature	Date: 6-12-00					
Reviewed By: S. Manthei Print Name	<i>S. Manthei</i> Signature	Date: 6-12-2000					
Approved By: <i>R.F. HORNAK</i> Print Name	<i>R. Hornak</i> Signature	Date: 6-15-00					

A/99  
REC'D JUN 16 2000

**Calculation Checklist (Optional for Non-QA Scope)**

Item No.	Attribute Description	N/A	Author	Reviewer
1.	<b>Purpose</b>			
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.	<b>Methodology and Acceptance Criteria</b>			
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.	<b>Assumptions</b>			
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
5.	<b>References</b>			
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
4.	<b>Inputs</b>			
a.	Have the applicable inputs and sources been identified?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no
6.	<b>Calculation</b>			
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.	<b>Computer-Aided Design Calculations (NP 7.2.4 Attachment A)</b>	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.	<b>Summary of Results and Conclusions</b>			
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.	<b>Administrative</b>				
	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 type="checkbox"/> yes	<input type="checkbox"/> no
	h. Has the review method been clearly identified on the cover page?		<input checked="" type="checkbox"/>	<input 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:
<p>No Technical Comments Editorial Comments Only SAM 6-12-2000</p>	<p>Editorial comments incorporated as noted. AF 6-12-2000</p>

# Table of Contents

PURPOSE.....	6
METHODOLOGY & ACCEPTANCE CRITERIA.....	6
ASSUMPTIONS .....	6
REFERENCES .....	6
INPUTS.....	6
CALCULATION .....	6
RESULTS & CONCLUSIONS.....	7



## 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-91-063. This addendum documents that the results of Calculation N-91-063 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-91-063 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. Crane Technical Paper 410, "Flow of Fluids through Valves, Fittings and Pipe", 1988.
3. Condition Report 99-1391, "Potential Common Mode Failure Mechanism Affecting Welds in AFW Pump Recirc. Line".
4. Purchase Order No. 4500291375.

## Inputs

1. Flowserve Control Valve Specification Serial No. 0D981A.004, attached.

## Calculation

Not Applicable.

BEST COPY AVAILABLE

## Results & Conclusions

The pressure drop of the existing restricting orifices RO-04008 and RO-04015 was compared to the pressure drop through the replacement ROs.  
The existing ROs' information is from the Calculation N-91-063. The replacement ROs' information is from the Vendor Specification (Design Input 1).

### EXISTING RO-4008 & 4015

Page 7 of 9       $\Delta P_s = 948$  psi

Page 9 of 9       $\Sigma \Delta P = 962.362$  psi

### REPLACEMENT ROs

$\Delta P_s = (Q/C_v)^2 \times 62.4/\rho$ ; per Ref.2, Eq 3-16  
where  $\rho_{100} = 62$

$\Delta P_s = (70/2.26)^2 \times 62.4 / 62$

$\Delta P_s = 965.54$  psi

$\Sigma \Delta P = 979.902$  psi

Iteration would result in equivalent value K for the recirc line, that is slightly higher (0.018%). As a result, slightly reduced flow rate, but still >70 gpm.  
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-91-063, that is, to maintain AF system pump P-38A and P-38B recirculating flow above 70 gpm.

ATTACHMENT A  
 WISCONSIN ELECTRIC  
 CALCULATION ADDENDUM N-91-063-00-A  
 PAGE 1 OF 1

FLOWSERVE CONTROL VALVE  
 SPECIFICATION SERIAL NO. 0D981A.004

Process Data For Control Valve Selection	Process Data					Actuator	Positioner	Pos Ind Sw	Solenoid	Others	Special Req
	1	2	3	4	5						
1	Pipe Size, Up/Down	2.000 / 2.000				151					None
2	Pipe Sch, Up/Down	80 / 80				152					
3	Allow Noise/Add Attr/Type	90 / 0 /				153					1.50
4	Process Fluid	Water				154					
5	Critical Pressure	3207.40 psi(a)				155					
6		Cond 1	Cond 2	Cond 3	Cond 4	156					
7	Temperature (°F)	120.000	100.000	100.000	100.000	157					
8	Inlet Press (psi (g))	1440.000	1180.000	1300.000	1190.000	158					
9	Outlet Press (psi (g))	50.000	15.000	15.000	15.000	159					
10	Liq Flow Rate (galUS/min)	84.680	77.085	80.958	77.415	160					
11	Gas Flow Rate (1000 SCFH)	0	0	0	0	161					
12	Viscosity (cP)	0.000	0.000	0.000	0.000	162					
13	Vapor Press (psi (at))	1.703	0.955	0.955	0.955	163					
14	SG-MW	0.970	0.980	0.980	0.980	164					
15	Max Shutoff / Shutoff Class	100.000 psi / N/A - No Plug				165					
16	Available Air Supply	80.000 psi (g)				166					
17	Fail Position / Valve Function	/ Throttling				167					
18		Cond 1	Cond 2	Cond 3	Cond 4	168					
19	Flow Coeff (Cv)	2.260	2.260	2.260	2.260	169					
20	Est Stroke (Percent)	N/A	N/A	N/A	N/A	170					
21	Pressure Drop (psi)	1390.000	1165.000	1285.000	1175.000	171					
22	Choke Drop (psi)	1453.077	1193.788	1313.788	1203.788	172					
23	Noise (Forward) (dBA)	<70	<70	<70	<70	173					
24	Valve Vel (ft/s)	61.528	56.010	58.824	56.249	174					
25	Pipe Vel (ft/s)	9.205				175					
26	Valve Model / Body Type	ChannelStream / Globe				176					
27	Size/Pressure Rating/Type	2 00 / CL 600 /				177					
28	Trim # - Cv / Characteristic	.75 Cv2.300 / Linear				178					
29	Number of Stages/Teeth	6 Stage				179					
30	Flow Direction	Flow Over				180					
31	Body Matl / Bonnet Matl	316 SS / 316 SS				181					
32	End Conn/Sch/Face to Face	Socket Weld / / ISA S75.03				182					
33	Flange Finish					183					
34	Bonnet Type	Blind Flange				184					
35	Trim Type	Unbalanced				185					
36	Plug Matl / Facing	None /				186					
37	Plug Stem Facing					187					
38	Seat Ring Matl / Facing	316 SS /				188					
39	Soft Seat Material					189					
40	Retainer Matl/Sleeve Matl	316 SS /				190					
41	Guides Upper/Lower	None/None				191					
42	Packing Matl / Style / Vac / Fire	None/N/A//				192					
43	Body Drain					193					
44	Bonnet Port Type					194					
45	Bellows Type					195					
46	Bellows Material					196					
47	Body Bolting/Bonnet Flange Matl	B7-2H / 316 SS				197					PO or Spec.
48	Gaskets	Spiral Graphite				198					Pressure Boundry and Trim
49	Gland Flange Material	None				199					
50	Gland Flange Bolting	None				200					

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> #4100
95	Certified By: <i>Mark D. Cowell, Sr.</i> Project Engineer
	Reviewed By: <i>M. K. Dunkelberger</i> 4/11/00
	Mike K. Dunkelberger, Project Engineer