

CL231 Series Regulator

Commercial Regulator



The CL231 regulator is designed primarily for use in medium size commercial and industrial installations requiring highly accurate pressure regulation. The CL231 can produce substantial savings for users in lower initial costs, lower installation costs, and lower maintenance costs.

The CL231 was designed for systems requiring highly accurate pressure regulation such as:

- » Metering loads (approx. 500 to 7500 CFH) without the need for expensive instrumentation
- » As a 1 ½" or 2" regulator covering the outlet range from 1 PSIG to 20 PSIG without downstream control
- » Where very accurate PSI to PSI regulation (\pm 1% outlet pressure absolute) is desired than is obtainable from conventional spring loaded regulators ahead of a "Fixed Factor Billing" meter or ahead of a "Pressure Compensating Index" meter
- » As a reliable and accurate replacement (without downstream control) for conventional regulators requiring downstream control

Description

» CL231R

The CL231R is a constant pressure loaded regulator equipped with a pilot internal relief valve. The pilot relief valve is not designed for "full capacity" relief, but rather to limit the loading chamber pressure to a safe value in the event of failure.

» CL231N

The CL231N is a constant pressure loaded regulator that utilizes a pilot with no internal relief (N). This regulator can be used where PSIG to PSIG regulation is required with no internal relief.

- » No special start-up procedures
- » Constant pressure loading
- » Light valve closing spring
- » Easy pressure adjustment via pilot regulator

Features

- » Internal bleed to prevent vapor lock-up
- » Internal lower diaphragm chamber pressure flow control
- » Wide range of set points available with minimum number of springs
- » Compact regulator able to provide flow rates up to 7500 CFH

Benefits

- » Lower installation and maintenance costs
- » Compact Design
- » Constant pressure loading great for fixed factor measurement accuracy
- » Stop stem in pilot insures token internal relief on 'R' models.

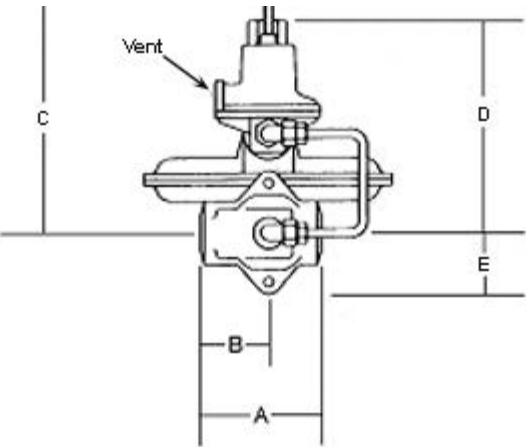
SHIPPING WEIGHT

CL231: 4 regulators per box

Box weight: 53 lbs.

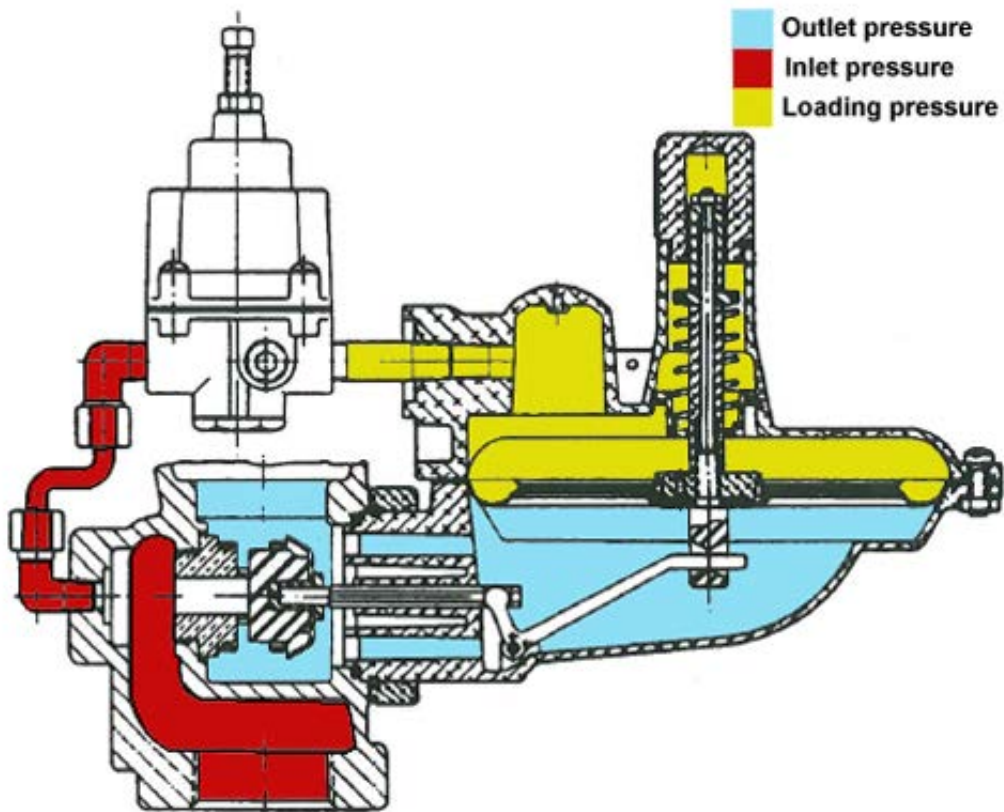
CL231 DIMENSIONS (INCHES)

Valve Body	A	B	C	D	E
NPT (all sizes)	5-3/4	2-7/8	8	6-1/2	2
Flanged (all sizes)	10	5			



OPERATIONAL SCHEMATIC

Shown with N-type pilot.



Note: Valve shown in closed position.

SPRING DATA, SPRING COLOR OUTLET PRESSURE RANGE*

Model R*	(PSIG)
Orange	1.0 to 1.6
Brown	1.6 to 2.6
Green	3.5 to 7.4
Black	3.8 to 13.3
Blue	4.6 to 21.5
Model N*	
Blue or Green	1 to 20

*Warning: Pilot springs are not interchangeable between N and R pilots.

ORIFICE DATA, WIDE OPEN FLOW COEFFICIENTS AND MAXIMUM PRESSURES

Orifice Size (inches)	K-Factor	Maximum Operating Inlet Pressure (PSIG)	Maximum Emergency Inlet Pressure (PSIG)	Maximum Emergency Outlet Pressure (PSIG)
1/4	125	125	175	60
3/8	290	75	100	
1/2	500	50	75	

OPERATING TEMPERATURE RANGE

- -20°F to 150°F

Available pilot vent sizes	1/4-inch NPT
Loading ring position	For inlet pressure < 15 PSIG: 12° For inlet pressure > 15 PSIG: 15°
Closing spring (non-adj.)	Light green only
Other available options	Seal wire to indicate unapproved tampering
	1/8" pipe plug tap on upstream side of valve body
	Pilot supply line filter (contact ROOTS Regulators, Owenton, KY)
	Stainless steel supply line fittings
	Teflon valve body gasket

CONSTRUCTION

ROOTS Regulators takes pride in delivering American made products with the utmost concern for safety, quality, and customer satisfaction.

Construction materials

Closing spring	Music wire
Valve body	High tensile strength cast iron (ASTM A-126, Class A)
Orifice	Brass (ASTM B16, Alloy 360), aluminum - optional
Valve seat	Buna-N or silicone (for temperatures below -20°F)
Valve stem	Plated steel (Aluminum alloy 2011-T3)
Lever pin	Stainless steel (Type 303)
Lever	Zinc and dichromate plated steel (AISI C1010)
Upper diaphragm plate	Zinc and dichromate plated steel (14 gauge steel)
Lower diaphragm plate	Die cast aluminum (ASTM B-85 Alloy SC84A)
Diaphragm	Buna-N and nylon
Pilot vent screen	Stainless steel (16 mesh)
Adjustment ferrule	Die cast aluminum (ASTM CS43A)
Seal cap	Die cast aluminum (ASTM CS43A)
Diaphragm case	Die cast aluminum (ASTM B85-Alloy SC84A)

VALVE BODY SIZES (INCHES)

Inlet	Outlet	Screwed (NPT-thread)	Flanged (ASA 125)
1-1/4	1-1/4	X	-
1-1/4	1-1/2	X	-
1-1/4	2	X	-
1-1/2	1-1/2	X	-
1-1/2	2	X	-
2	2	X	X
3	3	-	X

X indicates the valve body is available in that configuration.

CORRECTION FACTORS FOR NON-NATURAL GAS APPLICATIONS

The CL231 may be used to control gases other than natural gas. To determine the capacity for gases other than natural gas, multiply the values within the capacity tables by a correction factor. The table below lists the correction factors for some of the more common gases.

Gas Type	Specific Gravity	Correction Factor (CF)
Air	1.00	0.77
Butane	2.01	0.55
Carbon Dioxide (Dry)	1.52	0.63
Carbon Monoxide (Dry)	0.97	0.79
Natural Gas	0.60	1.00
Nitrogen	0.97	0.79
Propane	1.53	0.63
Propane-Air-Mix	1.20	0.71

To calculate the correction factor for gases not listed in the table above, use the gases' specific gravity and insert it in the formula listed below:

$$\sqrt{\frac{SG_1}{SG_2}}$$

Correction Factor (CF) =

Where: SG1 = Specific gravity of the gas in which the capacity is published.

SG2 = Specific gravity of the gas to be controlled.

Wide Open Flow Calculations

For wide-open orifice flow calculations use the following equations:

$$\text{For } \frac{P_1}{P_2} < 1.89 \quad \text{use: } Q = K\sqrt{P_2(P_1 - P_2)} \quad \text{For } \frac{P_1}{P_2} > 1.89 \quad \text{use: } Q = \frac{KP_1}{2}$$

Where: P1 = Absolute Inlet Pressure (PSIA) P2 = Absolute Outlet Pressure (PSIA)

Q = Flow Rate (SCFH)

K = Orifice Coefficient (SCFH/PSI)

CL231 CAPACITY TABLE (MODELS R AND N)* 1% ABSOLUTE DROOP

Capacities in SCFH of 0.6 S.G. gas; base conditions of 14.7 PSIA and 60°F.

Typical Capacity Info.	
Manufacturer	ROOTS Regulators
Type and model	CL231
Regulator	
Inlet size	2" NPT
Outlet size	2" NPT
Spring color	Varies
Position	5

Orifice Size				
Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1/4"	3/8"	1/2"
2	1	475	675	1100
3	1	675	1050	1750
	2	475	750	1250
5	1	940	1650	2600
	2	800	1550	2300
10	1	1440	2700	4350
	2	1400	2700	4200
	5	1150	2100	3000
15	1	1850	3550	5950
	2	1850	3550	5950
	5	1750	3200	5200
	10	1100	2100	2950
20	1	2200	4300	7250
	2	2200	4300	7250
	5	2100	4100	6700
	10	1850	3450	5700
	15	1100	1650	2600
30	1	2800	5800	7500
	2	2800	5800	7500
	5	2800	5800	7500
	10	2700	5350	7500
	15	2350	4350	7450
	20	2100	3600	6300
40	1	3500	7100	7500
	2	3500	7100	7500
	5	3500	7100	7500
	10	3500	7100	7500
	15	3300	6100	7500
	20	3200	6000	7500
50	1	4100	7500	7500
	2	4100	7500	7500
	5	4100	7500	7500
	10	4100	7500	7500
	15	4100	7500	7500
	20	3500	7500	7500

Notes:
*Individual regulator performance may vary from data shown.


CL231 CAPACITY TABLE (MODELS R AND N)* 1% ABSOLUTE DROOP

continued

	Orifice Size			
Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1/4"	3/8"	1/2"
60	1	4600	7500	
	2	4600	7500	
	5	4600	7500	
	10	4600	7500	
	15	4600	7500	
	20	4600	7500	
75	1	5600	7500	
	2	5600	7500	
	5	5600	7500	
	10	5600	7500	
	15	5600	7500	
	20	5600	7500	
100	1	7100		
	2	7100		
	5	7100		
	10	7100		
	15	7100		
	20	7100		
125	1	7500		
	2	7500		
	5	7500		
	10	7500		
	15	7500		
	20	7500		

Notes:

*Individual regulator performance may vary from data shown.

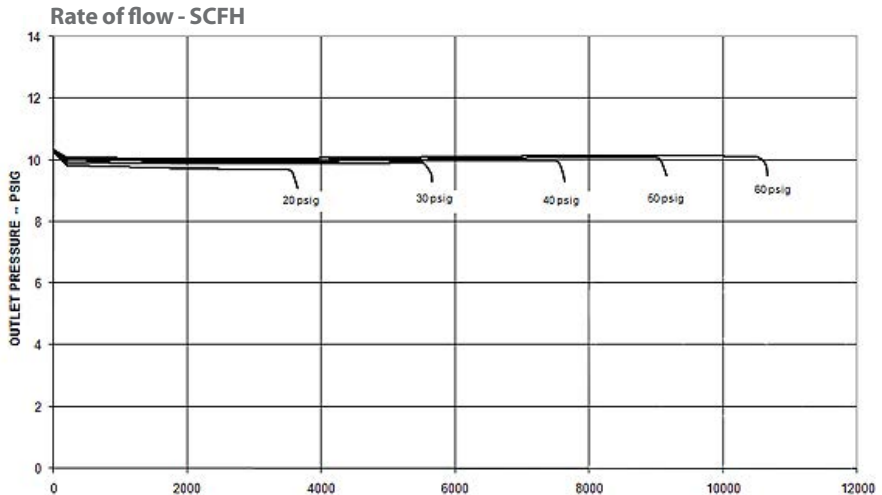
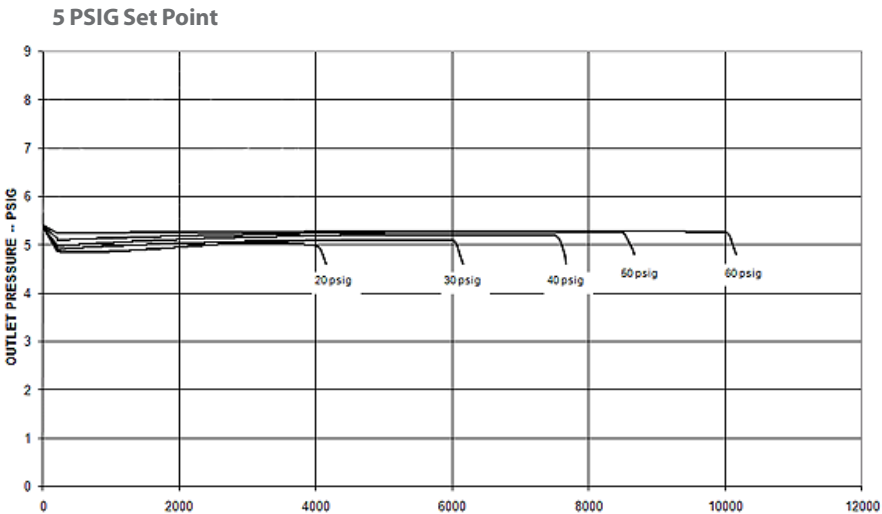
 Do not operate orifice in shaded inlet pressure area.

CL231 PERFORMANCE CURVES

5, 10 PSIG Set Point

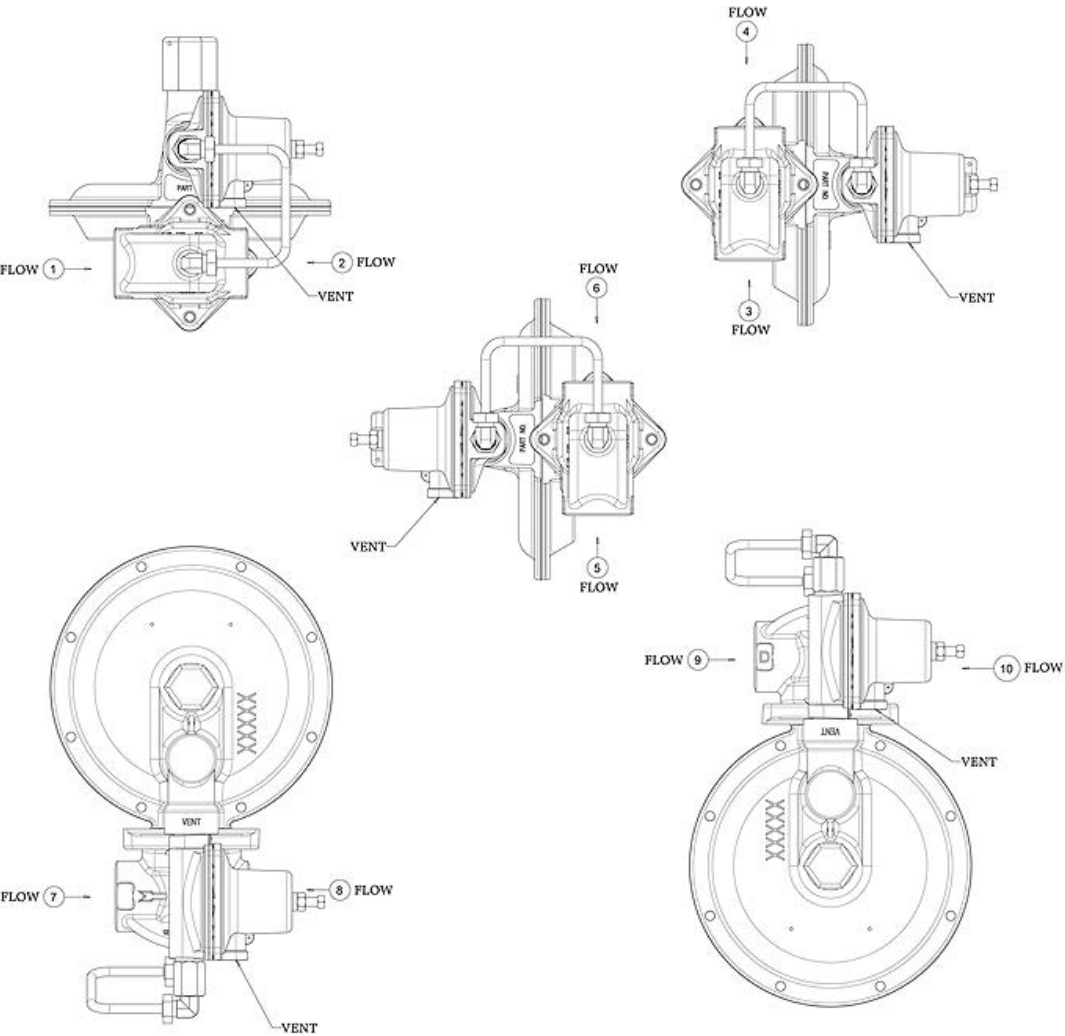
Type and model	CL231R
Inlet size	2" NPT
Outlet size	2" NPT
Orifice size	3/8"

All test results are reported at a base of 14.7 PSIA at 60° F and with 0.6 S.G. gas.

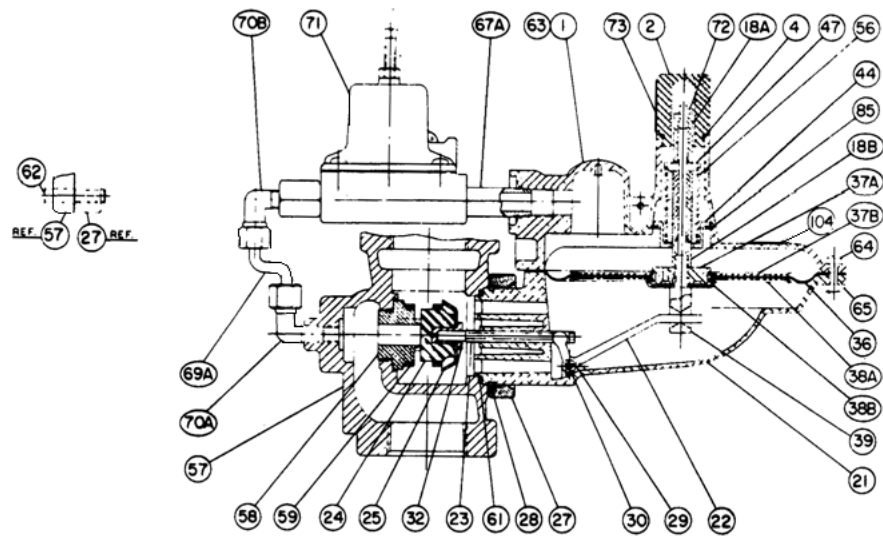


Rate of flow - SCFH 10 PSIG Set Point

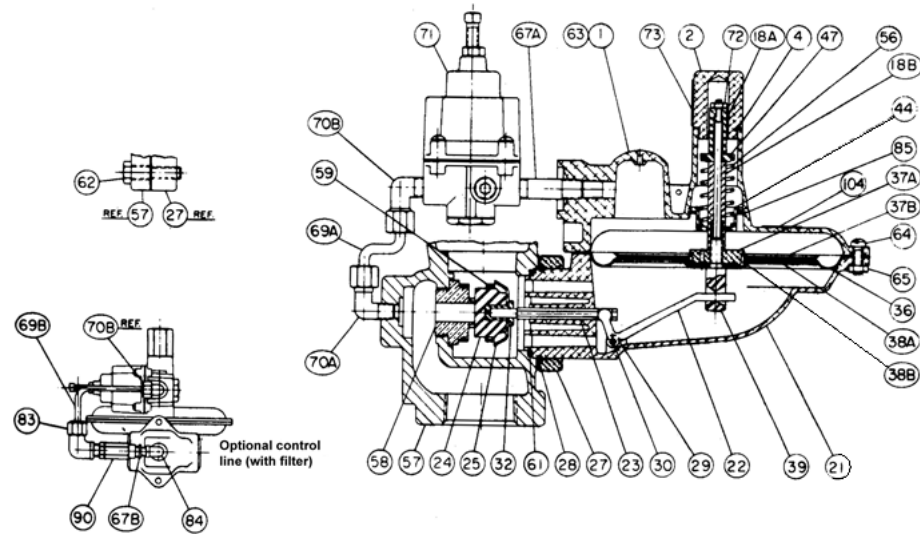
ASSEMBLY POSITIONS



CL231 PARTS SCHEMATIC
CL231 R



CL231 N



Item No.	Part No.	Quantity Required per Regulator Model		Description
		N	R	
1	753199		1	Upper diaphragm case, vent 3/8" ANPT pipe
	753194	1	1	Upper diaphragm case, vent 1/4" ANPT pipe
2				Seal cap, please specify type:
	760001	1	1	with seal wire hole, main spring seal cap
	760013	1	1	with seal wire hole, pilot seal cap (optional)
4	765503	1	1	Seal cap gasket
18A	754721	1	1	Stop stem spacer, upper
18B	754725	1		Stop stem spacer, lower
21	752124SU	1	1	Lower diaphragm case, 4:1 lever ratio
22	761231	1	1	Valve linkage lever, 4:1 lever ratio
23	754021	1	1	Valve stem—use with 32 754085
24	765203	1	1	Main case valve seat, Buna-N
25	761721	1	1	Deflector ring
27	751913	1	1	Valve body retainer plate, aluminum
28	755725	1	1	Retainer plate snap ring
29	755141	2	2	Valve linkage pin screw
30	754831	1	1	Valve linkage pin
32	754085	1	1	Valve stem adapter—use with 23 754021
36	766130-001	1	1	Diaphragm
37A	761031	1	1	Upper diaphragm plate
37B	761025	1	1	Upper diaphragm plate
38A	761025	1	1	Lower diaphragm plate
38B	756091	1	1	Lower diaphragm plate
39	754331	1	1	Stop stem
44	754901	1	1	Stop stem guide bushing
47	761495	1	1	Closing spring guide
56	762119	1	1	Closing spring, light green
57		1	1	Valve body, straight. Please specify type and size:
	750613WO			1-1/4" x 1-1/4" NPT with 1/8" NPT
	750636WO			1-1/4" x 1-1/2" NPT with 1/8" NPT
	750663WO			1-1/4" x 2" NPT with 1/8" NPT
	75069WO			1-1/2" x 1-1/2" NPT with 1/8" NPT
	750713WO			1-1/2" x 2" NPT with 1/8" NPT
	750741WO			2" x 2" NPT with 1/8" NPT
	750763WO			2" ASA flanged 125 lb. with 1/8" NPT
	750813WO			3" ASA flanged 125 lb. with 1/8" NPT
	750786WO			2" ASA short flanged 125 lb. with 1/8" NPT
58		1	1	Orifice, brass, specify size:
	758101			1/4" diameter
	758104			3/8" diameter
	758107			1/2" diameter
59	761761	1	1	Loading ring
61	765651	1	1	Valve body gasket
62	755386-001	2	2	Retainer plate screw, hex head, 5/16" 18 x 1-1/4"
63	769151	1	1	Curved two-hole regulator badge (optional)
64	755304-001	8	8	Case screw, hex head, 1/4", 20 x 3/4"

Item No.	Part No.	Quantity Required per Regulator Model		Description
		N	R	
65	755513-001	8	8	Case nut, hex, 1/4", 20
67A	768133		1	Nipple 3/8" NPT x 2"
	768123	1		Nipple 1/4" NPT x 2"
67B	768101	1	1	Pipe nipple, male, 1/8" x 1/4" NPT steel
69A	768501			Control line, 1/4" steel
69B	768541	1	1	Control line, 1/4" D tube steel
70A	768251	1	1	90° Male elbow, 1/4" tube x 1/8" NPTF steel
70B	768257	1	1	90° Male elbow, 1/4" tube x 1/4" NPTF steel
				*Optional control line with filter assembly
71	700321	1		Regulator pilot, N type only, blue or green spring
	762631		1	Orange, adjustment spring only
	762633		1	Brown, adjustment spring only
	762635		1	Green, adjustment spring only
	762637		1	Black, adjustment spring only
	762639		1	Blue, adjustment spring only
72	755621	1	1	Stop stem nut (hex) #10-24
73	769401	1	1	Warning sticker, seal cap
83	768251	1	1	90° Male elbow, 1/4" tube x 1/8" NPTF steel
84	768291	1	1	90° Street elbow, 1/8" NPT - steel
85	755731	1	1	Stem guide bushing retainer ring
90	768481	1	1	Control line filter

VENT LINES FOR REGULATORS

If you are constructing vent lines to be attached to regulators installed indoors, follow a few basic rules:

- a. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. If a long gas run must be used, ROOTS Regulators advises increasing the pipe one nominal size every ten feet to keep the flow restriction as low as possible.
- b. Keep the vent line length as short as possible to minimize the restriction and reduce the vent's tendency to cause regulator pulsation. c. Support the vent pipe to eliminate strain on the regulator diaphragm case.
- d. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe. Install a bug screen in the end of the pipe.
- e. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
- f. Adhere to all applicable codes and regulations.
- g. If your vent pipe causes regulator pulsation, consult your sales representative or manufacturer.
- h. ROOTS Regulators strongly recommends running a separate vent line for each regulator. Headers with various installed devices can cause regulator malfunction.

Caution Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to verify the vent line is exhausting to a safe environment.

INSTALLATION

Warning ROOTS Regulators does not endorse or warrant the completeness or accuracy of any third party regulator installation procedures or practices, unless otherwise provided in writing by ROOTS Regulators. Follow your company's standard operating procedures regarding the use of personal protection equipment (PPE). Adhere to guidelines issued by your company in addition to those given in this document when regulators are installed.

- a. Remove all shipping plugs from the regulator inlet, outlet, and vent before installation.
- b. Verify the piping interior and regulator inlet and outlet are clean and free of dirt, pipe dope, and other debris. Dirt and other foreign materials entering the regulator can cause a loss of pressure control.
- c. Apply pipe joint sealant to the male pipe threads. Do not use pipe joint material on the regulator's female threads. Joint sealant could become lodged in the regulator and cause a loss of pressure control.
- d. Gas must flow through the regulator's valve body in the direction cast on the regulator body. Gas flowing in the wrong direction can overpressure and cause damage to the regulator.
- e. The pilot diaphragm casing can be mounted in any position relative to the body through a full 360° angle at 90° increments.
- f. When the regulator is installed OUTDOORS, the vent must always be positioned so that rain, snow, moisture or foreign particles cannot enter the vent opening. ROOTS Regulators recommends positioning the pilot vent downward to avoid entry of water or other matter which could interfere with the proper operation of the regulator. The vent should be located away from building eaves, window openings, building air intakes and above the expected snow level at the site. The vent opening should be inspected periodically to insure it does not become blocked by foreign material as outlined in DOT PHMSA-RSPA-2004-19856.
- g. When the regulator is installed INDOORS, the vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. USING VENT PIPE SMALLER THAN THE VENT CONNECTION LIMITS THE REGULATOR'S INTERNAL RELIEF VALVE CAPACITY. The outlet end of the pipe must be protected from moisture and the entrance of foreign particles. The regulator should be specified by the user with the size vent and pipe threads desired to make the vent pipe connection.

START-UP PROCEDURE

- a. Mount a pressure gauge downstream of the regulator to monitor the downstream pressure.
 - b. With the downstream pressure valve closed, slowly open the inlet valve. The outlet pressure should rise to slightly more than the setpoint. Verify there are no leaks and all connections are tight.
 - c. The regulator was preset at the factory to match order specifications. If necessary, adjust the outlet pressure by removing the seal cap on the top of the pilot spring housing and adjusting the ferrule or screw inside the pilot spring housing using a large flat-head screwdriver. With a small amount of gas flowing through the regulator, rotate the pilot ferrule clockwise to raise the outlet pressure or counter-clockwise to lower the outlet pressure.
 - d. Replace the seal cap and check for leaks after the desired outlet pressure is achieved.
- The regulator is ready for operation.

SAFETY WARNING

This product, as of the date of manufacture, is designed and tested to conform to all governmental and industry safety standards as they may apply to the manufacturer. The purchaser/user of this product must comply with all fire control, building codes, and other safety regulations governing the application, installation, operation, and general use of this regulator to avoid leaking gas hazards resulting from improper installation, startup or use of this product.

ROOTS Regulators strongly recommends installation by a qualified professional and periodic inspection of pressure regulators (inspections may be required by local applicable codes or regulations).

Inspections should include checking for gas quality, cycle numbers, external environmental changes, and operating conditions that impact wear on the regulator's moving parts. To ensure safe and efficient operation of this product, replace worn or damaged parts found during inspection.

Limited Warranty

ROOTS Regulators are subject to the terms and conditions of the Natural Gas Solutions North America, LLC General Terms & Conditions For Sale of Products, Parts and Services, and no other terms shall apply, unless agreed upon by the parties in writing. The Natural Gas Solutions North America, LLC General Terms & Conditions For Sale of Products, Parts and Services can be found on the Dresser Utility website: dresserutility.com/forms-questionnaires-and-terms-conditions-sale.

Ordering Information

1. Inlet and outlet connection size and type
2. Model number
3. Outlet pressure desired
4. Inlet pressure range
5. Type of gas and maximum capacity required
6. Assembly position number (see diagram above)
7. Vent size
8. Special requirements such as tagging, pipe plug tap, seal wire, etc.

ROOTS Regulator + ROOTS Meter Compatibility		
<u>Small</u>	<u>Regular</u>	<u>Large</u>
5M175	2M-3M	11M175

ROOTS Regulators

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