

2015 Kansas Pipeline Safety Seminar

Odorization Program and Odorizer Updates

Regulator Station Updates

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Safety



Security



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Odorization Program and Odorizer Updates



Safety



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Product Representation Disclosure

- USDI DOES NOT represent any manufacturer of odorizers or odorant detection instruments.
- USDI DOES represent Chevron Phillips and is the exclusive microbulk delivery partner for Chevron Phillips Natural Gas Odorants in the Midwest.

OBJECTIVES

- Why Odorize?
- Do I have to Odorize?
- What does Part 192 say about Odorization?
- What type of Odorizer do I need?
- What type of Odorant do I use?
- How do I know I have an effective odorization program?
- Troubleshooting Odorizer issues.
- Filling Odorizers.

Simply so People Can Detect a Leak



Do I Have to Odorize?

- You DO IF:
- You are an LDC or Master Meter Operator
- You operate a Transmission Pipeline in a Class 3 or Class 4 Area.
- Your health, safety, legal or insurance coverage provider tells you to.
- Exemptions
 - Transmission Operators in Class 1 or 2
 - Some additional specific exemptions

Part 192.625

- 192.625 (a) Odorize to 1 / 5 of the LEL, detectible by a person with a “normal” sense of smell.
- 192.625(b) makes up about half of the section and VERY specifically describes EXACTLY who must odorize and who doesn't have to.

192.625

- 192.625 (c) and (d) describe the properties odorants must possess.

192.625

- 192.625 (e) “Equipment for odorization must introduce the odorant without wide variations in the level of odorant.”

192.625

- 192.625 (f) Periodic sampling of the gas using an instrument capable of determining the percent gas in air at which the odor becomes readily detectable.



Subpart P, Distribution Integrity Management

- Is a poorly performing odorizer a threat to your system?
- My answer would be a resounding YES.
- Not really, at least according to Subpart P.
- Will dollars for odorization improvements, upgrades etc. suffer as gas companies are forced to address the threats identified through their Integrity Management Programs?

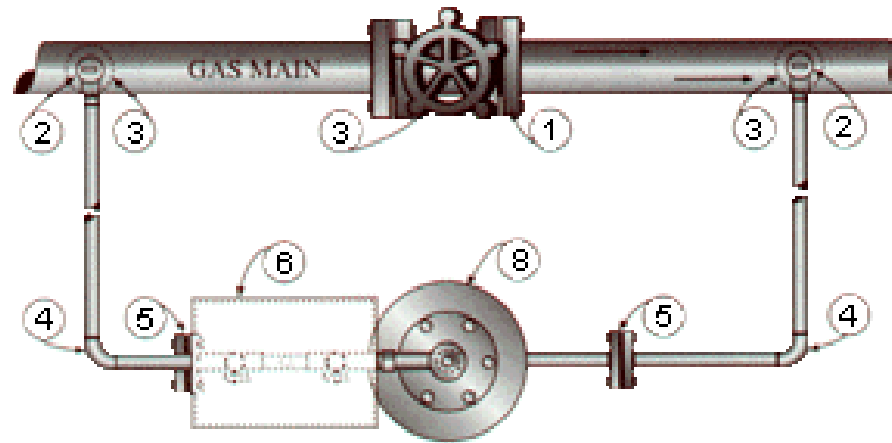
Odorizers

- **Home Made**
- **Simple Wick (Farm Tap Odorizer)**
- **Bypass (King Tool and Peerless)**
- **Pulse Bypass**
- **Pump Injection**

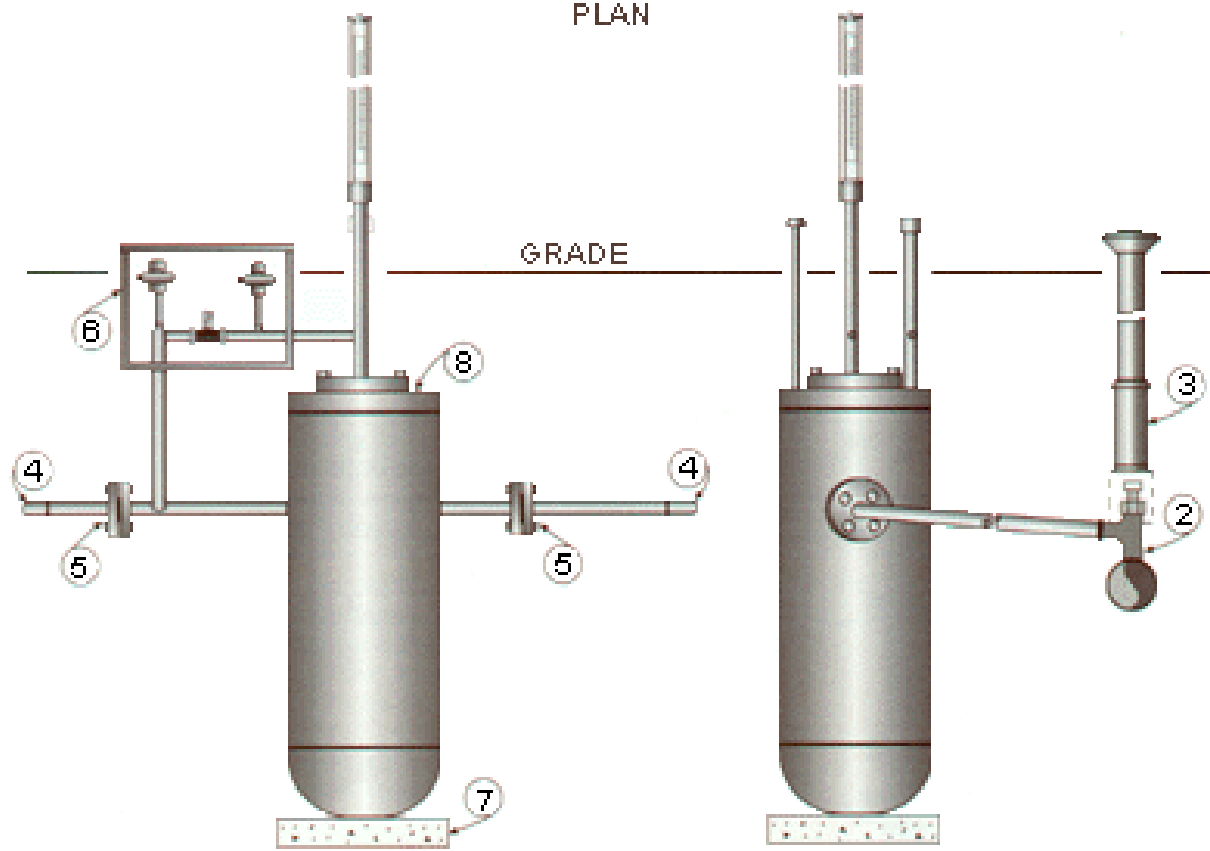


KING GAS ODORIZER
SERIAL NO. 1101405
MODEL 3V W.P. 300
MFR. BY
KING TOOL COMPANY
LONGVIEW, TEXAS





PLAN



ELEVATION

ELEVATION
Outlet End





03/29/2008



07/07/2008



Odorizer Lifecycle

- Bypass – 1 year to 50 years
- Injection – Average 20 years
- Example Injection Odorizer Cost/Year
- New Odorizer \$30,000.00
- $\$30,000 / 20 = \$1,500.00$
- Maintenance = \$1,500 every two years
- Total Cost per year = \$2,250.00 plus odorant
- Has to be done, has to be done well, cost of doing business

Odorants

- Odorant Components are Usually Blended to Achieve Desirable Traits.
- Typical Odorant Blends Used in Gas Utilities are 75-80% TBM and 20-25% DMS
- Know what Kind you are Using
- Take Care in Changing Blends, Odorants are NOT “All the Same”

Monitoring for Effectiveness

- **Calculating an Odorant Injection Rate**
- Determine Odorant Use in lbs (App. 6.8 Lbs/Gallon)
- Obtain gas use for the Same Period in MMCF
- Divide the Odorant Used by the MMCF to Obtain a Rate
- There is no Required Minimum or Maximum. This Number will Vary from System to System.

Monitoring for Effectiveness

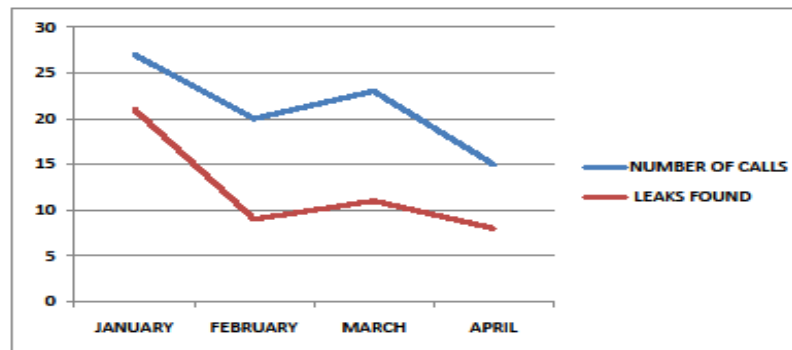
- **Performing Sniff Tests Using an Instrument**
- Odorometer, DTEX, Odorator
- Use a Properly Calibrated Instrument, Replace Hoses
- Vary the Locations
- System Extremities
- Normal Sense of Smell
- More than One Person
- Limit the Number of Tests in a Given period
- Documentation

Monitoring for Effectiveness

- Tracking and Trending Customer Leak Calls

ILLINOIS GAS COMPANY
CUSTOMER LEAK/ODOR COMPLAINT
2011

MONTH	NUMBER OF CALLS	LEAKS FOUND
JANUARY	27	21
FEBRUARY	20	9
MARCH	23	11
APRIL	15	8
MAY		
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		

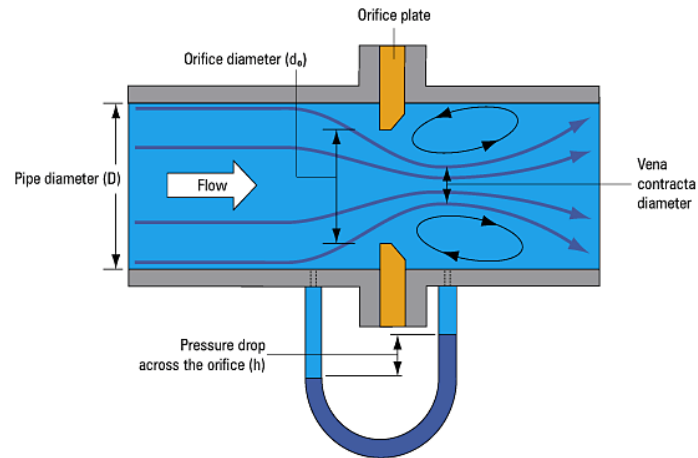


Monitoring for Effectiveness

- Look at Data from all Sources
- Maintain your Odorizers
- Replace Odorizers that are not Getting the Job Done with the Right Odorizer for the Application
- Maintain your Sniff Testing Instruments
- Know what Odorant Blend you are Using and Why
- Make Sure Your Records are Accurate and Meaningful

Common Issues With Bypass Odorizers

- Is the differential pressure in the acceptable range?
 - 30 in. W.C. to 80 in. W.C.



- Odorant tank almost empty
- Odorant tank too full
- Gauge or Float stuck or not operating correctly

Troubleshooting Odorizers

- “These odorizers are highly efficient and economical, as they have no moving parts and present almost no mechanical problems. “

- KingTool Company

- Although the bypass odorizer has no mechanical parts there are many more issues that can cause problems with odorization of the system.

Filling Odorizers

- Methods of Delivery
 - Bulk delivery
 - Drums
 - DOT Cylinders
 - Cans

Filling Odorizers

- Bulk Delivery
 - Closed Loop System
 - Cheapest, Safest
 - No disposal of cans or drums
- Small Trailer – up to 80 gallons
- Large Trailer- up to gallons
- Tanker – up to gallons



Filling Odorizers

- Drums
 - More expensive than bulk delivery
 - Issues with disposal



Filling Odorizers

- DOT Cylinders
 - More expensive due to low volume and high cost of shipping
 - Better for low volume usage



Filling Odorizers

- Cans
 - Extremely expensive
 - Hard to dispose of

Regulator Station Updates



Safety



Security



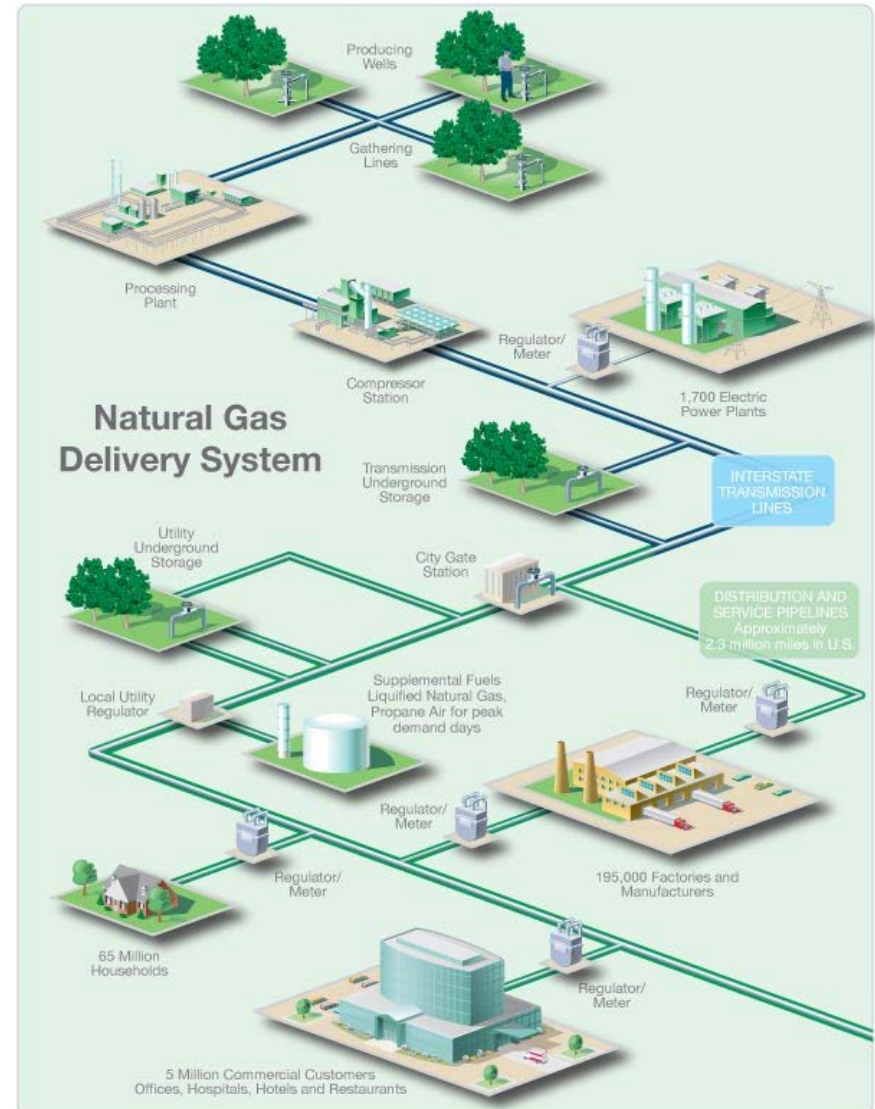
Partnership



Performance

Natural Gas Delivery System

- Regulator Locations
 - Transmission Pipeline Regulators
 - Town Border Stations
 - District Regulator Stations
 - Industrial and Commercial Meter Sets
 - Residential Meter Sets



Transmission Regulator Stations

- Protecting your system from overpressurization
- Inlet pressures as high as 900 psig.
- Regulator Station or Relief Valve can be used.



Town Border Stations

- Main pressure reduction from high pressure to town distribution system.



District Regulator Station

- Serving subdivisions, industrial parks, etc.



District Regulator Station (Farm Taps)

- Farm Taps serving more than two customers must be inspected annually at same standards as town border station.



Regulator Station Configurations

- Regulator and Relief



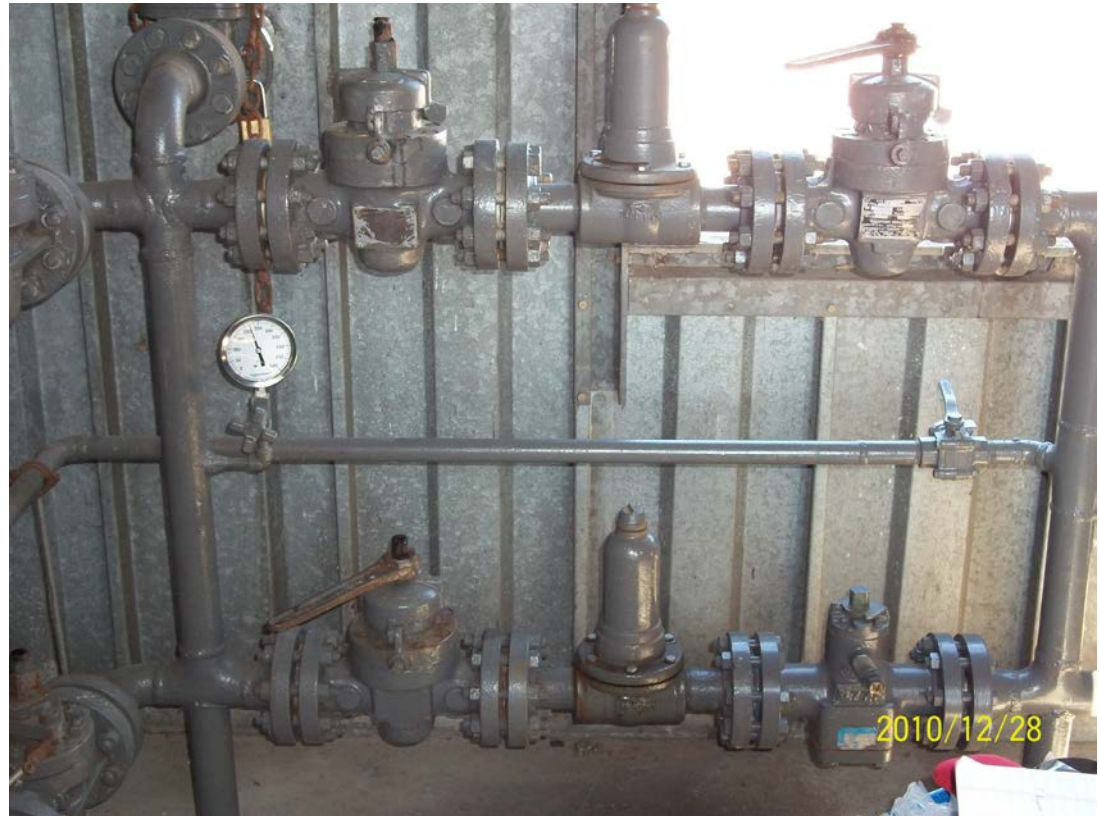
Regulator Station Configurations

- Dual Run Regulators and Relief



Regulator Station Configurations

- Multistage pressure reduction and Relief
- Cut from 800 psig to 200 psig
- 200 psig to 100 psig
- 100 psig to 20 psig
- Relief Valve Set at 35 psig



Regulator Station Configurations

- Worker Monitor with or without Relief



Making Inspections Easy

- Need to be able to perform lock up on each regulator at station.
 - Control lines inside upstream block valves.
 - Ports for gauges inside upstream block valves.



Making Inspections Easy

- Relief Valve Inspection
 - Pup between Relief Valve and Block Valve with port to introduce gas to test relief valve pressure setting.
 - Can easily install a TEE to attach gauge and connect nitrogen bottle to test relief valve.



Overpressure Protection

- Relief Valve
 - Relieves pressure off of system when pressure exceeds set point.
 - Warning Relief Valve vs. Full Capacity Relief Valve
- Monitor Regulator
 - Regulates the pressure downstream when the pressure exceeds it's set point.

Underpressure Protection

- Dual Run Stations
 - Having a second regulated run at the station protects against loss of pressure if working regulated fails closed.
- Monitor Regulator
 - Passes gas downstream when the pressure drops below it's set point.

Station Bypasses

- Could have a high pressure differential across valve.
- Regulated Bypasses allow for a second layer of under-pressure protection without the issues of an unregulated bypass.



Sizing of Regulators and Relief Valves

- Station Requirements
 - 100 MCFH or 100,000 CFH
 - 30 psig outlet
 - 200 psig inlet
 - Inlet MAOP of 250 psig
 - Outlet MAOP of 40 psig

FLOW COEFFICIENTS AND CONSTANTS

2" x 1" Single Port Valve				Swage Factor	
Percent Capacity	Cv	C1	Cg	1.5:1	2:1
100%	13.4	37	500	0.96	0.93
75%	10.7	30	320	0.97	0.95
50%	9.1	27	245	0.98	0.96
35%	5.5	26	144	1.00	0.99

NOTE: Allow a 5% factor of safety when calculating relief capacity

Table 5. Orifice Sizes and Flow and Sizing Coefficients

TRIM CONSTRUCTION	ORIFICE SIZE		FOR RELIEF SIZING WIDE-OPEN C _g	REGULATING C _g	C ₁	K _m	IEC SIZING COEFFICIENTS		
	INCHES	mm					X _T	F _D	F _L
Restricted capacity trim, Straight bore — Elastomer disk seat only	1/2 ⁽¹⁾	13 ⁽¹⁾	200	155	35	0.79	0.78	0.50	0.89
	3/4	19	425	330					
Restricted capacity trim, Stepped bore — Elastomer disk seat only	7/8 x 3/8	22 x 9.5	115	110					
	7/8 x 1/2	22 x 13	200	190					
	7/8 x 5/8	22 x 16	300	280					
Full capacity trim, Elastomer disk, or O-ring seats	7/8	22	550	408					
	1-1/8	29	850	680					

1. 1/2-inch / 13 mm is the only orifice size available for 1000 psig / 69.0 bar maximum inlet pressure.

Sizing of Regulators and Relief Valves

- Calculating Capacity of Regulator using C_g

$$\text{Capacity} = (\text{inlet pressure} + 14.7 \text{ psi}) * C_g * 1.29$$

$$\text{Capacity} = 214.7 * 500 * 1.29 = 138,481.5 \text{ CFH} = 138.4 \text{ MCFH}$$

If a worker monitor set up,

$$\text{Capacity} = 138.4 * 0.80 = 110.72 \text{ MCFH}$$

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TRIM CONSTRUCTION	ORIFICE SIZE		FOR RELIEF SIZING WIDE-OPEN C_g	REGULATING C_g
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Sizing of Regulators and Relief Valves

- Pressure Differential Concerns
 - With lower pressure differentials it is more difficult for regulator to operate at 100% capacity.

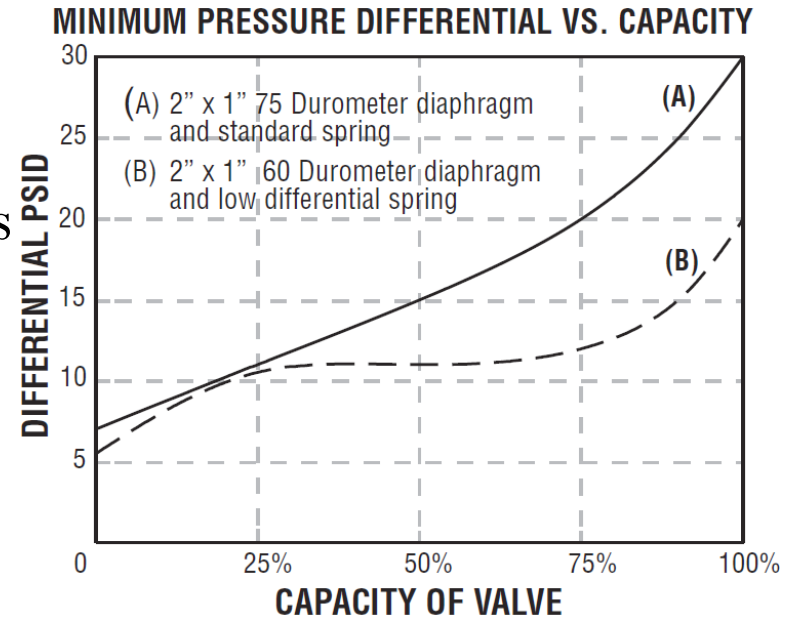


Table 3. Maximum Inlet Pressure, Allowable Pressure Drop, and Minimum Differential Pressures

MAXIMUM ALLOWABLE INLET PRESSURE / PRESSURE DROP		MAIN VALVE SPRING				MINIMUM DIFFERENTIAL PRESSURE FOR FULL STROKE		DISK MATERIALS	MAXIMUM ORIFICE SIZE ⁽¹⁾⁽⁵⁾		
		Part Number	Wire Diameter		Free Length				Inches	mm	
psig	bar			Inches	mm	Inches	mm	psig	bar		
25	1.7	1C277127022	0.148	3.76	6	152	0.75	0.05	Nitrile Disk Type Option (NBR) and Fluorocarbon (FKM)	1-1/8	29
50	3.4	1N801927022	0.156	3.96	7.13	181	1.5	0.10	Neoprene (CR) and Fluorocarbon (FKM)	1-1/8	29
150	10.3	1B883327022	0.187	4.75	6.63	168	3	0.21	Nitrile O-ring Type Option (NBR), Neoprene (CR), and Fluorocarbon (FKM)	1-1/8	29
175 ⁽²⁾	12.1 ⁽²⁾	1B883327022	0.187	4.75	6.63	168	3	0.21	Nitrile O-ring Type Option (NBR), Neoprene (CR), and Fluorocarbon (FKM)	7/8	22
250	17.2	1B883327022	0.187	4.75	6.63	168	3	0.21	Neoprene (CR) and Fluorocarbon (FKM)	7/8	22
300	20.7	0W019127022	0.281	7.22	6	152	10	0.69	Nylon (PA)	1-1/8 ⁽³⁾	29 ⁽³⁾
400	27.6	0W019127022	0.281	7.22	6	152	10	0.69	Nylon (PA) and PTFE	7/8	22
1000	69.0	0W019127022	0.281	7.22	6	152	10	0.69	Nylon (PA)	1/2 ⁽⁴⁾	13 ⁽⁴⁾

1. Can use all orifice sizes up to maximum size listed. See Table 5.
 2. CL125 FF flanged body only.
 3. 1-1/8-inch / 29 mm is the only orifice available for 300 psig / 20.7 bar maximum inlet pressure regulator.
 4. 1/2-inch / 13 mm is the only orifice available for 1000 psig / 69.0 bar maximum inlet pressure regulator.
 5. O-ring seat construction is only available for 7/8 and 1-1/8-inch / 22 and 29 mm orifice sizes.

Sizing of Regulators and Relief Valves

- Sizing Relief Valve

For Relief Valve sizing the capacity of the regulators are,

$$\text{Capacity} = (\text{MAOP} + 14.7 \text{ psi}) * C_g * 1.29$$

$$\text{Capacity} = 264.7 * 500 * 1.29 = 170,731.5 \text{ CFH} = 170.7 \text{ MCFH}$$

If a worker monitor set up,

$$\text{Capacity} = 170.7 * 0.80 = 136.6 \text{ MCFH}$$

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FLOW COEFFICIENTS AND CONSTANTS

Percent Capacity	2" x 1" Single Port Valve			Swage Factor	
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100%	13.4	37	500	0.96	0.93
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NOTE: Allow a 5% factor of safety when calculating relief capacity

Sizing of Regulators and Relief Valves

- Sizing Relief Valve

Capacity of Regulators = 136.6 MCFH

Table 2. Flow Coefficients at Maximum Rated Travels

BODY SIZE		PIPING STYLE													
		Line Size Equals Body Size							2:1 Line Size to Body Size						
NPS	DN	Linear Cage			Whisper Trim® III Cage			K _m	Linear Cage			Whisper Trim® III Cage			K _m
		C _g	C _v	C ₁	C _g	C _v	C ₁		C _g	C _v	C ₁	C _g	C _v	C ₁	
1	25	600	17.2	35.7	576	17.0	33.7	0.71	568	16.8	33.0	529	15.5	34.0	0.71
2	50	2280	63.3	36.0	1970	54.7	36.0	0.71	2050	59.6	34.4	1830	52.2	35.0	0.71
3	80	4630	132	35.1	3760	107	35.0	0.71	4410	128	34.4	3630	106	34.2	0.71
4	100	7320	202	36.2	6280	180	34.8	0.71	6940	198	35.0	6020	171	35.2	0.71
6	150	12,900	397	32.5	9450	295	32.0	0.71	12,100	381	31.7	9240	291	31.7	0.71
8 x 6	200 x 150	17,800	556	32.0	10,500	300	35.0	0.71	17,100	534	32.0	10,270	293	35.0	0.71

Capacity of Relief = (Set point + Buildup + 14.7) * C_g * 1.29

Capacity of 2" = (38 + 1.7 + 14.7) * 2280 * 1.29 = 124.0 MCFH

Capacity of 3" = (38 + 1.6 + 14.7) * 4630 * 1.29 = 324.3 MCFH

Sizing of Regulators and Relief Valves

- Sizing Relief Valve

Table 5. Type 63EG Relief Capacities⁽¹⁾ to atmosphere with Types 6358, 6358B, 6358EB, and 6358EBH Pilots (continued)

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER, AND COLOR		SET PRESSURE ⁽²⁾		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE ⁽³⁾		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE ⁽⁴⁾		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT		CAPACITIES ⁽¹⁾ OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN			Psig	bar	Psig	bar	Psig	bar	Psig	bar	Psig	bar	SCFH	Nm ³ /h
3	80	6358	Yellow	10 to 40	10	0,69	3.5	0,24	9.0	0,62	5.0	0,34	185 000	4958	
				/ 0,69 to 2,8	15	1,0	1.3	0,09	4.0	0,28			185 000	4958	
				1E392527022	20	1,4	1.2	0,08	2.0	0,14			203 000	5440	
				Yellow	30	2,1	1.2	0,08	1.5	0,10			260 000	6968	
			Green	35 to 125 psig	40	2,8	2.0	0,14	2.5	0,17			324 000	8683	
				/ 2,4 to 8,6	50	3,4	2.0	0,14	2.5	0,17			382 000	10 238	
				1K748527202	60	4,1	2.0	0,14	2.5	0,17			439 000	11 765	
				Red	80	5,5	2.0	0,14	2.5	0,17			555 000	14 874	
		6358B	Yellow	10 to 30	10	0,69	3.5	0,24	9.0	0,62	1.0	0,07	185 000	4958	
				/ 0,69 to 2,1	15	1,0	1.3	0,09	4.0	0,28			185 000	4958	
			1B788327022	20	1,4	1.2	0,08	2.0	0,14	203 000			5440		
			Silver	30	2,1	1.2	0,08	1.5	0,10	260 000			6968		
Green	30 to 60	30	2,1	1.6	0,11	2.0	0,14	2.0	0,14	263 000	7048				
		/ 2,1 to 4,1	40							2,8	322 000	8630			
	1B788427022	50	3,4	379 000	10 157										
	Blue	60	4,1	436 000	11 685										
60 to 125	60	60	4,1	2.0	0,14	2.5	0,17	3.0	0,21	439 000	11 765				
		/ 4,1 to 8,6	80	5,5	2.0	0,14	2.5			0,17	553 000	14 820			
	1K748527202	100	6,9	2.4	0,17	3.0	0,21			670 000	17 956				
	Red	125	8,6	2.4	0,17	3.0	0,21			812 000	21 762				

Issues Noticed

- Valves on control lines
- Ability to perform a lock up test.



Issues Noticed

- Adequate protection of the station.

- Bollards



- Buildings





Safety ● Security ● Partnership ● Performance

Questions