

**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES**

An extremely sensitive and accurate full lift, high capacity pressure reducing valve designed for use on steam, air and gases



**FEATURES**

- Provides reliable, constant and stable reduced pressures.
- Highly sensitive pilot valve provides a constant outlet pressure, irrespective of erratic inlet pressure or system demand.
- Provides very close accuracy of pressure control.
- Choice of bronze or carbon steel constructions.
- Threaded or flanged models available.
- High flow rates enable specification of smaller valves than the comparable direct acting valve.
- Fully compliant with and certified to the Pressure Equipment Directive (PED).
- Surplus/maintaining valves available to provide an economical solution for secondary or non-critical processes.

**GENERAL APPLICATION**

The G4 pilot operated pressure reducing valve provides extremely accurate levels of pressure regulation for steam, air and industrial gas applications.

**TECHNICAL DATA**

Materials:	Bronze, carbon steel
Sizes:	½" to 6" (DN 15 to 150)
Connections:	Threaded or flanged
Pressure ranges	
Inlet:	10.2 to 600 psig (0.7 to 41.4 barg)
Reduced:	1 to 300 psig (0.07 to 20.7 barg)
Temperature range:	-4° to 800°F (-20° to 427°C)

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES OVERVIEW

### SPECIFICATIONS

The G4 Series comprises a wide range of dependable pressure reducing valves which monitor the supply pressure independently and without intervention, delivering a consistent reduced pressure automatically.

There are five model variants:

The 2042 is a screwed bronze pilot operated pressure reducing valve.

The 2043 is a flanged bronze pilot operated pressure reducing valve.

The 2044 is a flanged carbon steel (bronze top) pilot operated pressure reducing valve.

The 2045 is a flanged carbon steel (bronze top) pilot operated pressure reducing valve.

The 2046 is a flanged carbon steel (carbon steel top) pilot operated pressure reducing valve.

#### Pressure Equipment Directive (PED)

The G4 pressure reducing valve is fully compliant/certified to the PED as follows:

Sizes DN 15 to DN 25 in accordance with article 3, paragraph 3 [sound engineering practice] hence do not require the CE mark.

Sizes DN 32 to DN 100 to Category II, group 1 gases [CE marked].

Sizes DN 32 to DN 150 to Category II, group 2 gases [CE marked].

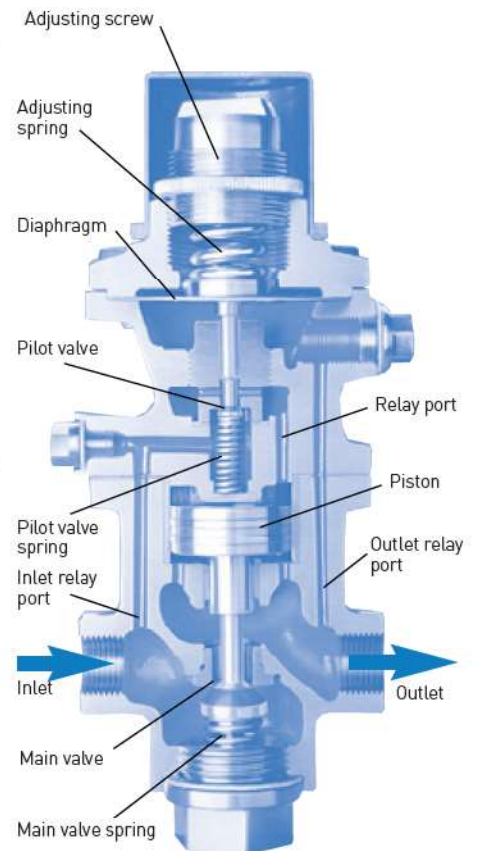
### OPERATION

Initially, with no compression on the adjusting screw, both the pilot and main valve seats are closed due to the action of the springs in the pilot and main valve. Fluid at the inlet pressure passes up the inlet relay port to the pilot valve seat which is opened by clockwise (viewed from above) rotation of the adjusting screw. This compresses the adjusting spring and applies load to the topside of the diaphragm, pushing open the pilot valve. Fluid now passes through the relay port to the top of the large diameter piston, which in turn pushes the main valve open.

The pressure of the fluid is reduced as it passes through the open main valve from the inlet to the valve outlet. At the same time fluid passes up the outlet relay port to the underside of the diaphragm, from where the outlet pressure is controlled.

The outlet pressure is a result of the balancing of the forces acting on the diaphragm, from the adjusting spring above and the reduced pressure from below.

The G4 is extremely sensitive and accurate, due to the large diaphragm. Inlet variations, or demand from the system, will attempt to affect the outlet pressure. Such attempts will result in movement of the pilot valve, which in turn moves the piston and main valve minutely. Thus the outlet pressure is maintained and the controlling cycle starts again.



**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES**  
MATERIALS

**MATERIALS**

Item	Part
1	Body
2❖	Main valve
3❖	Main valve seat
4	Bottom plug
5	Piston
6*❖	Piston rings
7	Piston liner
8	Piston guide
17*❖	Valve body top joint
21❖	Main valve spring
24*❖	Bottom plug joint
25	Pilot valve top
26❖	Pilot valve
27❖	Pilot valve plug
28*❖	Pilot valve cap
29*❖	Diaphragm
30	H.P. Port plug
31❖	Pilot valve spring
32	Pilot valve top cover
33	Adjusting spring
34	Adjusting spring bottom plate
35	Adjusting spring top plate
36	Adjusting screw
37	Locking ring
38	Padlock
42*❖	Diaphragm joint
43*❖	H.P. Port plug joint
44	Cap headed screws
48❖	Pilot valve head
49	L.P. Diaphragm
50	L.P. Screw joint
51	L.P. Adaptor flange
52	L.P. Top cover
53	L.P. Push rod
54	L.P. Top cover bolts
55	L.P. Top cover nuts
61	Top cap
68*❖	Pilot valve plug joint
69	Remote control plug
70*❖	Remote control plug joint

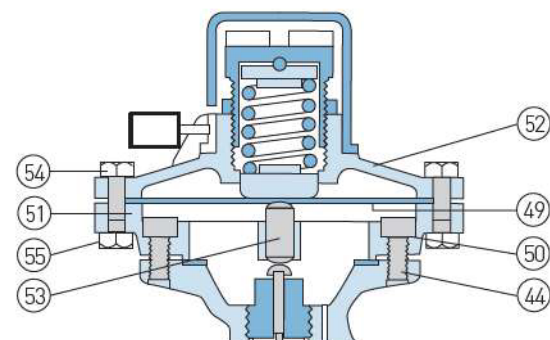
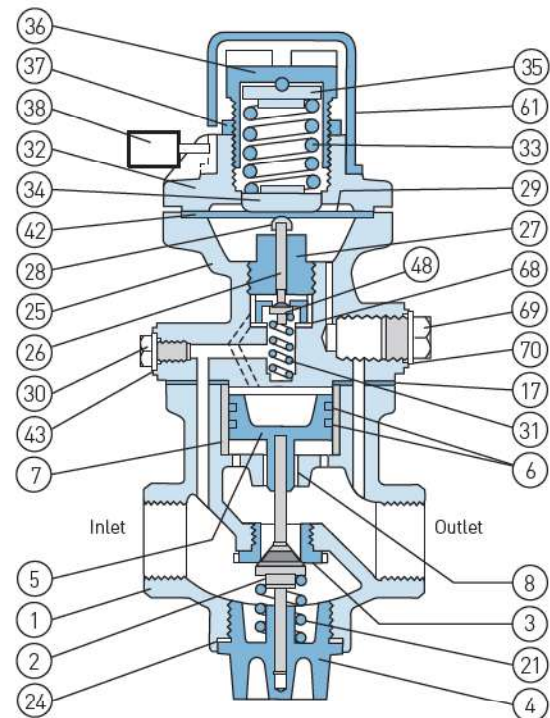
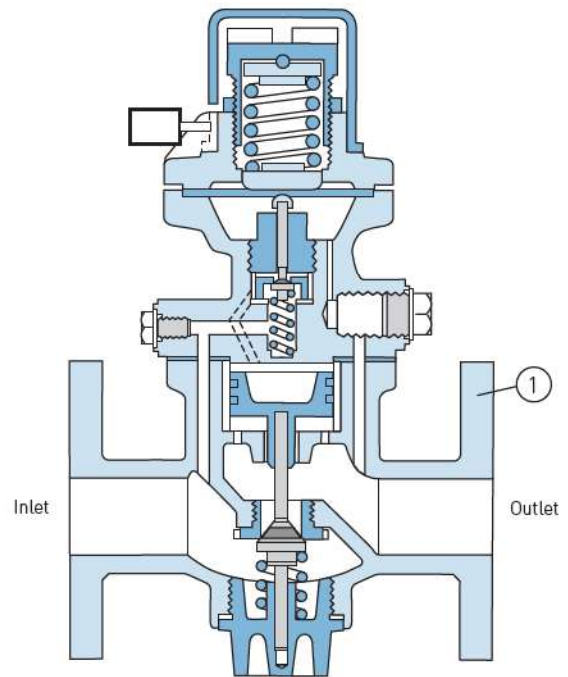
**NOTES**

A variety of elastomeric or PTFE seats and gaskets are available to suit various applications.

\* Routine service pack.

❖ Complete repair pack.

Recommended inspection every 12 months.



**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES**  
MATERIALS

**MATERIALS**

Item	2042 and 2043	2044	2045	2046
	Bronze	Carbon steel	Carbon steel	Carbon steel
1	Bronze	Carbon steel	Carbon steel	Carbon steel
2	Stainless steel	Stainless steel	Stainless steel	Stainless steel
3	Stainless steel	Stainless steel	Stainless steel	Stainless steel
4	Bronze	Bronze	Stainless steel	Stainless steel
5	Bronze	Bronze	Bronze	Stainless steel
6	Bronze	Bronze	Bronze	Chrome Iron
7	Stainless steel	Stainless steel	Stainless steel	Stainless steel
8	Stainless steel	Stainless steel	Stainless steel	Stainless steel
17	NAF	NAF	NAF	NAF
21	Stainless steel	Stainless steel	Stainless steel	Stainless steel
24	NAF	NAF	NAF	NAF
25	Bronze	Bronze	Bronze	Steel
26	Stainless steel	Stainless steel	Stainless steel	Stainless steel
27	Stainless steel	Stainless steel	Stainless steel	Stainless steel
28	Brass	Brass	Brass	Brass
29	Stainless steel	Stainless steel	Stainless steel	Stainless steel
30	Bronze	Bronze	Bronze	Carbon steel
31	Stainless steel	Stainless steel	Stainless steel	Stainless steel
32	Bronze	Bronze	Bronze	Carbon steel
33	Steel	Steel	Steel	Steel
34	Brass	Brass	Brass	Brass
35	Brass	Brass	Brass	Brass
36	Bronze	Bronze	Bronze	Bronze
37	Bronze	Bronze	Bronze	Bronze
38	Brass	Brass	Brass	Brass
42	NAF	NAF	NAF	NAF
43	NAF	NAF	NAF	NAF
44	Steel	Stainless steel	Stainless steel	Stainless steel
48	Stainless steel	Stainless steel	Stainless steel	Stainless steel
49	Bronze	Bronze	Bronze	N/A
50	Copper	Copper	Copper	N/A
51	Bronze	Bronze	Bronze	N/A
52	Bronze	N/A	N/A	N/A
53	Monel	Monel	Monel	N/A
54	Steel	Steel	Steel	N/A
55	Steel	Steel	Steel	N/A
61	Nylon	Nylon	Nylon	Nylon
68	Copper	Copper	Copper	Copper
69	Brass	Bronze	Bronze	Carbon steel
70	NAF	NAF	NAF	NAF

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SPECIFICATIONS

### TECHNICAL SPECIFICATION

Figure number	Size range DN	Pilot connections	Materials			Pressure barg		Temp. °C min-max
			Body	Top	Main valve trim	Inlet min-max	Outlet min-max	
2042	15-50	Screwed	Bronze	Bronze	St steel	0.7-35**	0.07-21	-20 to +260
❖2042GN	15-50	Screwed	Bronze	Bronze	Nitrile	0.7-31	0.07-21	-20 to +100
❖2042GV	15-50	Screwed	Bronze	Bronze	FKM	0.7-31	0.07-21	-18 to +150
❖2042GP	15-50	Screwed	Bronze	Bronze	PTFE	0.7-35	0.07-21	-20 to +170
2043	15-50	Flanged	Bronze	Bronze	St steel	0.7-35**	0.07-21	-20 to +260
❖2043GN	15-50	Flanged	Bronze	Bronze	Nitrile	0.7-31	0.07-21	-20 to +100
❖2043GV	15-50	Flanged	Bronze	Bronze	FKM	0.7-31	0.07-21	-18 to +150
❖2043GP	15-50	Flanged	Bronze	Bronze	PTFE	0.7-35	0.07-21	-20 to +170
2044	65-150*	Flanged	Carbon St.	Bronze	St steel	0.7-16◇**	0.07-15◇**	-20 to +220
2044GP	65-150*	Flanged	Carbon St.	Bronze	PTFE	1.0-16	0.07-15◇	-20 to +170
2045	65-150*	Flanged	Carbon St.	Bronze	St steel	0.7-35◇**	0.35-21◇**	-20 to +260
2045GP	65-150*	Flanged	Carbon St.	Bronze	PTFE	1.0-35	0.07-21**	-20 to +170
2046	15-100	Flanged	Carbon St.	Carbon St.	St steel	0.7-42◇**	0.35-21◇**	-20 to +400
#2046GN	15-50	Flanged	Carbon St.	Carbon St.	Nitrile	0.7-31	0.35-21	-20 to +100
#2046GV	15-50	Flanged	Carbon St.	Carbon St.	FKM	0.7-31	0.35-21	-18 to +150
#2046GP	15-100	Flanged	Carbon St.	Carbon St.	PTFE	1.0-42	0.35-21n	-20 to +170

### NOTES

The pressures and temperatures in this table are the maximum for the model shown, restrictions apply as shown below.

When outlet pressure is less than 0.35 barg a low pressure top will be fitted.

❖ 'G' for gas duty can be replaced by 'O' for oxygen duty.

\* A DN 150 body can be offered with a restricted main valve to give a DN 125 size flow rate.

\*\* Steam service restrictions see below.

\*\*\* When a stainless steel spring is fitted the maximum outlet pressure is 10.5 barg.

# DN 15/20/25 are all fitted into the DN 25 body (1" flanges).

DN 32/40/50 are all fitted into the DN 50 body (2" flanges).

◇ Air service restrictions see below.

### \*\* - STEAM SERVICE RESTRICTIONS

Figure number	Restriction on:	Restriction
2042	Inlet	25 barg to 225°C/17 barg to 260°C
2043	Inlet	25 barg to 225°C/17 barg to 260°C
2044	Inlet	13 barg max
2044	Outlet	12 barg max
2045	Inlet	65-150 mm 25 barg to 225°C/17 barg to 260°C
2045	Outlet	65-100 mm 21 barg to 225°C/16 barg to 260°C
2045	Outlet	125-150 mm 12 barg max
2046	Inlet	42 barg to 280°C/32 barg to 400°C
2046	Outlet	125-100 mm 12 barg max

### ◇ - AIR SERVICE RESTRICTIONS

Figure number	Restriction on:	Restriction
2044	Inlet	16 barg to 120°C/13 barg to 220°C
2044	Outlet	65-100 mm 15 barg to 120°C/12 barg to 220°C
2044	Outlet	125-150 mm 12 barg
2045	Inlet	65-150 mm 35 barg to 170°C/17 barg to 260°C
2045	Outlet	65-100 mm 21 barg to 170°C/16 barg to 260°C
2045	Outlet	125-150 mm 12 barg max
2046	Inlet	42 barg to 280°C/32 barg to 400°C
2046	Outlet	125-100 mm 12 barg

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES

### DIMENSIONS

#### DIMENSIONS

Valve type	Size DN	Connection, in	A			B		C		Weight kg
			ins	mm	DIN flange mm	ins	mm	ins	mm	
[1]	15	½ BSP	4.125	105	-	8.000	203	2.375	60	6.0
	20	¾ BSP	4.125	105	-	8.250	210	2.500	64	6.8
	25	1 BSP	4.500	114	-	8.375	213	2.625	67	7.0
	32	1¼ BSP	4.875	124	-	9.625	244	3.000	76	10.8
	40	1½ BSP	5.250	133	-	9.875	251	3.125	79	12.7
	50	2 BSP	6.375	162	-	10.250	260	3.250	83	15.4
[2]	15	½	5.500	140	130*	8.000	203	2.375	60	8.0
	20	¾	5.625	143	150*	8.250	210	2.500	64	8.6
	25	1	6.750	171	160*	8.375	213	2.625	67	9.0
	32	1¼	7.000	178	180*	9.625	244	3.000	76	13.6
	40	1½	7.500	191	200*	9.875	251	3.125	79	16.3
	50	2	8.500	216	230*	10.250	260	3.250	83	20.8
[3]	65	2½	10.000	254	254	11.250	286	5.125	130	38.0
	80	3	11.250	286	286	11.250	286	5.750	146	56.0
	100	4	13.500	343	343	12.750	324	7.000	178	80.0
	125	6	16.500	419	419	16.500	419	9.750	248	174.0
	150	6	16.500	419	419	16.500	419	9.750	248	174.0
[4]	65	2½	10.000	254	254	11.250	286	5.125	130	38.0
	80	3	11.250	286	286	11.250	286	5.750	146	56.0
	100	4	13.500	343	343	12.750	324	7.000	178	80.0
	125	6	16.500	419	419	16.500	419	9.750	248	174.0
	150	6	16.500	419	419	16.500	419	9.750	248	174.0
[5]	15	1	6.750	171	230❖	8.375	213	2.750	70	13.5
	20	1	6.750	171	230❖	8.375	213	2.750	70	13.5
	25	1	6.750	171	230❖	8.375	213	2.750	70	13.5
	32	2	9.000	229	229	10.500	267	3.500	89	26.3
	40	2	9.000	229	229	10.500	267	3.500	89	26.3
	50	2	9.000	229	229	10.500	267	3.500	89	26.3
	65	2½	10.000	254	254	11.250	286	5.125	130	42.0
	80	3	11.250	286	286	11.250	286	5.750	146	52.0
	100	4	13.500	343	343	12.750	324	7.000	178	87.0

1. Fig 2042 Screwed bronze
2. Fig 2043 Flanged bronze
3. Fig 2044 Flanged carbon steel (Brz. top)
4. Fig 2045 Flanged carbon steel (Brz. top)
5. Fig 2046 Flanged carbon steel (C.S. top)

Face to face dimensions are in accordance with \*Din 3300 (PN40)

❖Din 3300 (PN64)

#### Connection options

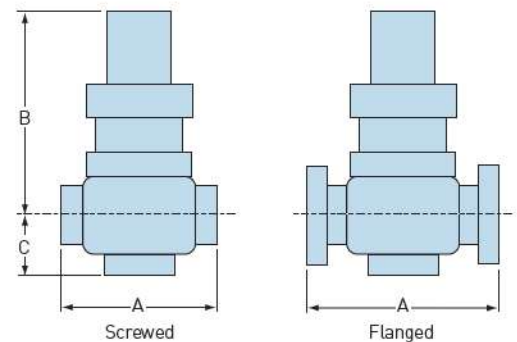
##### Screwed

BSP\*\* API/NPT

##### Flanged

BS4504 PN\*\* ANSI, BS10

\*\*Standard item.



## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES OPTIONS

### REMOTE PRESSURE SENSING FOR STEAM APPLICATIONS

The G4 is a self-actuated, pilot operated pressure reducing valve and it relies upon a stable pressure signal from the outlet pipe work in order to maintain stable control of the outlet pressure.

However, under certain conditions the signal pressure may be unstable in the immediate vicinity of the valve outlet which may result in erratic control.

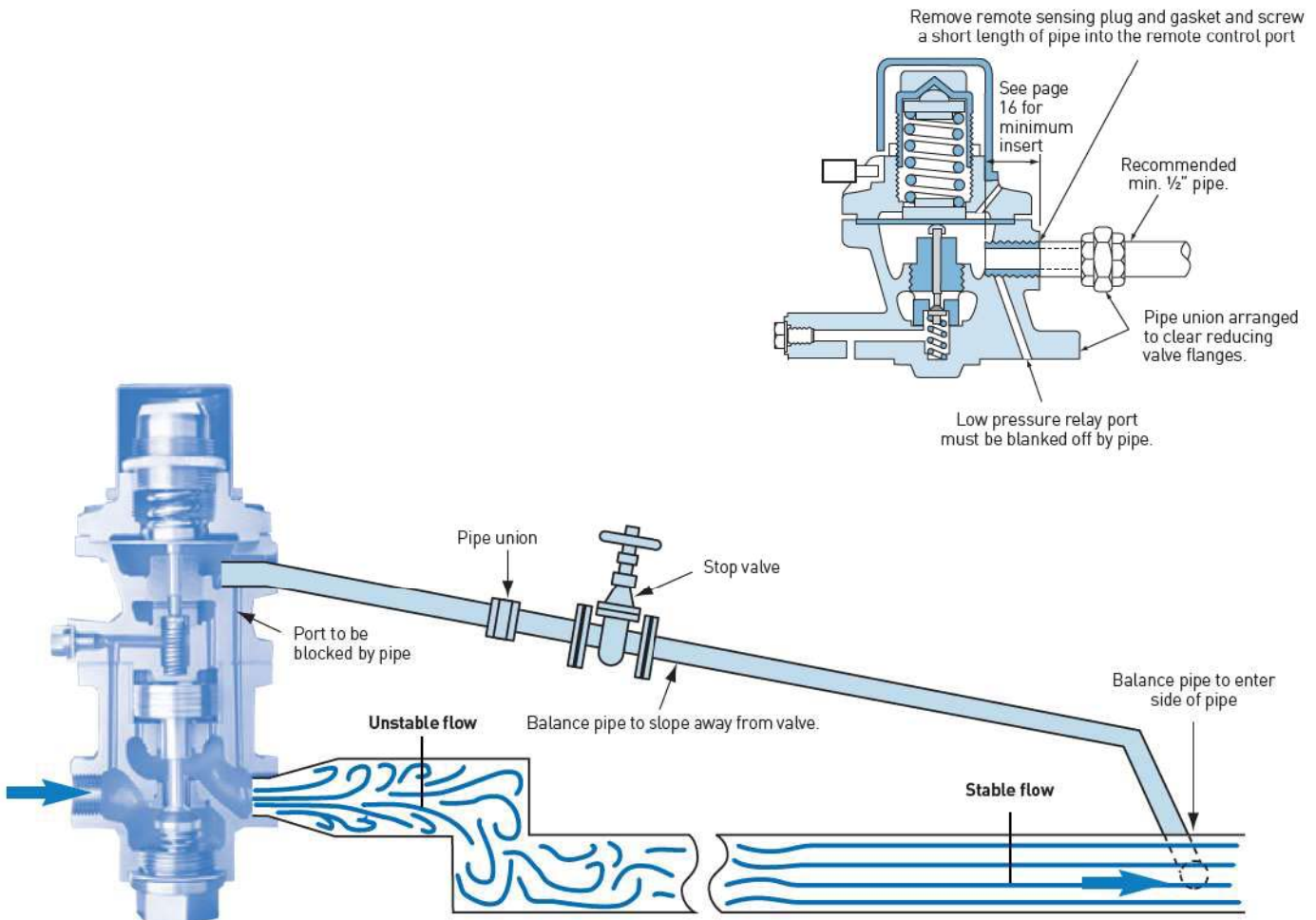
This can be overcome easily by installing a balance pipe from the remote sensing port to a straight section of the outlet pipe where stable flow has been resumed (see diagram below).

Ideally, the balance pipe should be a minimum of 2 metres (6 feet) long and must be screwed into the remote sensing port to the required depth (see page 16). It also should include a pipe union and stop valve to allow dismantling and isolation. It should be installed with a steady fall away from the reducing valve, to facilitate self-drainage of condensate.

### We recommend fitting a balance pipe:

1. When the reduced pressure is below 55% of the inlet pressure.
2. When a low pressure top is fitted.
3. When difficult outlet pipe work conditions occur.

We do not recommend fitting a balance pipe on air/gas applications. To ensure correct operation the G4 should be mounted at least 10 pipe diameters from restrictions such as other valves or bends.



## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES OPTIONS

### LOW PRESSURE TOP

The standard 'G4' pilot top can reduce pressures down to 0.35 barg (5 psig). For pressures below this, a bronze low pressure pilot top can be fitted in place of the standard top. It is suitable for outlet pressures from 0.07 to 0.35 barg (1 to 5 psig) using the yellow spring. The low pressure top is available for fitting on to valve sizes 15 to 100 mm (½" to 4") and a balance line should always be fitted to a low pressure top on steam duty and never on air/gas duty.

#### NOTE

A low pressure top is only suitable for inlet pressure up to a maximum of 7 barg (100 psig). Higher inlet pressures can be accommodated by use of two G4 valves 'in-series', refer to page 17.

The low pressure top can also be supplied as a conversion kit, allowing existing valves and stock to be modified quickly should the need arise suddenly.

### GAS AND OXYGEN DUTIES

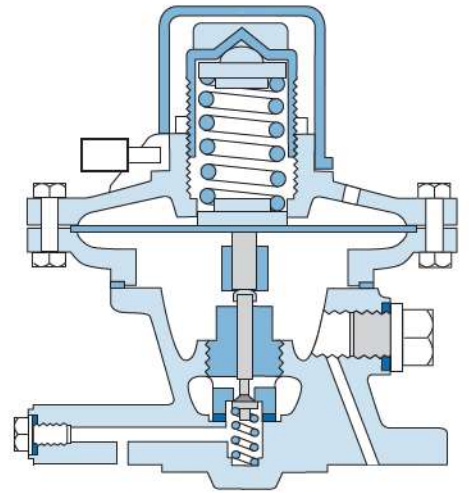
The G4 has been used successfully for many years with metal seats on demanding steam applications. However, soft seated versions are available for industrial fine gas applications involving such gases as carbon dioxide, nitrogen and oxygen. Typical application areas would include pharmaceuticals, food processing and brewing.

The G4 utilizes a range of soft elastomer seat materials to meet the ever growing demand for these specialist applications.

In addition, valves for active gases, such as oxygen and methane, can be supplied fully assembled and tested to 'oxygen service' standard in our state of the art clean room facility, which complies fully with the 'Industrial Gas Committee' guidelines.

All soft seat options can also be supplied as conversion kits, allowing existing valves and stock to be modified quickly should the need arise suddenly.

We do not recommend fitting a balance pipe on gas applications. To ensure correct operation, the G4 should be mounted at least 10 pipe diameters from restrictions such as other valves or bends.





## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SIZING

### SIZING

The G4 pressure regulator can give its best performance when sized correctly to match the maximum demand of the system. Therefore, it is important that the size of regulator is decided from the known or estimated consumption and never fitted just as a line size valve. It is useful to remember that the G4 is a full lift, high capacity valve and sized correctly will almost invariably be smaller than the size of the pipe work.

The valve sizing charts illustrate that the maximum capacity occurs when the outlet pressure is less than 55% of the inlet pressure (critical pressure drop sizing). When the outlet pressure is above 55% sub critical flow occurs and the capacity will be reduced.

Critical pressure drop sizing is only true when both the inlet and outlet pipework is sized correctly in accordance with the pipe sizing charts (see page 15).

It is important to remember that the outlet pipe is invariably larger than the inlet pipe, in order to pass the same quantity of steam, air or gas at a lower pressure.

### Capacity variations

The sizing charts give the maximum capacities which can be handled by the regulator for the given inlet and outlet pressures.

For trouble free operation, the minimum flow rate should be considered to be 10% of the maximum.

### Steam

If no steam capacity is given, size the regulator based on the maximum flow which can be achieved through the inlet pipe, according to the pipe sizing charts.

Alternatively, if the maximum heat requirement of the system is known, the following approximate relationship can be used:

Steam capacity:

$$\begin{aligned} \text{Kg/h} &= \text{Kcals} \div 554 \\ \text{kg/h} &= \text{kW} \times 0.6446 \\ \text{lbs/h} &= \text{BTU's/h} \div 1000 \end{aligned}$$

### Superheated steam

If the steam temperature is greater than the saturated steam temperature, the capacities shown in the tables will need to be reduced.

### NOTE

Undersized pipe work and fittings cause unnecessary and uncontrolled pressure losses and are a major cause of unstable control.

### DEGREES OF SUPERHEAT

°C	°F	Factor
0 - 10	0 - 50	x 0.96
10 - 50	50 - 100	x 0.92
50 - 75	100 - 150	x 0.89
75 - 100	150 - 200	x 0.86
100 - 150	200 - 300	x 0.82

### Air and gases

For gases other than air, divide the chart air capacity by  $\sqrt{\text{SG}}$  (SG of air = 1) to give the equivalent gas capacity.

### Other temperatures

The air/gas capacity tables are based on air at 15°C.

If the actual flowing temperature is different, the chart capacity will need to be divided by  $\sqrt{\text{T}/288}$

Where: T= flowing temperature °C + 273°k.

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SIZING EXAMPLES

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### REQUIREMENTS

Fluid - Steam at 184°C  
Inlet Pressure - 10 barg  
Outlet Pressure - 5.5 barg  
Required Capacity - 1100 kg/h

#### Sizing

Refer to the sizing chart on page 11. At an inlet pressure of 10 barg and an outlet pressure of 5.5 barg.

The first valve to pass more than 1100 kg/h is the 32 mm (1¼"), which will pass 1489 kg/h.

#### Selection

Refer to pages 2 and 5.

You can choose between models 2042, 2043 or 2046. The choice will then depend on your requirements for connections and materials. The most economical choice would be the 2042 screwed bronze valve.

At 5.5 barg a standard top is acceptable (ref. page 8), only one diaphragm is required (see opposite) and the black spring (ref. page 18) should be fitted with a range of 0.7 to 7.0 barg.

#### Inlet pipe size

Refer to page 15, at 10 barg the smallest pipe to pass the required flow of 1100 kg/h is 50 mm (2").

#### Outlet pipe size

Refer to page 15, at 5.5 barg the smallest pipe to pass the required flow of 1100 kg/h is 65 mm (2½").

### SPARES

#### Routine service pack:

1 Diaphragm  
1 Set of piston rings  
1 Pilot valve cap  
1 Set of joints

#### Complete repair kit:

1 Diaphragm  
1 Set of piston rings  
1 Pilot valve assembly  
1 Main valve  
1 Main valve seat  
1 Main valve spring  
1 Set of joints  
1 Pilot valve cap

Each carton of spares contains a leaflet, which not only identifies the parts supplied but also has a recommended list of 'check-points' to help identify common causes of reducing valve trouble.

### DIAPHRAGMS

One diaphragm is required for reduced pressures up to 10.5 barg (150 psig) but two are required for reduced pressures above this figure.



**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES CAPACITIES**

**G4 DRY SATURATED STEAM CAPACITY - kg/h**

Inlet pressure barg	Outlet pressure barg	R DN 15	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150
0.70	0.35	14.4	42.5	86.7	143	215	310	534	-	-	-	-	-
	*0.07	14.4	42.5	86.7	143	215	310	534	-	-	-	-	-
1.00	0.65	15.3	46.7	95.3	157	239	346	594	-	-	-	-	-
	0.55	16.3	49.5	101.0	166	254	367	630	-	-	-	-	-
	*0.32	16.3	49.5	101.0	166	254	367	630	1072	1337	2397	-	-
2.00	*0.07	16.3	49.5	101.0	166	254	367	630	1072	1337	2397	-	-
	1.65	19.2	58.7	120.0	197	300	434	747	-	-	-	-	-
	1.30	22.8	69.5	141.0	233	356	514	884	1418	1769	3171	4590	6538
	1.10	24.8	75.5	154.0	254	386	559	960	1540	1920	3442	4981	7095
	0.35	24.8	75.5	154.0	254	386	559	960	1540	1920	3442	4981	7095
5.00	*0.07	24.8	75.5	154.0	254	386	559	960	1540	1920	3442	-	-
	4.30	35.4	108.0	220.0	363	553	799	1374	-	-	-	-	-
4.00	39.9	121.0	248.0	408.0	623	900	1547	2347	2388	2978	5338	7727	-
	2.75	51.8	158.0	322.0	530	808	1168	2007	3219	4015	7196	10415	14834
	0.35	51.8	158.0	322.0	530	808	1168	2007	3219	4015	7196	10415	14834
	*0.07	51.8	158.0	322.0	530	808	1168	2007	3219	4015	7196	-	-
10.00	9.00	56.7	172.0	352.0	580	884	1279	2198	3024	3771	6759	9783	13934
	5.50	95.4	291.0	593.0	977	1489	2152	3699	5932	7398	13260	19193	27335
	1.20	95.4	291.0	593.0	977	1489	2152	3699	5932	7398	13260	19193	27335
	0.35	95.4	291.0	593.0	977	1489	2152	3699	5932	7398	13260	-	-
15.00	14.00	67.9	207.0	422.0	695	1059	1531	2633	3216	4011	7190	-	-
	12.00	108.0	330.0	673.0	1109	1690	2443	4199	6629	8267	14819	21448	30548
	8.25	139.0	423.0	862.0	1420	2164	3128	5377	8624	10755	19277	27901	39739
	2.90	139.0	423.0	862.0	1420	2164	3128	5377	8624	10755	19277	27901	39739
	*0.80	139.0	423.0	862.0	1420	2164	3128	5377	8624	10755	19277	-	-
20.00	19.00	78.3	238.0	487.0	802	1222	1767	3037	3360	4190	7511	-	-
	12.00	177.0	539.0	1101.0	1814	2764	3995	6868	11014	13736	24621	35636	50755
	11.00	181.0	552.0	1126.0	1855	2827	4086	7024	11265	14048	25180	36445	51906
	4.60	181.0	552.0	1126.0	1855	2827	4086	7024	11265	14048	25180	36445	51906
	3.10	181.0	552.0	1126.0	1855	2827	4086	7024	11265	14048	25180	-	-
	1.28	181.0	552.0	1126.0	1855	2827	4086	7024	-	-	-	-	-
25.00	20.70	164.0	500.0	1020.0	1680	2560	3700	6359	9717	12118	21720	-	-
	13.75	220.0	684.0	1395.0	2297	3500	5059	8696	13946	17392	31174	45120	64261
	12.00	220.0	684.0	1395.0	2297	3500	5059	8696	13946	17392	31174	45120	64261
	6.30	220.0	684.0	1395.0	2297	3500	5059	8696	13946	17392	31174	45120	64261
	2.80	220.0	684.0	1395.0	2297	3500	5059	8696	-	-	-	-	-

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES CAPACITIES

### G4 DRY SATURATED STEAM CAPACITY - kg/h (continued)

Inlet pressure barg	Outlet pressure barg	R DN 15	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150
30.00	20.70	243.0	743.0	1516.0	2497	3805	5500	9454	15162	18908	33891	-	-
	16.50	268.0	817.0	1667.0	2746	4184	6047	10395	16671	20789	37264	-	-
	12.00	268.0	817.0	1667.0	2746	4184	6047	10395	16671	20789	37264	53934	76816
	8.00	268.0	817.0	1667.0	2746	4184	6047	10395	16671	20789	37264	53934	76816
	6.90	268.0	817.0	1667.0	2746	4184	6047	10395	16671	20789	37264	-	-
	4.60	268.0	817.0	1667.0	2746	4184	6047	10395	-	-	-	-	-
35.00	20.70	305.0	930.0	1898.0	3126	4763	6884	11834	18979	23668	42425	-	-
	19.25	309.0	943.0	1923.0	3168	4827	6977	11993	19234	23986	42993	-	-
	12.00	309.0	943.0	1923.0	3168	4827	6977	11993	19234	23986	42993	62227	88627
	9.60	309.0	943.0	1923.0	3168	4827	6977	11993	19234	23986	42993	62227	88627
	7.50	309.0	943.0	1923.0	3168	4827	6977	11993	19234	23986	42993	-	-
	6.20	309.0	943.0	1923.0	3168	4827	6977	11993	-	-	-	-	-
40.00	20.70	353.0	1074.0	2195.0	3615	5508	7961	13684	21945	27367	49055	-	-
	12.00	353.0	1074.0	2195.0	3615	5508	7961	13684	21945	27367	49055	71000	101121
	10.30	353.0	1074.0	2195.0	3615	5508	7961	13684	21945	27367	49055	71000	101121
	8.07	353.0	1074.0	2195.0	3615	5508	7961	13684	21945	27367	49055	-	-
	6.20	353.0	1074.0	2195.0	3615	5508	7961	13684	-	-	-	-	-
	42.00	20.70	369.0	1125.0	2295.0	3780	5760	8325	14310	22950	28619	51299	-
12.00		369.0	1125.0	2295.0	3780	5760	8325	14310	22950	28619	51299	74249	105748
10.30		369.0	1125.0	2295.0	3780	5760	8325	14310	22950	28619	51299	74249	105748
8.30		369.0	1125.0	2295.0	3780	5760	8325	14310	22950	28619	51299	-	-
6.20		369.0	1125.0	2295.0	3780	5760	8325	14310	-	-	-	-	-
		369.0	1125.0	2295.0	3780	5760	8325	14310	-	-	-	-	-

### NOTES

- \* Low pressure top required for outlet pressures below 0.35 barg
- 1. The Max. and Min. outlet pressure for a given inlet pressure and valve size, can be determined from the above table. E.g. a 100 mm valve with an inlet pressure of 40 barg has a maximum available outlet pressure of 20.7 barg and a minimum of 8.07 barg.
- 2. To ensure the above flows, it is critical the correct size of outlet pipe is used. See page 15.
- 3. For superheated steam the above capacities need to be derated. See page 9.

**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES CAPACITIES**

**G4 AIR CAPACITY - l/s at 15°C**

Inlet pressure barg	Outlet pressure barg	R DN 15	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150
0.70	0.35	4.6	14.0	28.6	47.1	71.8	104	178	-	-	-	-	-
	*0.07	4.6	14.0	28.6	47.1	71.8	104	178	-	-	-	-	-
1.00	0.65	5.0	15.5	31.5	52.0	79.2	114	196	-	-	-	-	-
	0.55	5.4	16.4	33.5	55.2	84.2	122	209	-	-	-	-	-
	*0.32	5.4	16.4	33.5	55.2	84.2	122	209	357	445	797	-	-
2.00	*0.07	5.4	16.4	33.5	55.2	84.2	122	209	357	445	797	-	-
	1.65	6.3	19.3	39.5	65.0	99.1	143	246	-	-	-	-	-
	1.30	7.6	23.2	47.3	77.9	118.0	171	295	473	590	1057	1530	2180
	1.10	8.3	25.3	51.6	85.0	129.0	187	322	516	643	1153	1819	2377
5.00	0.35	8.3	25.3	51.6	85.0	129.0	187	322	516	643	1153	1819	2377
	*0.07	8.3	25.3	51.6	85.0	129.0	187	322	516	643	1153	-	-
	4.30	11.2	34.3	70.1	115.0	176.0	254	437	-	-	-	-	-
	4.00	12.8	39.1	79.8	131.0	200.0	289	497	765	954	1711	2477	3528
	2.75	17.0	51.8	106.0	174.0	265.0	383	659	1057	1318	2363	3803	4871
10.00	0.35	17.0	51.8	106.0	174.0	265.0	383	659	1057	1318	2363	3803	4871
	*0.07	17.0	51.8	106.0	174.0	265.0	383	659	1057	1318	2363	-	-
	9.00	17.4	53.3	108.0	179.0	272.0	394	678	912	1137	2039	2951	4204
	5.50	31.0	94.5	193.0	317.0	484.0	699	1202	1928	2404	4309	7008	8882
15.00	1.20	31.0	94.5	193.0	317.0	484.0	699	1202	1928	2404	4309	7008	8882
	0.35	31.0	94.5	193.0	317.0	484.0	699	1202	1928	2404	4309	-	-
	14.00	20.2	61.7	125.0	207.0	316.0	456	785	908	1132	2029	-	-
	12.00	34.3	104.0	213.0	351.0	536.0	775	1332	2099	2618	4692	6792	9673
20.00	8.25	45.0	137.0	280.0	460.0	702.0	1014	1743	2796	3486	6249	10187	12882
	2.90	45.0	137.0	280.0	460.0	702.0	1014	1743	2796	3486	6249	10187	12882
	*0.80	45.0	137.0	280.0	460.0	702.0	1014	1743	2796	3486	6249	-	-
	19.00	22.8	69.7	142.0	234.0	356.0	515	886	892	1112	1994	-	-
25.00	12.00	57.5	175.0	357.0	589.0	897.0	1297	2229	3579	4459	7993	11569	16478
	11.00	58.9	180.0	366.0	603.0	920.0	1329	2284	3664	4569	8190	13307	16882
	4.60	58.9	180.0	366.0	603.0	920.0	1329	2284	3664	4569	8190	13307	16882
	3.10	58.9	180.0	366.0	603.0	920.0	1329	2284	3664	4569	8190	-	-
	1.28	58.9	180.0	366.0	603.0	920.0	1329	2284	-	-	-	-	-
25.00	20.70	51.7	157.0	321.0	530.0	807.0	1167	2006	3049	3802	6815	-	-
	13.75	72.9	222.0	453.0	746.0	1137.0	1664	2826	4532	5651	10130	-	-
	12.00	72.9	222.0	453.0	746.0	1137.0	1664	2826	4532	5651	10130	14662	20882
	6.30	72.9	222.0	453.0	746.0	1137.0	1664	2826	4532	5651	10130	14662	20882
	2.80	72.9	222.0	453.0	746.0	1137.0	1664	2826	-	-	-	-	-

**NOTES**

- \* Low pressure top required for outlet pressures below 0.35 barg
- 1. The max. and min. outlet pressure for a given inlet pressure and valve size, can be determined from the above table. E.g. a 100 mm valve with an inlet pressure of 40 barg has a Maximum available outlet pressure of 20.7 barg and a minimum of 8.07 barg.
- 2. To ensure the above flows, it is critical the correct size of outlet pipe is used. See page 15.
- 3. For gases other than air and temperatures other than 15°C refer to page 9.

**KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES CAPACITIES**

**G4 AIR CAPACITY - l/s at 15°C (continued)**

Inlet pressure barg	Outlet pressure barg	R DN 15	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150
30.00	20.70	78.3	238.0	487.0	802.0	1222.0	1767	3038	4872	6076	10891	-	-
	16.50	86.8	265.0	540.0	889.0	1355.0	1959	3367	5400	6734	12070	-	-
	12.00	86.8	265.0	540.0	889.0	1355.0	1959	3367	5400	6734	12070	17470	24882
	8.00	86.8	265.0	540.0	889.0	1355.0	1959	3367	5400	6734	12070	17470	24882
	6.90	86.8	265.0	540.0	889.0	1355.0	1959	3367	5400	6734	12070	-	-
	4.60	86.8	265.0	540.0	889.0	1355.0	1959	3367	-	-	-	-	-
35.00	20.70	99.3	302.0	617.0	1017.0	1550.0	2241	3852	6178	7705	13811	-	-
	19.25	101.0	307.0	627.0	1032.0	1573.0	2274	3908	6268	7817	14011	-	-
	12.00	101.0	307.0	627.0	1032.0	1573.0	2274	3908	6268	7817	14011	20279	28882
	9.60	101.0	307.0	627.0	1032.0	1573.0	2274	3908	6268	7817	14011	20279	28882
	7.50	101.0	307.0	627.0	1032.0	1573.0	2274	3908	6268	7817	14011	-	-
	6.20	101.0	307.0	627.0	1032.0	1573.0	2274	3908	-	-	-	-	-
40.00	20.70	115.0	350.0	714.0	1175.0	1791.0	2589	4450	7136	8899	15951	-	-
	12.00	115.0	350.0	714.0	1175.0	1791.0	2589	4450	7136	8899	15951	23088	32882
	10.30	115.0	350.0	714.0	1175.0	1791.0	2589	4450	7136	8899	15951	23088	32882
	8.07	115.0	350.0	714.0	1175.0	1791.0	2589	4450	7136	8899	15951	-	-
	6.20	115.0	350.0	714.0	1175.0	1791.0	2589	4450	-	-	-	-	-
	42.00	20.70	120.0	367.0	748.0	1233.0	1878.0	2715	4666	7483	9332	16728	-
12.00		120.0	367.0	748.0	1233.0	1878.0	2715	4666	7483	9332	16728	24211	34482
10.30		120.0	367.0	748.0	1233.0	1878.0	2715	4666	7483	9332	16728	24211	34482
8.30		120.0	367.0	748.0	1233.0	1878.0	2715	4666	7483	9332	16728	-	-
6.20		120.0	367.0	748.0	1233.0	1878.0	2715	4666	-	-	-	-	-
		120.0	367.0	748.0	1233.0	1878.0	2715	4666	-	-	-	-	-

**Estimated air capacities**

Multiply chart capacities as follows:

1. Multiply chart capacity by 0.66 to give air flow in SCFM
2. Multiply chart capacity by 1.2 to give air flow in Nm<sup>3</sup>/h

Estimated air pressure drops:

For guidance, multiply the chart pressure drop by 1.23 to give an approximate air pressure drop.

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES CAPACITIES

### CAPACITIES FOR STEAM in kg/h (For lbs/h multiply capacity by 2.2046.)

Pressure		Pipe size - millimetres														
Psig	Barg	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250	DN 300	DN 350
7.5	0.5	9 (0.03)	18 (0.03)	30 (0.03)	45 (0.03)	88 (0.03)	159 (0.03)	308 (0.03)	476 (0.03)	705 (0.03)	1270 (0.03)	1540 (0.03)	3080 (0.02)	4620 (0.02)	6810 (0.02)	9430 (0.02)
15	1.0	12 (0.04)	22 (0.04)	39 (0.04)	59 (0.04)	118 (0.04)	218 (0.04)	400 (0.04)	590 (0.04)	975 (0.04)	1630 (0.04)	2270 (0.04)	4000 (0.03)	6430 (0.03)	9480 (0.03)	13100 (0.03)
30	2.0	16 (0.05)	33 (0.06)	55 (0.06)	88 (0.06)	177 (0.06)	305 (0.06)	545 (0.06)	840 (0.06)	1475 (0.06)	2450 (0.06)	3500 (0.06)	6140 (0.05)	8920 (0.04)	13100 (0.04)	18200 (0.04)
45	3.0	20 (0.07)	44 (0.08)	75 (0.08)	118 (0.09)	241 (0.10)	419 (0.10)	795 (0.09)	1180 (0.08)	1900 (0.08)	3080 (0.08)	4400 (0.08)	8160 (0.07)	12400 (0.06)	16700 (0.05)	23200 (0.05)
60	4.0	24 (0.10)	54 (0.10)	97 (0.11)	147 (0.12)	309 (0.13)	545 (0.12)	1040 (0.12)	1500 (0.12)	2450 (0.11)	4080 (0.11)	5670 (0.11)	10200 (0.10)	16900 (0.09)	23500 (0.08)	30400 (0.07)
75	5.0	29 (0.11)	67 (0.12)	116 (0.13)	180 (0.14)	359 (0.14)	625 (0.14)	1180 (0.14)	1820 (0.14)	2950 (0.13)	4760 (0.13)	6670 (0.13)	13100 (0.12)	20300 (0.11)	28600 (0.10)	37500 (0.09)
90	6.0	36 (0.12)	76 (0.14)	136 (0.15)	211 (0.16)	427 (0.16)	750 (0.16)	1400 (0.16)	2130 (0.16)	3450 (0.16)	5800 (0.16)	7950 (0.15)	15000 (0.14)	23700 (0.13)	33600 (0.12)	44500 (0.11)
100	7.0	43 (0.14)	91 (0.16)	154 (0.18)	245 (0.18)	490 (0.19)	864 (0.19)	1650 (0.19)	2450 (0.18)	3950 (0.18)	6600 (0.18)	9300 (0.17)	17200 (0.16)	27100 (0.15)	38600 (0.14)	51500 (0.13)
115	8.0	48 (0.15)	104 (0.17)	182 (0.20)	272 (0.21)	545 (0.22)	955 (0.22)	1860 (0.22)	2640 (0.20)	4300 (0.20)	7270 (0.20)	10200 (0.19)	19000 (0.18)	30500 (0.17)	43700 (0.16)	58500 (0.15)
130	9.0	52 (0.18)	113 (0.20)	200 (0.24)	309 (0.25)	613 (0.26)	1140 (0.26)	2180 (0.26)	3090 (0.25)	5080 (0.25)	8650 (0.25)	12200 (0.23)	21800 (0.22)	34800 (0.20)	50000 (0.19)	65500 (0.17)
145	10.0	57 (0.20)	123 (0.23)	222 (0.27)	336 (0.30)	668 (0.30)	1200 (0.30)	2360 (0.29)	3400 (0.28)	5580 (0.28)	9550 (0.28)	13400 (0.27)	25000 (0.26)	39900 (0.24)	57500 (0.23)	76100 (0.21)
175	12.0	67 (0.23)	136 (0.27)	259 (0.31)	418 (0.34)	818 (0.35)	1450 (0.35)	2900 (0.37)	4090 (0.36)	6850 (0.35)	11500 (0.35)	16100 (0.34)	30000 (0.31)	47500 (0.29)	68700 (0.28)	91700 (0.26)
220	15.0	75 (0.29)	168 (0.33)	318 (0.39)	510 (0.42)	1020 (0.44)	1820 (0.45)	3640 (0.46)	5220 (0.46)	8600 (0.46)	14300 (0.46)	19700 (0.43)	33200 (0.41)	59000 (0.39)	84600 (0.37)	113900 (0.35)
260	18.0	93 (0.35)	227 (0.40)	395 (0.46)	617 (0.49)	1230 (0.51)	2270 (0.52)	4300 (0.54)	6450 (0.55)	10900 (0.55)	17700 (0.55)	24500 (0.53)	47600 (0.51)	74100 (0.49)	106900 (0.47)	144800 (0.45)
290	20.0	107 (0.38)	250 (0.44)	435 (0.50)	680 (0.55)	1360 (0.57)	2460 (0.59)	4760 (0.62)	7030 (0.64)	12200 (0.64)	20000 (0.64)	28200 (0.63)	54000 (0.61)	85400 (0.59)	123600 (0.57)	168100 (0.55)
360	25.0	134 (0.47)	287 (0.54)	522 (0.61)	838 (0.66)	1680 (0.68)	2890 (0.71)	5400 (0.74)	8790 (0.76)	14700 (0.78)	24200 (0.78)	36100 (0.78)	66600 (0.76)	106000 (0.74)	154000 (0.72)	210000 (0.70)
435	30.0	159 (0.56)	342 (0.64)	619 (0.72)	995 (0.78)	2010 (0.82)	3450 (0.85)	6470 (0.89)	10500 (0.91)	17600 (0.93)	28900 (0.93)	43100 (0.93)	79600 (0.91)	127100 (0.89)	185000 (0.87)	253400 (0.85)
510	35.0	186 (0.66)	399 (0.75)	721 (0.84)	1170 (0.92)	2370 (0.98)	4060 (1.01)	7550 (1.04)	12200 (1.06)	20400 (1.08)	33500 (1.08)	50100 (1.08)	92700 (1.06)	148200 (1.04)	216200 (1.02)	296400 (1.00)
580	40.0	214 (0.76)	456 (0.86)	820 (0.95)	1320 (1.03)	2690 (1.10)	4610 (1.14)	8550 (1.17)	13900 (1.20)	23300 (1.23)	38200 (1.23)	57100 (1.23)	105800 (1.21)	169400 (1.19)	247500 (1.17)	339700 (1.15)
610	42.0	221 (0.79)	420 (0.89)	847 (0.99)	1360 (1.07)	2770 (1.14)	4750 (1.18)	11900 (2.20)	14400 (1.26)	24100 (1.29)	39700 (1.29)	59200 (1.29)	109800 (1.27)	175800 (1.25)	256900 (1.23)	352800 (1.21)

#### NOTES

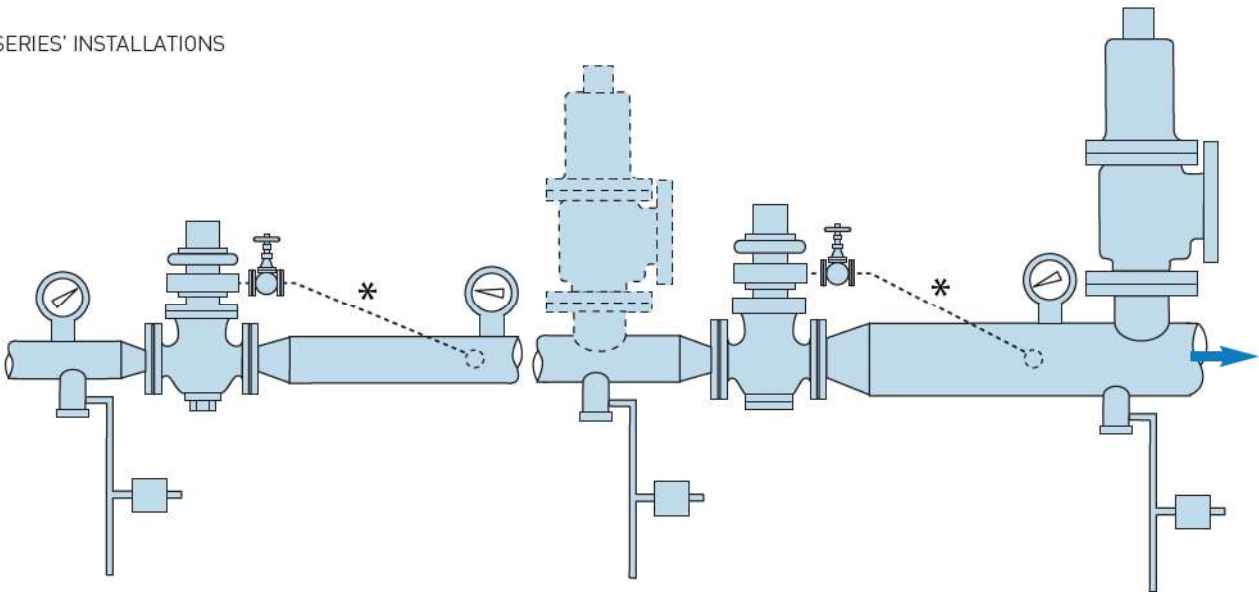
- Figures in brackets show pressure drops (barg) for equivalent lengths equal to 360 pipe diameters.  
When using this table, allowance should be made for the effects of bends and fittings in the pipe line.
- All capacity values are based on acceptable pressure drops, not velocity per unit length of pipe.  
Higher pressure drops will result in higher steam velocities and increased noise levels.

#### Example

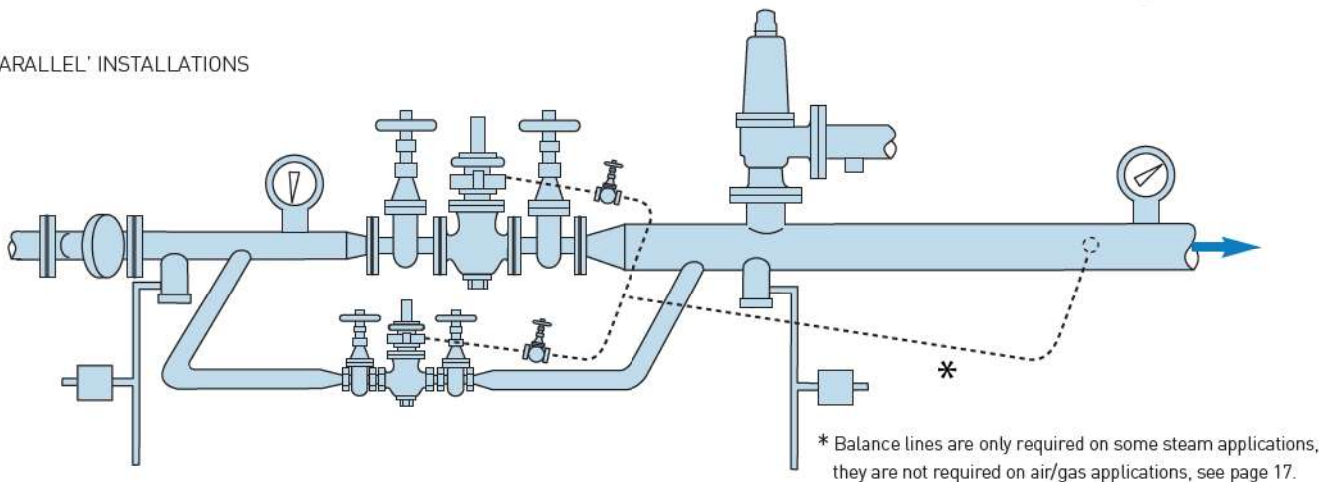
To find the size pipe which will pass 800 kg/h of dry saturated steam at 7 barg:  
50 mm pipe will pass 864 kg/h at 7 barg (pressure drop over 18 m (360 pipe diameters) will be approximately 0.19 barg).

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES INSTALLATION

### 'IN SERIES' INSTALLATIONS



### 'IN PARALLEL' INSTALLATIONS



\* Balance lines are only required on some steam applications, they are not required on air/gas applications, see page 17.

#### 'In series' installations

Multiple valves installed 'in series' should be considered for applications when high pressure drops are required. If the required outlet pressure is less than the minimum shown in the charts two valves can be used.

An 'in series' installation should be designed to drop the pressure in at least two steps/stages.

Setting the smaller valve slightly higher than the larger valve will ensure that the larger valve is closed at low flow rates. Increasing demand will then open the larger valve as outlet pressure falls to its set point.

A typical diagram is shown (using close coupled parallel slide isolating valves).

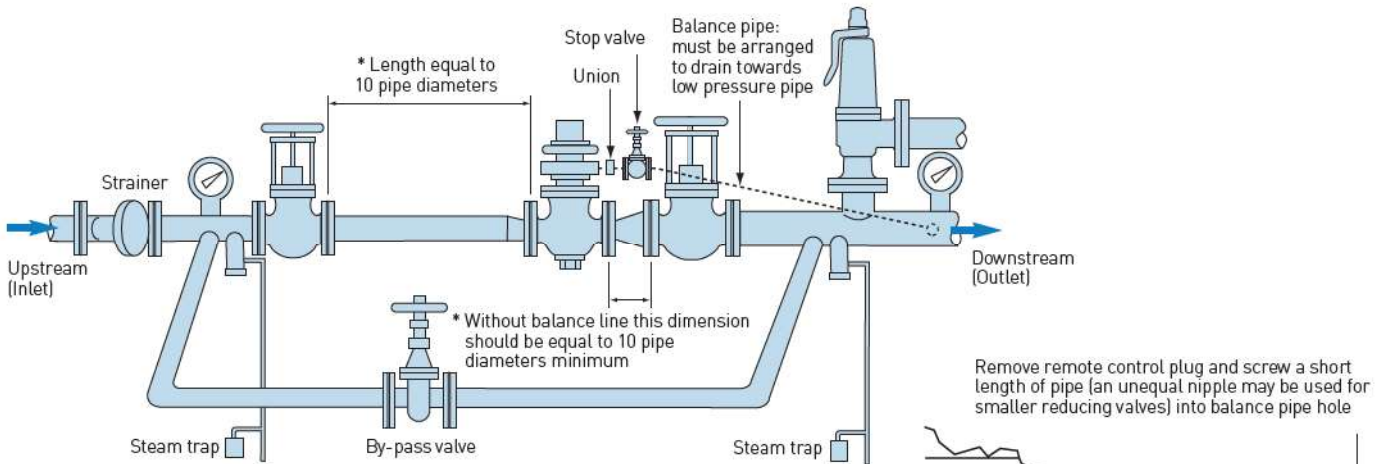
#### 'In parallel' installations

Multiple valves can be installed as an 'in parallel' system when the system has a very large variation in the required capacity. On such a system, one large and one small valve should be installed, with a combined capacity greater than the maximum required demand, the smaller valve having a capacity just greater than the minimum required demand.



# KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES INSTALLATION

## TYPICAL STEAM REDUCING VALVE INSTALLATION USING GLOBE STOP VALVES



### NOTE

If you use parallel slide stop valves, they can be close-coupled to the G4.

The majority of troubles experienced with pressure regulators can be attributed to installation faults. These can be avoided by giving attention to the following points:

### Sizing

The correct sizing and layout of regulators, pipework, stop valves, strainers and other fittings is extremely important for good performance.

### Inlet strainer

Dirt, grit and pipe scale are common causes of regulator failure. A strainer of upstream pipe size should be fitted at least 10 pipe diameters before the regulator.

### Steam traps

Steam reducing valve stations should have steam traps fitted on the inlet and outlet pipes, to prevent build-up of condensate in the regulator, particularly under 'no flow' conditions.

### Safety valve

Every installation should be fully protected against regulator failure by a safety valve. Care should be taken that the discharge from such a valve cannot cause damage to property or create a hazard to personnel. The safety valve should be sized to pass the maximum capacity of the regulator.

### Pipe work

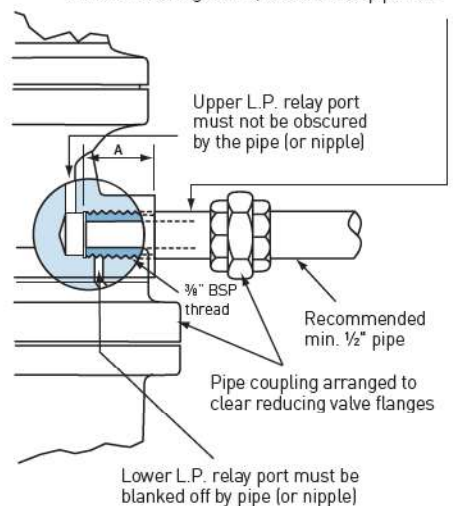
All pipework and fittings should be supported properly and free from any strain or vibrations which could affect their correct operation. All flanges should be aligned correctly and joints fitted carefully to avoid blockage of valve ports. If a jointing compound is used it should not be allowed to foul the internal ports or working parts of the valve.

### Balance pipe (steam applications only)

A balance pipe should be fitted when the reduced pressure is 55% or less of the inlet pressure, or to help counteract difficult turbulent downstream conditions caused by pipe fittings, valves or bends. The method of connecting the balance pipe to the reducing valve is shown in the diagram. It should drain downwards and be connected into the side of the downstream pipe at a point where smooth flow occurs (preferably downstream of the safety valve). Where isolation of the regulator is desired, a stop valve should be fitted in the balance line.

### Before putting a regulator into service

Prior to installing the valve, all pipes should be blown-through thoroughly to remove any dirt, grit or pipe scale. Additional cleaning can be done by removing the regulator bottom plug, main valve and spring and then opening the inlet stop valve carefully by a small amount. Remove any dirt lodged in the valve body and replace all parts.



'A' dimension must be  $\frac{9}{16} \pm \frac{1}{16}$ " on all stainless steel valves or CS Fig 2046. All other valves with bronze pilot tops, the pipe should penetrate 1" minimum.

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SETTING

### SETTING

#### Setting under no flow conditions

This is the most accurate method and may be carried out as follows:

- Any condensate remaining in the pipeline should be removed by first applying a little tension to the regulator adjusting spring (by rotating the adjusting screw clockwise for a few turns) and then slowly opening the outlet and inlet stop valves. When the downstream pressure starts to rise, close the inlet stop valve and remove all tension from the regulator adjusting spring.
- Close the outlet stop valve and open the inlet stop valve slowly. Wait for about one minute to confirm that the reduced pressure is maintained at zero. This is a check that the regulator gives 'deadtight' shut-off under no flow conditions.
- Raise the reduced pressure slowly (by rotating the regulator adjusting screw clockwise) until the desired pressure is obtained (do not forget to set the safety valve 15% above the reduced pressure, if necessary). The valve is now set correctly and the adjusting screw should be locked with the lock-nut provided.
- Bring the outlet stop valve slowly to 'full open' and, apart from a possible initial 'fall back' of the reduced pressure (whilst the systems is warmed through), the regulator should continue to maintain the reduced pressure.

#### Setting on flow

With the inlet and outlet stop valves closed, apply a little tension to the regulator adjusting spring (by rotating the adjusting screw clockwise for a few turns). Open the inlet and all downstream stop valves and then wait until all condensate has been removed and the system warmed through properly. Then raise the reduced pressure slowly by clockwise rotation of the adjusting screw until the desired reduced pressure is obtained (do not forget to set the safety valve, if necessary). If the flow is varying, some trial and error may be necessary before the correct setting is finally achieved. The reduced pressure under no-flow conditions should be checked as soon as convenient.

It is recommended strongly that the inlet strainer and reducing valve should be cleaned out one week after commissioning and the strainer and steam traps checked at regular intervals thereafter.

#### Outlet pressure regulation

Up to DN 80 (3") size  $\pm 1/2\%$  of outlet pressure ( $\pm 0.035$  barg ( $1/2$  psig) below 6.9 barg (100 psig))

Above DN 80 (3") size  $\pm 1\%$  of outlet pressure ( $\pm 0.07$  barg (1 psig) below 6.9 barg (100 psig))

Pressure rise at dead end (steam only) = 1%.

#### Spring selection

If possible, it is advisable to select a spring which has at least 10% additional adjustment above the required set pressure. As can be seen from the chart, the springs have overlapping ranges. Where possible, the spring with the lowest range should be selected.

### SPRING SELECTION

DN 15-100 (1/2" - 4") valves		
Barg	(Psig)	Color code
0.07-3.5	(1-50)	Yellow
0.7-7.0	(10-100)	Black
2.8-10.5	(40-150)	White
3.5-14.0	(50-200)	Green
7.0-21.0	(100-300)	Red
DN 150 (6")* valves		
Barg	(Psig)	Color code
0.35-1.4	(5-20)	Red
0.7-3.5	(10-50)	Yellow
2.8-7.0	(40-100)	Black
3.5-12.0	(50-175)	Green

\* A DN 150 body can be offered with a restricted main valve to give a DN 125 size flow rate.

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SURPLUS/MAINTAINING VALVES

### SURPLUS/MAINTAINING VALVES

The 'G4 surplus' valve can also be described as a 'pressure maintaining' or 'pressure sustaining' valve.

In these days of high energy costs and environmental emission controls, steam and air systems can be very expensive to install and run. Most industrial applications need steam or air for the main process plant and it is critical to maintain the supply to these processes. Additionally, such plants will also have other demands of a less critical nature such as compressed air lines, heating and cleaning systems.

Two separate systems could be employed, providing that the necessary funds are available to install and run both. Alternatively, the secondary and less critical applications can be run from the surplus generated from the main system. However, during periods of extreme demand the main process could be starved of steam or air, resulting in production disruption and product loss (see Figure 1).

#### The solution is to fit a G4 'surplus' valve.

The G4 'surplus' valve is designed to be installed in branch lines to non-essential equipment (Figure 1), to maintain the upstream pressure, thus maintaining the supply to the more vital process and subsequently maintaining production from the system.

Alternatively, to dump flow surplus to requirements to a drain or atmosphere.

Additionally, if the pressure in a boiler or air accumulator is allowed to fall too low, a lot of energy will be required to build up the pressure once again (see Figure 2).

#### The solution is to fit a G4 'maintaining' valve.

The G4 'maintaining' valve is designed to be installed in the main pipeline from the boiler or an air compressor (Figure 2), to maintain the pressure in the boiler or accumulator, thus preventing them from becoming exhausted.

### OPERATION

The inlet pressure is directed under the diaphragm. A small increase in pressure above the set pressure lifts the diaphragm and opens the pilot valve, which in turn opens the main valve. Subsequently, when excess demand drops the pressure below the required level, the adjusting spring will overcome the pressure under the diaphragm and close the pilot valve. This in turn causes the main valve to close, cutting the surplus supply and/or maintaining pressure in the main line, boiler or accumulator.

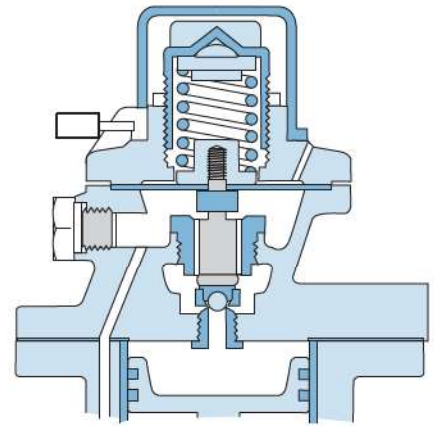


FIGURE 1

When the G4 surplus valve is closed, the full flow from boiler/compressor goes to the critical process.

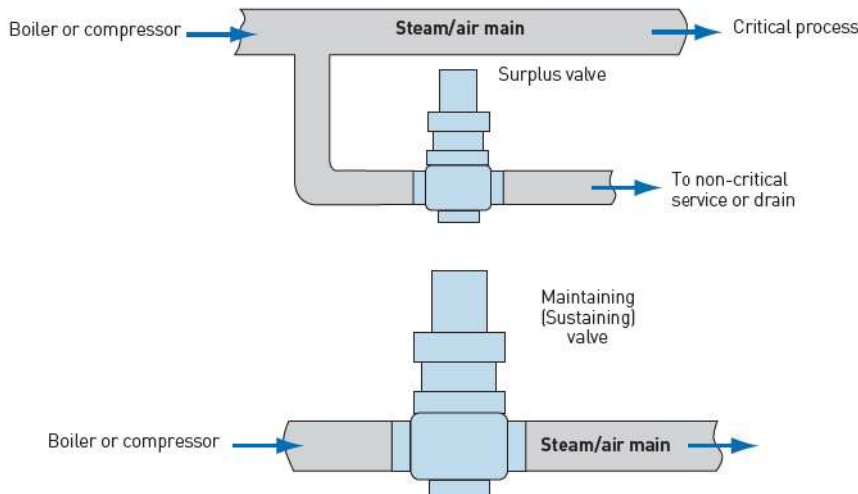


FIGURE 2

When the G4 maintaining valve is closed, the full flow from boiler/compressor is stopped and the minimum pressure of the boiler/accumulator is maintained.

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SURPLUS/MAINTAINING VALVES

### G4 SURPLUS/MAINTAINING VALVE SELECTION

#### Example 1: Surplus duty (see Figure 1, page 19)

A steam boiler normally working at a pressure of 10 barg delivers steam to a critical process which must not fall below 8 barg (closing pressure) to preserve correct operation. The excess (surplus) capacity produced can be used for a non-critical service. If this non-critical service requires 3500 Kg/h of saturated steam, the size of G4 surplus valve required is as follows:

Normally, a surplus valve is sized on the minimum allowable pressure drop across the valve ie: at an equivalent pressure equal to the maximum outlet setting of the valve. For a valve with a 10 barg inlet pressure, the maximum outlet setting is 9 barg.

The required flow is 3500 kg/h by 0.48 and it can be seen that the DN 80 (3") valve will pass a maximum flow of 3771 kg/h.

#### Example 2: Pressure maintaining duty (see Figure 2, page 19).

A steam boiler, normally working at a pressure of 10 barg, delivers steam to a process. It is determined that the boiler pressure must not fall below 8 barg. The process normally requires 3500 Kg/h of saturated steam.

Selecting a pressure maintaining valve is the same as selecting a surplus valve, therefore follow the same sizing procedure.

### Surplus/maintaining valve performance

A small pressure rise (accumulation) above the set point is required to fully open the valve, and a small pressure drop (regulation) below the set pressure is required to close the valve. Therefore, it is important to set the valve higher than the pressure at which the valve must be closed, to allow for this regulation.

In the examples above the valve must be set at a minimum of 8.15 barg. This allows for the regulation of 0.15 barg to ensure the valve is closed fully at 8 barg. The valve will be open fully by 8.35 barg (i.e. 0.2 barg accumulation above the set point of 8.15 barg).

### Spring selection

If possible, it is advisable to select a spring which has at least 10% adjustment above the required set pressure. As can be seen from the chart, the springs have overlapping ranges and therefore, where possible, the spring with the lowest pressure range should be selected.

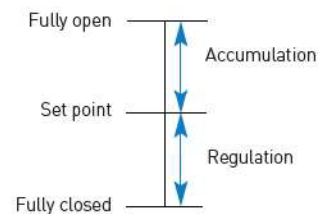
In the examples a spring for a pressure of 8.15 barg (ideally plus 10%, say 9 barg) is required. The white, green and red springs can handle this pressure and the white spring should be selected as it has the lower range.

### Valve selection

Referring to the details on page 21, it can be seen that models 2044 and 2045 are suitable for the given conditions.

### Diaphragms

For pressures above 10.3 barg (150 psig) two diaphragms must be fitted. Below this pressure only one diaphragm is fitted.



### PRESSURE

Closing pressure		Accumulation		Regulation	
Barg	(Psig)	Barg	(Psig)	Barg	(Psig)
0.35 - 3.5	(5 - 50)	0.10	(1.5)	0.04	(0.5)
3.5 - 7.0	(50 - 100)	0.10	(1.5)	0.10	(1.5)
7.0 - 10.3	(100 - 150)	0.20	(3.0)	0.15	(2.0)
10.3 - 20.7	(150 - 300)	0.50	(7.0)	0.70	(10.0)

### SPRING PRESSURE RANGE

Barg	(Psig)	Spring color code
0.35 - 3.5	(5 - 50)	Yellow
0.7 - 7.0	(10 - 100)	Black
2.8 - 10.3	(40 - 150)	White
3.5 - 14.0	(50 - 200)	Green
7.0 - 20.7	(100 - 300)	Red

## KUNKLE BAILEY G4 PILOT OPERATED PRESSURE REDUCING VALVES SURPLUS/MAINTAINING VALVES

### TECHNICAL SPECIFICATION - G4 SURPLUS/MAINTAINING VALVES

Figure No.	2042	2043	2044	2045	
Size	DN 15 - 50 (½ - 2ins)	DN 15 - 50 (½ - 2ins)	DN 65 - 100 (2½ - 4ins)	DN 65 - 100 (2½ - 4ins)	
Connections	Screwed	Flanged	Flanged	Flanged	
Material	Bronze	Bronze	Carbon steel	Carbon steel	
Max. inlet pressure	20.7 Barg (300 Psig)	20.7 Barg (300 Psig)	20.7 barg (300 Psig)	20.7 Barg (300 Psig)	
Min. inlet pressure	0.7 Barg (10 Psig)	0.7 Barg (10 Psig)	1.03 barg (15 Psig)	1.03 Barg (15 Psig)	
<b>Temperature range</b>	<b>Min.</b>	<b>Max.</b>	<b>Max.</b>	<b>Max.</b>	<b>Max.</b>
Stainless steel seat	-20°C [-68°F]	260°C [500°F]	260°C [500°F]	220°C [430°F]	260°C [500°F]
Nitrile seat	-20°C[-68°F]	100°C [212°F]	100°C [212°F]	NA	NA
FKM seat	-18°C[-64°F]	150°C [302°F]	150°C [302°F]	NA	NA
PTFE seat	-20°C[-68°F]	170°C [338°F]	170°C [338°F]	170°C [338°F]	170°C [338°F]