

Model 046 Field Regulators

Installation, Maintenance Instructions and Parts List

Simple design, rugged construction and top performance make these regulators a dependable, economical answer for the wide variety of pounds to pounds applications. They are also available with an internal relief valve (IRV) and with a stem seal and control line tap for use as the upstream regulator in a monitor set.

The 046 Regulators typically are used for farm taps, field regulator applications, propane tanks and high pressure industrial air or gas uses.

Maximum Inlet Pressure 046, 046-M and 046-C Models

Orifice	Springs		
	Yellow	Aluminum, White, Tan, Dark Green	Gray
1/8"	500 psi	1000 psi	1000 psi
3/16"	500 psi	1000 psi	1000 psi
1/4"	500 psi	500 psi	500 psi
5/16"	300 psi	400 psi	400 psi
3/8"	300 psi	300 psi	400 psi
1/2"	100 psi	100 psi	100 psi

Inlet Pressures to 1000 psi
 Outlet Pressures 3 to 200 psi
 Pipe Sizes 3/4", 1", and 1 1/4"

Maximum Inlet Pressure 046-2 and 046-2M Models

Orifice	Springs	
	Yellow	Aluminum, White, Tan, Dark Green
1/8"	500 psi	925 psi
3/16"	500 psi	925 psi
1/4"	500 psi	500 psi
5/16"	300 psi	400 psi
3/8"	300 psi	300 psi
1/2"	100 psi	100 psi

Inlet Pressures to 925 psi
 Outlet Pressures 3 to 125 psi
 Pipe Sizes 3/4", 1", and 1 1/4"

Maximum Inlet Pressure 046-PL and 046-CPL Models

Orifice	Springs	
	Yellow	Aluminum
1/8" to 1/2"	250 psi	250 psi

Inlet Pressures to 250 psi
 Outlet Pressures 5 to 100 psi
 Pipe Sizes 3/4", 1", and 1 1/4"

Valve Material	Max Inlet Pressure	Max Diff. Pressure
Poly-U Tan (90 Duro)	1000 psig	800 psig
Buna-N (80 Duro)	525 psig	400 psig
Vitron (70 Duro)	300 psig	250 psig

Installation and Start-Up

1. Remove the shipping plugs from both the regulator inlet and outlet connections.
2. Make certain that the inside of the piping and the regulator inlet and outlet connections are clean. They must be free of dirt, pipe dope and other debris.
3. Use pipe joint material only on the male threads of the pipe being connected to the regulator. Do not use pipe joint material on the female threads of the regulator.
4. Install the regulator in the line. Make certain that the gas flow through the regulator is in the direction indicated by the arrow on the regulator body.

The regulator may be installed in any position: right side up, upside down, vertical piping, diagonal piping, etc. If required, the diaphragm case may be rotated 360° in any number of increments. To rotate the diaphragm case assembly to another position in relation to the body, loosen coupling nut **33**. Make certain it is retightened to 35 to 50 ft.-lb. to hold the diaphragm case assembly in the new position and to reseal.

The diaphragm case vent must be positioned to protect against flooding, drain water, ice formation, traffic, tampering, etc. The vent must be protected against nest building animals, bees, insects, etc. to prevent vent blockage and to minimize the chances of foreign material collecting in the vent side of the regulator diaphragm.



CAUTION

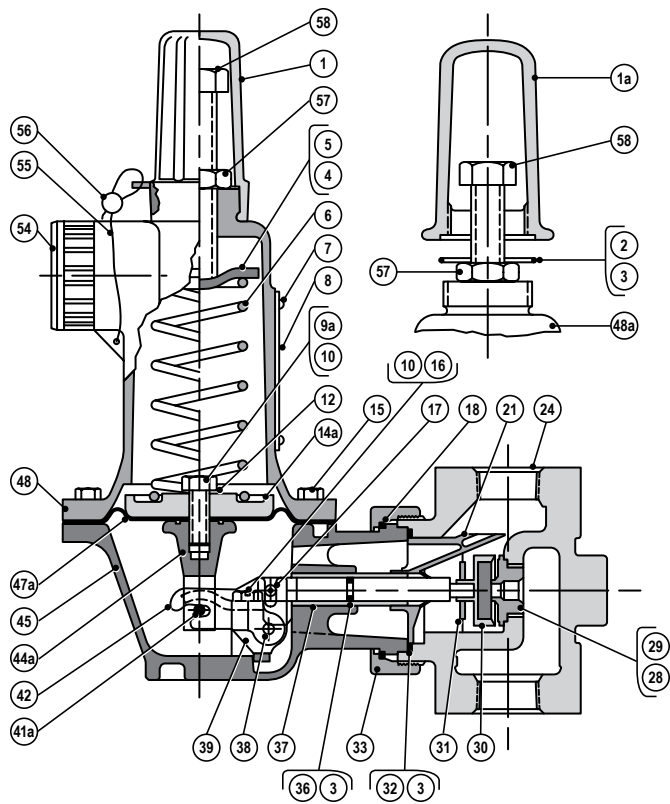
Turn gas on very slowly. If an outlet stop valve is used, it should be opened first. Do not overload the diaphragm with a sudden surge of inlet pressure. Monitor the outlet pressure during start-up to prevent an outlet pressure overload.

5. Turn gas on very slowly.
6. Make certain that there are no leaks and that all connections are tight.

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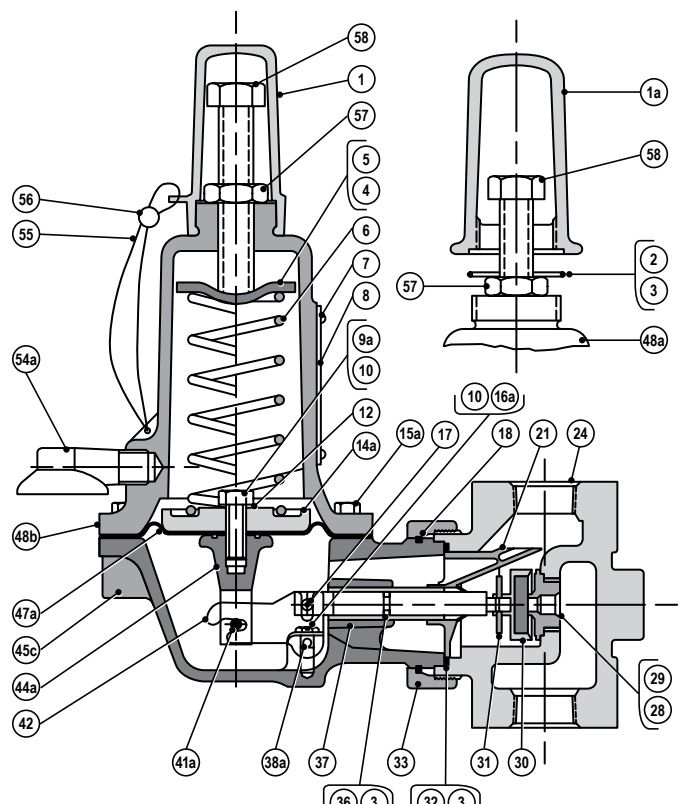
Model	Body	Diaphragm Case	Internal Relief Valve	Maximum Inlet Pressure	Outlet Pressure Range
046 046-M ¹ 046-C	Ductile Iron ASTM 395 GR 60-90-18	Aluminum	No	See Tables Above	3 to 200 psi
		Aluminum	No		
		Cast Iron	No		
046-2 046-2M ¹		Aluminum	Yes	See Tables Above	3 to 125 psi
		Aluminum	Yes		
046-PL 046-CPL		Aluminum	No	See Tables Above	5 to 100 psi
		Cast Iron	No		

1. Regulator requires a control line.



GIM1312-005

MODEL NO. 046



GIM1312-010

MODEL NO. 046-C

- Adjust set-point (outlet pressure) by turning adjustment screw **58**. Turn clockwise to increase and counterclockwise to decrease. Be sure to tighten nut **57** after adjustment is completed. Do not adjust when regulator is closed (no flow). Only adjust when gas is flowing through regulator (approximately 250 SCFH).

Except for lock-up (regulator closed), the outlet pressure during normal operation must not go higher than the maximum limit of the spring range. Whenever it goes higher, the spring could be overstressed. Also, the higher pressure springs could compress solid and thereby keep the regulator from closing.

Therefore, whenever the set-point is within the upper third of the spring range, set-point adjustment should be made at low flow (approximately 250 SCFH). If set-point, adjustment must be made when flow is greater, use the next higher range spring.

CAUTION

It is the user's responsibility to assure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from ANY POTENTIAL sources of ignition. Where vent lines are used, it is the user's responsibility to assure that each regulator is individually vented and that common vent lines ARE NOT used.

- The vent assembly **54** or **54A** is an escape path for flammable gas and it must be located and/or piped so that potential discharge occurs in a safe area away from buildings, open flames, collection areas, arcing devices, etc.

Regulators that are installed indoors or in a non-vented area must be vented to the outside. Simply run vent piping from the regulator vent connection to a non-hazardous location on the outside away from ANY

potential sources of ignition. The vent piping must be a minimum 1/4" NPT connection size or larger and piped to a safe area. The vent discharge must be protected against the potentials outlined in instructions 4, 8, 9 and 10.

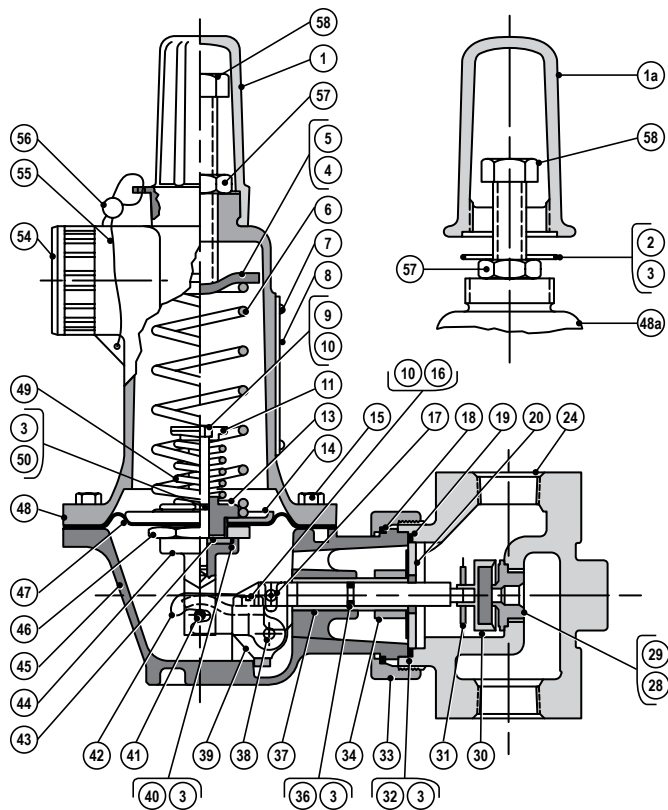
For regulators equipped with internal relief valves (IRV), models 046-2 and 046-2M, vent piping must be vent connection size (1" NPT) or larger. This will assure that the vent piping will be large enough to vent all of the IRV discharge to atmosphere without excessive back pressure that would result in excessive pressure increase in the regulator.

The outlet of the vent piping must allow for the free and unobstructed passage of air and gas and must be protected against the potentials listed in instructions 4, 8, 9 and 10.

- For outdoor installations, it is recommended that the regulator be installed so that the regulator vent faces down to avoid the potential for water or other foreign matter entering the regulator and interfering with the proper operation of the regulator.
- For application on combustible gas with a specific gravity greater than 1.0 (such as propane), it is recommended that the gas be vented outdoors where the gas will not collect in low areas and away from all open flames, arcing devices, etc.

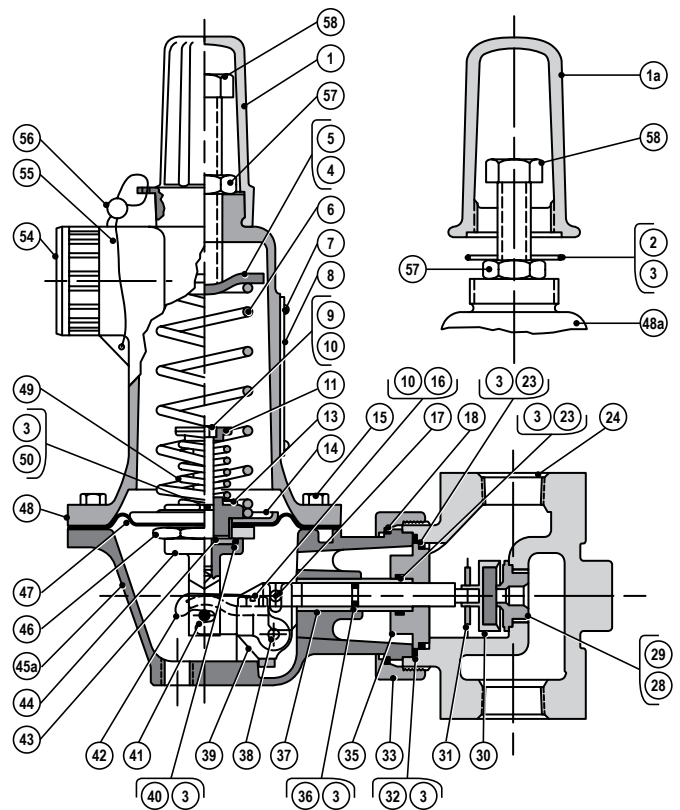
CAUTION

Regulators are pressure control devices with numerous moving parts subject to wear. Regulator wear is dependent upon particular operating conditions. To assure continuous satisfactory operation, a periodic inspection schedule must be adhered to with the frequency of inspection determined by the severity of service and applicable laws and regulations.



GIM1312-015

MODEL NO. 046-2



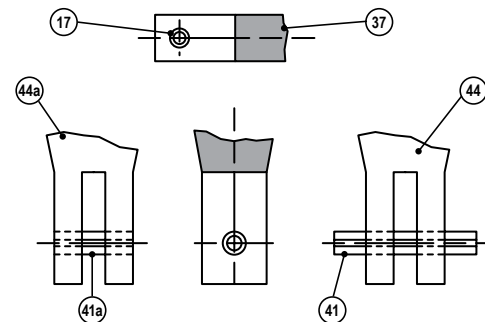
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MODEL NO. 046-2M

Service

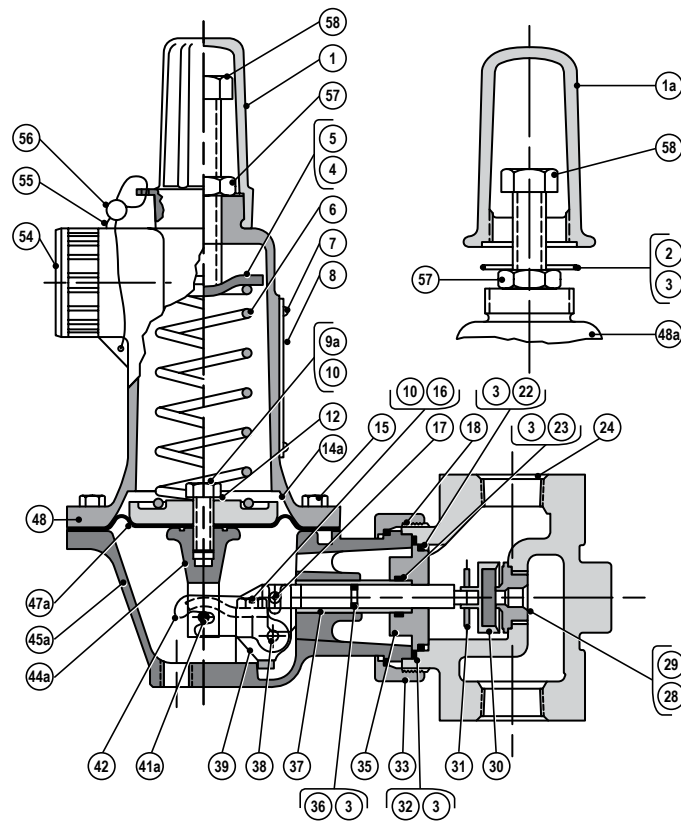
1. Make sure the regulator is entirely depressurized before disassembling.
2. In general, it is not necessary to disconnect the body **24** or **24A** from the piping. Leave in place in the line when servicing the regulator.
3. Carefully note the location and position of each part during disassembly to make certain reassembly is correct. Replace all worn, damaged or otherwise unsatisfactory parts.
4. To service the valve or orifice, first loosen coupling nut **33** and separate the diaphragm case assembly from the body. Remove and inspect the body to lower case seal **32**. Replace if damaged. To remove the valve assembly **30**, first remove hair pin **31**. Orifice **29** unscrews from body using 1" hex socket wrench "thin wall" type. Use a moderate amount of pipe dope on the sealing surface (male threads) when replacing the orifice.
5. During reassembly, make sure tetraseal **32** is correctly positioned. Tighten coupling nut **33** with a torque of 35 to 50 ft.-lbs.
6. To change spring **6**, remove cover cap **1** or **1a**, and turn adjusted screw **58** counterclockwise to remove spring load. Remove screws **15** or **15a**, remove upper diaphragm case **48**, **48a** or **48b** and spring ferrule **5**. Make sure the new spring is correctly nested on diaphragm pan **14** or **14a** and install spring ferrule **5**. Also, make sure diaphragm **47** or **47a** is not pinched.
7. To replace the diaphragm, follow step 6 during disassembly and reassembly. Remove screw **9a** to disassemble the diaphragm assembly and remove diaphragm **47** or **47a**. On

- regulators with internal relief valves (all -2 models), remove IRV bolt **9** and IRV spring **49** slowly, as force is required to keep the spring from expanding rapidly. Remove clamping nut **46** and replace diaphragm **47**. Assemble diaphragm **47** in reverse order. Inspect IRV "O" rings **50** and **40** and replace if necessary. Align roll pin **41** parallel and square to the diaphragm centerline. Make sure roll pin **41** or **41a** is correctly positioned as shown below. On reassembly, tighten screws **15** or **15a** evenly to a torque of 125 in.-lbs. The screws must be tight enough to prevent leakage, but not so tight as to crush or damage the diaphragm. The diaphragm coupling roll pin **41** or **41a** must be assembled parallel and square to the diaphragm centerline to prevent binding of coupling **44** or **44a** and lever **42**. Also, diaphragm **47** or **47a** must not be twisted or pinched.
8. Upon completing servicing, make sure the regulator is free of leaks.



GIM1312-025

SPIROL/ROLL PIN POSITIONING



GIM1312-030

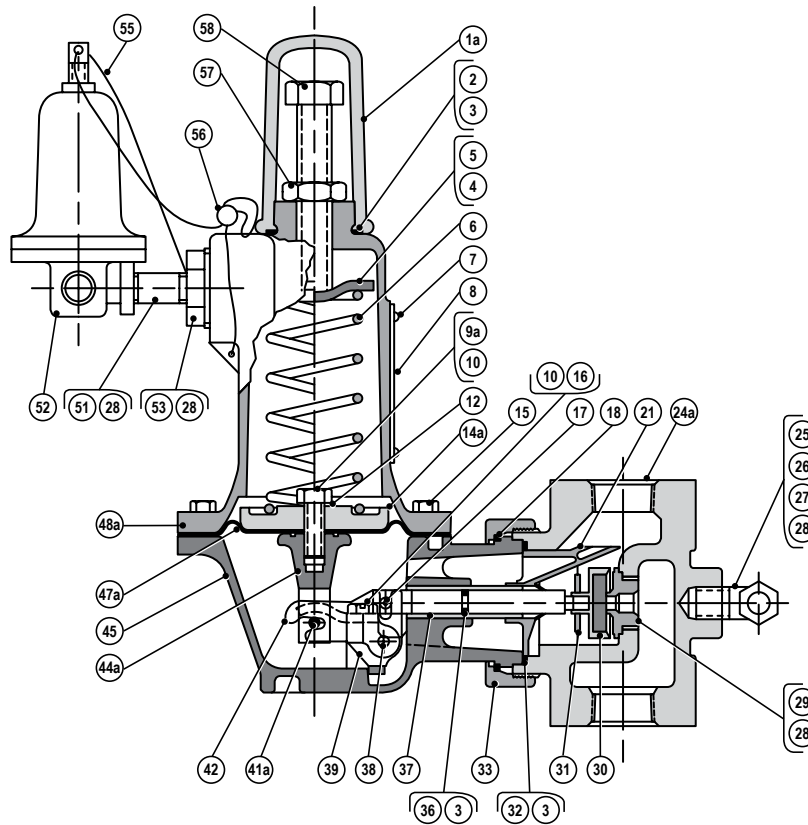
MODEL NO. 046-M

046 Parts List

The following are the parts for the 046 regulators. Those parts generally required in maintenance and servicing are in bold type.

Illustration Number	Description	Part Number
1	Plastic Cover Cap	046-00-005-00
1a	Cast Iron Cover Cap	046-00-005-01
2	Tetraseal, Buna-N Tetraseal, (or O-ring), Viton	950805 950806
3	O-ring Lube	1191074
4	Aero-Lubriplate	1191073
5	Spring Ferrule	141-62-009-00
6	Spring	See Chart
7	#0 x 1/8" Ig. Drive Screw	914760
8	Nameplate Nameplate (Taipei City)	046-00-086-00 046-00-086-01
9	IRV Guide Bolt	046-00-153-00
9a	5/16" - 18 x 7/8" Ig. Hex Head Screw	910029
10	Loctite 242	906114
11	Spring Holder	046-00-009-00
12	Stat-O-Seal (High Temp Only)	904983
13	Guide Bushing	046-00-074-00
14	Diaphragm Pan (IRV)	046-00-022-01

Illustration Number	Description	Part Number
14a	Diaphragm Pan	046-00-022-00
15	5/16" - 18 x 3/4" Hex Head Cap Screw	951136
15a	1/4" - 20 x 5/8" Ig. Hex Head Cap Screw	907558
16	1/4" - 20 x 3/4" Ig. Hex Head Thd Forming Screw	903164
16a	#10 - 24 x 1/2" Ig. Bind Head Mach Screw	903314
17	Spirol Pin 5/32" x 5/16" Ig.	950381
18	Retaining Ring	141-62-130-00
19	Stabilizer Disc	141-62-035-00
20	Stabilizer	141-62-034-00
21	Boost Tube	141-62-045-00
22	O-ring, Buna-N O-ring, Viton	934010 902987
23	O-ring, Buna-N O-ring, Viton	908771 950746
24	Body, 3/4" Conn. Body, 1" Conn. Body, 1 1/4" Conn.	046-00-001-06 046-00-001-04 046-00-001-05



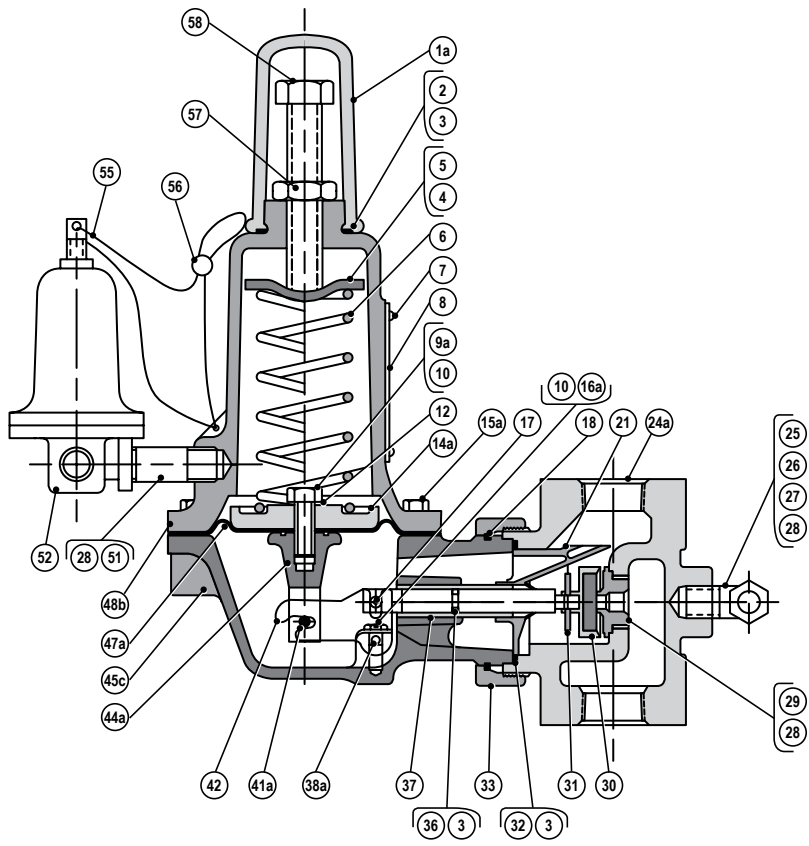
GIM1312-035

MODEL NO. 046-PL

046 Parts List (Continued)

The following are the parts for the 046 regulators. Those parts generally required in maintenance and servicing are in bold.

Illustration Number	Description	Part Number	Illustration Number	Description	Part Number
24a	Body, 3/4" Conn. With Inlet Tap (1/4" NPT)	046-00-001-09	33	Coupling Nut	143-62-102-00
	Body, 1" Conn. With Inlet Tap (1/4" NPT)	046-00-001-10	34	Stabilizer Hub	141-62-036-00
	Body, 1 1/4" Conn. With Inlet Tap (1/4" NPT)	046-00-001-11	35	Monitor Throat Block	046-00-038-00
25	Elbow 3/8" x 1/4" NPT	903989	36	O-ring, Buna-N O-ring, Viton	934005 904839
26	Conn. 3/8" Tube x 1/4" NPT	903973	37	Valve Stem, Brass Valve Stem, Stainless Steel (s.s.)	046-00-016-00 046-00-016-01
27	Tube 3/8" O.D. x .035 Wall	51125	38	Fulcrum Dowel Pin 3/16" x 3/4" lg. (s.s.)	950728
28	Loctite 222 Mild	905115	38a	Fulcrum Pin	141-62-033-00
29	1/8" Stainless Steel Valve Orifice	046-00-023-02	39	Pivot Bracket	046-00-029-00
	3/16" Stainless Steel Valve Orifice	046-00-023-03	40	O-ring, Buna-N	904824
	1/4" Stainless Steel Valve Orifice	046-00-023-04	41	Roll Pin, 3/16" x 1 1/4" lg.	901695
	5/16" Stainless Steel Valve Orifice	046-00-023-05	41a	Roll Pin, 3/16" x 3/8" lg.	901697
	3/8" Stainless Steel Valve Orifice	046-00-023-06	42	Lever	046-00-030-00
	1/2" Stainless Steel Valve Orifice	046-00-023-07	43	IRV Coupling Disc	046-00-154-00
	1/8" Brass Valve Orifice	046-00-023-22	44	Diaphragm Coupling (IRV)	046-00-028-01
	3/16" Brass Valve Orifice	046-00-023-23	44a	Diaphragm Coupling	046-00-028-00
	1/4" Brass Valve Orifice	046-00-023-24	45	Lower Case (Stainless Steel Bushing Assembly) Lower Case (Brass Bushing Assembly)	046-00-602-09 046-00-602-08
	5/16" Brass Valve Orifice	046-00-023-25			
	3/8" Brass Valve Orifice	046-00-023-26			
	1/2" Brass Valve Orifice	046-00-023-27			
30	Valve Assembly, Buna-N	141-62-511-03			
	Valve Assembly, Poly-U Tan	141-62-511-01			
	Valve Assembly, Viton	141-62-511-04			
31	Hair Pin Cotter	141-62-118-00			
32	Tetraseal, Buna-N	902497			
	Tetraseal (or O-ring), Viton	907718			



GIM1312-040

MODEL NO. 046-CPL

046 Parts List (Continued)

The following are the parts for the 046 regulators. Those parts generally required in maintenance and servicing are in bold.

Illustration Number	Description	Part Number
45a	Monitor Lower Case (Stainless Steel Bushing Assembly) Monitor Lower Case (Bushing Assembly)	046-00-602-11 046-00-602-10
45c	CI Lower Case (Stainless Steel Bushing Assembly) CI Lower Case (Brass Bushing Assembly)	046-00-602-07 046-00-602-06
46	Clamping Nut	046-00-155-00
47	IRV Diaphragm, Buna-N	046-00-150-01
47a	Diaphragm, Buna-N Diaphragm, Viton	046-00-150-00 046-00-150-02
48	Upper Case (Aluminum) Cover	046-00-003-03
48a	Upper Case (Aluminum With Thd's) Cover	046-00-003-04
48b	Upper Case (Cast Iron With Thd's) Cover	046-00-003-01
49	Spring Dark Blue (IRV)	080-02-021-01
50	O-ring, Buna-N	934003
51	Nipple 1/4" x 2"	924059

Illustration Number	Description	Part Number
52	Pilot 67R 3-20 psi Pilot 67R 5-35 psi Pilot 67R 30-60 psi Pilot 67R 35-100 psi Pilot 67RS 3-20 psi IRV Pilot 67RS 5-35 psi IRV Pilot 67RS 30-60 psi IRV Pilot 67RS 35-100 psi IRV	1191495 1191496 1191497 1191498 1191509 1191510 1191511 1191512
53	Hex bushing 1" NPT to 1/4" NPT	904397
54	Vent Assembly 1" NPT	046-00-527-00
54a	Vent Cap Assembly	137-02-505-03
55	Seal Wire 12" lg.	001-63-057-50
56	Seal	001-60-157-00
57	1/16" - 12 unc Hex Steel Jam Nut	921006
58	1/16" - 12 unc x 3" lg. Hex hd stl Cap scr	950655
Not Shown	Customer Badge	141-62-086-04

Over-Pressurization Protection

Protection must be provided for the downstream piping system and the regulator’s low pressure chambers to assure against the potential over-pressurization due to a regulator malfunction or a failure of the regulator to lock up. The allowable over-pressurization is the lowest of the maximum pressures permitted by federal codes, state codes, Sensus Bulletin RDS-1498 or other applicable standards. The method of providing over-pressure protection could be a relief valve, a monitor regulator, a shutoff device or any similar device.

Internal Relief Valve (IRV) Capacity

Internal relief valves, like all relief valves, must be carefully checked for adequate capacity. IRVs only have full capacity relief capability when the inlet pressure to the regulator is low enough and the regulator orifice is small enough. If either or both are too large, the IRV will not have full capacity relief capability and will not be able to prevent the outlet pressure from exceeding the maximum allowable limit.

Capacity for the full open 046 IRV can be calculated with the following formula.

$$Q = \frac{K P_o}{2} \text{ for 0.6 specific gravity gas}$$

where

- K = 600 (IRV constant)
- P_o = absolute outlet pressure (psia)

Field regulators with internal relief valves can be obtained by specifying Models 046-2 or 046-2M. The 046-2M is a limited capacity IRV unit due to flow through the control line.

Spring Ranges

046, 046-M, 046-C and 046-CM Models

Outlet Pressures	Spring Color	Part Number
3 to 10 psig	Yellow	046-00-021-00
8 to 20 psig	Aluminum	046-00-021-01
15 to 52 psig	White	046-00-021-02
50 to 125 psig	Tan	046-00-021-03
100 to 200 psig	Gray	046-00-021-04
10 to 95 psig	Dark Green ¹	046-00-021-05

046-2 and 046-2M Models

Outlet Pressures	Spring Color	Part Number
3 to 10 psig	Yellow	046-00-021-00
8 to 20 psig	Aluminum	046-00-021-01
15 to 52 psig	White	046-00-021-02
50 to 125 psig	Tan	046-00-021-03
10 to 95 psig	Dark Green ¹	046-00-021-05

1. General Purpose Spring

Spring Ranges and Combinations

046-PL and 046-CPL

For this Outlet Pressure Range	Use These Springs		
	046 Regulator		Loading Regulator
5 to 15 psi	Yellow	3 psig	2 to 20 psig
15 to 25 psi	Yellow	10 psig	2 to 20 psig
20 to 40 psi	Yellow	10 psig	5 to 35 psig
30 to 50 psi	Aluminum	20 psig	5 to 35 psig
50 to 75 psi	Aluminum	20 psig	30 to 60 psig
60 to 100 psi	Aluminum	20 psig	35 to 100 psig

Full Open Capacity

Use the following formulas for calculating the full open capacity of 046 regulators. Do not use full open capacity when sizing one of these regulators for an application. Instead, use the capacity tables in Bulletin R-1312.

- $Q = K \sqrt{P_o(P_i - P_o)}$

- $Q = \frac{K P_i}{2}$

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas)

K = the “K” factor, the regulator constant (from the table)

P_i = absolute inlet pressure (psia)

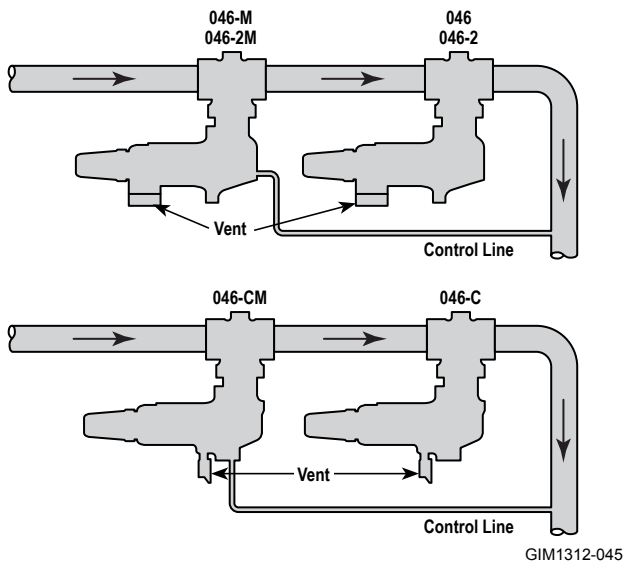
P_o = absolute outlet pressure (psia)

Use formula 1, when $\frac{P_i}{P_o}$ is less than 1.894.

Use formula 2, when $\frac{P_i}{P_o}$ is greater than 1.894.

Orifice	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"
“K” Factor	33	74	132	206	292	520

When sizing relief valves for use with 046 regulators, use full open capacity as calculated with the above formulas. Do not use values from the capacity tables in Bulletin R-1312.



MONITOR SET

Monitoring

The 046 regulator makes an excellent monitor, which is a standby regulator installed in series that assumes control if a failure in the operating regulator permits the outlet pressure to exceed the set-point. It can be in either the upstream or the downstream position.

When an 046 is used to monitor a regulator with an identical inner valve (another 046), the total maximum capacity through both regulators can be figured at 70% of the capacity of one of them alone. This applies with the monitor located either up or downstream.

Maximum Emergency Pressure

The maximum pressure the regulator inlet may be subjected to under abnormal conditions without causing damage to the regulator is:

- 046, 046-2, 046-M, 046-2M, 046-PL
and 046-CPL Max. Inlet Pressure + 100 psi

The maximum pressure the regulator outlet may be subjected to without causing damage to the internal parts of the regulator is:

- For set-points of 3 to 200 psi set-point+100 psi

Set-point is defined as the outlet pressure a regulator is adjusted to deliver.

If any of the above pressure limits are exceeded, the regulator must be taken out of service and inspected. Damaged or otherwise unsatisfactory parts must be replaced or repaired.

The maximum pressure that can be safely contained by the diaphragm case is:

- 046, 046-2, 046-C, 046-M, 046-2M 400 psi
- 046-PL and 046-CPL 250 psi

Safely contained means no leakage as well as no bursting.

Temperature Limits

The 046 regulators can be used for flowing temperatures from -20°F to 150°F.

Other Gases

The 046 regulators are mainly used for natural gas service; however, these regulators will perform equally as well on other gases. When using the 046 regulators on other gases, the regulator capacities must be adjusted using the following correction factors.

Type of Gas	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (Specific Gravity 1.20)	0.71
Nitrogen (Specific Gravity 0.97)	0.79
Dry Carbon Dioxide (Specific Gravity 1.52)	0.63

For other non-corrosive gases use the following formula:

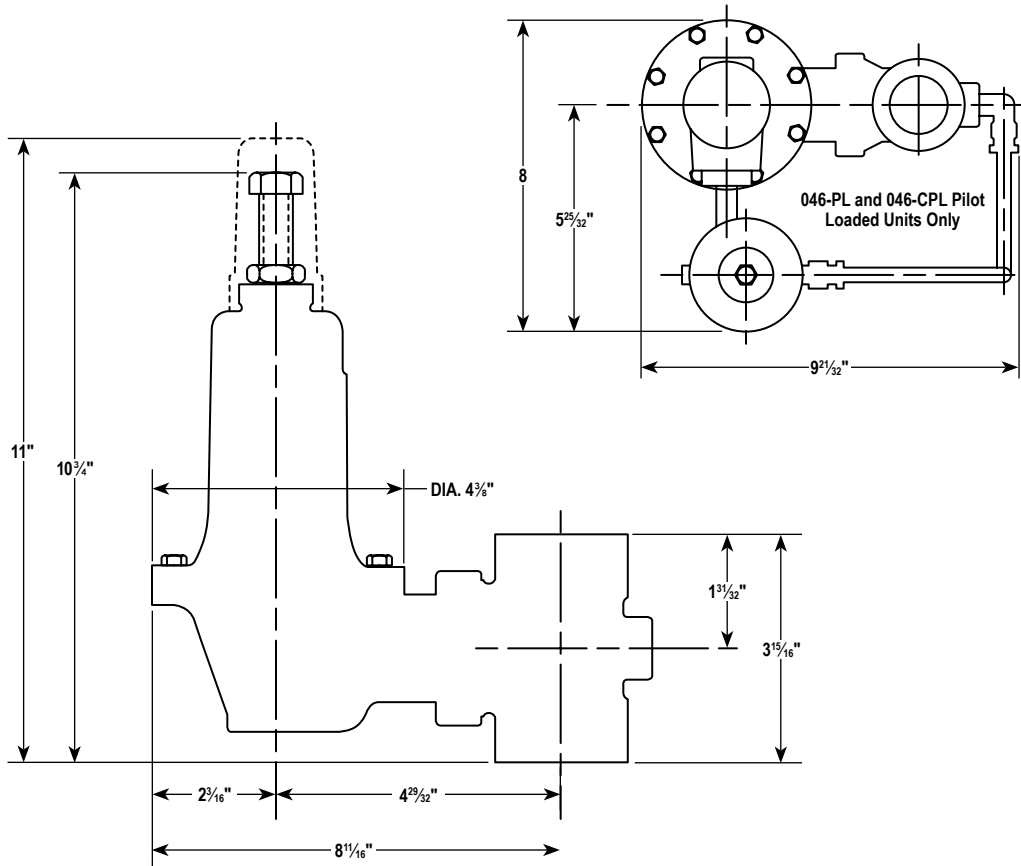
$$\text{Correction Factor} = \sqrt{\frac{60}{\text{Specific gravity of the gas}}}$$

For use with gases not listed above, please contact your Sensus Representative or Industrial Distributor for recommendations.

Buried Service

The 046 regulators **are not** recommended for buried service.

Dimensions



Model 046 Field Regulators

Installation, Maintenance Instructions and Parts List

Authorized Distributor:

All products purchased and services performed are subject to Sensus' terms of sale, available at either <http://na.sensus.com/TC/TermsConditions.pdf> or 1-800-METER-IT. Sensus reserves the right to modify these terms and conditions in its own discretion without notice to the customer.

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