GENERAL NOTES

The size of a reducing valve should be based on the known maximum steam consumption. It is a common mistake to use a valve too large for the duty, with the result that the valve component will hover near the seating surface causing considerable wear. If a valve too small for the duty is selected, there will be a fall off in the delivery pressure at full flow. This leaflet will help you to determine the correct size of valve, but our Technical Department is always ready to give any assistance required.

When using saturated steam for general purposes, the pipe line velocity should be approximately 100/120 feet per second, and compressed air 25/30 feet per second. It will be seen, therefore, that it is not good enough merely to select a 25mm reducing valve because the pipe line size happens to be 25mm. As the volume of compressed gases increases due to pressure reduction, it will often be necessary to use larger bore piping on the outlet side of the reducing valve, in order to maintain the above stated velocities in both upstream and downstream pipe work.

INSTALLATION RECOMMENDATIONS

IMI Bailey Birkett '470' reducing valves can be installed as shown in the drawing or upside down; this has no effect on their operation. It should be noted, however, that it is essential that the spring axis be vertical.

It is recommended that each reducing valve should be accompanied by a stop valve and 'Y' type strainer on the upstream side, a pressure gauge and safety valve on the downstream side. We strongly advise that when the valve is being fitted in the pipe line, great care should be taken to see that jointing compound, and other jointing materials are used sparingly, and thoroughly cleaned out from the pipe bore before installing the reducing valve.

MAINTENANCE

Close the stop valve.

To inspect the seating surfaces and the strainer, remove cap (5). This exposes the seating surfaces, valve spring (6) and strainer element (7). It is unnecessary to make any adjustment to the main spring tension to carry out this inspection. The strainer element should be cleaned, also the seat (3) and the valve (4). If necessary these two components should be lapped together (after removing main spring compression), with a little fine lapping compound, which must be thoroughly cleaned away before reassembly.

To inspect or replace the diaphragm (10), remove compression from the main spring (13) by means of locknut (16) and adjusting screw (15), remove flange bolts and the cover (2). The diaphragm (10) is now exposed. If the diaphragm is in any way damaged it is recommended that a replacement should be obtained from IMI Bailey Birkett Ltd. Should the diaphragm gasket (11) need replacing 1/32" thick jointing material should be used, thicker material will not do. When reassembling care should be taken to tighten up the cover bolts uniformly. This operation should only be carried out by experienced and approved personnel.

POSSIBLE FAULTS

If under low flow or shut off conditions the downstream pressure creeps, or increases, the seating surfaces of seat (3) and valve (4) should be inspected to see that they are in good condition, and that no **foreign matter** is trapped between the two components. Carefully clean, relap if necessary and replace.

Should the downstream pressure decrease abnormally at high rates of flow, the strainer element (7) should be inspected and cleaned and a check made to see that the valve (4) is free to move in the guide of the seat (3).

Should the medium being handled leak through the bleed hole in the cover (2), the diaphragm (10) should be inspected for rupture.

ORDERING

When ordering please state:

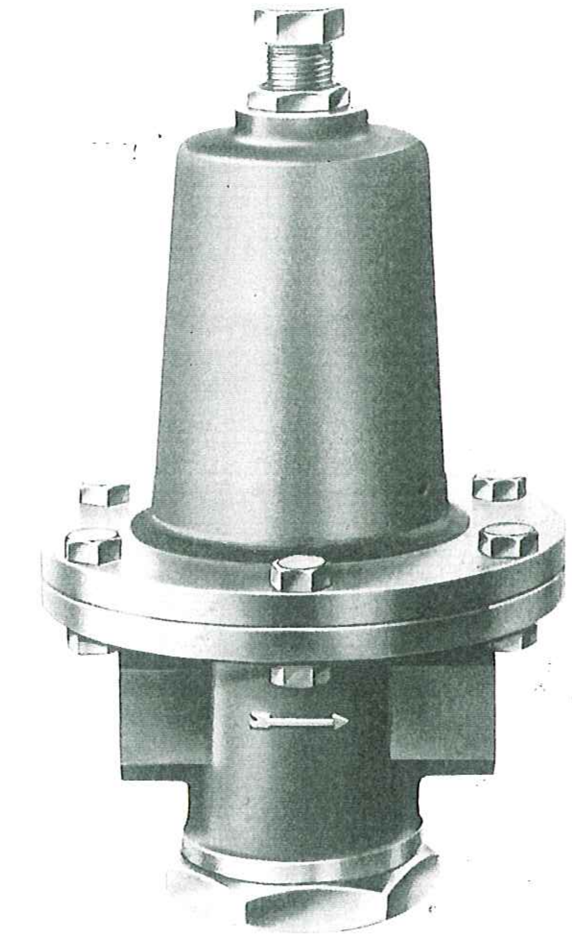
1. Whether for steam, air, gas or liquid.
2. Total temperature.
3. Maximum flow rate.
4. Inlet (upstream) pressure and reduced (downsteam) pressure required.
5. Screwing required.

IMI Bailey Birkett Ltd

Head Office: Sharp Street, Worsley,
Manchester M28 5NA, England. Tel: 061-790 7741
Telex: 669029 BAILEY G. Fax No. 061 799 4335

IMI
A subsidiary of IMI plc

Type 470 Pressure Reducing Valve



DESIGN

The 470 direct acting pressure reducing valve is designed to automatically maintain a reduced pressure on the downstream side of the valve. A simple and reliable design has been adopted to allow for ease of maintenance.

APPLICATIONS

The 470 pressure reducing valve is specifically designed for use on pipelines using compressed air, water, steam or other gases or liquids which are compatible with the valve materials.

FEATURES AND BENEFITS

- Spherical valve, which is practically self cleaning.
- Tight closure when there is no demand.
- Renewable seats in gunmetal or stainless steel.
- Large integral strainer.
- Easy maintenance.

TECHNICAL DATA

Valve Sizes:	15mm to 50mm		
Maximum Pressure:	Inlet (Upstream):	Steam	17.2 bar
		Air & Water	21 bar
	Outlet (Downstream)	15mm, 20mm	10.3 bar
		larger sizes	8.5 bar
Maximum Temperature:	450°F (230°C)		
Connections:	Standard screwed B.S.P. parallel female. A.P.I./N.P.T. & B.S.P. Taper can be supplied on request.		

INSTALLATION

The 470 pressure reducing valve can be installed either upright or inverted. This has no effect on its operation however it is essential that the spring axis be vertical.

We recommend that each reducing valve should be accompanied by a stop valve and 'Y' type strainer on the upstream side and a pressure guage and safety valve on the downstream side.

As the volume of compressed gases and steam increases due to pressure reduction, it is often necessary to use larger bore pipework on the outlet side of the reducing valve.

CAPACITY

All capacities listed in tables A to C assume a pressure drop of 10% of nominal downstream pressure from "dead end" condition.

TABLE A
SATURATED STEAM CAPACITY IN KILOGRAMMES PER HOUR.

INLET PRESSURE BAR G	SATURATED STEAM CAPACITY kg/h. 15mm VALVE	20mm VALVE	25mm VALVE	32mm VALVE	40mm VALVE	50mm VALVE
0.7	7.3	18.8	44.4	58.1	86.9	86.9
1	9.4	24.1	56.8	75.1	126.0	126.0
2	15.5	40.0	92.6	122.6	200.1	200.1
3	21.3	58.0	121.9	166.9	251.5	251.5
4	26.1	67.4	153.2	204.3	303.9	303.9
5	30.9	79.5	183.8	243.0	366.8	366.8
7	41.0	105.9	244.1	322.3	483.3	483.5
9	51.0	132.3	305.2	403.9	543.3	543.3
10	56.4	145.5	355.0	440.8	595.0	595.0
12	67.8	176.3	379.8	483.8	669.2	669.2
14	76.1	193.6	424.0	525.4	728.2	728.2
17.2	81.6	222.2	471.7	555.6	784.6	784.6

TABLE B
AIR CAPACITY IN NORMAL CUBIC METRES PER HOUR.

INLET PRESSURE BAR G	AIR CAPACITY IN nm³/h. 15mm VALVE	20mm VALVE	25mm VALVE	32mm VALVE	40mm VALVE	50mm VALVE
0.7	10.3	25.7	59.9	77.0	114.6	114.6
1	12.5	31.8	75.2	100.3	167.1	167.1
2	20.6	54.3	123.5	162.8	267.6	267.6
3	28.9	77.8	162.8	222.5	334.6	334.6
4	34.4	89.8	204.4	271.3	405.0	405.0
5	41.3	105.8	247.9	323.9	489.2	489.2
7	55.1	141.2	327.2	430.6	645.8	645.8
9	67.1	176.7	406.4	538.9	724.4	724.4
10	75.8	194.5	445.1	588.5	791.2	791.2
12	89.6	236.8	507.3	642.6	892.9	892.9
14	101.7	258.6	568.8	699.8	965.3	965.3
17.2	110.3	296.8	627.6	741.2	1048.2	1048.2
20.6	118.5	313.2	660.3	761.8	1083.5	1083.5

TABLE C
WATER CAPACITY IN LITRES PER MINUTE.

PRESSURE DIFFERENCE BAR G	WATER CAPACITY IN l/m. 15mm VALVE	20mm VALVE	25mm VALVE	32mm VALVE	40mm VALVE	50mm VALVE
0.7	8.3	19.3	47.2	60.5	81.6	81.6
1.4	9.2	21.1	50.4	65.1	87.1	87.1
2.1	9.6	22.9	53.6	69.7	94.0	94.0
2.8	10.5	25.2	56.4	73.8	100.4	100.4
3.5	11.5	27.5	59.1	77.9	106.4	106.4
4.1	12.2	29.0	61.6	81.5	111.4	111.4
4.8	12.7	30.9	64.4	85.8	117.5	117.5
5.5	13.2	32.7	66.8	89.5	122.2	122.2
6.2	13.6	34.6	69.1	92.8	126.4	126.4
6.9	14.1	36.4	71.5	95.6	130.6	130.6
8.6	15.0	37.7	75.0	100.0	136.3	136.3
10.4	16.0	38.8	77.6	104.9	141.4	141.4

70-90

SIZING AND SELECTION

The following is an example of how to size a valve for use with steam or compressed air.

The capacities listed in tables 'A' and 'B' allow the correct size of valve to be selected for any steam or air flow, **provided the downstream pressure (L.P.) is half or less than half the upstream pressure (H.P.),** i.e. 6.90 bar a (5.86 bar g) reducing to below 3.45 bar a (2.41 bar g).

When the L.P. is greater than half the H.P., i.e. 6.90 bar a (5.86 bar g) reducing to 5.52 bar a (4.48 bar g) the capacity of the valve is decreased, so before using the the tables the maximum flow rate required should be multiplied by a capacity factor W obtained from table 'D'.
To use table 'D':
Divide absolute L.P. by H.P.–the capacity factor W is then read from the table:

TABLE D

Pressure Ratio	0.96	0.94	0.92	0.91	0.89	0.88	0.86	0.83	0.79	0.73	0.58
Capacity Factor W	2.5	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0

EXAMPLE
Maximum flow rate 181.8 kg/h of steam.
Upstream pressure (H.P.) 6.90 bar a (5.86 bar g).
Downstream pressure (L.P.) 6.21 bar a (5.17 bar g).
Divide L.P. by H.P. to obtain pressure ratio:

$$\frac{6.21}{6.90} = 0.9$$

From table 'D' the resultant capacity factor is 1.65 (by interpolation). Now the maximum flow rate must be multiplied by the capacity factor:
181.8 x 1.65=300 kg/h.

By referring to table 'A' it will be seen that a 32mm size valve is required. The sizing of valves for use with compressed air is carried out in a similar way to the above, but using table 'B' therefore its a 25mm valve. The full capacity of a valve is at a maximum when the L.P. is half the H.P.: and does not increase if the L.P. is decreased.

The following is a brief description of how to size a valve for use on water.

The correct size of valve for any water flow rate can be obtained from table 'C' **if the difference between the upstream and downstream pressure is known.**

For example 28.5 metre head pressure difference at a flow rate of 70 litres per minute. Divide 28.5 by 10.2 to convert to bar g (2.79). Read across the 2.8 pressure difference line to select the correct size valve 32mm (73.8 l/m).

When used with water and other liquids the valves should be fitted in an inverted position, i.e. with the adjusting screw (15) pointing downwards.

SPRING RANGE AND SELECTION

Three springs per size of valve are required for regulating the downstream pressure, and their range and colour code is as follows.

0.6-3.4 Bar	Orange
2.0-6.2 Bar	Purple
3.4-10.3 Bar	(15mm, 20mm) Green
3.4-8.5 Bar	(25mm to 50mm) Green

The valve spring (6) is not changed for pressure alterations.

DIMENSIONS

VALVE SIZE	A	B	C	D	E	Weight kg
15	13	73	41	159	21	3.5
20	19	89	54	175	137	5
25	25	108	64	200	152	8
32	32	130	70	259	178	12
40	38	159	87	298	222	19
50	51	165	87	305	222	20

All sizes quoted are mm.

OPERATION

In the following description mention is only made of steam, although the valves are suitable for air, water or non-corrosive gases.

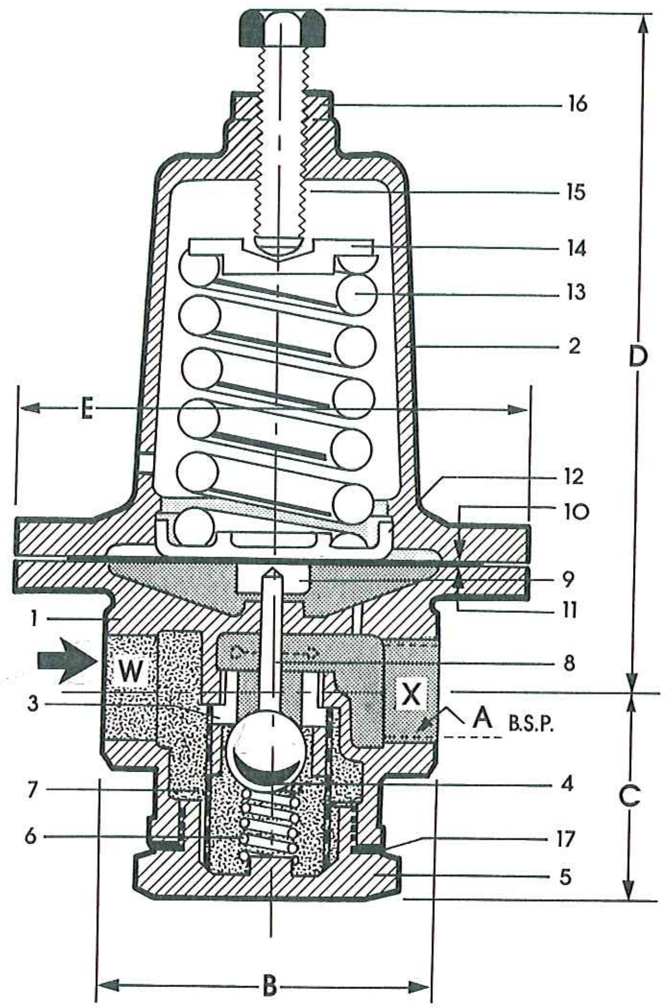
The steam enters at the inlet port W, passing through the strainer screen and seat, to the valve outlet X. Throttling with consequent reduction in pressure is effected by the distance of the valve (4) from the seat (3). The amount of opening is controlled by the diaphragm (10).

The diaphragm (10) moves in accordance with the forces exerted upon it by the main spring (13), and the downstream pressure acting on the area of the diaphragm opposing the main spring.

When the force exerted by the main spring (13) is greater than that exerted by the downstream pressure, the valve (4) is pushed off its seat by means of the push rod (8), thus allowing steam to flow from port W to port X. When the force exerted by the downstream pressure is equal or greater than that exerted by the main spring (13), then the diaphraghm (10) will return to a horizontal position, and the valve spring (6), assisted by the steam pressure, will force the valve (4) against the seat (3), thus cutting off the flow.

In actual operation, the valve (4) will find a steady open position in relation to the seat (3).

SPECIFICATION



Inlet (upstream) pressure

Reduced (downstream) pressure

No	PART	MATERIAL
1	BODY	GUNMETAL
2	COVER	CAST IRON
3	SEAT	GUNMETAL*
4	VALVE	STAINLESS STEEL
5	CAP	GUNMETAL
6	VALVE SPRING	STAINLESS STEEL
7	STRAINER	BRASS
8	PUSHER ROD	STAINLESS STEEL
9	PUSHER DISC	BRASS
10	DIAPHRAGM	STAINLESS STEEL
11	DIAPHRAGM GASKET	C.A.F.
12	GUIDE PLATE	GUNMETAL
13	MAIN SPRING	STEEL
14	SPRING PLATE	BRASS
15	ADJUSTING SCREW	BRASS
16	LOCK NUT	BRASS
17	CAP GASKET	COPPER/ASBESTOS

* Stainless steel seats available on request.