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Cryogenic Pressure Regulator

BESTOBELL AQUATRONIX
SINCE / DEPUIS 1953
BEP-Bestobell
www.bestobell.com

Pressure Build-Up Regulator and Economiser DN15 (½”)

The Parker Bestobell cryogenic pressure regulator (also known as Cryoreg) is used to regulate pressure of storage vessels, including static and transportable tanks. It features combined pressure build-up, regulator and economiser regulation functions within one valve.

This includes:
- Pressure build up regulator
- Economiser valve
- Thermal relief on two of the ports

Cryoreg is designed to fit downstream of the pressure build-up coil and therefore controls the gaseous flow during the pressure build up phase of its operation. The valve operation is such that it maintains a system pressure on a container or storage unit during transfer of gas from the trailer to a storage unit or vice versa. Pressure must be maintained to allow flow to occur at desired rates during transfer.

All valves are degreased for oxygen duty, assembled in clean room conditions and pressure tested prior to dispatch.

DN15 Cryogenic Pressure Regulator Valve

Maximum Working Pressure (MWP)

Subject to end connections

Up to 25 bar (360 psi) at -196°C to + 65°C

Features

- Combined pressure build-up regulator and economiser functions for simpler pipework and fewer joints
- High flow characteristics – for closer control of tank pressure
- Operates on liquid or gas – to suit every installation
- Single adjustment for both functions – for simpler tank setting
- High accuracy/low deadband allows higher tank pressure – reduced boil-off in pipelines
- Dual thermal relief valve action – for added system protection
- Strainer fitted as standard on inlet and outlet
- Ball check fitted to economiser outlet as standard

Technical

- Designed and engineered for use with Group 1 gases.
- DN15 – DN25 bull nose end connections available. Please contact us with your requirements.
- Designed and manufactured in accordance with ASTM B31.1, BS EN 1626 and BS ISO 21011
- Optional full material traceability backed by BS EN 10204 3.1/3.2 certification.

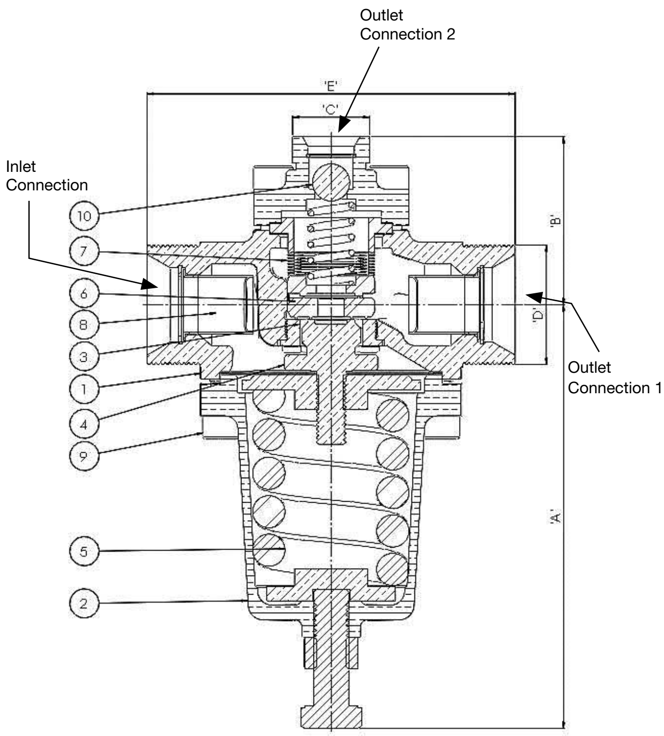
The Cryoreg is available with a choice of springs to give optimum control in all applications. Set pressure tolerance will normally be held on gas ± 3% and liquid side ± 5%.

DN15 Pressure Regulator with Bull Nose End Connector and Extended Stubs

DN15 Pressure Regulator with Bull Nose End Connector and Socket Ends

Materials

	Bronze
1. Body	Gunmetal BS EN1982 CC491K
2. Spring Housing	Gunmetal BS EN1982 CC491K
3. Seat	Bronze BS EN 12163 CW451K
4. Disc Assembly	Beryllium Copper/Phosphor Bronze
5. Spring	Stainless Steel Series 300
6. Seal	Virgin PTFE
7. Bellows Assembly	Stainless Steel Series 300
8. Strainer	Monel
9. Fasteners	Stainless Steel BS6105 A2/A4 Gr.70
10. Ball	Phosphor Bronze BS EN 12163 CW451K



Specifications

Pressure Ranges	Dimension					Weight (kg)
	A	B	C	D	E	
1.5 - 5 bar	134	57.5	¾ BSP	1¼ BSP	126	3.5
4 - 12 bar	134	57.5	¾ BSP	1¼ BSP	126	3.5
10 - 25 bar	134	57.5	¾ BSP	1¼ BSP	126	3.5

How to Order

The correct part number is easily derived from the following number sequence

CK	30	10	10	10	1	7000
Series	**Valve Size Diameter Dominal (DN)**	**Inlet Connection**	**Outlet Connection 1**	**Outlet Connection 2**	**Thread Size**	**Pressure Range**
CK Cryogenic Pressure Regulator	**30** DN15	**10** 1¼" BSP-PL c/w 60° Cone	**10** 1¼" BSP-PL c/w 60° Cone	**10** ¾" BSP-PL c/w 60° Cone	**1** 1¼"	**7000** 22-73 psi (1.5-5 bar)
		E3 ½" NPT Female	**E3** ½" NPT Female	**E2** 3/8" NPT Female		**7100** 58-174 psi (4-12 bar)
		E5 1" NPT Female	**E5** 1" NPT Female	**E3** ½" NPT Female		**7200** 145-363 psi (10-25 bar)
		S9 ½" NB x Butt Weld Schedule 10	**S9** ½" NB x Butt Weld Schedule 10	**E4** ¾" NPT Female		
		SN 1" NB x Butt Weld Schedule 10	**SN** 1" NB x Butt Weld Schedule 10	**S9** ½" NB x Butt Weld Schedule 10		

Please contact us for other options.

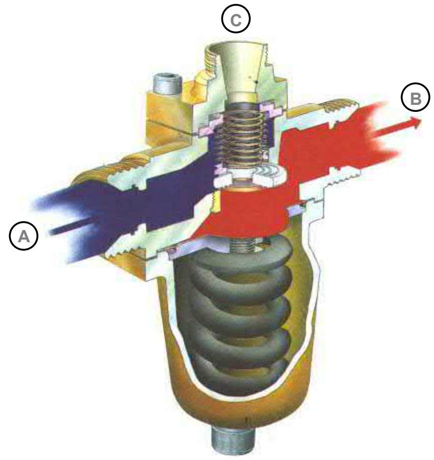
Cryogenic Pressure Regulator

Pressure Build-Up Regulator and Economiser

DN15 (½”)

Description of Operation

In the following explanation of the “Cryoreg” it is assumed to be fitted downstream of the pressure build-up coil and will therefore be controlling a gaseous flow during the pressure build-up phase of its operation. Operation is identical when fitted upstream of the PBU coil except that liquid will be passed during the pressure build-up phase.



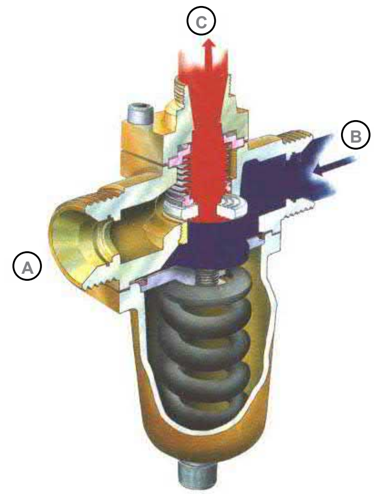
First function

First Function

Pressure build-up regulator

As the customer draws liquid or gas from the tank the pressure inside the tank will fall. To compensate for this, the “Cryoreg” will open to allow liquid to pass through the pressure build-up coil. Sufficient gas will thus be generated to bring the tank back to its normal working pressure.

In this phase of operation, flow is from port A to port B via the pressure build-up seat on the multi-function disc, the flow path being formed from the upward movement of the diaphragm assembly lifting the multi-function disc away from the main seat. This upward movement arises as a result of the force in the pressure setting spring overcoming the pressure force acting over the sensing diaphragm. As soon as the pressure in the tank has recovered, the diaphragm assembly is pushed back down again, closing off the flow path.



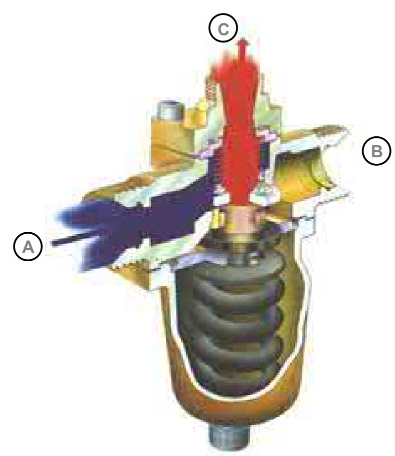
Second function

Second Function

Economiser Valve

When heat leaks into a cryogenic storage tank, liquid will revert to its gas phase leading to a pressure rise in the tank. Left unchecked, the process may continue until the relief valve lifts, wastefully venting gas to atmosphere. The function of an economiser valve is to divert excess gas into the customer’s supply line. Providing the customer is drawing gas, diverting the flow in this manner will prevent the relief valve lifting, avoiding waste and reducing the overall cost of storing the liquefied gas. To accomplish this; a flow path is formed within the “Cryoreg” to allow gas to pass from port B, up through the centre of the valve to exit via the economiser port C. The flow path is formed from the downward movement of the diaphragm (which senses tank pressure) having overcome over the force in the pressure setting spring. This occurs when the tank pressure exceeds the valve set pressure by more than 0.54 barg.

Note that this mechanism is also used to provide thermal relief into the economiser from outlet B.



Third function

Third function

Thermal relief

Inadvertent closure of the valve supplying the pressure build-up coil could lead to liquid being trapped between the coil and the “Cryoreg”. A thermal relief valve would normally be required to protect the coil-associated pipework from the high pressures generated by warming of the trapped liquid. This function, however, is built in to the “Cryoreg”, which will automatically vent the gas into either the economiser line (port C) or the gas supply line to the tank (port A). This function is accomplished by the differential pressure across the bellows assembly forcing it to compress, leaving the multi-function disc in place. This allows a flow path to form from port A, up through the centre of the bellows to exit from the economiser port. Remember that thermal relief is provided on port B by the economiser function described above giving protection under all foreseeable circumstances.

Note that if an isolating valve is fitted in the economiser line it will be necessary to fit a separate Thermal Relief Vvalve between the economiser port (C) and the isolation valve. This is not necessary if a Parker Bestobell Check Valve is installed.

$Q = kw \sqrt{\Delta p} / p$ where
Q = Actual flow in m3/h
Δp = Pressure drop in bar
p = Liquid density in kg/m3

Cryoreg Flow Data

Cryoreg on liquid side of vapouriser

Flow rates given are in kg/hr with 1 meter liquid head in vessel. For change in liquid head multiply flow by square root liquid head.

Maximum Flow through regulator to give pressure build kg/hr

Bar g		2	4	6	8	10	12	14	16	18	20	25	30	35	40
psi g		29	58	87	116	145	174	203	232	261	290	362.5	435	507.5	580
LIN	kg/hr	513	499	477	460	445	431	418	407	393	378	347	310	-	-
LOX	kg/hr	728	711	686	667	651	636	622	609	595	581	551	524	495	467
LAR	kg/hr	888	888	837	813	792	774	757	741	726	704	669	634	597	563
CO2	kg/hr	-	-	758	746	727	715	703	692	681	672	648	627	607	586

Maximum gas withdrawal from tank M3/hr

Bar g	psi g	LIN M3/hr	LOX M3/hr	LAR M3/hr	CO2 M3/hr
2	29	25313	48940	43151	-
4	58	14544	28991	25388	-
6	87	9434	18940	16929	24155
8	116	6708	13798	12359	17835
10	145	5014	10680	9494	13646
12	174	3861	8533	7549	11184
14	203	3040	6998	6141	9379
16	232	2436	5805	5080	8006
18	261	1938	4867	4267	6786
20	290	1537	3991	3552	5968
25	362.5	877	2664	2409	4285
30	435	507	1841	1669	3281
35	507.5	-	1262	1131	2522
40	580	-	853	750	1901

Liquid Density kg/M3				Vapour Density kg/M3			
LIN	LOX	LAR	CO2	LIN	LOX	LAR	CO2
780	1106	1350	-	12.45	11.4	15.4	-
758	1080	1319	-	20.24	18.2	24.8	-
725	1043	1272	1152	28.19	25.8	34.3	18
699	1014	1235	1134	36.35	33.2	43.9	23.5
676	989	1204	1105	44.8	40.4	53.8	29
655	966	1176	1086	53.7	47.9	63.9	34
636	946	1150	1068	63.1	55.4	74.3	39
618	925	1126	1051	72.8	63.2	85.1	44
597	904	1103	1035	83.3	71.2	96	50
574	883	1070	1021	94.3	81.6	107	55
527	838	1017	985	126.6	106.0	137	70
471	796	963	953	154.6	132.2	169	84
-	752	907	922		162.0	207	100
-	710	855	890		196.8	253	120

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