

# Model 046 Regulator Brochure



## Introduction

### Who We Are

Utility Solutions Group is a manufacturer of natural gas regulators and relief valves based in Columbus, OH. All products are made in the USA and compliant with the requirements of the Build America, Buy America Act. Utility Solutions Group's Quality Management System is certified to ISO 9001 by Smithers Quality Assessments.

### Model 046 Family of Field Regulators Construction and Design Features

Based on years of operating experience, the Model 046 family of field regulators combines simplicity of design, rugged construction, exceptional performance, and operational safety to provide a dependable, flexible, and economical answer to pounds-to-pounds pressure regulation applications. Model 046 regulators are available with standard construction, an internal relief valve (IRV), blocked throat and control line tap for remote or monitor applications.

Typical applications for the Model 046 Field Regulators include: farm taps, field regulator, high pressure industrial air or gases, and gas blanketing systems.

### Construction Materials

Component	Construction
Body	Ductile Iron
Valve trim	Poly-U Tan (standard), Buna-N or Viton
Internal trim	Brass
External trim	Carbon Steel
Diaphragm case	Aluminum
Valve Material	Poly-U Tan (90 duro), Buna-N (80 duro), Viton (70 duro)

### Spring Identification

Spring Color	Outlet Pressure Range	Part Number
Yellow	3 to 10 psi	04600-021-00
Aluminum	8 to 20 psi	04600-021-01
White	15 to 52 psi	04600-021-02
Green	10 to 95 psi	04600-021-05
Tan	50 to 125 psi	04600-021-03
Gray*	100 to 200 psi	04600-021-04

\*046 or 046-M only

## Basic Models

### Standard Regulator 046

This is a non-relief type regulator which requires separate over-pressure protection to safeguard the downstream system.

Standard regulators are available in the configurations and trims found below. The regulator body is configured to provide increased capacity by means of an integral boost tube.

### Monitor Regulator 046-M

These regulators are identical to the 046 regulators respectively, except for the fact they have no integral boost tube and have remote pressure sensing, requiring separate over-pressure protection to prevent damage to the downstream system.

### Internal Relief Valve Regulator 046-2

This regulator has relief protection to prevent damage to internal parts and the downstream system. The relief valve is activated by internal over-pressurization of the outlet chamber above the set outlet pressure of the regulator. Integral IRV stops reduce relief pressure build-up for added safety. No integral boost tube.

### Internal Relief Valve Monitor Regulator 046-2M

This regulator is identical to the 046-2 except it has remote pressure sensing and relief protection through the remote control line to prevent damage to internal regulator parts. For full open capacity relief, separate over-pressure protection is required to prevent damage to the downstream system.

## Environmental Conditions

### Model 046 Family of Field Regulators Construction and Design Features

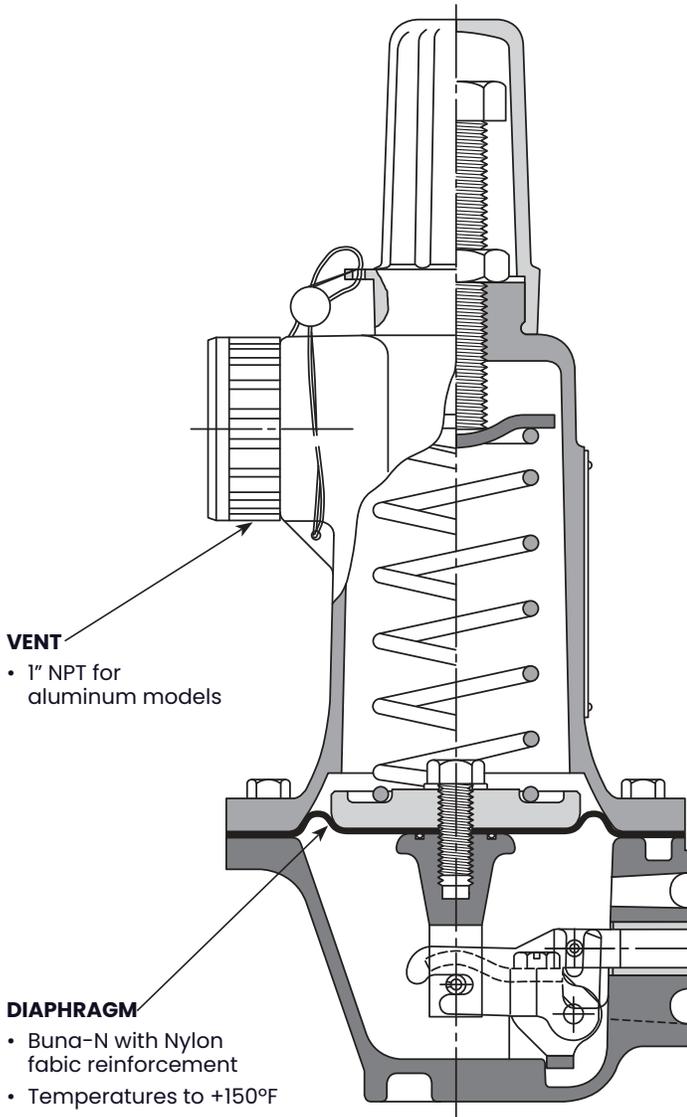
046 Regulators are designed for outdoor and indoor installation. Operating temperature range, all materials: -20°F to +150°F Higher temperature materials available. Contact your sales representative for application.

Minimum Melting Temperature:	Casing: + 700°F Ductile Iron Body: + 1,000°F
Inlet Pressure Range:	5 to 1,000 psi
Outlet Pressure Range:	3 to 200 psi

## Valve Assembly Maximum Pressures - Non IRV Units

Material	Differential	Inlet*
Poly-U-Tan	800 psi	1,000 psi
Buna-N	400 psi	600 psi
Viton	250 psi	300 psi

## Pipe Sizes 3/4", 1", and 1 1/4" NPT



## Valve Assembly Maximum Pressures - IRV Units

Material	Differential	Inlet*
Poly-U-Tan	800 psi	1,000 psi
Buna-N	400 psi	525 psi
Viton	250 psi	300 psi

The maximum inlet pressure and valve material are determined by a review of pressure limitations on the spring, orifice, differential pressure (maximum inlet minus minimum outlet pressure), and the required inlet pressure.

\*For best performance the differential should be limited to 800 psi; however, the regulator has handled higher differential pressures.

## Maximum Inlet Pressure - Model 046 Regulator

Orifice	Springs		
	Yellow	Aluminum, White, Green, Tan	Grey
1/8"	500 psi	1,000 psi	1,000 psi
5/16"	500 psi	1,000 psi	1,000 psi
1/4"	500 psi	500 psi	500 psi
3/16"	300 psi	400 psi	400 psi
3/8"	300 psi	300 psi	400 psi
1/2"	100 psi	100 psi	100 psi

### UNION CONNECTION

- Easy inspection and servicing
- Diaphragm assembly easily rotated for best installed position

### ORIFICE

- Brass
- Features a metal backup for loss of soft seat

### SOFT SEATS

- Buna-N
- Poly-U
- Viton

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Pipe Size	Orifice		Orifice	
				⅛	⅜	¼	⅜
Outlet Pressure 3 to 10 psi Yellow Spring 04600-021-00	5	10	325	700	1,050	700	1,050
		15	450	920	1,450	920	1,450
		20	540	1,100	1,650	1,100	1,800
		30	690	1,450	2,200	1,450	2,300
		40	840	1,800	2,950	1,800	3,000
		50	1,000	2,100	3,100	2,100	3,800
		75	1,400	2,950	3,700	2,950	5,300
		100	1,800	3,800	4,350	3,800	6,900
Outlet Pressure 10 to 95 psi Green Spring 04600-021-05	10	15	177	265	355	265	355
		20	232	347	464	247	464
		25	276	413	553	413	553
		50	456	682	912	682	912
		75	633	947	1,266	947	1,266
		100	810	1,211	1,620	1,211	1,620
		150	1,164	1,741	2,329	1,741	2,329
		200	1,518	2,270	3,037	2,270	3,037
		300	2,227	3,329	4,453	3,329	4,453
		500	3,643	5,446	7,286	5,446	7,286
Outlet Pressure 8 to 20 psi Aluminum Spring 04600-021-01	15	20	450	950	1,600	950	1,600
		25	575	1,200	2,100	1,200	2,100
		50	1,000	2,100	3,600	2,100	3,700
		75	1,400	2,950	4,850	2,950	5,200
		100	1,800	3,800	6,000	3,800	6,900
		150	2,600	5,400	8,100	5,400	9,900
		200	3,300	7,100	9,750	7,100	12,800
		300	4,800	10,400	12,400	10,400	18,900
		400	6,400	13,700	12,500	13,700	24,500
		500	8,000	14,500	15,800	17,000	30,500
		750	11,500	20,000	-	25,000	-
1,000	15,500	25,000	-	34,000	-		

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Pipe Size	Orifice		Orifice	
				⅛	⅜	¼	⅜
Outlet Pressure 8 to 20 psi Aluminum Spring 04600-021-01	20	25	500	1,050	1,950	1,050	1,950
		30	640	1,350	2,400	1,350	2,400
		50	1,000	2,100	3,800	2,100	3,800
		75	1,400	2,950	4,950	2,950	5,300
		100	1,800	3,800	6,700	3,800	6,900
		150	2,600	5,400	8,500	5,400	9,900
		200	3,300	7,100	10,000	7,100	12,800
		300	4,800	10,400	12,450	10,400	18,900
		400	6,400	13,700	14,200	13,700	24,500
		500	8,000	17,000	19,400	17,000	30,500
850	11,500	20,000	-	25,000	-		
1,000	15,500	25,000	-	34,000	-		
Outlet Pressure 10 to 95 psi Green Spring 04600-021-05	25	30	575	982	1,314	982	1,314
		50	1,000	1,701	2,275	1,701	2,275
		75	1,400	2,366	3,166	2,366	3,166
		100	1,000	3,028	4,051	3,028	4,051
		150	2,600	4,352	5,822	4,352	5,822
		200	3,300	5,675	7,592	5,675	7,592
		300	4,800	8,322	11,133	8,322	11,133
		400	6,400	10,969	14,675	10,969	14,675
		500	8,000	13,618	18,216	13,616	18,216
		750	11,500	20,000	-	20,233	-
1,000	1,500	25,000	-	26,851	-		
Outlet Pressure 15 to 52 psi White Spring 04600-021-02	30	35	640	1,350	2,300	1,350	2,300
		40	780	1,650	2,800	1,650	2,800
		50	980	2,100	3,500	2,100	3,500
		75	1,400	2,950	5,000	2,950	5,000
		100	1,800	3,800	6,400	3,800	6,400
		150	2,600	5,400	9,200	5,400	9,200
		200	3,300	7,100	11,600	7,100	12,000
		300	4,800	10,400	15,200	10,400	17,500
		400	6,400	13,700	18,850	13,700	23,000
		500	8,000	17,000	23,000	17,000	29,000
		750	11,500	20,000	-	25,000	-
1,000	15,500	25,000	-	34,000	-		

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Orifice	Orifice		Orifice	
			⅛	⅜	¼	⅜	¼
Outlet Pressure Range 15 to 52 psi White Spring 04600-021-02	40	45	760	1,620	2,900	1,620	2,900
		50	900	1,950	3,400	1,950	3,400
		75	1,400	2,950	5,200	2,950	5,200
		100	1,800	3,800	6,900	3,800	6,900
		150	2,600	5,400	9,900	5,400	9,900
		200	3,300	7,100	12,200	7,100	12,800
		300	4,800	10,400	16,650	10,400	18,900
		400	6,400	13,700	19,600	13,700	24,500
		500	8,000	17,000	22,600	17,000	30,500
	750	11,500	20,000	-	25,000	-	
	1,000	15,500	25,000	-	34,000	-	
	50	60	1,020	2,150	3,850	2,150	3,950
		75	1,350	2,850	5,250	2,850	5,250
		100	1,760	3,800	6,900	3,800	6,900
		150	2,600	5,400	9,900	5,400	9,900
		200	3,300	7,100	12,800	7,100	12,800
		300	4,800	10,400	17,500	10,400	18,900
		400	6,400	13,700	20,000	13,700	24,500
		500	8,000	17,000	24,500	17,000	30,500
750		11,500	25,000	-	25,000	-	
1,000	15,500	29,000	-	34,000	-		
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	75	80	1,190	2,300	3,450	2,300	3,450
		90	1,450	2,900	4,250	2,900	4,250
		100	1,680	3,450	4,900	3,450	4,900
		150	2,500	5,400	7,300	5,400	7,300
		200	3,300	7,100	9,700	7,100	9,700
		300	4,800	10,400	14,200	10,400	14,200
		400	6,400	13,700	18,700	13,700	18,700
		500	8,000	17,000	23,000	17,000	23,000
		750	11,500	25,000	-	25,000	-
1,000	15,500	29,000	-	34,000	-		

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psia - 60°F)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size		¾", 1" Pipe Size		1 ¼" Pipe Size	
			Orifice	Orifice		Orifice		Orifice		Orifice	
			⅛	⅜	¼	⅜	¼	⅝	⅜	⅝	⅜
Outlet Pressure Range 50 to 125 psi Tan Spring 04600-021-03	100	110	1,640	3,500	5,900	3,500	5,900	6,300	7,900	6,300	7,900
		125	2,000	4,300	7,300	4,300	7,300	8,400	10,400	8,400	10,400
		150	2,500	5,400	9,100	5,400	9,100	11,300	13,700	11,300	13,700
		200	3,300	7,100	12,000	7,100	12,000	16,200	19,300	16,200	19,300
		300	4,800	10,400	17,600	10,400	17,600	23,700	24,750	23,700	28,400
		400	6,400	13,700	23,000	13,700	23,000	29,650	-	31,200	-
		500	8,000	17,000	28,800	17,000	28,800	-	-	-	-
		750	11,500	25,000	-	25,000	-	-	-	-	-
	1,000	15,500	29,000	-	34,000	-	-	-	-	-	
	125	135	1,960	4,200	7,600	4,200	7,600	9,500	11,400	9,500	11,400
		150	2,340	5,000	9,100	5,000	9,100	5,000	9,100	12,000	15,000
		200	3,300	7,100	12,800	7,100	12,800	19,000	22,650	19,300	23,600
		300	4,800	10,400	18,900	10,400	18,900	22,850	28,550	28,300	34,700
		400	6,400	13,700	24,500	13,700	24,500	28,000	-	37,300	-
500		8,000	17,000	29,500	17,000	30,500	-	-	-	-	
Outlet Pressure Range 100 to 200 psi Gray Spring 04600-021-04	100	125	1,420	2,300	3,200	2,300	3,200	4,400	5,300	4,400	5,300
		150	1,750	3,000	4,000	3,000	4,000	5,500	6,650	5,500	6,650
		200	2,300	4,100	5,300	4,100	5,300	7,300	8,800	7,300	8,800
		300	4,100	6,300	7,800	6,300	7,800	10,700	12,900	10,700	12,900
		400	5,400	8,300	10,300	8,300	10,300	14,100	17,000	14,100	17,000
		500	6,700	10,300	12,800	10,300	12,800	-	-	-	-
		750	10,000	15,300	-	15,300	-	-	-	-	-
	1,000	13,100	20,200	-	20,200	-	-	-	-	-	
	150	175	2,400	4,300	6,900	4,300	6,900	8,900	10,000	8,900	10,000
		200	2,900	5,700	8,300	5,700	8,300	10,800	12,000	10,800	12,000
		300	4,400	9,450	12,600	9,450	12,600	16,300	18,200	16,300	18,200
		400	5,800	12,400	16,600	12,400	16,600	21,600	24,000	21,600	24,000
		500	7,200	15,400	20,600	15,400	20,600	-	-	-	-
		750	10,700	23,000	-	23,000	-	-	-	-	-
200	1,000	14,200	30,500	-	30,500	-	-	-	-	-	
	225	3,100	7,000	10,600	7,000	10,600	14,600	17,000	14,600	17,000	
	300	4,600	10,000	15,600	10,000	15,600	21,500	24,700	21,500	24,700	
	400	6,200	13,500	20,600	13,500	20,600	28,500	3,300	28,500	33,000	
	500	7,700	16,500	25,800	16,500	25,800	-	-	-	-	
750	11,400	24,500	-	24,500	-	-	-	-	-		
1,000	15,200	33,000	-	33,000	-	-	-	-	-		

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psia - 60°F)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾ Pipe Size			1" Pipe Size			1 ¼" Pipe Size		
			Orifice			Orifice			Orifice		
			⅝	¾	½	⅝	¾	½	⅝	¾	½
Outlet Pressure Range 3 to 10 psi Yellow Spring 04600-021-00	5	10	1,400	1,550	1,900	1,550	2,100	2,600	1,550	2,100	2,600
		15	1,800	1,950	2,450	2,150	2,800	3,500	2,150	2,800	3,500
		20	2,050	2,400	2,850	2,550	3,400	4,850	2,550	3,400	5,100
		30	2,600	3,050	3,550	3,500	4,700	6,450	3,500	4,900	7,039
		40	3,400	3,550	4,400	4,900	5,600	8,800	4,900	6,000	8,625
		50	3,500	4,000	4,550	6,200	6,650	9,950	6,200	7,645	10,210
		75	4,200	4,500	5,350	8,500	8,200	12,950	8,500	10,612	14,174
		100	5,000	5,350	6,100	10,600	10,450	14,500	10,600	13,580	18,137
	125	5,650	6,050	-	13,000	12,200	-	13,000	16,547	-	
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	10	15	443	523	699	443	523	699	443	523	699
		20	580	685	915	580	685	915	580	685	915
		25	690	815	1,089	690	815	1,089	690	815	1,089
		50	1,139	1,345	1,797	1,139	1,345	1,797	1,139	1,345	1,797
		75	1,581	1,868	2,494	1,571	1,868	2,494	1,581	1,868	2,494
		100	2,023	2,390	3,192	2,023	2,390	3,192	2,023	2,390	3,192
		150	2,907	3,434	-	2,907	3,434	-	2,907	3,434	-
		200	3,792	4,479	-	3,792	4,479	-	3,792	4,479	-
	300	5,560	6,568	-	5,560	6,568	-	5,560	6,568	-	
Outlet Pressure Range 8 to 20 psi Aluminum Spring 04600-021-01	15	20	2,100	2,650	3,450	2,150	2,900	4,000	2,150	2,900	4,000
		25	2,750	3,650	4,450	2,900	3,700	5,500	2,900	3,700	5,500
		50	5,200	5,400	7,500	6,000	7,600	11,350	6,000	7,600	11,400
		75	6,550	6,850	9,900	8,300	10,500	16,000	8,300	10,800	18,000
		100	7,850	8,700	10,950	10,600	13,800	78,350	10,600	15,000	21,800
		150	9,750	10,700	-	15,000	17,850	-	15,000	21,000	-
		200	11,300	12,400	-	19,500	21,600	-	19,500	27,000	-
		300	13,350	15,250	-	29,000	28,850	-	29,000	40,000	-
		400	14,050	-	34,000	-	-	38,000	-	-	
	20	25	2,600	3,450	4,600	2,600	3,450	4,900	2,600	3,450	4,900
		30	3,300	4,200	5,800	3,400	4,300	6,600	3,400	4,300	6,600
		50	5,450	6,850	8,650	6,200	7,800	11,700	6,200	7,800	11,700
		75	6,950	8,200	10,950	8,500	10,800	17,050	8,500	10,800	18,000
		100	8,150	10,350	12,100	10,600	15,000	19,900	10,600	15,000	23,000
		150	10,350	12,900	-	15,000	20,450	-	15,000	21,000	-
		200	12,300	15,100	-	19,500	24,850	-	19,500	27,000	-
300		15,700	18,100	-	29,000	32,500	-	29,000	40,000	-	
	400	17,100	-	34,000	-	-	38,000	-	-		

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Models 046, 046-M and 046-2M\* in SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾ Pipe Size			1" Pipe Size			1 ¼" Pipe Size			
			Orifice			Orifice			Orifice			
			⅝	¾	½	⅝	¾	½	⅝	¾	½	
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	25	30	1,360	1,937	2,587	1,640	1,937	2,587	1,640	1,937	2,587	
		50	2,841	3,355	4,481	2,841	3,355	4,481	2,841	3,355	4,481	
		75	3,952	4,669	6,236	3,952	4,669	6,236	3,952	4,669	6,236	
		100	5,058	5,974	7,979	5,058	5,974	7,979	5,058	5,974	7,979	
		150	7,268	8,586	-	7,268	8,586	-	7,268	8,589	-	
		200	9,479	11,197	-	9,479	11,197	-	9,479	1,197	-	
		300	13,900	16,419	-	13,900	16,419	-	13,900	16,419	-	
		400	18,321	-	-	18,321	-	-	18,321	-	-	
Outlet Pressure Range 15 to 52 psi White Spring 04600-021-02	30	35	2,650	3,500	4,400	2,650	3,500	4,500	2,650	3,500	4,500	
		40	3,250	4,400	5,400	3,250	4,400	5,700	3,250	4,400	5,700	
		50	4,250	5,600	6,900	4,250	5,600	7,600	4,250	5,600	7,600	
		75	6,150	7,900	8,950	6,300	8,500	11,500	6,300	8,500	11,500	
		100	7,900	9,200	10,950	8,300	10,800	16,000	8,300	10,800	16,000	
		150	11,150	12,800	-	12,400	16,500	-	12,400	16,500	-	
		200	13,750	15,500	-	16,000	21,500	-	16,000	21,500	-	
			300	18,100	19,500	-	23,500	31,500	-	23,500	31,500	-
			400	21,000	-	-	31,000	-	-	31,000	-	-
		40	45	3,300	4,800	5,900	3,300	4,800	6,000	3,300	4,800	6,000
			50	4,000	5,800	7,000	4,000	5,800	7,200	4,000	5,800	7,200
			75	6,400	8,150	11,600	6,450	8,600	12,500	6,450	8,600	12,600
			100	8,250	10,500	14,400	8,600	12,000	15,600	8,600	12,000	17,000
			150	11,700	14,200	-	13,000	18,000	-	13,000	18,000	-
			200	14,850	17,250	-	17,500	22,700	-	17,500	23,500	-
			300	19,500	21,900	-	26,000	29,850	-	26,000	34,500	-
			400	22,450	-	-	34,000	-	-	34,000	-	-
		50	75	4,950	6,300	8,650	4,950	6,300	8,900	4,950	6,300	8,900
			80	6,700	8,900	12,400	5,900	8,900	13,500	6,900	8,900	13,500
			100	9,300	11,100	15,250	9,700	12,500	16,750	9,700	12,500	18,500
			150	13,300	15,200	-	14,500	19,000	-	14,500	19,000	-
	200		16,550	18,600	-	19,000	23,700	-	19,000	25,500	-	
	300		21,900	23,300	-	28,000	30,800	-	28,000	37,500	-	
		400	26,000	-	-	34,000	-	-	37,000	-	-	
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	75	80	3,800	5,000	6,250	3,800	5,000	6,250	3,800	5,000	6,950	
		90	4,700	6,300	7,100	4,700	6,300	7,100	4,700	6,300	11,800	
		100	5,400	7,600	8,050	5,400	7,600	8,050	5,400	7,600	15,500	
		150	8,150	12,000	-	8,150	12,000	-	8,150	12,000	-	
		200	11,800	15,700	-	11,800	15,700	-	11,800	17,000	-	
		300	17,150	20,450	-	17,150	20,450	-	17,300	25,200	-	
		400	21,650	-	-	21,650	-	-	22,800	-	-	

Capacities are based on 20% droop.

\* 046-2M is limited to 125 psi maximum outlet pressure and 925 psi maximum inlet pressure.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Pipe Size	Orifice		Orifice	
				⅛	⅜	¼	⅜
Outlet Pressure 3 to 10 psi Yellow Spring 04600-021-00	5	10	325	700	893	700	893
		15	450	782	1,233	782	1,233
		20	540	935	1,403	935	1,530
		30	590	1,233	1,650	1,233	1,725
		40	714	1,530	2,213	1,530	2,250
		50	850	1,785	2,325	1,785	2,850
		75	1,190	2,213	2,775	2,213	3,975
		100	1,530	2,850	3,263	2,850	5,175
Outlet Pressure 10 to 95 psi Green Spring 04600-021-05	10	15	177	265	355	265	355
		20	232	347	464	347	364
		25	276	413	553	413	553
		50	456	682	775	682	775
		75	633	805	1,076	805	1,076
		100	689	1,030	1,377	1,030	1,377
		150	990	1,480	1,747	1,480	1,747
		200	1,291	1,703	2,278	1,930	2,278
		300	1,670	2,497	3,340	2,497	3,340
		500	2,732	4,085	4,736	4,085	5,465
Outlet Pressure 8 to 20 psi Aluminum Spring 04600-021-01	15	20	450	808	1,360	808	1,360
		25	575	1,020	1,785	1,020	1,785
		50	850	1,785	2,700	1,785	2,775
		75	1,190	2,213	3,638	2,213	3,900
		100	1,530	2,850	4,500	2,850	5,175
		150	1,950	4,050	5,265	4,050	6,435
		200	2,475	4,615	6,338	4,615	6,656
		300	3,600	6,448	6,820	6,448	6,993
		400	4,160	6,850	7,250	6,850	8,085
		500	5,200	7,250	8,690	7,140	10,065
		750	5,750	8,000	-	8,750	-
925	6,200	8,750	-	10,200	-		

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Pipe Size	Orifice		Orifice	
				⅛	⅜	¼	⅜
Outlet Pressure 8 to 20 psi Aluminum Spring 04600-021-01	20	25	500	893	1,658	893	1,658
		30	640	1,148	1,800	1,148	1,800
		50	850	1,785	2,850	1,785	2,850
		75	1,190	2,213	3,713	2,213	3,975
		100	1,530	2,850	4,355	2,850	5,175
		150	1,950	4,050	5,525	4,050	6,435
		200	2,475	4,615	6,500	4,615	6,656
		300	3,600	6,448	6,848	6,448	6,993
		400	4,160	6,850	7,384	6,850	8,085
		500	5,200	7,140	7,760	7,140	10,065
		750	5,750	8,500	-	8,750	-
925	6,200	8,750	-	10,200	-		
Outlet Pressure 10 to 95 psi Green Spring 04600-021-05	25	30	575	835	1,117	835	1,117
		50	850	1,446	1,934	1,446	1,934
		75	1,190	1,775	2,374	1,775	2,374
		100	1,530	2,271	3,038	2,271	3,038
		150	1,950	3,264	4,366	3,264	4,366
		200	2,475	3,689	4,935	4,256	4,935
		300	3,600	5,160	6,123	5,409	6,123
		400	4,160	5,484	6,310	6,252	6,457
		500	5,200	5,719	6,740	6,536	6,740
		750	5,980	7,082	-	7,486	-
925	6,200	8,592	-	8,592	-		
Outlet Pressure 15 to 52 psi White Spring 04600-021-02	30	35	640	1,148	1,725	1,148	1,725
		40	780	1,403	2,100	1,403	2,100
		50	833	1,785	2,625	1,785	2,625
		75	1,190	2,213	3,750	2,213	3,750
		100	1,530	2,850	4,800	2,850	4,800
		150	1,950	4,050	5,520	4,050	5,520
		200	2,475	4,615	5,800	4,615	6,000
		300	3,600	5,928	6,080	6,448	7,000
		400	4,800	6,165	6,975	6,850	8,050
		500	5,200	6,800	8,050	7,650	10,150
		750	5,750	8,000	-	8,750	-
925	6,200	8,750	-	10,200	-		

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size	
			Pipe Size	Orifice		Orifice	
				⅛	⅜	¼	⅜
Outlet Pressure Range 15 to 52 psi White Spring 04600-021-02	40	45	760	1,377	2,175	1,377	2,175
		50	765	1,658	2,550	1,658	2,550
		75	1,190	2,213	3,900	2,213	3,900
		100	1,530	2,850	4,485	2,850	4,485
		150	1,950	4,050	5,445	4,050	6,435
		200	2,475	4,615	5,734	4,615	6,656
		300	3,600	6,448	6,660	6,448	6,993
		400	4,800	6,850	7,252	6,850	8,085
		500	5,200	7,140	7,910	7,140	10,065
	50	750	5,750	8,000	-	8,750	-
		925	6,200	8,750	-	10,200	-
		60	867	1,828	2,963	1,828	2,963
		75	1,148	2,138	3,938	2,138	3,938
		100	1,496	2,850	4,485	2,850	4,485
		150	1,950	4,050	5,940	4,050	6,435
		200	2,475	4,615	6,016	4,615	6,656
		300	3,600	6,448	6,650	6,448	6,993
		400	4,160	6,850	8,000	6,850	8,085
		500	5,200	7,140	8,575	7,140	10,065
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	75	80	1,012	1,955	2,588	1,955	2,588
		90	1,233	2,175	3,188	2,175	3,188
		100	1,428	2,588	3,675	2,588	3,675
		150	1,875	4,050	5,110	4,050	5,110
		200	2,475	5,325	6,305	5,325	6,305
		300	3,600	6,760	7,100	6,760	7,100
		400	4,800	7,535	7,854	7,124	7,480
		500	5,200	7,990	8,050	7,650	7,820
		750	6,555	8,750	-	5,750	-
925	6,975	10,150	-	10,880	-		

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾", 1", 1 ¼"	¾" Pipe Size		1", 1 ¼" Pipe Size		¾", 1" Pipe Size		1 ¼" Pipe Size	
			Orifice	Orifice		Orifice		Orifice		Orifice	
			⅛	⅜	¼	⅜	¼	⅝	⅜	⅝	⅜
Outlet Pressure Range 50 to 125 psi Tan Spring 04600-021-03	100	110	1,394	2,625	3,835	2,625	3,835	4,095	5,135	4,095	5,135
		125	1,700	3,225	4,745	3,225	4,745	5,208	5,720	5,208	5,720
		150	1,875	4,050	5,642	4,050	5,642	6,215	6,439	6,215	6,439
		200	2,475	4,615	6,000	4,615	6,000	6,480	6,755	6,480	6,755
		300	3,600	6,240	6,512	6,448	6,512	8,295	8,663	8,295	9,940
		400	4,800	7,535	8,050	6,850	8,050	10,378	-	10,920	-
		500	5,200	8,500	10,080	7,140	10,080	-	-	-	-
		750	5,750	8,750	-	8,750	-	-	-	-	-
		925	6,200	10,150	-	10,200	-	-	-	-	-
	125	135	1,666	3,150	4,940	3,150	4,940	6,175	6,270	6,175	6,270
		150	1,755	3,750	5,642	3,750	5,642	6,600	6,750	6,600	6,750
		200	2,475	4,615	6,656	4,615	6,656	7,600	7,927	7,720	8,260
		300	3,600	6,448	6,993	6,448	6,993	7,997	9,993	9,056	11,104
		400	4,800	6,850	8,085	6,850	8,085	9,800	-	11,936	-
		500	5,200	7,140	9,440	7,140	10,065	-	-	-	-
	750	5,750	8,750	-	8,750	-	-	-	-		
	925	6,200	9,280	-	10,200	-	-	-	-		

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾" Pipe Size			1" Pipe Size			1 ¼" Pipe Size		
			Orifice			Orifice			Orifice		
			⅝	¾	½	⅝	¾	½	⅝	¾	½
Outlet Pressure Range 3 to 10 psi Yellow Spring 04600-021-00	5	10	1,190	1,318	1,615	1,318	1,785	1,950	1,318	1,785	1,950
		15	1,530	1,658	1,838	1,828	2,100	2,625	1,828	2,100	2,625
		20	1,743	1,800	2,138	1,913	2,550	3,638	1,913	2,550	3,825
		30	1,950	2,288	2,663	2,625	3,525	4,193	2,625	3,675	4,680
		40	2,550	2,663	3,300	3,675	4,200	5,720	3,675	4,500	6,600
		50	2,625	300	3,413	4,650	4,988	6,468	4,650	5,850	6,750
		75	3,150	3,375	4,013	6,150	6,375	7,123	6,375	8,100	7,030
		100	3,750	4,013	4,575	6,793	6,890	7,250	7,950	8,550	8,820
	125	4,238	4,538	-	4,930	8,450	-	8,450	11,700	-	
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	10	15	443	523	699	443	523	699	443	523	699
		20	580	685	778	580	685	778	580	685	778
		25	690	815	926	690	815	926	690	815	926
		50	968	1,143	1,527	968	1,143	1,527	968	1,143	1,527
		75	1,344	1,587	1,871	1,344	1,587	1,871	1,344	1,587	1,871
		100	1,720	1,792	2,394	1,720	1,792	2,394	1,720	1,792	2,394
		150	2,180	2,576	-	2,180	2,576	-	2,180	2,576	-
		200	2,844	3,359	-	2,844	3,359	-	2,844	3,359	-
	300	4,170	4,269	-	4,170	4,269	-	4,170	4,269	-	
Outlet Pressure Range 8 to 20 psi Aluminum Spring 04600-021-01	15	20	1,575	1,988	2,588	1,613	2,175	3,000	1,613	2,175	3,000
		25	2,063	2,738	3,338	2,175	2,775	4,125	2,175	2,775	4,125
		50	3,900	4,050	4,875	4,500	4,940	5,675	4,500	4,940	5,700
		75	4,258	4,453	6,435	5,395	5,775	5,920	5,395	5,940	6,660
		100	5,103	5,655	7,118	6,360	6,486	6,790	6,360	6,750	7,630
		150	6,338	6,955	-	7,500	8,033	-	7,500	8,400	-
		200	6,780	7,440	-	8,190	8,640	-	8,190	9,450	-
		300	7,343	8,388	-	10,150	10,675	-	10,150	12,800	-
		400	7,728	-	-	11,900	-	-	12,160	-	-
		20	25	1,950	2,588	3,082	1,950	2,588	3,185	1,950	2,588
	30	2,475	3,150	3,480	2,550	3,225	3,630	2,550	3,225	3,630	
	50	4,088	4,453	5,623	4,650	5,070	5,850	4,650	5,070	5,850	
	75	4,518	5,330	6,241	5,525	6,156	6,309	5,525	6,480	6,660	
	100	5,298	6,210	6,655	6,360	6,750	6,965	6,360	6,750	8,050	
	150	6,210	7,095	-	6,600	7,567	-	6,600	7,770	-	
	200	6,765	7,550	-	6,825	8,698	-	6,825	9,450	-	
	300	7,065	8,145	-	10,150	11,375	-	10,150	14,000	-	
	400	7,695	-	-	11,900	-	-	13,300	-	-	

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## Capacity Tables - Model 046-2 in SCHF of Natural Gas

(0.6 Specific Gravity - 14.65 psia - 60°F) (Continued)

Outlet Pressure and Spring	Outlet Pressure psi	Inlet Pressure psi	¾" Pipe Size			1" Pipe Size			1 ¼" Pipe Size		
			Orifice			Orifice			Orifice		
			⅝"	¾"	½"	⅝"	¾"	½"	⅝"	¾"	½"
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	25	30	1,394	1,647	1,941	1,394	1,647	1,941	1,394	1,647	1,941
		50	2,130	2,516	3,361	2,130	2,516	3,361	2,130	2,516	3,361
		75	2,964	3,502	4,677	2,964	3,502	4,677	2,964	3,502	4,677
		100	3,793	4,481	5,187	3,793	4,481	5,187	3,793	4,481	5,187
		150	4,724	5,581	-	4,724	5,366	-	4,724	5,581	-
		200	6,161	6,382	-	5,877	6,158	-	5,687	6,158	-
		300	6,533	6,896	-	6,255	6,568	-	6,255	6,568	-
		400	6,779	-	-	7,328	-	-	7,328	-	-
Outlet Pressure Range 15 to 52 psi White Spring 04600-021-02	30	35	1,988	2,625	3,300	1,988	2,625	3,375	1,988	2,625	3,375
		40	2,438	3,300	4,050	2,438	3,300	4,275	2,438	3,300	4,275
		50	3,188	4,200	4,485	3,188	4,200	4,940	3,188	4,200	4,940
		75	4,613	5,135	5,818	4,725	5,525	5,750	4,725	5,525	5,750
		100	5,056	5,520	7,118	5,146	6,156	6,400	5,146	6,156	6,400
		150	5,798	6,016	-	6,200	6,930	-	6,200	7,425	-
		200	6,188	6,510	-	6,720	7,525	-	6,720	8,600	-
		300	6,335	6,825	-	8,225	10,080	-	8,225	11,025	-
	400	7,350	-	-	9,920	-	-	10,850	-	-	
	40	45	2,475	3,600	4,425	2,475	3,600	4,500	2,475	3,600	4,500
		50	3,000	4,350	4,550	3,000	4,350	4,680	3,000	4,350	4,680
		75	4,800	5,298	5,800	4,838	5,590	5,875	4,838	5,590	5,922
		100	5,115	5,985	6,048	5,160	6,600	6,864	5,160	6,600	7,140
		150	5,850	6,674	-	6,500	8,460	-	6,500	8,460	-
		200	5,940	6,900	-	7,350	9,080	-	7,350	9,400	-
		300	6,825	7,665	-	9,100	10,448	-	9,100	12,075	-
		400	7,857	-	-	11,900	-	-	11,900	-	-
	50	60	3,713	4,095	4,758	3,713	4,095	5,340	3,713	4,095	5,518
		75	4,355	5,340	5,580	4,485	5,785	4,940	4,485	5,785	6,075
		100	5,766	6,105	6,405	5,820	6,500	6,700	5,820	6,500	6,845
		150	6,251	6,384	-	7,250	7,980	-	7,250	7,980	-
200		6,455	6,510	-	7,980	8,295	-	7,980	8,925	-	
300		7,665	8,155	-	9,800	10,780	-	9,800	12,000	-	
400		9,100	-	-	11,900	-	-	11,840	-	-	
Outlet Pressure Range 10 to 95 psi Green Spring 04600-021-05	75	80	2,850	3,750	4,063	2,850	3,750	4,063	2,850	3,750	-
		90	3,525	4,536	4,615	3,525	4,725	4,615	3,525	4,725	-
		100	4,050	4,940	5,233	4,050	4,940	5,233	4,050	4,940	-
		150	5,298	6,600	-	5,298	6,240	-	5,298	6,240	4,518
		200	6,726	7,065	-	6,490	6,751	-	6,490	6,800	6,136
		300	7,203	7,567	-	7,203	7,567	-	6,920	8,064	6,510
		400	8,119	-	-	7,577	-	-	7,980	-	-

Capacities are based on 20% droop.

**NOTE:** The above performance data is based on normal testing at 70°F flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

## 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:

$$Q = K\sqrt{P_0(P_1 - P_0)} \dots\dots\dots \text{(for } P_i/P_o \text{ less than 1.894)}$$

$$Q = \frac{K P_1}{2} \dots\dots\dots \text{(for } P_i/P_o \text{ less than 1.894)}$$

Q = Full open capacity in SCFH of 0.6 specific gravity natural gas.

K = the "K" factor, the regulator constant (see table below).

P<sub>i</sub> = absolute inlet pressure (psi).

P<sub>o</sub> = absolute outlet pressure (psi).

	Orifice Size					
Decimal	.12"	.18"	.25"	.31"	.37"	.50"
Fraction	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"
K	33	74	132	206	292	520

## Overpressurization Protection

The downstream piping system, as well as the regulator low pressure chambers, need to be protected against overpressurization. This is generally caused by potential regulator malfunctions or failure to achieve complete lockup.

Methods of over-pressure protection can be a relief valve, monitor regulator, automatic shutoff device, or mechanisms with similar function.

Allowable outlet pressures are the lowest of the maximum pressures permitted by federal and state codes, Utility Solutions Group document USG-IG-038, or other applicable standards.

## Periodic Inspection

Regulators are pressure control devices with numerous moving parts which are subject to wear that is dependent on particular operating conditions. To ensure continuous satisfactory operation, a periodic inspection schedule must be followed, with the frequency of inspection determined by the severity of service and applicable laws and regulations. See installation and maintenance manual USG-IMM-024 for field service instructions.

## Maximum Emergency Pressure

### Maximum Inlet Pressure

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

Maximum Allowable Inlet Pressure ..... + 100 psi

### Maximum Outlet Pressure

The maximum outlet pressure the diaphragm can be subjected to, without causing internal damage are:

Outlet Pressure Set Point ..... + 100 psi

The maximum outlet pressure the diaphragm can be subjected to, without leakage or rupture is:

Maximum Total Outlet Pressure ..... 400 psi

**NOTE:** Set-point is defined as the outlet pressure which 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 or suspected parts must be repaired or replaced.

## Other Gases

Model 046 Regulators are mainly designed for service in natural gas applications. However, these regulators will perform equally well when regulating the pressure of nitrogen, dry carbon dioxide (CO<sub>2</sub>), air, as well as other industrial gases.

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:

$$\text{Correction factor} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$$

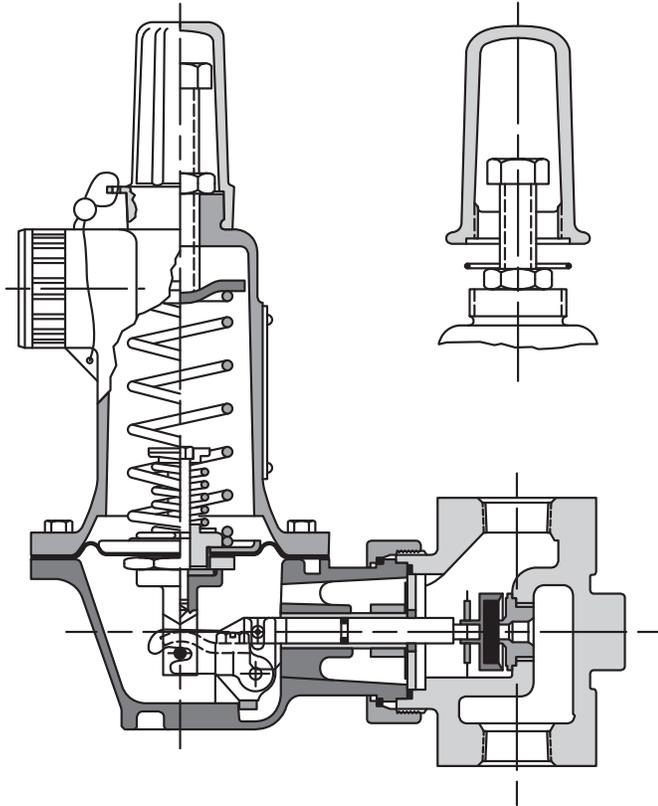
When used with gases not listed above, please contact your Utility Solutions Group representative or Industrial Distributor for recommendations.

**NOTE:** Model 046 Field Regulators are not suitable for use with sour gases, high purity gases, or liquid service.

## Buried Service

Model 046 Field Regulators are not suitable for buried (underground) service.

## 046-2 Regulator with Internal Relief Valve



046-2 and 046-2M field regulators have internal relief protection (IRV) to prevent damage to internal parts and the downstream system caused by regulator malfunction or failure to achieve complete lockup. The relief valve is activated by internal overpressurization of the outlet chamber above the set outlet pressure of the regulator. For added safety, integral IRV stops reduce relief pressure build-up. The 046-2M can be utilized as a monitor regulator. It has remote pressure sensing and relief protection through the control line.

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 one, or both, are too large, the IRV will not be capable of full capacity relief and will not be able to prevent the outlet pressure from exceeding the maximum allowable limit.

Full open IRV capacity can be calculated from the formula:

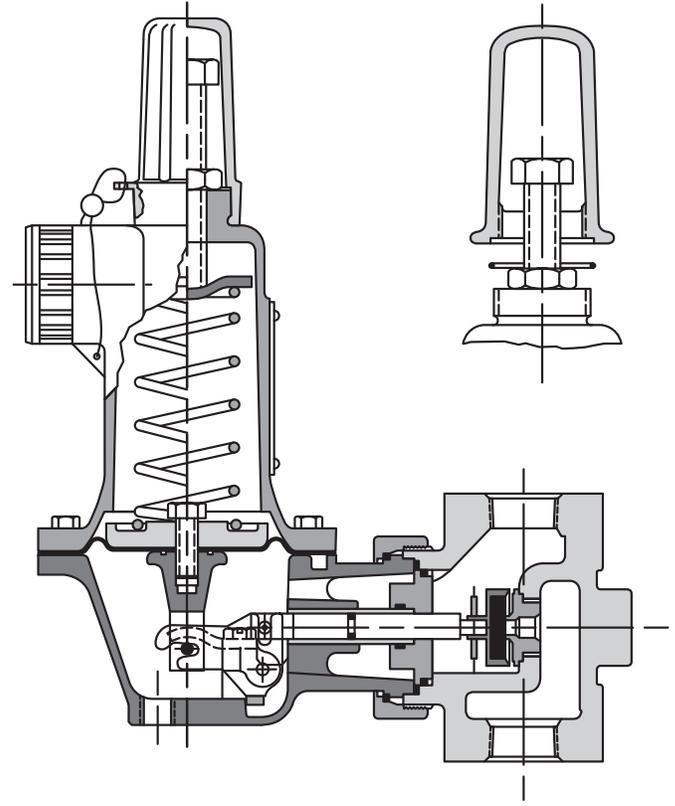
$$Q = \frac{K \cdot P_o}{2} \text{ for 0.6 specific gravity gas, where;}$$

$K = 600$  (the IRV constant) and;

$P_o =$  absolute outlet pressure (psia)

See graphs on page 17 for more information.

## 046-M Monitor Regulator



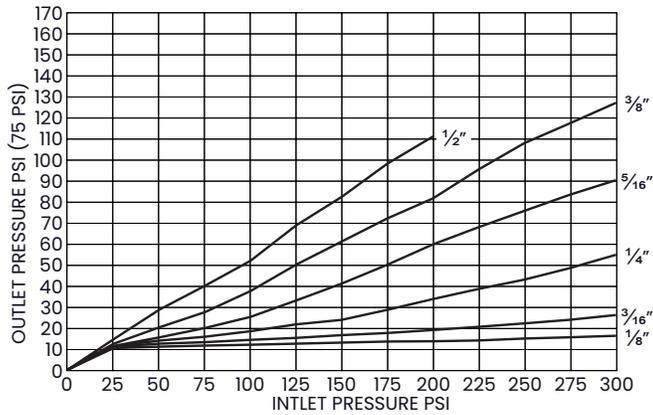
046-M and 046-2M field regulators have a blocked throat and a stem seal. They are designed for remote pressure sensing. These regulators have no integral boost tube and require separate overpressure protection to prevent damage to the downstream system. They are intended to be used as the upstream regulator in a monitor set (see illustration), or for other applications requiring a control line. Pipe sizes are 3/4", 1", and 1 1/4". Maximum inlet pressure is 1000 psi. For capacities see tables.

When an 046 is used to monitor another 046 with an identical inner valve, the total maximum capacity through both regulators is approximately 70% the capacity of a single regulator. This applies whether the monitor is installed upstream or downstream.

## IRV Relief Buildup - Regulator Blocked Open

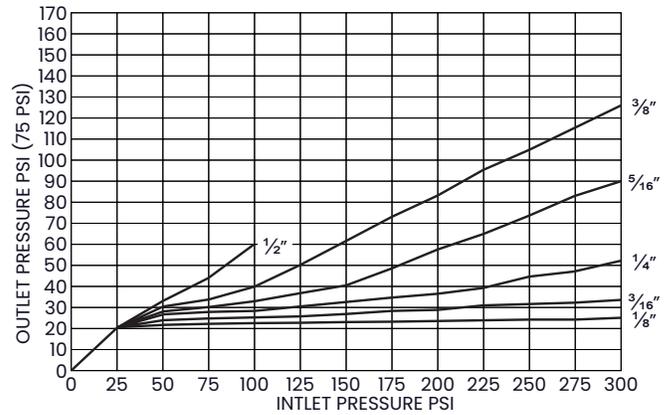
### 046-2 Field Regulator

Diaphragm Depressed 0.3" - Yellow Spring



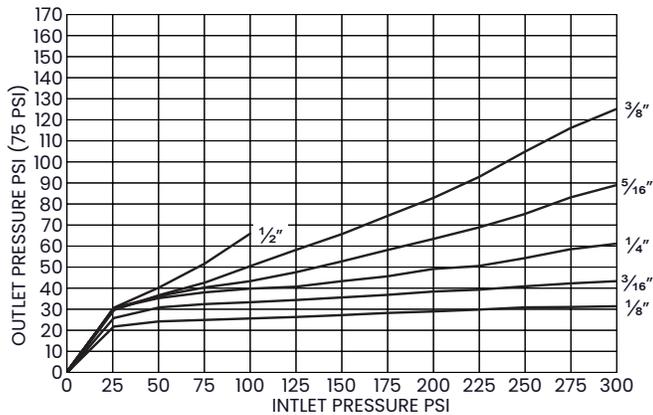
### 046-2 Field Regulator

Diaphragm Depressed 0.3" - Aluminum Spring



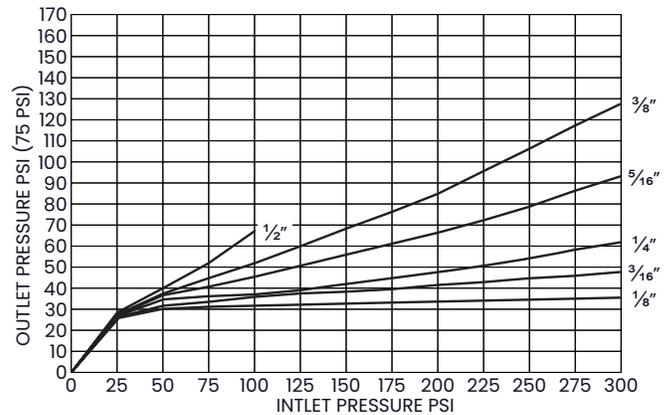
### 046-2 Field Regulator

Diaphragm Depressed 0.3" - White Spring



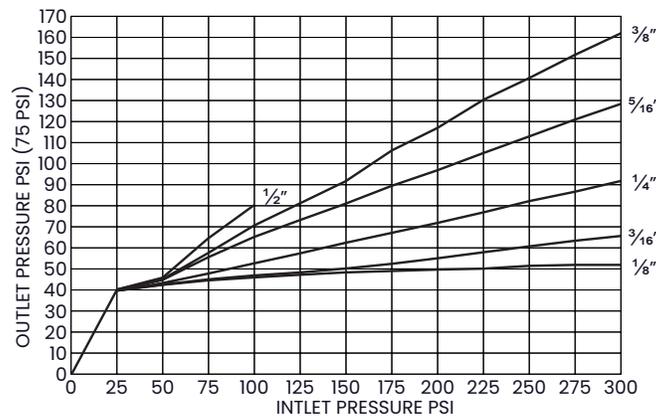
### 046-2 Field Regulator

Diaphragm Depressed 0.3" - Green Spring

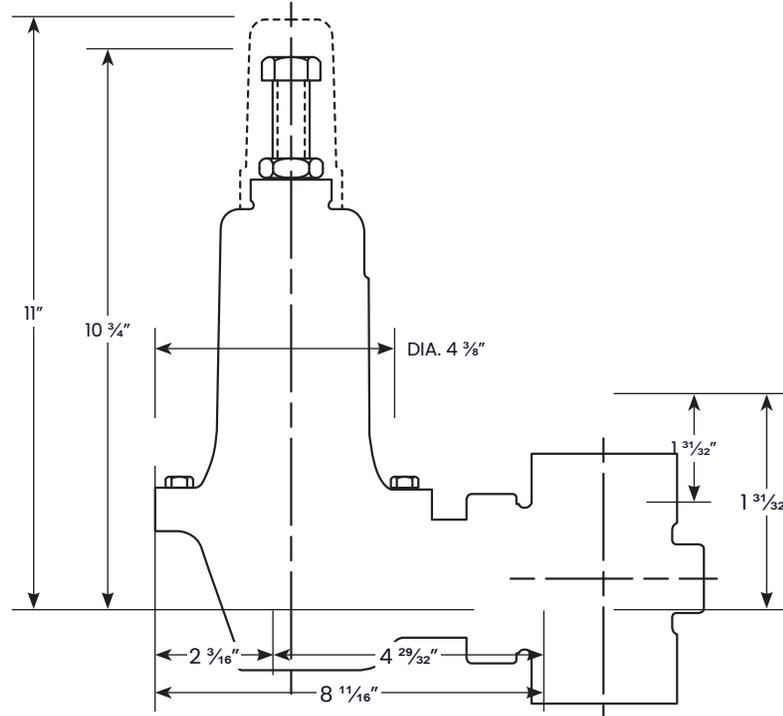


### 046-2 Field Regulator

Diaphragm Depressed 0.3" - Tan Spring



## Dimensions



Model	Body Material	Diaphragm Case Material	Internal Relief Valve	Maximum Inlet Pressure	Outlet Pressure Range
046	Ductile Iron	Aluminum	No	1,000 psi <sup>2</sup>	3 to 200 psi
046-2			Yes	1,000 psi <sup>2</sup>	3 to 125 psi
046-M <sup>1</sup>			No	1,000 psi <sup>2</sup>	3 to 200 psi
046-2M <sup>1*</sup>			Yes	925 psi <sup>*</sup>	3 to 125 psi

<sup>1</sup> Regulator requires a control line.

<sup>2</sup> Maximum inlet pressure is limited by orifice, spring ranges, and valve material (see capacity tables on pages 3-14).

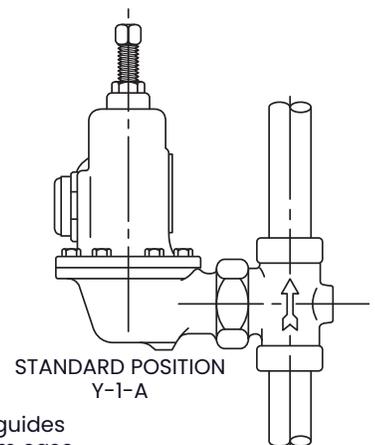
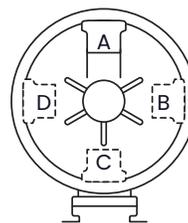
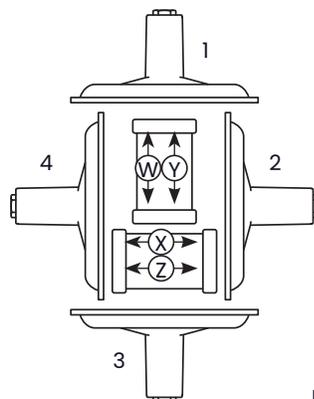
\*046-2M is limited to 925 psi maximum inlet pressure.

**NOTE:** For specific maximum allowable inlet pressures, see tables on pages 1-2 and capacity tables on pages 3-14.

## How to Order

When ordering, please specify the following:

1. Model Number
2. Pipe Size
3. Orifice Size
4. Inlet Pressure (max. and min., if available)
5. Outlet Pressure Setting
6. Spring Part Number
7. Capacity Required (SCFH)
8. Type or Specific Gravity of Gas
9. Mounting Position



Use these diagrams as guides to specify vent, diaphragm case, and body arrangement. When mounting position is not specified, position Y-1-A will be supplied.



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