

# Gas Pressure Regulator Series 800 Maxflo™ (402)



## PRODUCT INFORMATION

**Serving the Gas Industry  
Worldwide**



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**GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)**

Introduction, Application, Features, Technical Data

**Introduction**

- The Series 800 Maxflo™/RMG 402 is a pilot operated gas pressure regulator. Utilisation of integral/external pilots ensure a constant outlet pressure independent of flow rate and inlet pressure variations.
- Use with confidence on natural and manufactured gases of non-aggressive nature, including Nitrogen, Carbon Dioxide, Propane and Butane.

**Application**

- Designed for use on gas pressure reduction services for municipal distribution, industrial and power station control systems

**Features**

- Wide operational pressure range
- Pilot operated for accurate control
- In Line Servicing
- Completely independent operation of regulator and safety cut-off valve
- Regulator can be fitted with an integral Over Pressure (OPCO) or Under/Over Pressure (UPCO/OPCO) Safety Cut-Off valve. These devices protect the downstream system in the event that a dangerous gas pressure condition develops.
- Optional trip indicator to show open/closed condition (safety cut-off valve)
- Optional noise reduction

SIZE RANGE			
Ductile Iron Body (800)		Cast Steel Body (402)	
Inlet	Outlet	Inlet	Outlet
-	-	25	25
DN50	DN 50	50	50
-	-	50	100
DN 80	DN 80	80	80
-	-	80	150
DN 100	DN 100	100	100
-	-	100	200
Flanges to: PN16, PN25 BS EN 1092-2 ANSI 150		Flanges to: PN16, PN25 PN40, BS EN 1092-2 ANSI 150, ANSI 300*	

SERVICE CONDITIONS	
Maximum Inlet Pressure: (dependent on body material and pilot)	Up to 50 barg (725 psig)
Outlet Pressure Range: (dependent on pilot)	0.02 to 40 barg (0.29 to 580 psig)
Minimum Differential Pressure:	0.5 barg (7.25 psig)
Temperature Range:	-20°C to +60°C

\* Note: RMG 402 Steel Body Version supplied for Class 300 (50 bar) applications

CONTROL CLASSIFICATIONS			
Pilot Type	Outlet Pressure Range (Pa)	Control	Closing
	barg	Accuracy (RG)	Accuracy (SG)
RMG 620	0.02 - 0.03	10*/20	30*/50
	>0.03 - 0.10	5*/10	20*/30
	>0.10 - 0.50	5*/10	10*/20
	>0.5 - 2.5	5	10
RMG 630	0.3 - 0.5	20	30
	>0.5 - 1	10	20
	>1 - 5	2.5	10
	>5 - 90	1	5
RMG 640a	0.3 - 1	20*/30	30*/50
	>1 - 3	20	30
	>3 - 5	10	20
	>5	2.5	10

Note: Alternative pilots may be used to suite specific applications and accuracy requirements. Accuracy classes in accordance with DVGW Certificate 96/395/4301/778

\*Better accuracy and lock-up classes apply if Inlet Pressure Variation <8 barg



## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

### Pilot & Safety Cut-Off Valve Selection

PILOT SELECTION					
Pilot Type	Max. Inlet Pressure	Set Point Spring			Outlet Pressure Range
		No.	Colour	Wire dia. (mm)	barg
RMG 620 (integral)	25 barg* (362.5 psig)	2	Blue	3.6	0.02 - 0.15
		3	Yellow	5.6	0.1 - 0.5
		4	Brown	6.3	0.2 - 1
		5	Red	7.0	0.5 - 2
		6	Green	8/7	1 - 4
RMG 630 (integral)	50 barg* (725 psig)	1	Blue	3.6	0.5 - 2
		2	Black	4.5	1 - 5
		3	Grey	5	2 - 10
		4	Brown	6.3	5 - 20
		5	Red	7	10 - 40
Load limiting stage			Green	5.0	5 - 15 (above outlet pressure)
Series 600	25 barg (362 psig)	See Series 600 table below			

### Application Notes

- RMG 620 Integral Pilot – for use when low outlet pressures are required (0.02 to 1 barg/0.29 to 2.9 psig)
- RMG 630 Separate 2-Stage Pilot – for use at higher (above 1 barg/14.5 psig) outlet pressures when inlet pressure variations can be greater than 15 barg (217.5 psig)
- RMG 640a Separate Single Stage Pilot – for use at higher (above 1 barg/14.5 psig) outlet pressures when inlet pressure variations are less than 15 barg (217.5 psig)

SAFETY CUT-OFF VALVE					
Model	Type	Spring		Cut-Off Range	
		Number	Colour	barg	psig
MP1	OPCO	1158	White	0.055 - 0.09	0.8 - 1.3
		1159	Gold	0.08 - 0.14	1.16 - 2.03
		1160	Purple	0.13 - 0.25	1.89 - 3.63
		1130	White/Yellow	0.25 - 0.4	3.63 - 5.8
		1131	White/Green	0.33 - 0.6	4.79 - 8.7
MP2	OPCO	1132	White/Blue	0.5 - 0.88	7.2 - 11.6
		1133	White/Red	0.7 - 1.1	10.1 - 16
		1134	White/Grey	1 - 1.8	14.5 - 26.1
		1135	White/Brown	1.5 - 2.9	21.7 - 42
MP4	OPCO	1192	White/Purple	2 - 4	29 - 58
MP5	OPCO	1192	White/Purple	Nested	43.5 - 87
		1132	White/Blue	3.0 - 6.0	
MP1	UPCO	1104	Purple	0.05 - 0.15	0.72 - 2.2
MP2		1105	Black	0.10 - 0.30	1.4 - 4.3
MP4		1255	Green	0.25 - 0.70	3.6 - 10.1
MP5		1028	Black/White	0.64 - 1.6	9.2 - 23.2
HP	OPCO	1197	Blue	3 - 14	43.5 - 203
		UPCO	1104	Purple	0.055 - 0.4
	1105		Black	0.45 - 0.82	6.5 - 11.9
	1255		Green	0.60 - 1.80	8.7 - 26.1
	1028		Black/White	2.0 - 3.5	29 - 50.7

\*Higher trip ranges are available utilising the RMG range of safety cut-off valves - contact BD-RMG for details

SINGLE STAGE PILOT - SERIES 600			
Pilot Type	Range barg	Spring Number	Colour/Wire Diameter
600 LP	0.015 to 0.14	1047	Blue
	0.025 to 0.2	TX002	3.7mm
	0.15 to 0.5	TX003	Lt Blue/4.5mm
600 MP	0.14 to 0.35	1047	Blue
	0.35 to 2.0	TX002	3.7mm
	2.0 to 4.0	TX003	Lt Blue/4.5mm
600 HP	0.7 to 4.0	TX002	3.7mm
	4.0 to 8.0	TX003	Lt Blue/4.5mm

Note: It is recommended that the minimum OPCO setting is 35 mbarg (14" wg) or 10% above regulator set point, whichever is the higher.

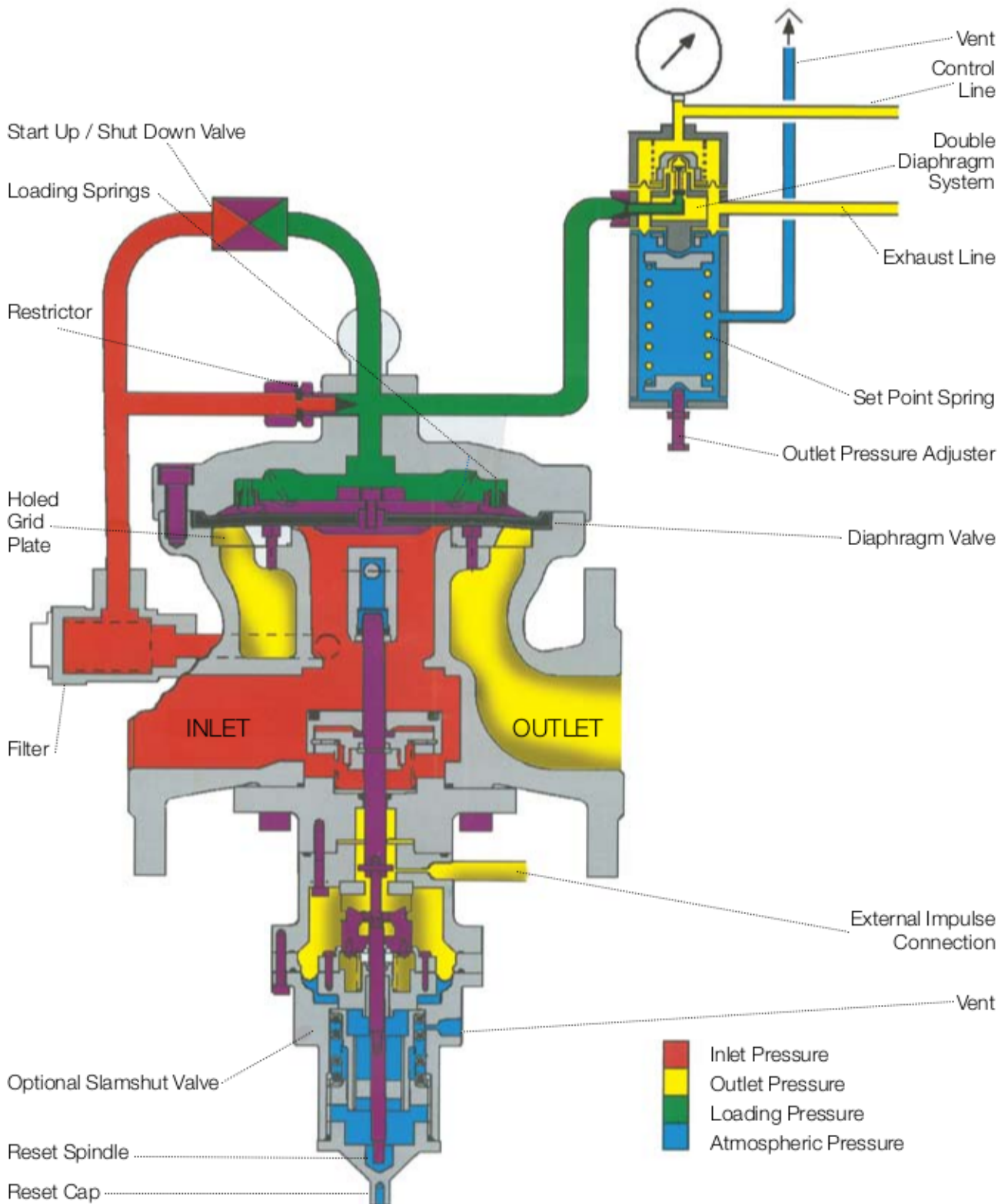
A minimum differential pressure of 45 mbarg (18" wg) on the MP1 and 85 mbarg (34" wg) for the MP2, 4 and HP should be maintained between UPCO and OPCO setting.



**GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)**

Sectional Arrangement

**Series 800 (402) with RMG 640a Pilot**

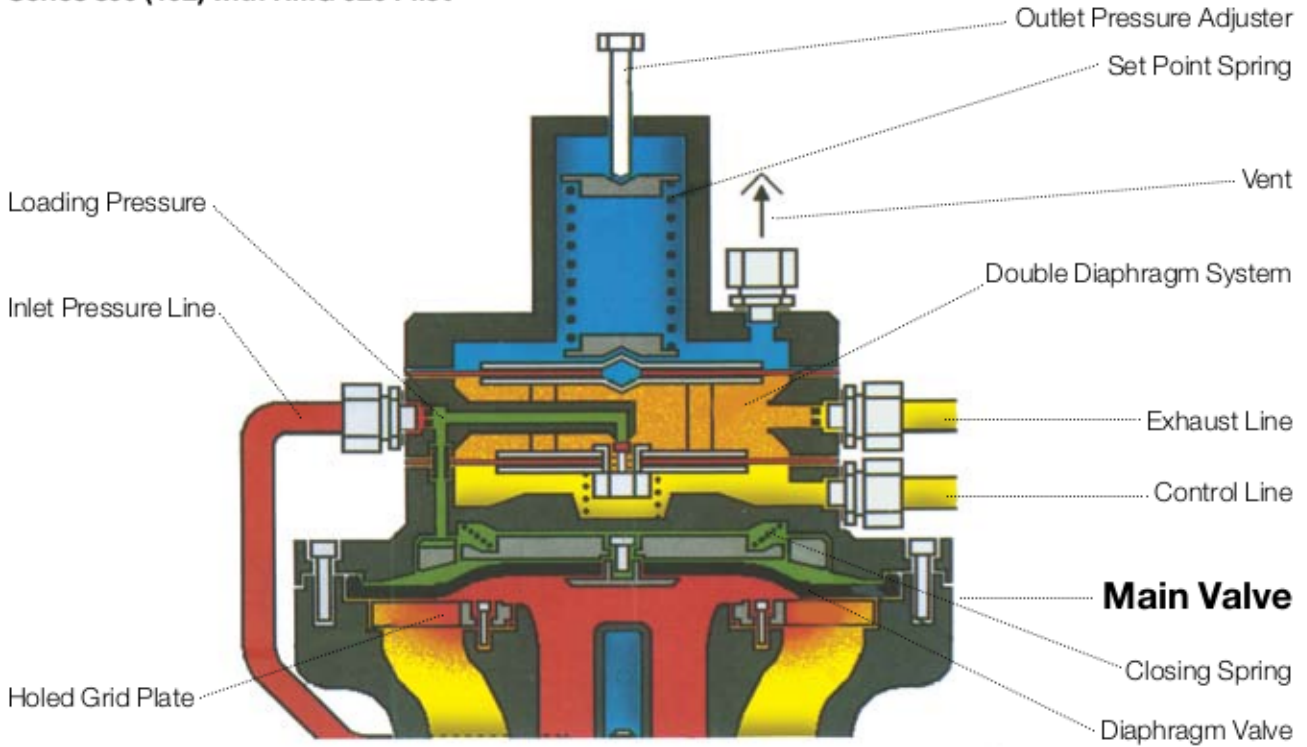




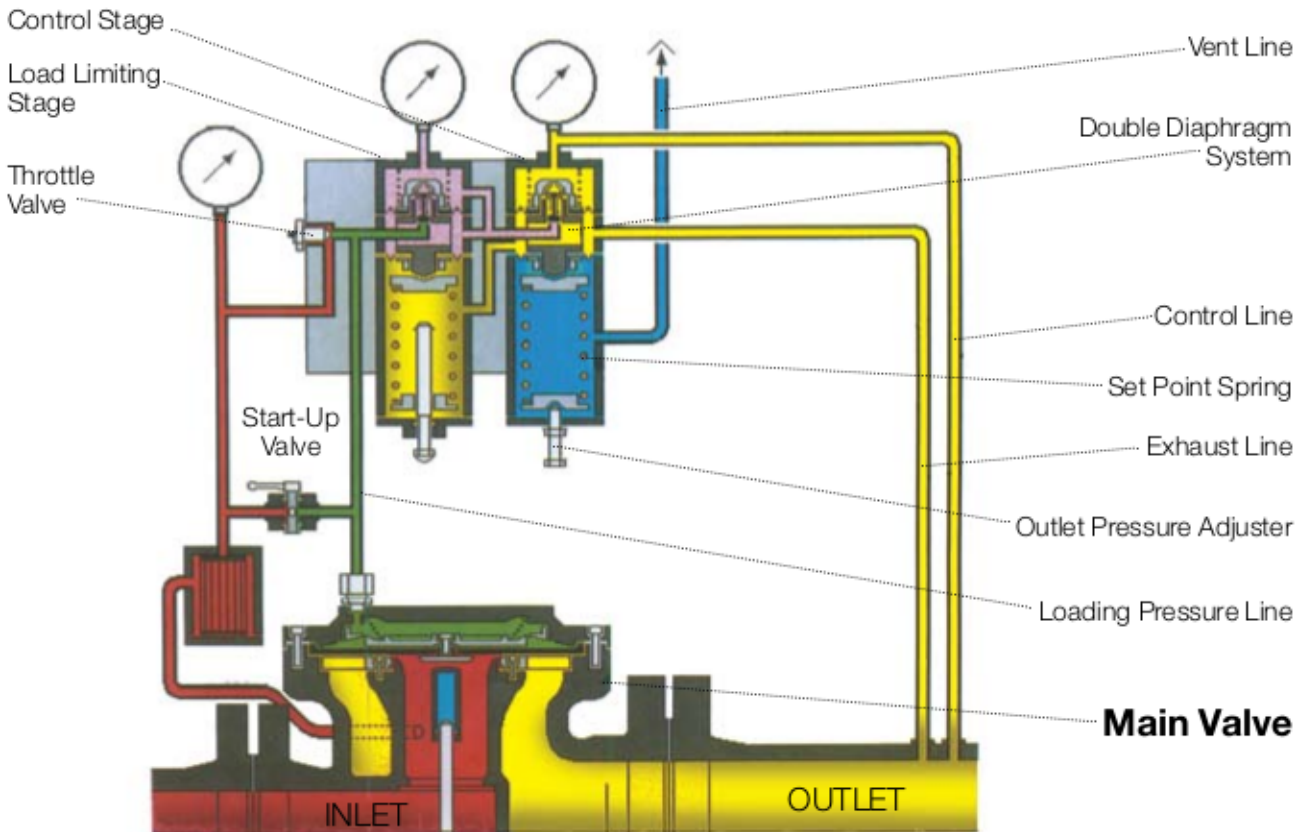
### GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

Sectional Arrangement

#### Series 800 (402) with RMG 620 Pilot



#### Series 800 (402) with RMG 630 Pilot





## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

Performance

VALVE DATA								
Pipe Size	Inlet	DN 25	DN 50	DN 50	DN 80	DN 80	DN 100	DN 100
	Outlet	DN 25	DN 50	DN 100	DN 80	DN 150	DN 100	DN 200
K <sub>G</sub> - value (in m <sup>3</sup> /hr*)		350	1300	1500	3500	3800	5200	5500

\* Note: When special noise reduction ring fitted the K<sub>G</sub>-value is reduced by approximately 15%

### Calculation of Flow Rate Coefficients

The K<sub>G</sub>-value indicates the flow rate of the valve in the full-open position under an absolute inlet pressure of P<sub>e</sub> = 2.013 bar and an absolute outlet pressure of P<sub>a</sub> = 1.013 bar. The K<sub>G</sub>-value is a factor which indicates the flow capacity of a gas regulator - all K<sub>G</sub>-values stated above refer to natural gas as the flow rate medium. The diagram opposite shows the graphic method to determine the flow rate coefficient K<sub>G</sub>- required for given service data of:

- Minimum inlet pressure P<sub>u</sub>
- Maximum outlet pressure P<sub>d</sub>
- Maximum flow rate Q<sub>b</sub>

This graphic method of K<sub>G</sub>-value determination is based upon the following formulae for flow rate calculation of natural gas:

#### Sub-Critical Flow:

$$\frac{P_d}{P_u} \geq 0.53$$

$$Q_b = K_G \sqrt{P_d (P_u - P_d)} \text{ in m}^3/\text{h}$$

#### Critical Flow-Rate:

$$\frac{P_d}{P_u} < 0.53$$

$$Q_b = K_G \cdot \frac{P_u}{2} \text{ in sm}^3/\text{h}$$

To ensure sufficient flow capacity the flow rate coefficient of the regulator chosen should always be higher than the flow rate coefficient determined from the diagram or calculated through the above formulae. It is recommended that the regulator flow rate coefficient (K<sub>G</sub>-value) should be approximately 20% above the required K<sub>G</sub>-value.

#### Definition:

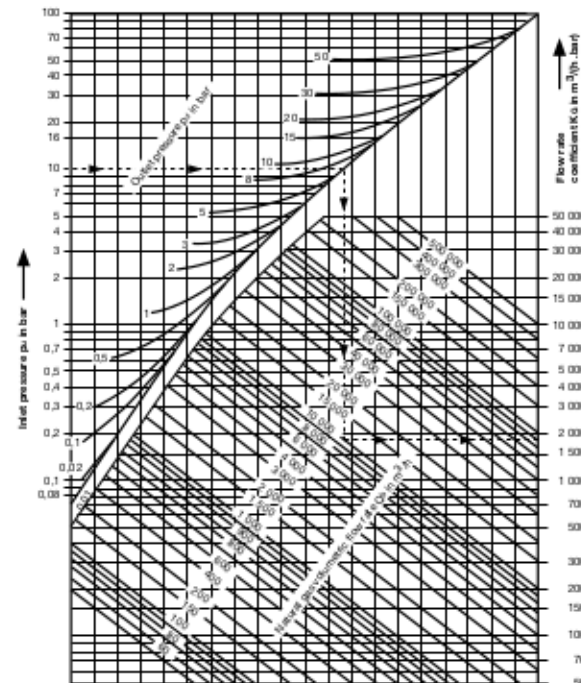
K<sub>G</sub> = Flow Coefficient

P<sub>u</sub> = Min. Inlet Pressure  
(bar Abs.)

P<sub>d</sub> = Max. Outlet Pressure  
(bar Abs.)

Q<sub>b</sub> = Max. Flow Rate  
(sm<sup>3</sup>/hr – natural gas)

### Diagram for K<sub>G</sub>-value Determination – (valid for natural gas)



### Example

Duty:

Inlet Pressure : 10 to 12 barg

Outlet Pressure : 1.5 to 2 barg

Capacity required : 10,000 m<sup>3</sup>/hr

Medium : Natural Gas (SG 0.6)

Reading from the K<sub>G</sub>-value diagram, the required valve flow rate coefficient is K<sub>G</sub> = 1800 – therefore the chosen regulator size is DN 80 x DN 80 Giving a **K<sub>G</sub>-value 3500**

Flowrate Calculation: P<sub>u</sub> = 11.013 bar A  
P<sub>d</sub> = 3.013 bar A

$$Q_b = \frac{P_d}{P_u}$$

$$Q_b = \frac{3.013}{11.013} = 0.273$$

**Hence: Critical flow: <0.53**

$$Q_b = K_G \times \frac{P_u}{2}$$

$$Q_b = 3500 \times \frac{11.013}{2}$$

$$Q_b = 19,272 \text{ sm}^3/\text{hr}$$



## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

### Mode of Operation

#### Key:

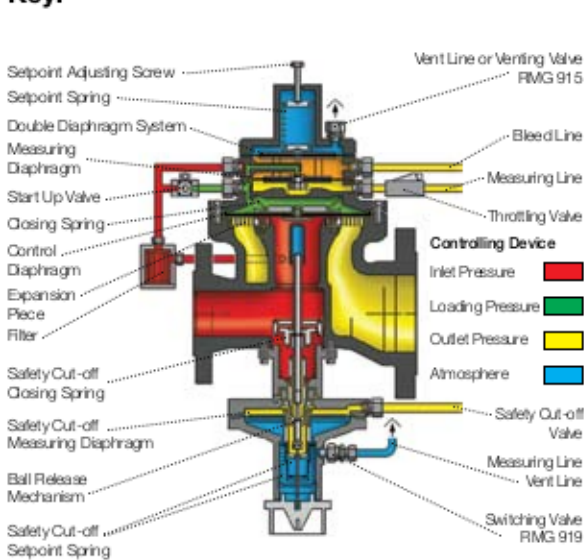


Illustration showing BD-RMG 800 (402) with RMG 620 pilot and RMG 720/K4 safety cut-off valve

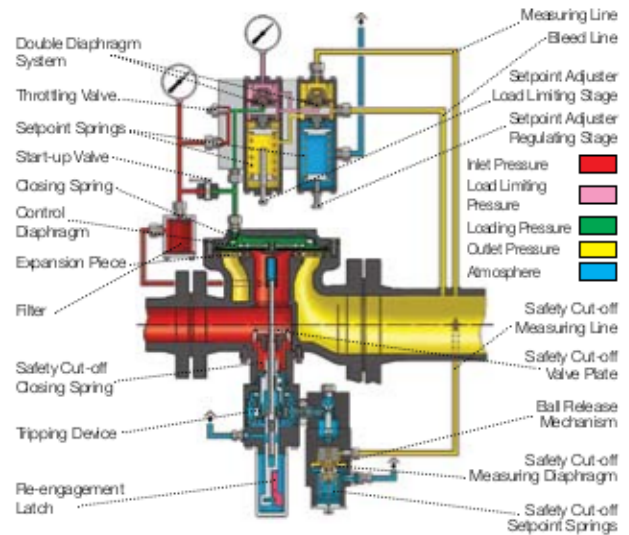


Illustration showing BD-RMG 800 (402) with RMG 630a pilot and RMG 721/K10a safety cut-off valve

The Series 800 Maxflo™/RMG 402 is designed to maintain a constant outlet pressure irrespective of inlet pressure and flow rate variations.

The regulator is pilot operated, biased closed, fail-open type, with a spring loaded diaphragm valve controlling flow through holed grid plate. There are two types of pilots used in conjunction with the regulator, an integral pilot (RMG 620) mounted directly on to the top of the unit and a separate pilot (RMG 630/640) mounted in the auxiliary pipework, both pilots control the regulator in the same way.

An optional safety cut-off device can also be fitted, Over Pressure (OPCO) or Under Pressure (UPCO/OPCO) versions are available and protect the downstream system in the event that a dangerous pressure condition develops.

The Design of the unit using of a relatively small number of components, ensures straightforward maintenance without removal of the body from the pipeline.

Under **normal operating conditions**, the safety cut-off valve is in the open position, inlet pressure is fed through the auxiliary filter to the control pilot (unloading type), which gives a constant sensing of the prevailing outlet pressure and therefore, its internal control valve and diaphragm are continually modulating to provide smooth constant outlet pressure control in accordance with the prevailing gas demand.

Hence, on **falling gas demand** the outlet pressure will tend to increase above the set point of the control pilot, causing the control valve in the pilot to close. This equalises the pressure on either side of the main regulator diaphragm allowing the closing spring to force the main diaphragm onto the holed grid plate, thus reducing the flow of gas.

Similarly, on **rising flow demand** the outlet pressure sensed by the control pilot will fall below the pilot set point, causing the control valve in the pilot to open and unloads the pressure from the topside of the main regulator diaphragm. With reduced pressure on the topside of the main regulator diaphragm, the inlet pressure acting on the underside of the main diaphragm causes it to lift from the holed grid plate and allow increased flow of gas to the outlet.

**Under fault condition** - with Safety Cut-Off device fitted, automatic shut-off of the inlet pressure would occur should the sensed pressure rise above the set-point of an over pressure device (OPCO) or fall below the set-point in the case of an under pressure device (UPCO).

After closure, the safety cut-off valve must be manually reset to the open position after normal pressure conditions have been restored.



## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

Materials of Construction

REGULATOR	
Body	Ductile Iron - Series 800 Cast Steel - RMG 402
Valve	Aluminium
Diaphragm	Nitrile
Top Cover	Ductile Iron or Cast Steel
Seals	Nitrile

PILOT	
Body	Ductile Iron or Cast Steel
Diaphragm	Nitrile Reinforced
Seals	Nitrile

SAFETY CUT-OFF VALVE	
Body	Steel
Housings: MP 1/2/4	Aluminium
HP	Steel
Diaphragms: MP 1/2/4	Nitrile
HP	Epichlorhydrin Reinforced
Seals	Nitrile

### Ease of Maintenance

Reduced down Time with easy exchange of diaphragm - without removing the body from the pipeline



Optional noise reducing ring

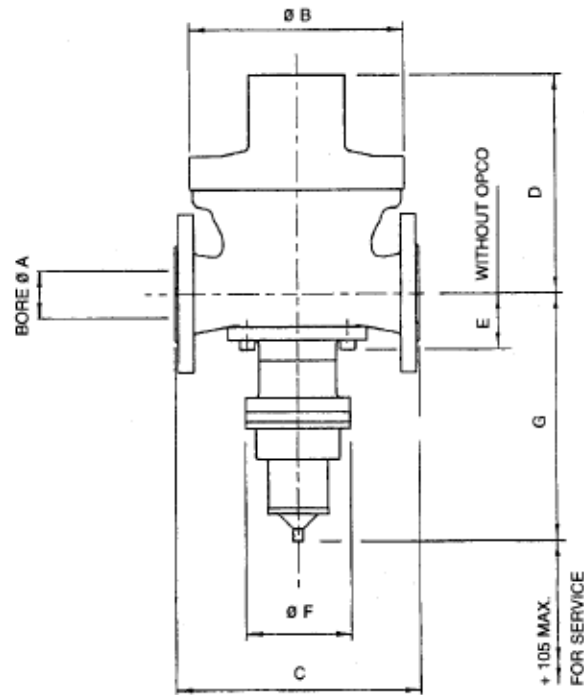
Optional safety cut-off valve - cartridge type construction





## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

### Dimensions and Weights



DIMENSIONS AND WEIGHTS							
A	B	C		D		E	F
		PN16, PN25 ANSI 150	ANSI 300	RMG 620	RMG 630/640a		
DN 25 (DI)	190	184	-	360	370	105	110
DN 50 (DI)	230	254	-	360	370	105	110
DN 80 (DI)	375	298	-	450	560	105	110
DN 100 (DI)	375	352	-	450	580	105	110
DN 50 (CS)	230	-	267	420	400	105	110
DN 80 (CS)	375	-	318	500	620	105	110
DN100 (CS)	375	-	368	520	630	105	110
DN 50/100 (CS)	230	310	310	370	600	105	110
DN 80/150 (CS)	375	400	400	500	620	105	110
DN 100/200 (CS)	375	430	430	500	630	105	110

DIMENSIONS AND WEIGHTS						
A	G			Weight Kg (with OPKO)		
	MP 1	MP2/4	HP	MP1	MP2/4	HP
DN 25 (DI)				30	30	33
DN 50 (DI)	280	290	310	36	36	39
DN 80 (DI)	305	315	330	81	81	84
DN 100 (DI)	305	315	330	86	86	89
DN 50 (CS)	300	310	330	53	53	56
DN 80 (CS)	305	315	330	98	98	101
DN 100 (CS)	305	315	330	113	113	116
DN 50/100 (CS)	280	290	310	-	-	-
DN 80/150 (CS)	305	315	330	-	-	-
DN 100/200 (CS)	DN 100/200	315	330	-	-	-

All dimensions in mm      DI = Ductile Iron Body      CS = Cast Steel Body



## GAS PRESSURE REGULATOR SERIES 800 MAXFLO™ (402)

Spares

REGULATOR SPARES KITS		
	Size	Kit Reference
Series 800/402	DN 50	202/MS-002 (Regulator Only)
Series 800/402	DN 80	203/MS-002 (Regulator Only)

SPARES KITS FOR PILOT OPTIONS	
	Kit Reference
RMG 620	200/GS-003
RMG 640a	200/GS-001

SPARES KITS FOR SAFETY CUT-OFF VALVES	
	Kit Reference
Series 309 LP OPCO	200/VS-007
Series 309 MP1 OPCO	200/VS-009
Series 309 MP2 OPCO	200/VS-011
Series 309 MP4 OPCO	200/VS-013
Series 309 HP OPCO	200/VS-023