

Salishan Uprate 2012
Job Number: 887024719
Regulator Station Overpressure Protection Review

Salishan Supply

Facility ID
RS-2695
RS-2696
RS-2697
RS-2698
RS-2723
RS-2311 (Monitor Protected – Relief Review Not Applicable)

Pierce Transit Supply

Facility ID
RS-2558

District Regulator Station - 2558

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Sini Pendikatta</i>	Date	6/1/12
Remarks	Proposed Review - Salishan Uprate (250 psig) Inlet pressure takes into account pressure losses		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	100 %	

2. Relief Valve Information:

Relief Valve Manufacturer	American	
Relief Valve Type	Axial Flow	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2558

4A. Calculate the Failure Flow through the Regulator:

$P_{reg\ set\ pt} =$	Regulator set pressure or downstream MAOP	45 psig
$P_{reg\ in\ max} =$	Maximum inlet pressure to the regulator	234 psig
$C_{g\ fail} =$	Gas sizing coefficient for regulator failure	1.491
$Q_{reg\ fail\ max} = (P_{reg\ in\ max} + 14.696) \times C_{g\ fail} \times 1.291$		
$Q_{reg\ fail\ max} =$	Maximum flow rate through failed regulator	478,325 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

$R.V.\ set\ point =$	Relief valve set point	47.00 psig
$R.V.\ build-up =$	Per manufacturers documentation	1.50 psig
$P_{S.L.T.I.P.} = P_{reg\ set\ pt} + R.V.\ buffer + R.V.\ build-up$		
$P_{S.L.T.I.P.} =$	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

$MAOP_{D/S\ L.O.D.} =$	MAOP downstream of L.O.D. outlet	45 psig
$P_{max\ allow\ B/D} =$	Allowable pressure build-up over MAOP	6.00 psig
$P_{max\ allow\ D/S\ L.O.D.} = MAOP_{D/S\ L.O.D.} + P_{max\ allow\ B/D}$		
$P_{max\ allow\ D/S\ L.O.D.} =$	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

$Test\ Pressure =$	Assume 90 psig if cannot be confirmed	90 psig
$MAOP_{reg\ to\ L.O.D.} =$	MAOP between the regulator and the L.O.D.	60.00 psig
$P_{max\ allow\ B/D} =$	Allowable pressure build-up over MAOP	6.00 psig
$P_{max\ allow\ reg\ to\ L.O.D.} = MAOP_{reg\ to\ L.O.D.} + P_{max\ allow\ B/D}$		
$P_{max\ allow\ reg\ to\ L.O.D.} =$	Max. allow. pressure between reg. and L.O.D.	66.00 psig

District Regulator Station - 2558

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	14.10 ft	48.50 psig	48.64 psig

P L.O.D.	48.64 psig
-----------------	------------

P_{max allow D/S L.O.D.}	51.00 psig
---	------------

Is P L.O.D. less than or equal to P_{max allow D/S L.O.D.}?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	228.66 ft	48.64 psig	50.86 psig
4st	162.00 ft	50.86 psig	61.10 psig

P reg outlet	61.10 psig
---------------------	------------

P_{max allow regtoL.O.D.}	66.00 psig
--	------------

Is P reg outlet less than or equal to P_{max allow regtoL.O.D.}?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	16.67 ft	48.50 psig	48.33 psig

Use P R.V. inlet to calculate Q_{relief} in Item 9

District Regulator Station - 2558

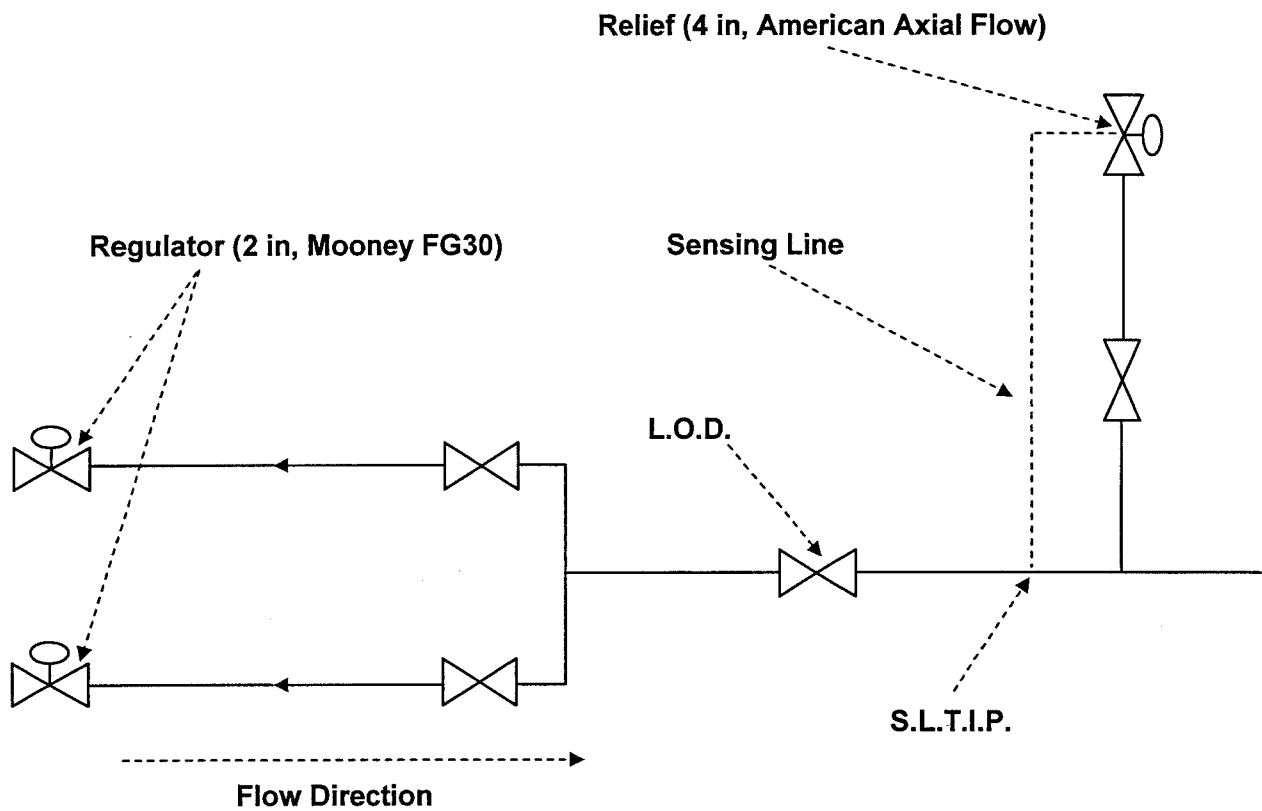
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input type="checkbox"/> Click here if not American Axial Flow Valve	n/a
-----------------------------	--	-----

P R.V. inlet	48.33 psig
Q relief	499,000 scfh
Q reg fail max	478,325 scfh

Is Q relief greater than or equal to Q reg fail max? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2558

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" stw pipe	1.00	1.00	6st
1	6" wld tee (through)	10.10	10.10	6st
3	6" stw pipe	1.00	3.00	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Nordstrom valve fig. 143	82.00	82.00	6st
9	6" stw pipe	1.00	9.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
3	6" stw pipe	1.00	3.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
14	6" stw pipe	1.00	14.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
1	6" stw pipe	1.00	1.00	6st
1	6" wld tee (through)	10.10	10.10	6st
2.25	6" stw pipe	1.00	2.25	6st
0	6" X 4" wld reducing tee (modeled by 6" tee+ 6" X 4" reducer)	1.00		6st
1	6" wld tee (branch)	30.30	30.30	6st
1	6" X 4" wld reducer (enlargement-larger)	31.41	31.41	6st
1	4" Plug valve, Nordstrom fig #525	14.00	14.00	4st
4	4" stw pipe	1.00	4.00	4st
1	4" X 2" wld reducer (enlargement-larger)	144.00	144.00	4st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	6" stw pipe	1.00	2.00	6st
1	6" Nordstrom valve fig. 143	4.00	4.00	6st
5.5	6" stw pipe	1.00	5.50	6st
1	6" X 4" wld reducer (contraction-larger)	5.17	5.17	6st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	14.10	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	228.66	
		4st	162.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	16.67	

INLET PRESSURE LOSS CALCULATION

Inlet Pressure Losses Calculation

	Description (Inlet Piping)		Equiv. ft/unit	Total Equiv. Ft	Equiv. Size
Common Piping					
1	6"	Bottom Out Class 300 H-17281 (65 ft of 6" = 9.0ft of 4")	9.07	9.07	4st
1	6" x 4"	Reducer Elbow 90 deg	6.41	6.41	4st
1	4"	Elbow 45 deg	5.37	5.37	4st
1	4"	Pipe	1.00	1.00	4st
1	4"	Elbow 45 deg	5.37	5.37	4st
3	4"	Pipe	1.00	3.00	4st
1	4"	Valve, Nordstrom Fig 2045 1/2	10.00	10.00	4st
2	4"	Pipe	1.00	2.00	4st
1	4"	Elbow 90 deg	10.10	10.10	4st
15	4"	Pipe	1.00	15.00	4st
1	4"	Elbow 90 deg	10.10	10.10	4st
Singl Run Piping					
1	4"	Branch Tee	20.10	20.10	4st
1	4"	Nord Fig 525	14.00	14.00	4st
2.42	4"	Pipe	1.00	2.42	4st
1	4" x 2"	Reducer	59.12	59.12	4st
1	2"	Strainer (31.1 ft of 2" = 763.4 ft of 4")	763.40	763.40	4st
Total 4" Length				936.456667	

Maximum Inlet Pressure Calculation

Inlet Pressure	Failure Flow
250	508220
231.74	472549
234.05	477070
233.77	476522
233.8	476581
233.8	

District Regulator Station - 2558

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		FAIL	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Suzi Potholite</i>	Date	6/1/12
Remarks	Proposed Review - Salishan Uprate (268 psig) Inlet pressure takes into account pressure losses		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	100 %	

2. Relief Valve Information:

Relief Valve Manufacturer	American	
Relief Valve Type	Axial Flow	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2558

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	251 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,491
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	511,183 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	90 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	60.00 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	66.00 psig

District Regulator Station - 2558

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	14.10 ft	48.50 psig	48.66 psig

P L.O.D.	48.66 psig
-----------------	------------

P_{max allow D/S L.O.D.}	51.00 psig
---	------------

Is P L.O.D. less than or equal to P_{max allow D/S L.O.D.}?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	228.66 ft	48.66 psig	51.15 psig
4st	162.00 ft	51.15 psig	62.55 psig

P reg outlet	62.55 psig
---------------------	------------

P_{max allow regtoL.O.D.}	66.00 psig
--	------------

Is P reg outlet less than or equal to P_{max allow regtoL.O.D.}?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	16.67 ft	48.50 psig	48.31 psig

Use P R.V. inlet to calculate Q_{relief} in Item 9

District Regulator Station - 2558

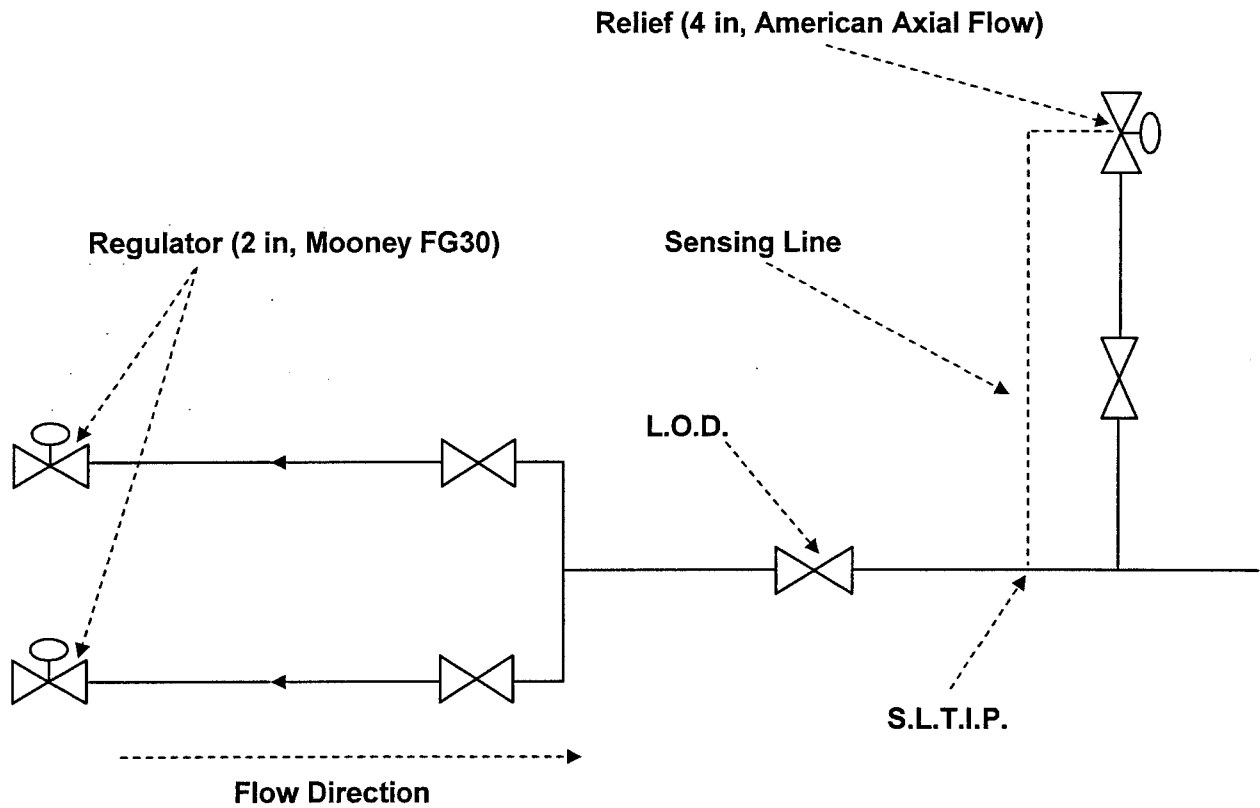
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input type="checkbox"/> Click here if not American Axial Flow Valve	n/a
-----------------------------	--	-----

P_{R.V. inlet}	48.31 psig
Q_{relief}	499,000 scfh
Q_{reg fail max}	511,183 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? NO

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2558

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" stw pipe	1.00	1.00	6st
1	6" wld tee (through)	10.10	10.10	6st
3	6" stw pipe	1.00	3.00	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Nordstrom valve fig. 143	82.00	82.00	6st
9	6" stw pipe	1.00	9.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
3	6" stw pipe	1.00	3.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
14	6" stw pipe	1.00	14.00	6st
1	6" X 90 deg wld ell	15.20	15.20	6st
1	6" stw pipe	1.00	1.00	6st
1	6" wld tee (through)	10.10	10.10	6st
2.25	6" stw pipe	1.00	2.25	6st
0	6" X 4" wld reducing tee (modeled by 6" tee+ 6" X 4" reducer)	1.00		6st
1	6" wld tee (branch)	30.30	30.30	6st
1	6" X 4" wld reducer (enlargement-larger)	31.41	31.41	6st
1	4" Plug valve, Nordstrom fig #525	14.00	14.00	4st
4	4" stw pipe	1.00	4.00	4st
1	4" X 2" wld reducer (enlargement-larger)	144.00	144.00	4st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	6" stw pipe	1.00	2.00	6st
1	6" Nordstrom valve fig. 143	4.00	4.00	6st
5.5	6" stw pipe	1.00	5.50	6st
1	6" X 4" wld reducer (contraction-larger)	5.17	5.17	6st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	14.10	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	228.66	
		4st	162.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	16.67	

INLET PRESSURE LOSS CALCULATION

Inlet Pressure Losses Calculation

	Description (Inlet Piping)		Equiv. ft/unit	Total Equiv. Ft	Equiv. Size
Common Piping					
1	6"	Bottom Out Class 300 H-17281 (65 ft of 6" = 9.0ft of 4")	9.07	9.07	4st
1	6" x 4"	Reducer Elbow 90 deg	6.41	6.41	4st
1	4"	Elbow 45 deg	5.37	5.37	4st
1	4"	Pipe	1.00	1.00	4st
1	4"	Elbow 45 deg	5.37	5.37	4st
3	4"	Pipe	1.00	3.00	4st
1	4"	Valve, Nordstrom Fig 2045 1/2	10.00	10.00	4st
2	4"	Pipe	1.00	2.00	4st
1	4"	Elbow 90 deg	10.10	10.10	4st
15	4"	Pipe	1.00	15.00	4st
1	4"	Elbow 90 deg	10.10	10.10	4st
Singl Run Piping					
1	4"	Branch Tee	20.10	20.10	4st
1	4"	Nord Fig 525	14.00	14.00	4st
2.42	4"	Pipe	1.00	2.42	4st
1	4" x 2"	Reducer	59.12	59.12	4st
1	2"	Strainer (31.1 ft of 2" = 763.4 ft of 4")	763.40	763.40	4st
Total 4" Length				936.4566667	

Maximum Inlet Pressure Calculation

Inlet Pressure	Failure Flow
268	543264
248.73	505744
251.13	510424
250.84	509858
250.87	

District Regulator Station - 2723

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2011
Approved by	<i>Salishan Uprate</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (250 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2723

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	60 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	250 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	405,625 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	62.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	63.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	60 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	66.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	464 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	309.33 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	30.93 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	340.27 psig

District Regulator Station - 2723

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	21.20 ft	63.50 psig	63.63 psig

P L.O.D.	63.63 psig
-----------------	------------

P max allow D/S L.O.D.	66.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.? YES

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	130.41 ft	63.63 psig	64.40 psig
4st	224.50 ft	64.40 psig	73.32 psig

P reg outlet	73.32 psig
---------------------	------------

P max allow regtoL.O.D.	340.27 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.? YES

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	54.66 ft	63.50 psig	63.17 psig
4st	69.20 ft	63.17 psig	60.17 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2723

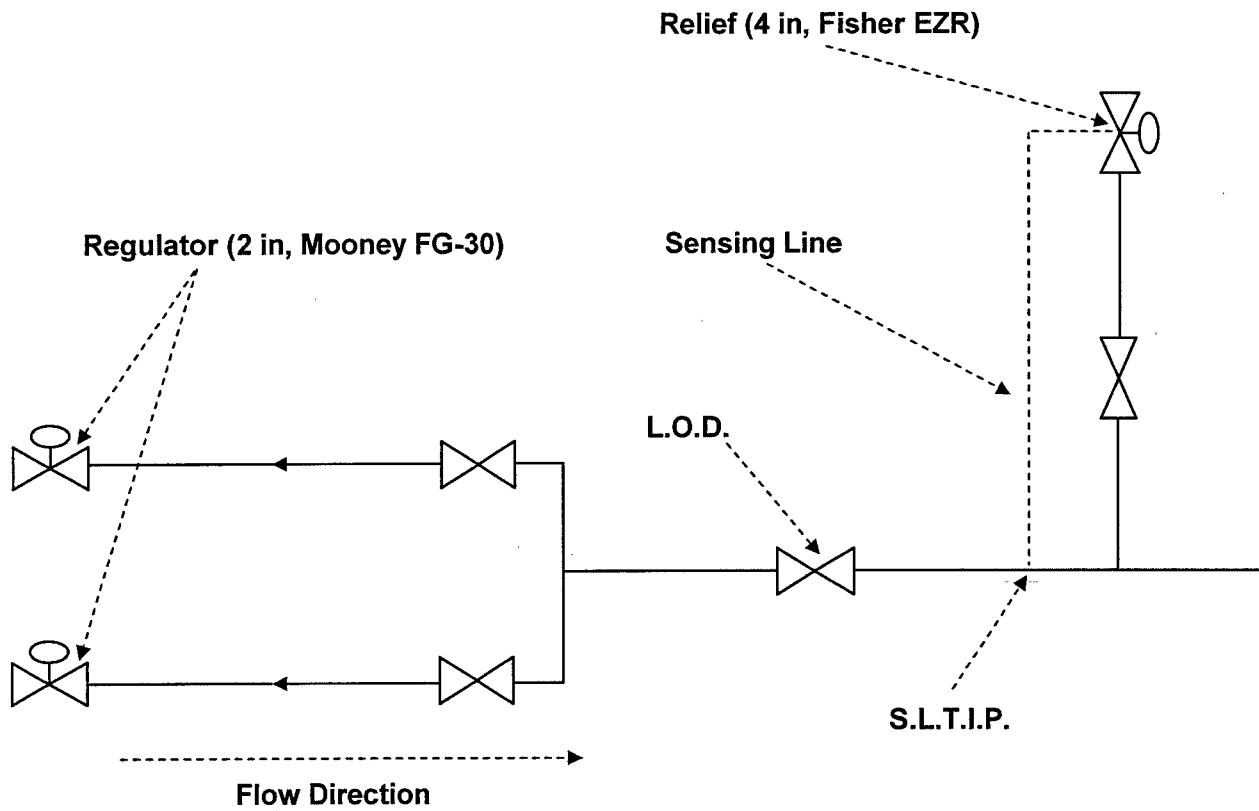
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	60.17 psig
Q relief	563,452 scfh
Q reg fail max	405,625 scfh

Is Q relief greater than or equal to Q reg fail max? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2723

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" stw pipe	1.00	1.00	6st
1	6" st 90 elbow	15.20	15.20	6st
5	6" stw pipe	1.00	5.00	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Nordstrom Fig 1485 Valve	60.00	60.00	6st
39	6" stw pipe	1.00	39.00	6st
1	6" x 4" reducing elbow (expansion)	31.41	31.41	6st
5	4" stw pipe	1.00	5.00	4st
1	4" st 90 elbow	10.10	10.10	4st
4	4" stw pipe	1.00	4.00	4st
1	4" weld tee branch	20.10	20.10	4st
1	4" stw pipe	1.00	1.00	4st
1	4" Ballomax ball valve	29.20	29.20	4st
1	4" st 90 elbow	10.10	10.10	4st
1	4" stw pipe	1.00	1.00	4st
1	4" x 2" reducer (expansion)	144.00	144.00	4st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
7	6" stw pipe	1.00	7.00	6st
1	6" x 6" weld tee (branch)	30.30	30.30	6st
1	6" x 4" reducer (contraction)	17.36	17.36	6st
15	4" stw pipe	1.00	15.00	4st
1	4" Rockwell Fig 305 Valve	15.00	15.00	4st
13	4" stw pipe	1.00	13.00	4st
1	4" st 90 elbow	10.10	10.10	4st
6	4" stw pipe	1.00	6.00	4st
1	4" st 90 elbow	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	21.20	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	130.41	
		4st	224.50	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	54.66	
		4st	69.20	

District Regulator Station - 2723

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2011
Approved by	<i>Don Frieze</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (268 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2723

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	60 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	268 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	433,208 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	62.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	63.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP D/SofL.O.D. =	MAOP downstream of L.O.D. outlet	60 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP D/SofL.O.D. + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	66.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	464 psig
MAOP regtoL.O.D. =	MAOP between the regulator and the L.O.D.	309.33 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	30.93 psig
P_{max allow regtoL.O.D.} = MAOP regtoL.O.D. + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	340.27 psig

District Regulator Station - 2723

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	21.20 ft	63.50 psig	63.64 psig

P L.O.D.	63.64 psig
-----------------	------------

P max allow D/S L.O.D.	66.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	130.41 ft	63.64 psig	64.51 psig
4st	224.50 ft	64.51 psig	74.47 psig

P reg outlet	74.47 psig
---------------------	------------

P max allow regtoL.O.D.	340.27 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	54.66 ft	63.50 psig	63.13 psig
4st	69.20 ft	63.13 psig	59.74 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2723

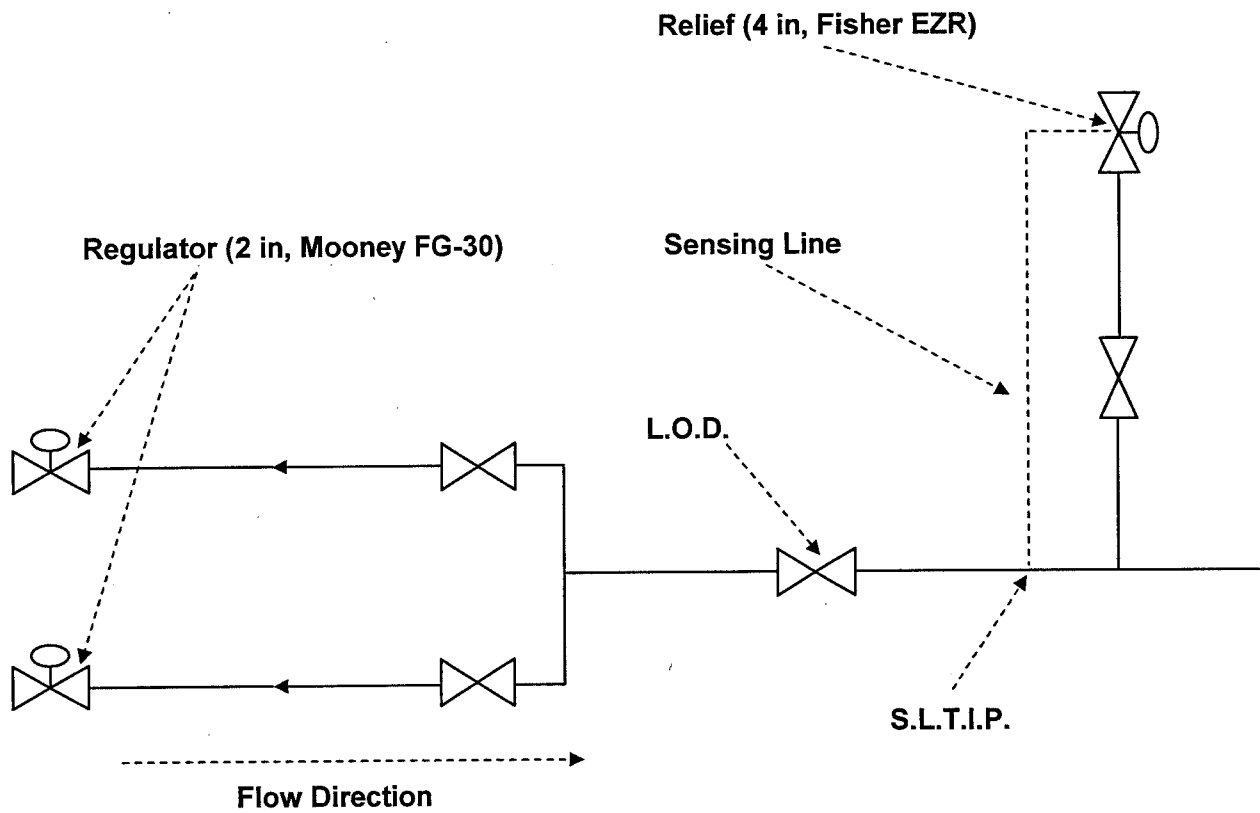
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_{g relief}	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	59.74 psig
Q_{relief}	560,218 scfh
Q_{reg fail max}	433,208 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2723

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" stw pipe	1.00	1.00	6st
1	6" st 90 elbow	15.20	15.20	6st
5	6" stw pipe	1.00	5.00	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Nordstrom Fig 1485 Valve	60.00	60.00	6st
39	6" stw pipe	1.00	39.00	6st
1	6" x 4" reducing elbow (expansion)	31.41	31.41	6st
5	4" stw pipe	1.00	5.00	4st
1	4" st 90 elbow	10.10	10.10	4st
4	4" stw pipe	1.00	4.00	4st
1	4" weld tee branch	20.10	20.10	4st
1	4" stw pipe	1.00	1.00	4st
1	4" Ballomax ball valve	29.20	29.20	4st
1	4" st 90 elbow	10.10	10.10	4st
1	4" stw pipe	1.00	1.00	4st
1	4" x 2" reducer (expansion)	144.00	144.00	4st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
7	6" stw pipe	1.00	7.00	6st
1	6" x 6" weld tee (branch)	30.30	30.30	6st
1	6" x 4" reducer (contraction)	17.36	17.36	6st
15	4" stw pipe	1.00	15.00	4st
1	4" Rockwell Fig 305 Valve	15.00	15.00	4st
13	4" stw pipe	1.00	13.00	4st
1	4" st 90 elbow	10.10	10.10	4st
6	4" stw pipe	1.00	6.00	4st
1	4" st 90 elbow	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	21.20	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	130.41	
		4st	224.50	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	54.66	
		4st	69.20	

District Regulator Station - 2698

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2011
Approved by	<i>Sari Pendikatta</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (250 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	35%	

2. Relief Valve Information:

Relief Valve Manufacturer	American	
Relief Valve Type	Axial Flow	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2698

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	250 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	641
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	219,044 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP D/SofL.O.D. =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP D/SofL.O.D. + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	481 psig
MAOP regtoL.O.D. =	MAOP between the regulator and the L.O.D.	320.67 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	32.07 psig
P_{max allow regtoL.O.D.} = MAOP regtoL.O.D. + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	352.73 psig

District Regulator Station - 2698

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
4st	0.00 ft	48.50 psig	48.50 psig

P L.O.D.	48.50 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.? YES

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
4st	228.20 ft	48.50 psig	52.34 psig
2st	2.00 ft	52.34 psig	53.13 psig

P reg outlet	53.13 psig
---------------------	------------

P max allow regtoL.O.D.	352.73 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.? YES

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
4st	167.40 ft	48.50 psig	45.53 psig
6st	138.41 ft	45.53 psig	45.18 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2698

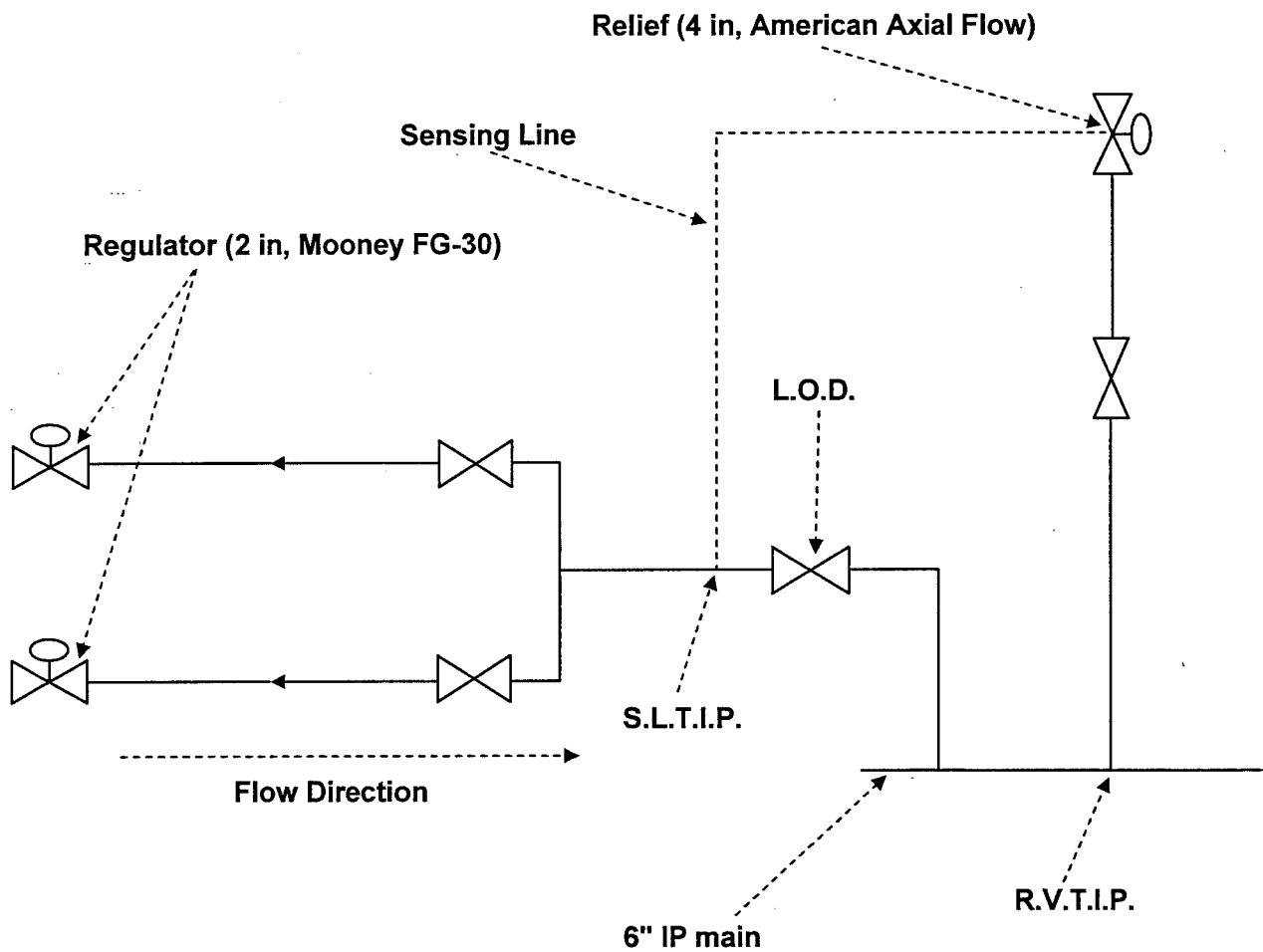
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input type="checkbox"/> Click here if not American Axial Flow Valve	
-----------------------------	--	--

P_{R.V. inlet}	45.18 psig
Q_{relief}	474,000 scfh
Q_{reg fail max}	219,044 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2698

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	Static	0.00	0.00	
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
21	4" STW pipe	1.00	21.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
5	4" bare steel pipe	1.00	5.00	4st
1	4" steel tee (branch)	20.10	20.10	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
1	4" ball valve	13.90	13.90	4st
1	4" x 2" 90° reducing elbow (expanding, larger)	148.00	148.00	4st
2	2" bare steel pipe	1.00	2.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	4" STW pipe	1.00	2.00	4st
1	4" ROCKWELL valve FIG 2045, 1/4	10.00	10.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
2	4" STW pipe	1.00	2.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
17	4" STW pipe	1.00	17.00	4st
1	6" x 4" 90° reducing elbow (expanding, larger)	37.41	37.41	6st
1	6" bottom out line stopper	65.00	65.00	6st
36	6" STW IP pipe	1.00	36.00	6st
1	4" H17505 Flange tee	60.00	60.00	4st
1	4" NORD valve FIG 143	11.00	11.00	4st
25	4" STW pipe	1.00	25.00	4st
2	4" 90° steel weld elbow	10.10	20.20	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		4st	0.00	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		4st	228.20	
		2st	2.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	167.40	
		6st	138.41	

District Regulator Station - 2698

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2011
Approved by	<i>S. Pendikatta</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (268 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	35%	

2. Relief Valve Information:

Relief Valve Manufacturer	American	
Relief Valve Type	Axial Flow	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2698

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	268 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	641
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	233,940 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	481 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	320.67 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	32.07 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	352.73 psig

District Regulator Station - 2698

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
4st	0.00 ft	48.50 psig	48.50 psig

P L.O.D.	48.50 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
4st	228.20 ft	48.50 psig	52.80 psig
2st	2.00 ft	52.80 psig	53.70 psig

P reg outlet	53.70 psig
---------------------	------------

P max allow regtoL.O.D.	352.73 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
4st	167.40 ft	48.50 psig	45.15 psig
6st	138.41 ft	45.15 psig	44.75 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2698

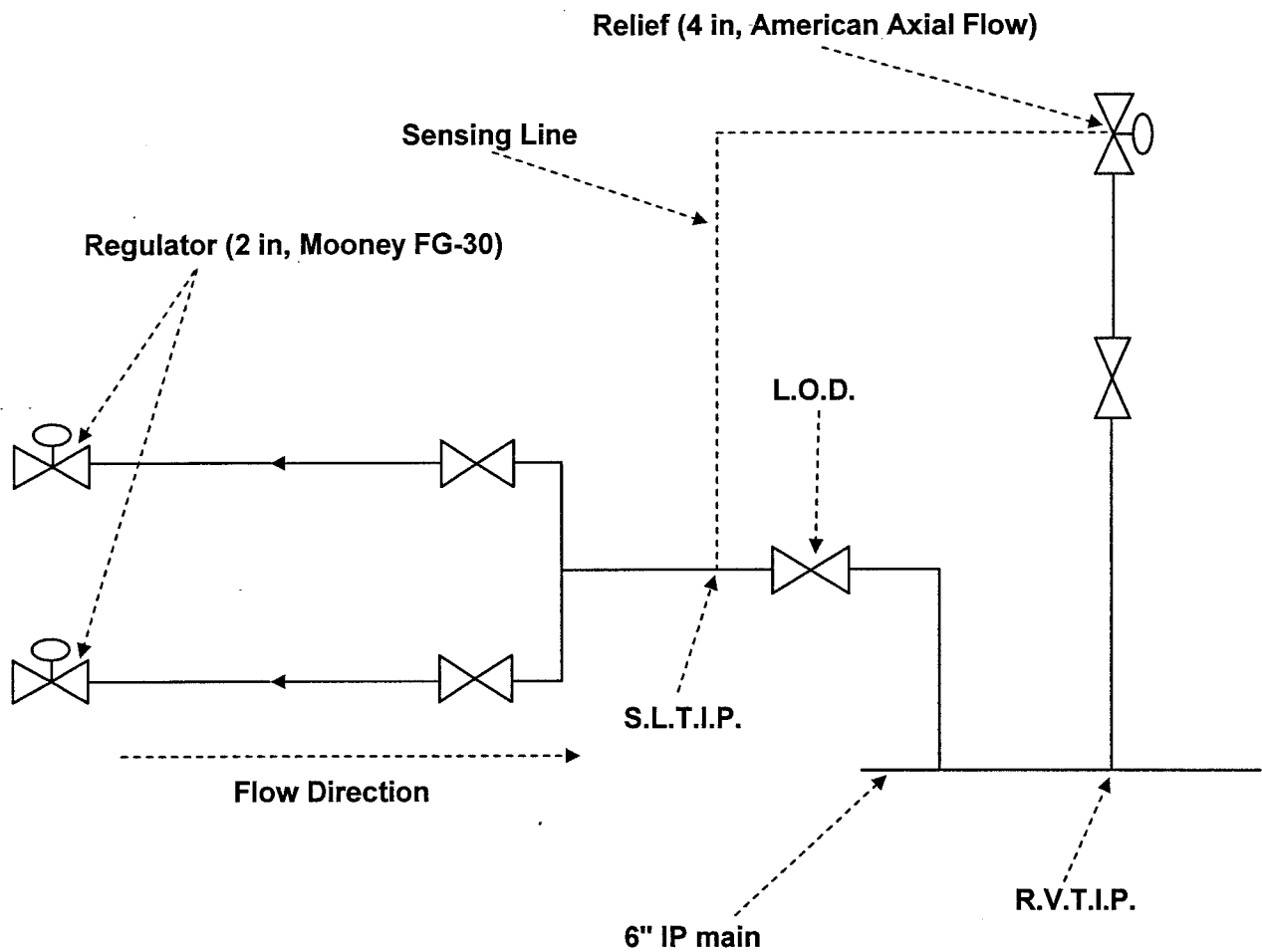
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input type="checkbox"/> Click here if not American Axial Flow Valve	
-----------------------------	--	--

P_{R.V. inlet}	44.75 psig
Q_{relief}	471,000 scfh
Q_{reg fail max}	233,940 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2698

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	Static	0.00	0.00	
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
21	4" STW pipe	1.00	21.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
5	4" bare steel pipe	1.00	5.00	4st
1	4" steel tee (branch)	20.10	20.10	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
1	4" ball valve	13.90	13.90	4st
1	4" x 2" 90° reducing elbow (expanding, larger)	148.00	148.00	4st
2	2" bare steel pipe	1.00	2.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	4" STW pipe	1.00	2.00	4st
1	4" ROCKWELL valve FIG 2045, 1/4	10.00	10.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
2	4" STW pipe	1.00	2.00	4st
1	4" 90° steel weld elbow	10.10	10.10	4st
17	4" STW pipe	1.00	17.00	4st
1	6" x 4" 90° reducing elbow (expanding, larger)	37.41	37.41	6st
1	6" bottom out line stopper	65.00	65.00	6st
36	6" STW IP pipe	1.00	36.00	6st
1	4" H17505 Flange tee	60.00	60.00	4st
1	4" NORD valve FIG 143	11.00	11.00	4st
25	4" STW pipe	1.00	25.00	4st
2	4" 90° steel weld elbow	10.10	20.20	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		4st	0.00	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		4st	228.20	
		2st	2.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	167.40	
		6st	138.41	

District Regulator Station - 2697

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Srin: Phobhalla</i>	Date	<i>5/30/12</i>
Remarks	Proposed Review - Salishan Uprate (268 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig (blue)	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 7.

District Regulator Station - 2697

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	268 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	433,208 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturer documentation	1.50 psig
P_{S.L.T.I.P.} = R.V. set point + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	476 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	317.33 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	31.73 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	349.07 psig

District Regulator Station - 2697

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to the R.V.T.I.P.

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V.T.I.P.
4st	3.00 ft	48.50 psig	48.68 psig
6st	26.36 ft	48.68 psig	48.89 psig

P R.V.T.I.P.	48.89 psig
---------------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is **P R.V.T.I.P.** less than or equal to **P max allow D/S L.O.D.**? **YES**

6. Calculate Pressure Build-Up from R.V.T.I.P. to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P reg outlet
6st	105.33 ft	48.89 psig	49.75 psig
4st	179.68 ft	49.75 psig	59.45 psig
2st	1.00 ft	59.45 psig	60.67 psig

P reg outlet	60.67 psig
---------------------	------------

P max allow regtoL.O.D.	349.07 psig
--------------------------------	-------------

Is **P reg outlet** less than or equal to **P max allow regtoL.O.D.**? **YES**

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P R.V.T.I.P.	P R.V. inlet
4st	55.70 ft	48.50 psig	45.12 psig

Use **P R.V. inlet** to calculate **Q relief** in **Item 9**

District Regulator Station - 2697

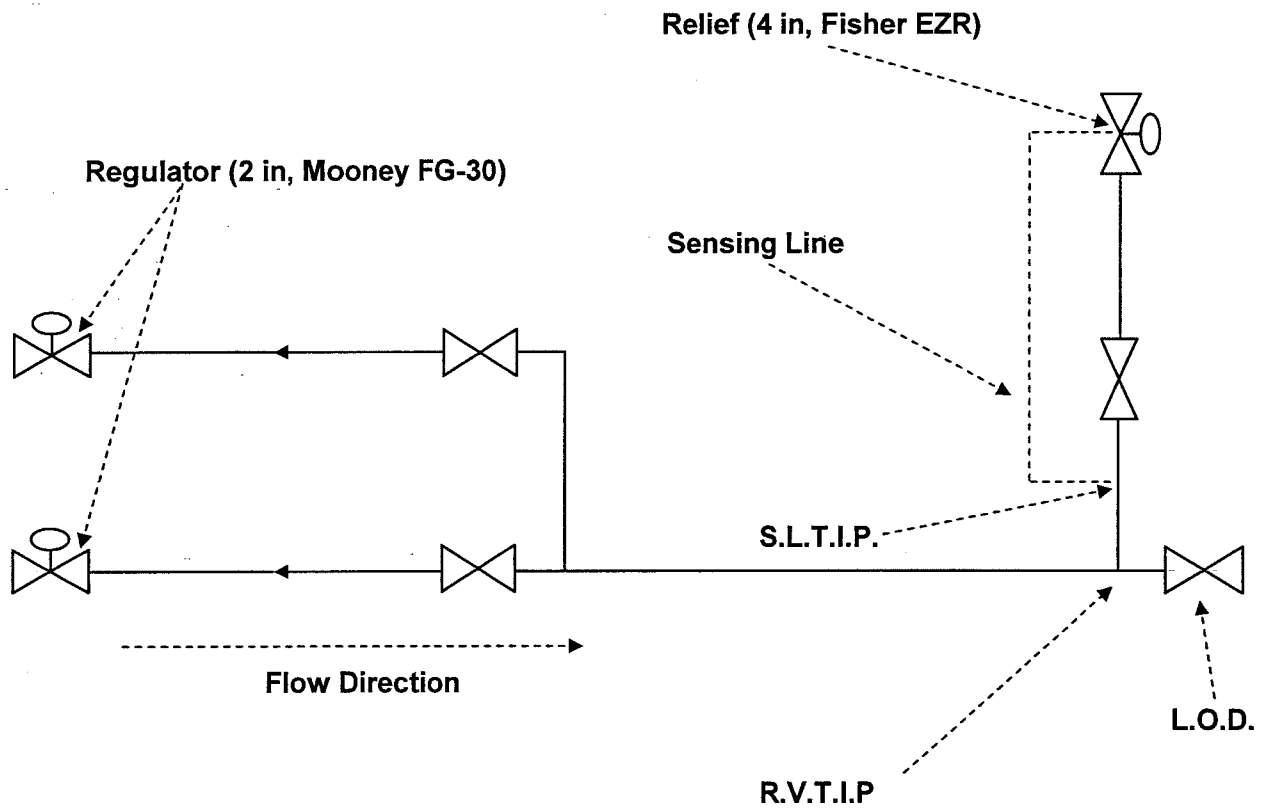
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_{g relief}	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	45.12 psig
Q relief	450,174 scfh
Q reg fail max	433,208 scfh

Is Q relief greater than or equal to Q reg fail max? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2697

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to R.V.T.I.P.	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
3	4" STW Pipe	1.00	3.00	4st
1	6" x4" Reducing Elbow (Contraction - Larger Pipe)	23.36	23.36	6st
3	6" STW Pipe	1.00	3.00	6st
#2 Units	Description From R.V.T.I.P. to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Weld Tee - Branch	30.30	30.30	6st
9	6" STW Pipe	1.00	9.00	6st
1	6" Elbow 45°	8.09	8.09	6st
3.6	6" STW Pipe	1.00	3.60	6st
1	6" Elbow 45	8.09	8.09	6st
3.75	6" STW Pipe	1.00	3.75	6st
1	6" Elbow 90, LR	8.09	8.09	6st
3	6" STW Pipe	1.00	3.00	6st
1	6" x4" Reducer (Expansion - Larger Pipe)	31.41	31.41	6st
1	4" Weld Tee - Branch	20.10	20.10	4st
0.5	4" STW Pipe	1.00	0.50	4st
1	4" Elbow 90°	10.10	10.10	4st
1	4" Ball Valve	0.98	0.98	4st
1	4" x 2" Reducing Elbow (Expansion - Large Pipe)	148.00	148.00	4st
1	2" STW Pipe	1.00	1.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" STW Pipe	1.00	1.00	4st
1	4" Fig. 305 Valve	15.00	15.00	4st
14	4" STW Pipe	1.00	14.00	4st
1	4" Elbow 90°	10.10	10.10	4st
5.5	4" STW Pipe	1.00	5.50	4st
1	4" Elbow 90°	10.10	10.10	4st
#1	From S.L.T.I.P. to R.V.T.I.P.	Equiv Size	Total ft	
		4st	3.00	
		6st	26.36	
#2	From S.L.T.I.P. to regulator outlet body	Equiv Size	Total ft	
		6st	105.33	
		4st	179.68	
		2st	1.00	
#3	From R.V.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	55.70	

District Regulator Station - 2697

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>S. Pendikatta</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (250 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig (blue)	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 7.

District Regulator Station - 2697

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	250 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1.187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	405,625 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturer documentation	1.50 psig
P_{S.L.T.I.P.} = R.V. set point + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	476 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	317.33 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	31.73 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	349.07 psig

District Regulator Station - 2697

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to the R.V.T.I.P.

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V.T.I.P.
4st	3.00 ft	48.50 psig	48.66 psig
6st	26.36 ft	48.66 psig	48.85 psig

P R.V.T.I.P.	48.85 psig
---------------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is **P R.V.T.I.P.** less than or equal to **P max allow D/S L.O.D.**? **YES**

6. Calculate Pressure Build-Up from R.V.T.I.P. to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P reg outlet
6st	105.33 ft	48.85 psig	49.62 psig
4st	179.68 ft	49.62 psig	58.30 psig
2st	1.00 ft	58.30 psig	59.41 psig

P reg outlet	59.41 psig
---------------------	------------

P max allow regtoL.O.D.	349.07 psig
--------------------------------	-------------

Is **P reg outlet** less than or equal to **P max allow regtoL.O.D.**? **YES**

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P R.V.T.I.P.	P R.V. inlet
4st	55.70 ft	48.50 psig	45.50 psig

Use **P R.V. inlet** to calculate **Q relief** in Item 9

District Regulator Station - 2697

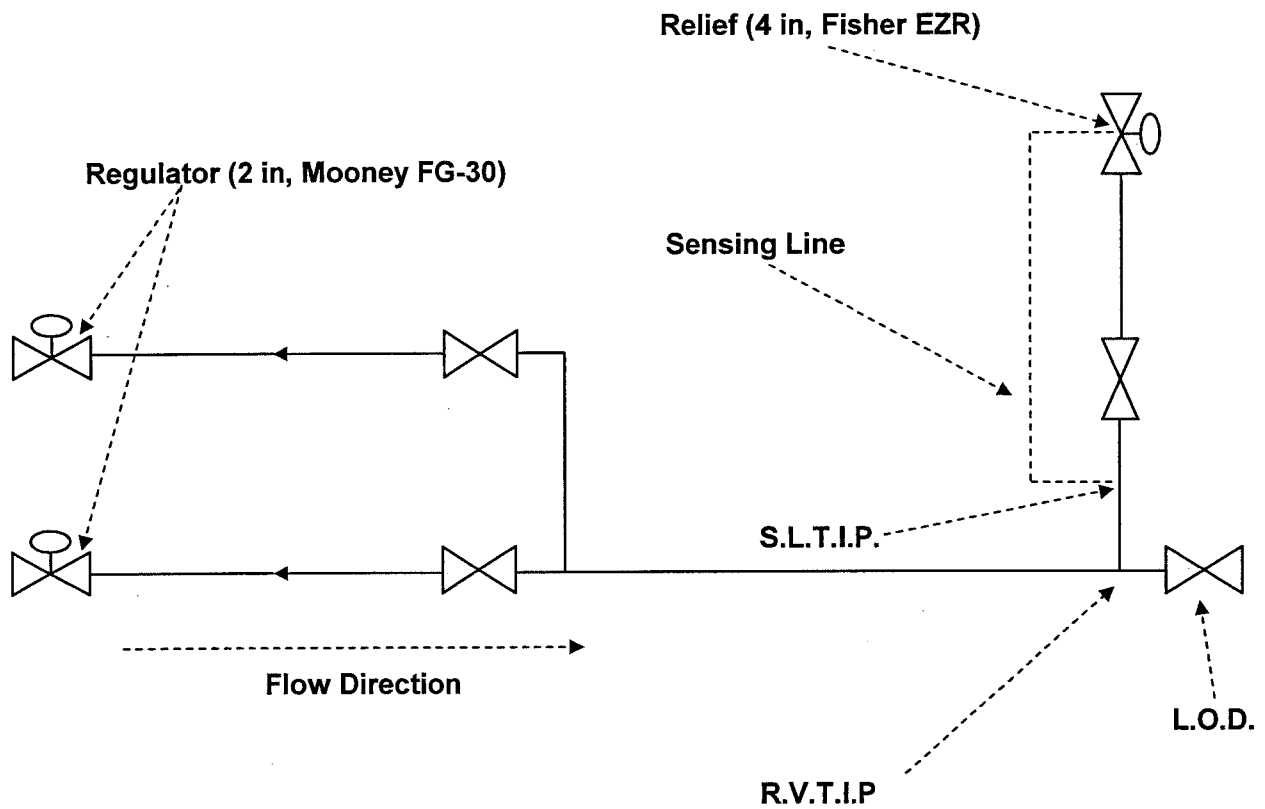
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_{g relief}	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5.830
-----------------------------	---	-------

P_{R.V. inlet}	45.50 psig
Q_{relief}	453,090 scfh
Q_{reg fail max}	405,625 scfh

Is **Q_{relief}** greater than or equal to **Q_{reg fail max}**? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2697 EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to R.V.T.I.P.	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
3	4" STW Pipe	1.00	3.00	4st
1	6" x4" Reducing Elbow (Contraction - Larger Pipe)	23.36	23.36	6st
3	6" STW Pipe	1.00	3.00	6st
#2 Units	Description From R.V.T.I.P. to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Weld Tee - Branch	30.30	30.30	6st
9	6" STW Pipe	1.00	9.00	6st
1	6" Elbow 45°	8.09	8.09	6st
3.6	6" STW Pipe	1.00	3.60	6st
1	6" Elbow 45	8.09	8.09	6st
3.75	6" STW Pipe	1.00	3.75	6st
1	6" Elbow 90, LR	8.09	8.09	6st
3	6" STW Pipe	1.00	3.00	6st
1	6" x4" Reducer (Expansion - Larger Pipe)	31.41	31.41	6st
1	4" Weld Tee - Branch	20.10	20.10	4st
0.5	4" STW Pipe	1.00	0.50	4st
1	4" Elbow 90°	10.10	10.10	4st
1	4" Ball Valve	0.98	0.98	4st
1	4" x 2" Reducing Elbow (Expansion - Large Pipe)	148.00	148.00	4st
1	2" STW Pipe	1.00	1.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" STW Pipe	1.00	1.00	4st
1	4" Fig. 305 Valve	15.00	15.00	4st
14	4" STW Pipe	1.00	14.00	4st
1	4" Elbow 90°	10.10	10.10	4st
5.5	4" STW Pipe	1.00	5.50	4st
1	4" Elbow 90°	10.10	10.10	4st
#1	From S.L.T.I.P. to R.V.T.I.P.	Equiv Size	Total ft	
		4st	3.00	
		6st	26.36	
#2	From S.L.T.I.P. to regulator outlet body	Equiv Size	Total ft	
		6st	105.33	
		4st	179.68	
		2st	1.00	
#3	From R.V.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	55.70	

District Regulator Station - 2696

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Simi Pendikatta</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (268 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2696

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	268 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	433,208 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	487 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	324.73 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	32.47 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	357.21 psig

District Regulator Station - 2696

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	15.10 ft	48.50 psig	48.62 psig

P L.O.D.	48.62 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	141.91 ft	48.62 psig	49.79 psig
4st	161.90 ft	49.79 psig	58.57 psig
2st	2.00 ft	58.57 psig	61.03 psig

P reg outlet	61.03 psig
---------------------	------------

P max allow regtoL.O.D.	357.21 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	18.36 ft	48.50 psig	48.35 psig
4st	53.20 ft	48.35 psig	45.11 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2696

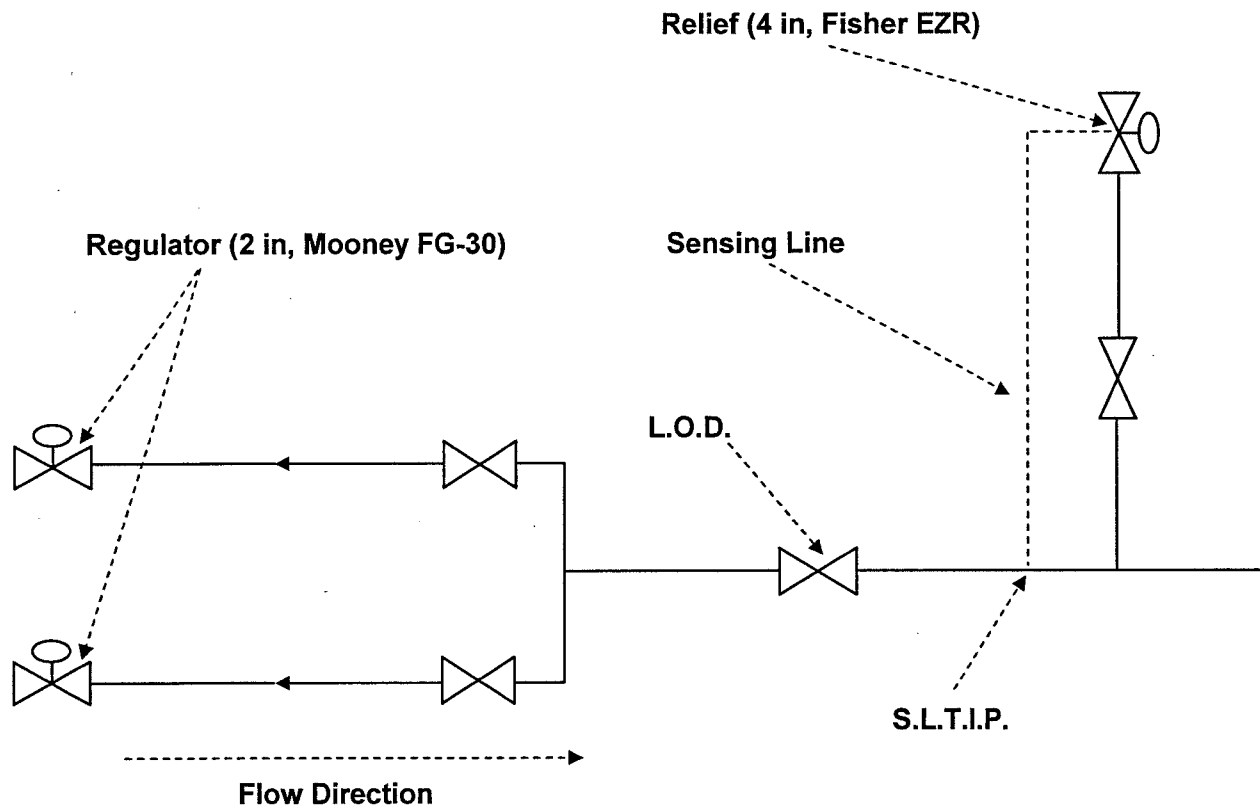
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	45.11 psig
Q relief	450,142 scfh
Q reg fail max	433,208 scfh

Is Q relief greater than or equal to Q reg fail max? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2696

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
5	6" BARE pipe	1.00	5.00	6st
1	6" STD tee (thru)	10.10	10.10	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Valve FIG.4245-1/4	33.00	33.00	6st
22	6" BARE pipe	1.00	22.00	6st
1	90° 6" STD elbow	15.20	15.20	6st
4	6" BARE pipe	1.00	4.00	6st
1	6" STD tee (branch)	30.30	30.30	6st
1	90° 6" x 4" WELD reducing elbow (expanding, Larger)	37.41	37.41	6st
1	4" BALL Valve	13.90	13.90	4st
1	90° 4" x 2" WELD reducing elbow (expanding, Larger)	148.00	148.00	4st
2	2" BARE pipe	1.00	2.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" BARE pipe	1.00	1.00	6st
1	6" x 4" Weld reducer (contracting, Larger)	17.36	17.36	6st
1	4" Valve FIG.143	11.00	11.00	4st
17	4" STW pipe	1.00	17.00	4st
1	90° 4" STD elbow	10.10	10.10	4st
5	4" BARE pipe	1.00	5.00	4st
1	90° 4" STD elbow	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	15.10	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	141.91	
		4st	161.90	
		2st	2.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	18.36	
		4st	53.20	

District Regulator Station - 2696

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>S. Pendikatta</i>	Date	<i>5/30/12</i>
Remarks	Proposed Review - Salishan Uprate (250 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2696

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	250 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	405,625 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	487 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	324.73 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	32.47 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	357.21 psig

District Regulator Station - 2696

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
6st	15.10 ft	48.50 psig	48.61 psig

P L.O.D.	48.61 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.? YES

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
6st	141.91 ft	48.61 psig	49.64 psig
4st	161.90 ft	49.64 psig	57.52 psig
2st	2.00 ft	57.52 psig	59.74 psig

P reg outlet	59.74 psig
---------------------	------------

P max allow regtoL.O.D.	357.21 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.? YES

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
6st	18.36 ft	48.50 psig	48.36 psig
4st	53.20 ft	48.36 psig	45.50 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2696

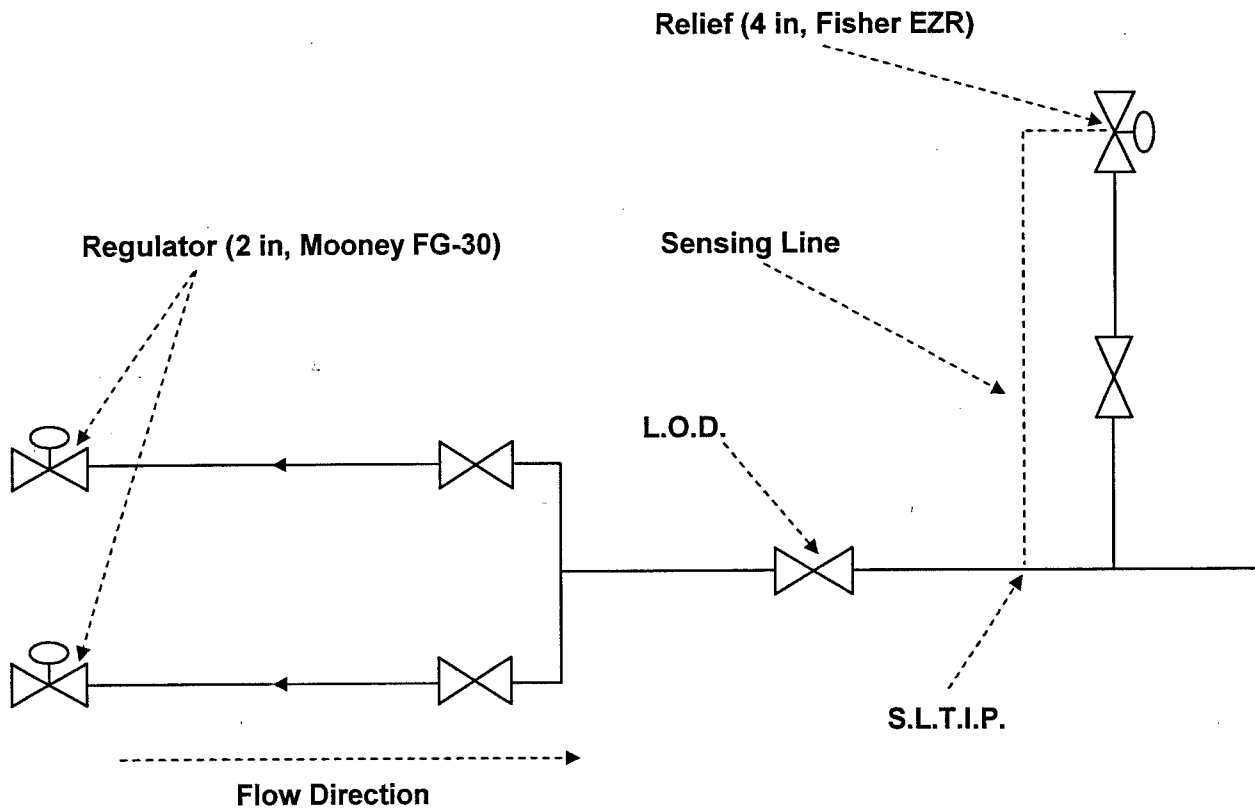
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	45.50 psig
Q_{relief}	453,061 scfh
Q_{reg fail max}	405,625 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2696

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
5	6" BARE pipe	1.00	5.00	6st
1	6" STD tee (thru)	10.10	10.10	6st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" Valve FIG.4245-1/4	33.00	33.00	6st
22	6" BARE pipe	1.00	22.00	6st
1	90° 6" STD elbow	15.20	15.20	6st
4	6" BARE pipe	1.00	4.00	6st
1	6" STD tee (branch)	30.30	30.30	6st
1	90° 6" x 4" WELD reducing elbow (expanding, Larger)	37.41	37.41	6st
1	4" BALL Valve	13.90	13.90	4st
1	90° 4" x 2" WELD reducing elbow (expanding, Larger)	148.00	148.00	4st
2	2" BARE pipe	1.00	2.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	6" BARE pipe	1.00	1.00	6st
1	6" x 4" Weld reducer (contracting, Larger)	17.36	17.36	6st
1	4" Valve FIG. 143	11.00	11.00	4st
17	4" STW pipe	1.00	17.00	4st
1	90° 4" STD elbow	10.10	10.10	4st
5	4" BARE pipe	1.00	5.00	4st
1	90° 4" STD elbow	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		6st	15.10	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		6st	141.91	
		4st	161.90	
		2st	2.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		6st	18.36	
		4st	53.20	

District Regulator Station - 2695

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Sini Pambella</i>	Date	<i>5/30/12</i>
Remarks	Proposed Review - Salishan Uprate (250 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the **EQUIVALENT LENGTH OF PIPE WORKSHEET** on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2695

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	250 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	405,625 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	477 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	318.00 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	31.80 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	349.80 psig

District Regulator Station - 2695

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
4st	8.71 ft	48.50 psig	48.96 psig

P L.O.D.	48.96 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.?

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
4st	238.70 ft	48.96 psig	60.38 psig
2st	1.00 ft	60.38 psig	61.46 psig

P reg outlet	61.46 psig
---------------------	------------

P max allow regtoL.O.D.	349.80 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.?

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
4st	52.20 ft	48.50 psig	45.70 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2695

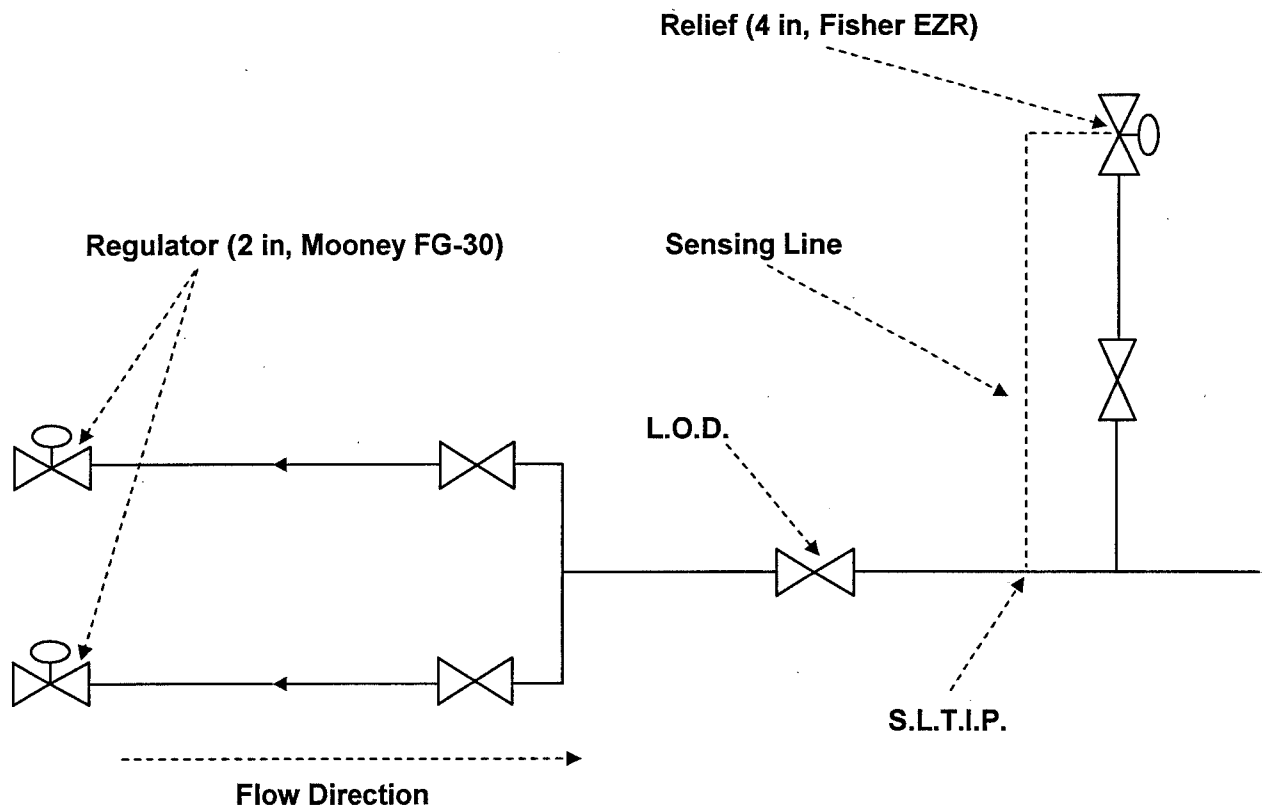
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	45.70 psig
Q_{relief}	454,540 scfh
Q_{reg fail max}	405,625 scfh

Is Q_{relief} greater than or equal to Q_{reg fail max}? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2695

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	4" STW Pipe	1.00	2.00	4st
1	4" Weld Tee - Thru	6.71	6.71	4st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" Nordstrom Fig. 2045 1/4 Valve	10.00	10.00	4st
22	4" STW Pipe	1.00	22.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
4	4" STW Pipe	1.00	4.00	4st
1	4" Weld Tee - Branch	20.10	20.10	4st
0.5	4" STW Pipe	1.00	0.50	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
1	4" Ball Valve	13.90	13.90	4st
1	4" x 2" Weld Reducing Ell (Expansion - Larger Pipe)	148.00	148.00	4st
1	2" STW Pipe	1.00	1.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" STW Pipe	1.00	1.00	4st
1	4" Nordstrom Fig. 143 Valve	11.00	11.00	4st
14	4" STW Pipe	1.00	14.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
6	4" STW Pipe	1.00	6.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		4st	8.71	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		4st	238.70	
		2st	1.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	52.20	

District Regulator Station - 2695

Refer to the "Annual Regulator Station Relief Review Process" for more information on all the steps below.

Review Status		PASS	
Prepared by	Don Frieze	Date	May 23rd, 2012
Approved by	<i>Simon P. ...</i>	Date	5/30/12
Remarks	Proposed Review - Salishan Uprate (268 psig)		

1. Regulator Information:

Regulator Manufacturer	Mooney	
Regulator Type	FG-30	
Regulator Size	2 inch	
In/Out Pipe Size of Regulator	2 inch	2 inch
Orifice/Capacity Limiter	75%	

2. Relief Valve Information:

Relief Valve Manufacturer	Fisher	
Relief Valve Type	EZR	
Relief Valve Size	4 inch	
In/Out Pipe Size of R.V.	4 inch	4 inch
Orifice/Capacity Limiter	100 %	
Relief Pilot Type	Mooney Series 20	
Relief Pilot Spring Range	25-90 psig	

3. Calculate Equivalent Length:

- Use the EQUIVALENT LENGTH OF PIPE WORKSHEET on page 5

4. Pressure and Flow Rate Calculations:

Note: Only update the gray-colored cells for Item 4 through 8.

District Regulator Station - 2695

4A. Calculate the Failure Flow through the Regulator:

P_{reg set pt} =	Regulator set pressure or downstream MAOP	45 psig
P_{reg in max} =	Maximum inlet pressure to the regulator	268 psig
C_{g fail} =	Gas sizing coefficient for regulator failure	1,187
Q_{reg fail max} = (P_{reg in max} + 14.696) x C_{g fail} x 1.291		
Q_{reg fail max} =	Maximum flow rate through failed regulator	433,208 scfh

4B. Calculate the Inlet Pressure to the Relief Valve:

R.V. set point =	Relief valve set point	47.00 psig
R.V. build-up =	Per manufacturers documentation	1.50 psig
P_{S.L.T.I.P.} = P_{reg set pt} + R.V. buffer + R.V. build-up		
P_{S.L.T.I.P.} =	Inlet pressure to the R.V.	48.50 psig

4C. Calculate the Maximum Allowable Pressure Downstream of the L.O.D.:

MAOP_{D/SofL.O.D.} =	MAOP downstream of L.O.D. outlet	45 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	6.00 psig
P_{max allow D/S L.O.D.} = MAOP_{D/SofL.O.D.} + P_{max allow B/D}		
P_{max allow D/S L.O.D.} =	Max. allowable pressure downstream of L.O.D.	51.00 psig

4D. Calculate the Maximum Allowable Pressure between the Regulator and the L.O.D.:

Test Pressure =	Assume 90 psig if cannot be confirmed	477 psig
MAOP_{regtoL.O.D.} =	MAOP between the regulator and the L.O.D.	318.00 psig
P_{max allow B/D} =	Allowable pressure build-up over MAOP	31.80 psig
P_{max allow regtoL.O.D.} = MAOP_{regtoL.O.D.} + P_{max allow B/D}		
P_{max allow regtoL.O.D.} =	Max. allow. pressure between reg. and L.O.D.	349.80 psig

District Regulator Station - 2695

5. Calculate Pressure Build-Up from Relief Valve S.L.T.I.P. to L.O.D. Outlet:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P L.O.D.
4st	8.71 ft	48.50 psig	49.01 psig

P L.O.D.	49.01 psig
-----------------	------------

P max allow D/S L.O.D.	51.00 psig
-------------------------------	------------

Is P L.O.D. less than or equal to P max allow D/S L.O.D.? YES

6. Calculate Pressure Build-Up from L.O.D. Outlet to Regulator Outlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P L.O.D.	P reg outlet
4st	238.70 ft	49.01 psig	61.74 psig
2st	1.00 ft	61.74 psig	62.93 psig

P reg outlet	62.93 psig
---------------------	------------

P max allow regtoL.O.D.	349.80 psig
--------------------------------	-------------

Is P reg outlet less than or equal to P max allow regtoL.O.D.? YES

7. Calculate Pressure Drop from S.L.T.I.P. to R.V. Inlet Body:

Use GAS Calc 3.0 program

Pipe Size	Equivalent Length	P S.L.T.I.P.	P R.V. inlet
4st	52.20 ft	48.50 psig	45.33 psig

Use P R.V. inlet to calculate Q relief in Item 9

District Regulator Station - 2695

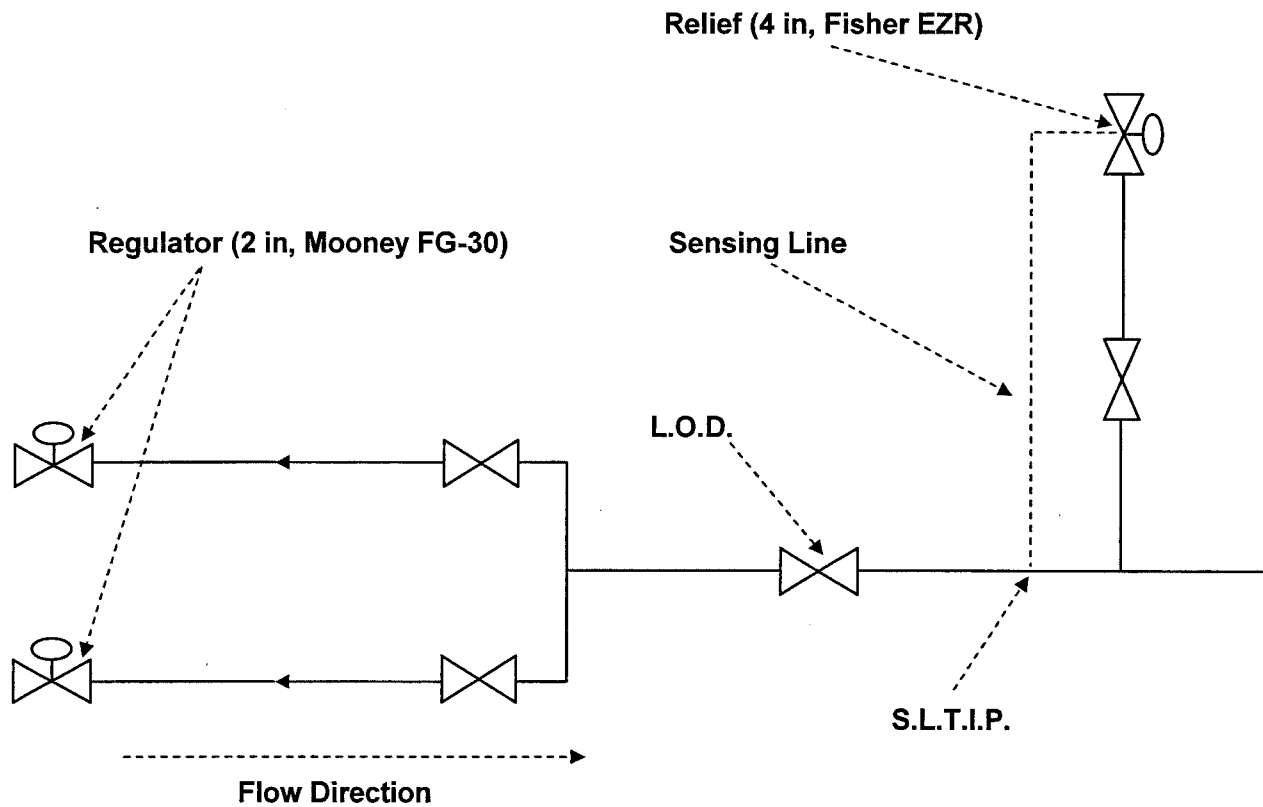
8. Calculate Relief Capacity and Compare Regulator Failure Capacity to Relief Capacity:

C_g relief	<input checked="" type="checkbox"/> Click here if not American Axial Flow Valve	5,830
-----------------------------	---	-------

P R.V. inlet	45.33 psig
Q relief	451,817 scfh
Q reg fail max	433,208 scfh

Is Q relief greater than or equal to Q reg fail max? YES

9. Schematic Diagram of the District Regulator Station:



District Regulator Station - 2695

EQUIVALENT LENGTH OF PIPE WORKSHEET

#1 Units	Description From S.L.T.I.P. to L.O.D. outlet	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
2	4" STW Pipe	1.00	2.00	4st
1	4" Weld Tee - Thru	6.71	6.71	4st
#2 Units	Description From L.O.D. outlet to regulator outlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" Nordstrom Fig. 2045 1/4 Valve	10.00	10.00	4st
22	4" STW Pipe	1.00	22.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
4	4" STW Pipe	1.00	4.00	4st
1	4" Weld Tee - Branch	20.10	20.10	4st
0.5	4" STW Pipe	1.00	0.50	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
1	4" Ball Valve	13.90	13.90	4st
1	4" x 2" Weld Reducing Ell (Expansion - Larger Pipe)	148.00	148.00	4st
1	2" STW Pipe	1.00	1.00	2st
#3 Units	Description From S.L.T.I.P. to R.V. inlet body	Equiv. ft/unit	Total Equiv. ft	Equiv. Size
1	4" STW Pipe	1.00	1.00	4st
1	4" Nordstrom Fig. 143 Valve	11.00	11.00	4st
14	4" STW Pipe	1.00	14.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
6	4" STW Pipe	1.00	6.00	4st
1	4" x 90 Weld Ell	10.10	10.10	4st
#1	From S.L.T.I.P. to L.O.D. outlet	Equiv Size	Total ft	
		4st	8.71	
#2	From L.O.D. outlet to regulator outlet body	Equiv Size	Total ft	
		4st	238.70	
		2st	1.00	
#3	From S.L.T.I.P. to R.V. inlet body	Equiv Size	Total ft	
		4st	52.20	