Mechanical Pressure Regulators

Pressure Regulators

Basic Terms and Technical Information

Capacity regulators
Regulator series ACP and CPHE are hot gas bypass regulators and serve the purpose of compensating excess compressor capacity.
Thus they prevent the generation of evaporator pressures below predetermined levels.
In case of hot gas injection into the suction line, a liquid injection valve in conjunction with a solenoid valve is required to desuperheat the excessively hot suction gas. The capacity should not be reduced below 60 % of maximum in this application to avoid oil return problems.
With hot gas injection at the evaporator inlet, no liquid injection valve is necessary. The injection must be such that the incremental gas volume is taken into account. No problems with oil return should be expected even when regulating 100% of capacity.

Condensing pressure regulators
The HP series regulator are designed to keep condensing pressures above certain levels in case of low ambient temperatures.
Thus they ensure sufficient pressure at the inlet port of the expansion valve and permit trouble free start-up of the refrigerant circuit independent of ambient temperatures.
This kind of refrigeration circuit design is “flooding the condenser” at low ambient conditions and therefore requires increased receiver capacity.

Evaporator pressure regulators
Series PRE regulators serve the purpose of maintaining evaporator pressure above certain predetermined levels.
The most important application is the use of several evaporators with different evaporating temperatures in conjunction with a common suction line.
The freezing of water in water chillers and air-conditioning systems can be savely prevented if evaporating temperatures are kept above 0°C, even when loads are greatly reduced.

Crankcase pressure regulators
Series PRC regulators serve the purpose of preventing excessively high suction pressures to protect compressor motors from overloading.
Excessively high suction pressures can occur at start-up of a refrigeration circuit in case of high loads and after defrost. Crankcase regulators are adjusted to the maximum allowed suction pressure rating of the compressors as given by the compressor manufacturers.

Selection Guide for Pressure Regulators

Selection Criteria	Series				
	ACP	CPHE	HP	PRE	PRC
Head Pressure Control			+		
Capacity Control	+	+			
Evaporator Pressure Regulator				+	
Crankcase Pressure Regulator					+
Receiver Pressure Regulator			+		
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Hot Gas Bypass Regulators Series ACP

Features

- High quality materials and processes for high reliability and long lifetime
- Internal equalization
- Compact size

ACP

Technical Data

Adjustable from:	0 to5 bar
Factory Setting:	2,7 bar
Max. operating Pressure PS:	31 bar
Operating Temperature Range TS:	–40°C to 120°C
Ambient Temperature Range:	-40 to 50°C
Transport Temperature Range:	-40 to 70°C

Capacity Data

Type	Order No.	Connection, Angle Solder/ODF inch	Nominal Bypass Capacity Q_n kW				
			R 134a	**R 22**	**R 407C**	**R 404A/507**	**R 410A**
ACP 1	**047 680**	$^1/_4$ x $^3/_8$"	0.21	0.35	0.41	0.30	0.5
ACP 3	**047 283**	$^1/_4$ x $^3/_8$"	0.50	0.77	0.89	0.68	1.2
ACP 5	**053 374**	$^3/_8$ x $^3/_8$"	1.18	1.83	2.12	1.59	2.8

Nominal capacities at +38°C condensing temperature, +4°C evaporating temperature (saturated temperatures / dew point) and 1 K liquid subcooling at the inlet of the expansion valve.

Hot Gas Bypass Regulators Series CPHE

Features

- High quality materials and processes for high reliability and long lifetime
- Superior partial load performance due to double seat orifice design (CPHE 3 to CPHE 6)
- Modular design for economical logistics and easy assembly and servicing
- External equalization

Specific connection sizes and flanges available on request. Selection see page 35.

CPHE

Technical Data

Adjustable from:	-0,4 to 5 bar
Factory Setting:	1,4 bar
Max. operating Pressure PS:	28 bar
Operating Temperature Range TS:	–40°C to 120°C
Ambient Temperature Range:	-40 to 50°C
Transport Temperature Range:	-40 to 70°C

Capacity Data CPHE

Type	Nominal Bypass Capacity Q_n kW					Orifice	Standard Flange Solder/ODF		Power Assembly
	R 134a	R 22	R 407C	R 404A/507	R 410A		mm	inch	
CPHE - 1	3.3	4.6	5.4	4.3	7.2	**X 22440-B5B**	**C 501 - 7 mm** 12 x 16	**C 501 - 7** $^1/_2$ x $^5/_8$	
CPHE - 2	7.1	10.0	11.6	9.2	15.6	**X 22440-B8B**	**A 576 mm** 16 x 22 (22 x 28 ODM)	**A 576** $^5/_8$ x $^7/_8$ ($^7/_8$ x 1-$^1/_8$ ODM)	**X7118 - 4**
CPHE - 3	10.8	15.5	17.9	13.8	24.1	**X 11873-B5B**	**10331** 22 x 22	**10331** $^7/_8$ x $^7/_8$ (1-$^1/_8$ x 1-$^1/_8$ ODM)	
CPHE - 3,5	15.4	21.7	25.1	19.5	33.7	**X 9117-B7B**	**9153** 22 x 22	**9153** $^7/_8$ x $^7/_8$ (1-$^1/_8$ x 1-$^1/_8$ ODM)	
CPHE - 4	25.6	36.3	42.1	32.5	56.4	**X 9117-B9B**			
CPHE - 5	33.0	46.6	54.0	41.7	72.5	**X 9166-B10B**			**X7428 - 2**
CPHE - 6	44.7	63.1	73.2	56.6	98.1	**X 9144-B13B**	**9149** 22 x 22	**9149** $^7/_8$ x $^7/_8$ (1-$^1/_8$ x 1-$^1/_8$ ODM)	

Nominal capacities at +38°C condensing temperature, +4°C evaporating temperature (saturated temperatures / dew point) and 1 K liquid subcooling at the inlet of the expansion valve.

Correction Tables for Series ACP and CPHE

For other evaporating temperatures the bypass capacity Q_{Byp} shall be multiplied with the correction factor K_{Byp}.

$$Q_{Byp} \times K_{Byp} = Q_n$$

Q_{Byp}: Required bypass capacity
K_{Byp}: Correction factor for evaporating temperature
Q_n: Nominal valve capacity

Refrigerant	Condensing Temperature °C	**Correction Factor K_{Byp}** Evaporating Temperature °C					
		+10	0	-10	-20	-30	-40
R 134 a	50	0.78	0.77	0.78	0.80		
	40	0.99	0.94	0.93	0.94		
	30	1.35	1.21	1.15	1.14		
R 22	50	0.80	0.77	0.77	0.77	0.79	0.82
	40	1.00	0.93	0.91	0.91	0.92	0.95
	30	1.34	1.19	1.12	1.10	1.09	1.12
R 407 C	50	0.83	0.82	0.83	0.86		
	40	0.99	0.95	0.95	0.97		
	30	1.26	1.17	1.13	1.13		
R 404A/ R 507	50	0.86	0.85	0.87	0.91	0.97	1.06
	40	0.99	0.95	0.94	0.96	1.00	1.05
	30	1.26	1.13	1.09	1.08	1.10	1.14
R 410A	30	1.31	1.16	1.11	1.07	1.08	1.10
	40	0.99	0.94	0.92	0.92	0.92	0.95
	50	0.84	0.81	0.81	0.82	0.94	0.87

Head Pressure Control Valves Series HP

Features

- Fast attainment of required minimal condensing pressure
- For larger capacities the HP can be applied in parallel
- Compact size; replacing a receiver pressure regulator (or a check valve) and a condensing pressure regulator respectively.

HP

Technical Data

Max. Operating Pressure PS:	28 bar
Max. Test Pressure PT:	31 bar
Operating Temperature Range TS:	–40°C to 150°C
Max. Ambient Temperature:	-40 to 50°C
Max. Transport Temperature:	-40 to 70°C
Max. Body Temperature:	150°C

Capacity Data

Type		Order-No.	Connection Solder/ODF	Nominal Capacity Q_n kW (Minimum Capacity Q_n kW)				
				R134a	**R22**	**R404A/R 507**	**R 407C**	**R 410A**
HP5 T4	**-165**	**803 531**	$^1/_2$"	16.3	17.6	11.6	16.9	17.1
	-225	**803 545**		(2.4)	(2.6)	(1.7)	(2.5)	(2.6)
HP8 T5	**-165**	**803 512**	$^5/_8$"					
	-225	**803 504**		43.9	47.5	30.6	45.6	46.0
HP8 T7	**- 95**	**803 518**		(8.8)	(9.5)	(6.1)	(9.1)	(9.2)
	-165	**803 519**	22 mm / $^7/_8$"					
	-225	**803 521**						
HP14 T11	**-165**	**803 515**	35 mm / 1-$^3/_8$"	109.9	118.9	76.7	114.0	115.2
	-225	**803 526**		(22.0)	(23.8)	(15.4)	(22.8)	(23.0)

Temperature Codes for Minimum Condensing Temperatures

	R 134a	**R 22**	**R 404A/R 507**	**R 407C**	**R 410A**
- 95	30°C				
-165	47°C	30°C	25°C	26°C	15°C
-225		43°C	35°C	37°C	25°C

Nominal capacities at +38°C condensing temperature, +4°C evaporating temperature (saturated temperatures / dew point) and 1 K liquid subcooling at the inlet of the expansion valve.

Valve selection for other operating conditions see page 50.

Correction Tables for Series HP

Valve selection for operating conditions other than +4°C/+38°C and 1 K liquid subcooling:

$$Q_n = Q_o \times K_t \times K_{\Delta p}$$

Q_n: Nominal valve capacity
K_t: Correction factor for evaporting and liquid temperature
$K_{\Delta p}$: Correction factor for pressure drop at valve
Q_o: Required cooling capacity

Liquid Temperature entering Valve °C	Correction Factor K_t Evaporating Temperature R 134a				R 22						R 404A					
	+10	0	-10	-20	+10	0	-10	-20	-30	-40	+10	0	-10	-20	-30	-40
+60	1,33	1,40	1,48	1,56	1,26	1,30	1,33	1,38	1,44	1,50	1,74	1,88	2,06	2,28	2,57	2,95
+55	1,23	1,29	1,36	1,43	1,19	1,22	1,25	1,29	1,34	1,39	1,46	1,55	1,68	1,83	2,01	2,25
+50	1,15	1,20	1,26	1,32	1,12	1,15	1,18	1,21	1,26	1,30	1,26	1,34	1,43	1,54	1,68	1,84
+45	1,08	1,12	1,17	1,22	1,06	1,08	1,11	1,14	1,18	1,23	1,12	1,18	1,26	1,34	1,45	1,57
+40	1,01	1,05	1,10	1,14	1,01	1,03	1,05	1,08	1,12	1,16	1,02	1,07	1,13	1,20	1,28	1,38
+35	0,96	0,99	1,03	1,07	0,96	0,98	1,00	1,03	1,06	1,10	0,93	0,97	1,02	1,08	1,15	1,23
+30	0,91	0,94	0,98	1,01	0,92	0,94	0,96	0,98	1,01	1,04	0,86	0,90	0,94	0,99	1,05	1,11
+25	0,86	0,89	0,92	0,95	0,88	0,89	0,91	0,94	0,96	0,99	0,80	0,83	0,87	0,92	0,97	1,02
+20	0,82	0,85	0,88	0,91	0,84	0,86	0,87	0,90	0,92	0,95	0,75	0,78	0,81	0,85	0,90	0,95
+15	0,78	0,81	0,84	0,86	0,81	0,82	0,84	0,86	0,88	0,91	0,71	0,73	0,76	0,80	0,84	0,88
+10		0,77	0,80	0,82		0,79	0,81	0,82	0,85	0,87		0,69	0,72	0,75	0,79	0,83
+5		0,74	0,76	0,78		0,76	0,78	0,79	0,81	0,83		0,66	0,68	0,71	0,74	0,78
0			0,73	0,75			0,75	0,76	0,78	0,80			0,65	0,68	0,71	0,74
-5			0,70	0,72			0,74	0,74	0,75	0,77			0,62	0,65	0,67	0,70
-10				0,69				0,71	0,73	0,74				0,62	0,64	0,67

Correction Factor $K_{\Delta p}$													
Δp (bar)	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,55	0,60	0,65	0,70
$K_{\Delta p}$	1,87	1,53	1,32	1,18	1,08	1,00	0,94	0,88	0,84	0,80	0,76	0,73	0,71

Liquid Temperature entering Valve °C	Correction Factor K_t Evaporating Temperature R 407C				R 507						R 410A					
	+10	0	-10	-20	+10	0	-10	-20	-30	-40	+10	0	-10	-20	-30	-40
+55	1,28	1,34	1,40	1,48	1,45	1,54	1,65	1,79	1,95	2,16						
+50	1,17	1,22	1,27	1,33	1,27	1,34	1,42	1,52	1,64	1,79	1,23	1,26	1,30	1,35	1,40	1,46
+45	1,08	1,12	1,17	1,22	1,13	1,19	1,25	1,33	1,43	1,54	1,12	1,15	1,18	1,22	1,26	1,31
+40	1,01	1,04	1,08	1,13	1,03	1,07	1,13	1,20	1,27	1,36	1,03	1,06	1,08	1,12	1,15	1,20
+35	0,94	0,98	1,01	1,05	0,94	0,98	1,03	1,09	1,15	1,22	0,96	0,98	1,00	1,03	1,06	1,10
+30	0,89	0,92	0,95	0,99	0,88	0,91	0,95	1,00	1,05	1,11	0,90	0,92	0,94	0,96	0,99	1,02
+25	0,84	0,87	0,90	0,93	0,82	0,85	0,88	0,92	0,97	1,02	0,85	0,86	0,88	0,90	0,93	0,96
+20	0,80	0,82	0,85	0,88	0,77	0,79	0,82	0,86	0,90	0,95	0,80	0,81	0,83	0,85	0,87	0,90
+15	0,76	0,78	0,81	0,84	0,72	0,75	0,77	0,81	0,84	0,88	0,76	0,77	0,79	0,81	0,83	0,85
+10		0,75	0,77	0,80		0,70	0,73	0,76	0,79	0,83		0,74	0,75	0,77	0,78	0,81
+5		0,72	0,74	0,76		0,67	0,69	0,71	0,74	0,78		0,70	0,71	0,73	0,75	0,77
0			0,71	0,73			0,65	0,68	0,70	0,73			0,68	0,70	0,71	0,73
-5			0,68	0,70			0,62	0,64	0,66	0,69			0,65	0,67	0,68	0,70
-10				0,67				0,61	0,63	0,65				0,64	0,65	0,67

Correction Factor $K_{\Delta p}$													
Δp (bar)	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,55	0,60	0,65	0,70
$K_{\Delta p}$	1,87	1,53	1,32	1,18	1,08	1,00	0,94	0,88	0,84	0,80	0,76	0,73	0,71

Evaporator and Crankcase Pressure Regulator Series PRE and PRC

Features

- Compact Design permits minimal space requirements
- Schraeder Valve on Inlet for ease of setting
- Direct operated Regulator
- Balanced Port Design provides accurate Pressure Control
- Copper tubes for easy soldering

Technical Data

Refrigerant		HFC, HCFC
Oil compatibility		Mineral, Alkyl Benzene and Polyol-Ester (POE) lubricants
Max. Operating Pressure PS:		25 bar
Max. Test pressure PT:		30 bar
Material, Housing		CW509L (EN12420)
Temperature:	Storage	-30°C to 80°C
	Medium	TS: -30°C to 80°C
	Ambient	-30°C to 80°C

Pressure change per turn:	
Valve Size 1	0,6 bar
Valve Size 2	0,4 bar
Pressure range:	0,5 to 6,9 bar
Factory setting:	2 bar
Weight:	
PRC/PRE-1..	0,6 kg
PRC/PRE-2..	1,3 kg

Evaporator Pressure Regulator Series PRE

Nominal Capacity

Type	Order-No.	Tube Connection ODF	Nominal Capacity Q_n kW			
			R 134a	**R 404A / R 507**	**R 407C**	**R 22**
PRE - 11A	800 380	16 mm - 5/8"	3,0	4,5	4,5	4,8
PRE - 11B	800 381	22 mm - 7/8"				
PRE - 21C	800 382	28 mm	7,4	11,1	11,1	11,9
PRE - 21D	800 383	1 -1/8"				

Correction Table

Refrigerant	Condensing Temperature °C	Evaporating Temperature °C				
		10	0	-10	-20	-30
R 404A / R 507	60	1,35	1,91	2,77	4,18	6,53
	50	1,05	1,46	2,07	3,05	4,62
	40	0,88	1,22	1,71	2,48	3,69
	30	0,77	1,06	1,48	2,12	3,13
R 407C	55	1,02	1,42	2,04		
	50	0,94	1,31	1,87		
	40	0,84	1,17	1,66		
	30	0,77	1,06	1,50		
R 134a	60	1,04	1,51	2,17		
	50	0,92	1,34	1,91		
	40	0,83	1,20	1,71		
	30	0,76	1,1	1,55		
R 22	60	1,02	1,37	1,87	2,67	3,91
	50	0,93	1,25	1,70	2,42	3,53
	40	0,86	1,15	1,57	2,22	3,23
	30	0,80	1,07	1,45	2,05	2,98

Crankcase Pressure Regulator Series PRC

Nominal Capacity

Type	Order-No.	Tube Connection ODF	Nominal Capacity Q_n kW			
			R 134a	**R 404A/R 507**	**R 407C**	**R 22**
PRC - 11A	800 384	16 mm - $^5/_8$"	3,0	4,5	4,5	4,8
PRC - 11B	800 385	22 mm - $^7/_8$"				
PRC - 21C	800 386	28 mm	7,4	11,1	11,1	11,9
PRC - 21D	800 387	1 -$^1/_8$"				
PRC - 21E	800 388	33 mm -1 -$^3/_8$"				

Correction Table

Refrigerant	Evaporating Temperature °C	Valve setting °C													
		Valve Size 1 PRC-1xx							Valve Size 2 PRC-2xx						
		-20	-15	-10	-5	0	5	10	-20	-15	-10	-5	0	5	10
R 22	-29	2,3	3,4	4,4	4,8	4,9			5,8	8,8	10,0	10,0	10,0		
	-21		2,4	4,1	5,4	5,8				6,5	12,1	12,1	12,1		
	-14			2,7	4,9	6,2					8,1	13,8	13,8		
	-8				3,5	5,3						9,0	15,4		
	-3					3,1							9,9		
R 407 C	-6				3,1	4,8						7,9	13,9		
	-1					2,9							9,2		
R 134 a	-6					2,1	3,9	5,3					5,2	10,3	12,9
	1						2,4	4,7						6,1	12,2
	7							3,3							8,1
R 404A / R 507	-27	1,6	2,9	3,7	3,9				4,8	8,2	8,2	8,2			
	-20		1,9	3,5	4,5					5,7	9,8	9,8			
	-14			2,2	4,5						6,8	11,6			
	-10				3,1							8,1			