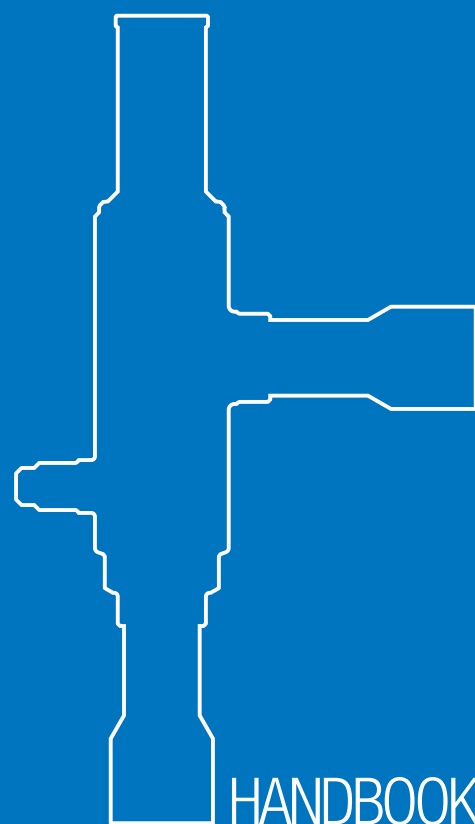
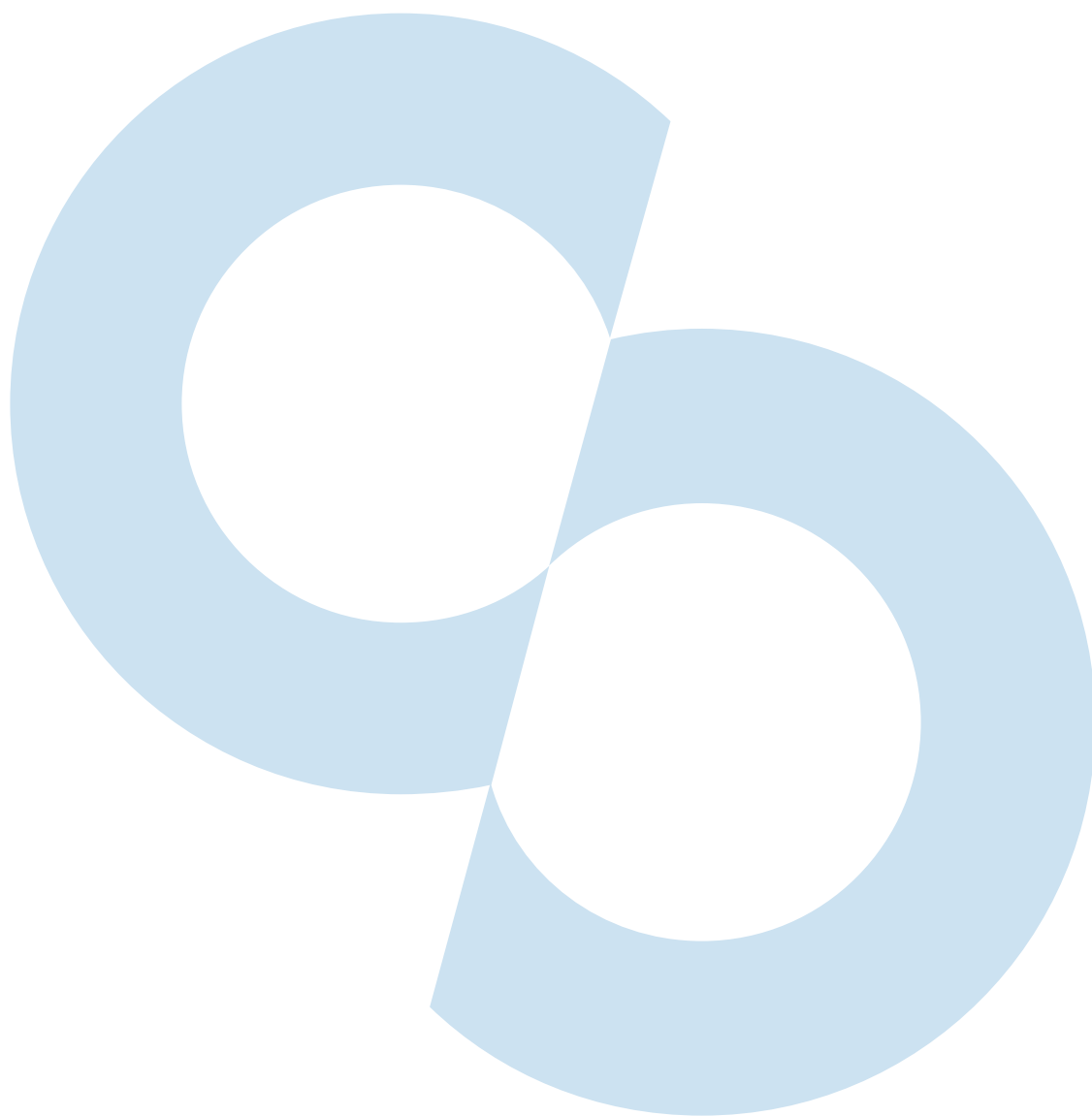




HANDBOOK

REGULATING VALVES FOR REFRIGERATING SYSTEMS



INDEX

Capacity Regulators	07
Crankcase Pressure Regulators	14
Evaporating Pressure Regulators	25
Condensing Pressure Regulators	32
Liquid Receiver Pressure Regulators	47
Water Regulating Valves	49

FROM QUALITY OUR NATURAL DEVELOPMENT

Achieved the goal of fifty years working in the industry of Refrigeration and Air Conditioning, Castel Quality Range of Products is well known and highly appreciated all over the world. Quality is the main issue of our Company and it has a special priority, in every step, all along the production cycle. UNI EN ISO 9001:2008, issued by ICIM, certifies the Quality System of the Factory. Moreover Castel Products count a number of certifications in conformity with EEC Directives and with European and American Quality Approval. We produce on high tech machinery and updated automatic production lines, operating in conformity with the safety and environment standards currently enforced. Castel offers to the Refrigeration and Air Conditioning Market and to the Manufacturers fully tested products suitable with HCFC and HFC Refrigerants currently used in the Refrigeration & Air Conditioning Industry.



External leakage

All the products illustrated in this Handbook are submitted, one by one, to tightness tests besides to functional tests. Allowable external leakage, measurable during the test, agrees to the definition given in Par. 9.4 of EN 12284: 2003 Standard:

“During the test, no bubbles shall form over a period of at least one minute when the specimen is immersed in water with low surface tension, ...”

Pressure containment

All the products illustrated in this Handbook, if submitted to hydrostatic test, guarantee a pressure strength at least equal to 1,43 x PS in compliance with the Directive 97/23/EC.

All the products illustrated in this Handbook, if submitted to burst test, guarantee a pressure strength at least equal to 3 x PS according to EN 378-2 : 2008 Standard. A great number of products illustrated in this Handbook can guarantee an higher pressure strength, equal to 5 x PS according the UL Standard 207: 2009

Weights

The weights of the items listed in this Handbook include packaging.

Guarantee

All Castel products are covered by a 12 – months warranty. This warranty covers all products or parts thereof that turn out to be defective within the warranty period. In this case, at his own expenses, the customer shall return the defective item with a detailed description of the claimed defects. The warranty doesn't apply if the defect of Castel products are due to mistakes either by customer or by third parties such wrong installations, use contrary to Castel indications, tampering. In case of defects of its own products, Castel will only replace the defective goods and will not refund damages of any kind.

The technical data shown on this catalogue are indicative. Castel reserves the right to modify the same at any time without any previous notice.

The products listed in this handbook are protected according to the law.

CAPACITY REGULATORS SERIES 3310

Approved by Underwriters Laboratories Inc.



APPLICATIONS

The capacity regulators series 3310, shown in this chapter, are classified "Pressure accessories" in the sense of the Pressure Equipment Directive 94/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.

They are designed to operate on refrigerating systems, which use the following refrigerant fluids: R22 , R134a , R404A , R407C , R507 proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

On air conditioning systems it is desirable to limit the minimum evaporating pressure during periods of low load to prevent coil icing. On refrigerating systems it is desirable to limit the minimum evaporating pressure during periods of low load to avoid operating the compressor at a lower suction pressure than it was designed to operate. Capacity regulators series 3310 are a practical and economical solution to these problems while they permit to bypass a portion of the hot discharge gas directly to the low side maintaining a desired minimum evaporating pressure regardless of the decrease in evaporator load.

OPERATION

Capacity regulators series 3310 adjust the flow of hot gas according to changes of suction pressure, downstream the regulator. When the evaporating pressure is above the valve setting, the shutter remain closed. As the suction pressure drops below the valve setting, the shutter begins to open and the amount of its opening is proportional to the change of suction pressure. As the suction pressure continues to drop, the shutter continues to open farther until the limit of the stroke is reached and the valve is completely open. On normal applications there is not sufficient pressure change available to open these valves to the limit of their stroke; so the shutter works inside its stroke. Regulators series 3310 regulate only in dependence on the outlet pressure change, pressure change on the inlet side do not affect the degree of opening since the valve is equipped with an equalization bellow with an effective area equal to valve seat. The factory pressure setting of these valves is 2 bar, this means that until the suction pressure is above the 2 bar the valve remains closed, when the suction pressure drops below the 2 bar the valve begin to open. According to the characteristics of the refrigerating system it can be necessary to change the valve setting adjusting the setting screw on the top of the body; the pressure setting range is from 0,2 bar up to 6 bar.

CONSTRUCTION

The main parts of capacity regulators series 3310 are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Austenitic stainless steel AISI 321 for bellow
- Brass bar EN 12164 – CW 614N for shutter
- Brass bar EN 12164 – CW 614N for setting screw
- Spring steel DIN 17223/84 Class C/D for setting spring
- Chloroprene rubber (CR) for outlet seal gaskets

INSTALLATION

Capacity regulators series 3310 are applied in a branch line off the discharge line. The bypassed vapor can enter in the low side at one of the following locations:

- to evaporator inlet (with or without distributor)
- to suction line

On this second application to avoid the danger of overheating the compressor it is required to install a liquid injection valve (desuperheating TEV) that supplies enough liquid refrigerant in the suction line , to cool the bypassed hot gas.

SELECTION

A correct selection of capacity regulators series 3310 is possible if complete system information are available. The selection involves these basic items:

1. Refrigerant

2. Minimum allowable evaporating temperature at reduced load condition. This data depends on the system, for air conditioning system this value must be set to prevent coil icing, in refrigerating system this value must be set to avoid suction temperature lower than minimum values recommended by compressors manufacturers.

3. Minimum required evaporating temperature. The temperature when the valve begins to open.

4. Compressor capacity at minimum allowable evaporating temperature. Consult compressor manufacturer for this value.

5. Minimum evaporator load at which the system is to be operated. It depends on the type of system; it can be a percentage of maximum load (15-25%) or near to zero.

6. Liquid temperature when minimum load exist.

The 3310 capacity regulator must be selected to handle the difference between the compressor capacity (item 4) and the minimum evaporator load (item 5). The refrigerating capacities indicated on tables 3A, 4A, 5A, 6A are the regulator capacities, not the system capacities on which the valves installed, these capacities are based on a reference liquid temperature of 36,7 °C. The data listed on these tables are based on:

- used refrigerant (item 1)
- minimum allowable evaporating temperature at reduced load condition (item 2)
- allowed evaporating temperature (pressure) change downstream the regulator, this is the temperature (pressure) change necessary to move the valve shutter from the “begin to open” position up to “rating capacity” position (temperature on item 3 – temperature on item 2)

With liquid temperature different from 36,7 °C the required capacity of regulator shall be:

$$(Q_{\text{compr}} - Q_{\text{evap}}) \times K_{T \text{ liquid}} = Q_{\text{valve}}$$

with:

Q_{compr} = Compressor capacity at minimum allowable evaporating temperature [kW]

Q_{evap} = Minimum evaporator load at which the system is to be operated. [kW]

$K_{T \text{ liquid}}$ = Correction factor for $T_{\text{liquid}} \neq 36,7 \text{ }^{\circ}\text{C}$

Q_{valve} = Refrigerating capacity requested to regulator [kW]

EXAMPLE

Refrigerant: R404A
Minimum required evaporating temperature: -15 [°C]
Minimum allowable evaporating temperature at reduced load condition: -19 [°C]
Compressor capacity at minimum allowable evaporating temperature: 10 [kW]
Minimum evaporator load at which the system is to be operated: 5 [kW]
Liquid temperature when minimum load exist: 35 [°C]
Solder connections

1. Fix, by means of the table 5B, the correction factor for liquid temperature $T_{\text{Liquid}} = 35 \text{ }^{\circ}\text{C}$.

$$K_{T \text{ liquid}} = 1,03$$

2. Calculate the capacity required to the regulator.

$$Q_{\text{valve}} = (Q_{\text{compr}} - Q_{\text{evap}}) \times K_{T \text{ liquid}} = (10 - 5) \times 1,03 = 5,15 \text{ kW}$$

3. Calculate the evaporating temperature change.

$$T_{\text{ev}} - T_{\text{ev min}} = -15 - (-19) = 4 \text{ }^{\circ}\text{C}$$

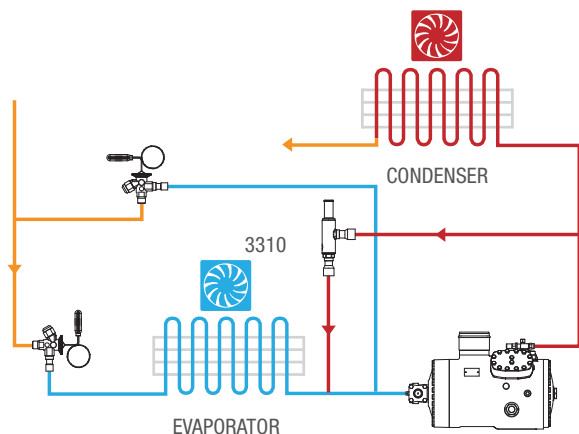
4. With the following parameters:

- Minimum capacity = 5,15 KW
- Evaporating temperature change = 4 °C
- Minimum allowable evaporating temperature = - 19 °C

Choose the proper valve in table 5A.

The select valves are:

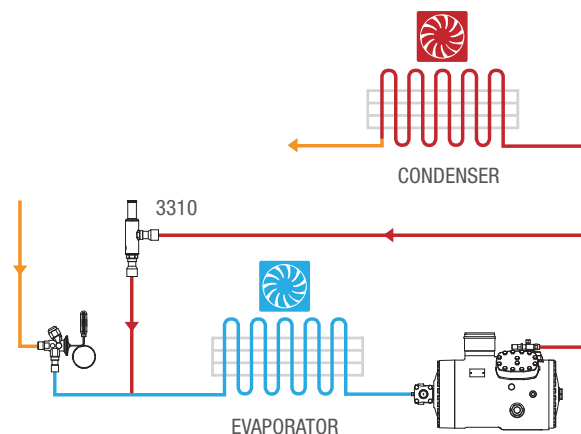
- 3310/M12 with solder connections diameter 12 mm
- 3310/4 with solder connections diameter 1/2"



Installation (1)

The regulator is installed as a bypass between compressor discharge and suction line.
The regulator opens as evaporation pressure decreases.

Note: there must be a liquid injection valve for desuperheating suction line gas.



Installation (2)

The regulator may also be installed as a bypass between compressor discharge and the expansion valve outlet.

TABLE 1: General characteristics of capacity regulators 3310

Catalogue Number	Connections			Kv Factor [m³/h]	Regulating range [bar]		Factory setting [bar]	TS [°C]		PS [bar]	Risk Category according to PED
	SAE Flare	ODS			min.	max.		min.	max.		
		Ø [in.]	Ø [mm]								
3310/4	1/2"	—	—	0,70	0,2	6	2	-40	+110	28	Art. 3.3
3310/M12S	—	—	12								
3310/4S	—	1/2"	—								
3310/5	5/8"	—	—	1,26							
3310/5S	—	5/8"	16								
3310/7S	—	7/8"	22								

TABLE 2: Dimensions and Weights of regulators 3310

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H ₁	H ₂	L ₁	L ₂	D	
3310/4	159	76,5	—	48	—	32	520
3310/M12S	183	100,5	—	64	—		490
3310/4S	183	100,5	—	64	—		490
3310/5	163	80,5	—	52	—		550
3310/5S	183	100,5	—	64	—		480
3310/7S	194	112	—	75,5	—		560

TABLE 3A: Refrigerant Flow Capacity of capacity regulators 3310 [kW]

Catalogue Number	Evaporator temperature change [°C] (1)	Minimum allowable evaporator temperature at reduced load conditions [°C]									
		10	4,4	0	-5	-10	-15	-20	-25	-30	-35
3310/4 3310/M12S 3310/4S	1	1,70	1,70	1,67	1,63	1,60	1,57	1,53	1,50	1,46	1,43
	2	3,30	3,30	3,23	3,17	3,10	3,04	2,97	2,91	2,84	2,78
	3	4,41	4,41	4,32	4,24	4,15	4,06	3,97	3,89	3,80	3,71
	4	4,95	4,95	4,85	4,75	4,66	4,56	4,46	4,36	4,27	4,17
	5	5,21	5,21	5,10	5,00	4,90	4,79	4,69	4,59	4,49	4,38
	6	6,08	6,08	5,96	5,84	5,72	5,60	5,48	5,36	5,24	5,12
3310/5 3310/5S	1	2,49	2,49	2,44	2,38	2,33	2,27	2,22	2,16	2,11	2,05
	2	4,27	4,27	4,17	4,07	3,97	3,87	3,77	3,67	3,56	3,46
	3	5,92	5,92	5,80	5,68	5,56	5,43	5,31	5,19	5,07	4,95
	4	8,48	8,48	8,31	8,13	7,96	7,79	7,61	7,44	7,27	7,09
	5	10,05	10,05	9,84	9,64	9,43	9,23	9,02	8,81	8,61	8,40
	6	11,43	11,43	11,19	10,96	10,72	10,49	10,25	10,02	9,79	9,55
3310/7S	1	2,46	2,46	2,42	2,39	2,35	2,31	2,28	2,24	2,20	2,17
	2	4,39	4,39	4,32	4,26	4,19	4,13	4,06	4,00	3,93	3,87
	3	5,62	5,62	5,54	5,45	5,37	5,29	5,20	5,12	5,03	4,95
	4	8,32	8,32	8,20	8,07	7,95	7,82	7,70	7,58	7,45	7,33
	5	11,02	11,02	10,86	10,69	10,53	10,36	10,20	10,04	9,87	9,71
	6	14,60	14,60	14,38	14,16	13,94	13,73	13,51	13,29	13,08	12,86

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

(1) temperature change required to move the valve shutter from "start to open" position to rated opening position

TABLE 3B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,28	1,23	1,18	1,13	1,08	1,03	0,97	0,92	0,86

TABLE 4A: Refrigerant Flow Capacity of capacity regulators 3310 [kW]

Catalogue Number	Evaporator temperature change [°C] (1)	Minimum allowable evaporator temperature at reduced load conditions [°C]									
		6	0	-5	-10	-15	-20	-25	-30	-35	-40
3310/4 3310/M12S 3310/4S	1	2,25	2,25	2,21	2,16	2,12	2,07	2,03	1,98	1,94	1,89
	2	4,65	4,65	4,56	4,47	4,37	4,28	4,19	4,10	4,01	3,92
	3	6,21	6,21	6,09	5,96	5,84	5,72	5,60	5,47	5,35	5,23
	4	6,90	6,90	6,76	6,63	6,49	6,35	6,22	6,08	5,95	5,81
	5	7,25	7,25	7,10	6,96	6,82	6,67	6,53	6,39	6,24	6,10
	6	8,45	8,45	8,29	8,12	7,95	7,78	7,62	7,45	7,28	7,12
3310/5 3310/5S	1	3,65	3,65	3,57	3,50	3,43	3,36	3,29	3,22	3,15	3,08
	2	6,05	6,05	5,94	5,84	5,73	5,62	5,52	5,41	5,30	5,19
	3	8,22	8,22	8,05	7,88	7,71	7,55	7,38	7,21	7,04	6,87
	4	11,81	11,81	11,57	11,33	11,08	10,84	10,60	10,36	10,12	9,87
	5	14,01	14,01	13,72	13,43	13,15	12,86	12,57	12,28	12,00	11,71
	6	15,94	15,94	15,61	15,28	14,96	14,63	14,30	13,98	13,65	13,32
3310/7S	1	3,44	3,44	3,38	3,33	3,28	3,23	3,18	3,13	3,08	3,03
	2	6,11	6,11	6,01	5,92	5,83	5,74	5,65	5,56	5,47	5,38
	3	7,83	7,83	7,71	7,60	7,48	7,36	7,25	7,13	7,01	6,90
	4	13,66	13,66	13,46	13,26	13,05	12,85	12,65	12,44	12,24	12,04
	5	16,43	16,43	16,19	15,95	15,70	15,46	15,21	14,97	14,72	14,48
	6	21,57	21,57	21,24	20,92	20,60	20,28	19,96	19,64	19,32	19,00

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

(1) temperature change required to move the valve shutter from "start to open" position to rated opening position

TABLE 4B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,23	1,19	1,16	1,11	1,06	1,01	0,98	0,94	0,9

TABLE 5A: Refrigerant Flow Capacity of capacity regulators 3310 [kW]

Catalogue Number	Evaporator temperature change [°C] (1)	Minimum allowable evaporator temperature at reduced load conditions [°C]									
		4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3310/4 3310/M12S 3310/4S	1	2,46	2,38	2,34	2,30	2,26	2,21	2,17	2,13	2,09	2,05
	2	4,75	4,59	4,51	4,43	4,35	4,27	4,19	4,11	4,03	3,95
	3	6,49	6,27	6,16	6,05	5,94	5,83	5,72	5,61	5,50	5,39
	4	7,08	6,84	6,72	6,60	6,48	6,36	6,24	6,12	6,00	5,88
	5	7,42	7,17	7,04	6,91	6,79	6,66	6,54	6,41	6,29	6,16
	6	8,63	8,34	8,19	8,05	7,90	7,75	7,61	7,46	7,32	7,17
3310/5 3310/5S	1	3,67	3,52	3,44	3,37	3,29	3,22	3,15	3,07	3,00	2,92
	2	6,30	6,04	5,91	5,78	5,65	5,53	5,40	5,27	5,14	5,01
	3	8,72	8,36	8,19	8,01	7,83	7,65	7,48	7,30	7,12	6,94
	4	12,49	11,98	11,73	11,47	11,22	10,96	10,71	10,45	10,20	9,94
	5	14,80	14,19	13,89	13,59	13,29	12,99	12,69	12,38	12,08	11,78
	6	16,82	16,13	15,79	15,45	15,10	14,76	14,42	14,08	13,73	13,39
3310/7S	1	3,70	3,49	3,38	3,27	3,16	3,05	2,94	2,83	2,72	2,61
	2	6,59	6,21	6,01	5,82	5,62	5,43	5,24	5,04	4,85	4,65
	3	8,44	7,94	7,69	7,44	7,19	6,95	6,70	6,45	6,20	5,95
	4	14,98	14,10	13,66	13,22	12,77	12,33	11,89	11,45	11,01	10,57
	5	18,18	17,11	16,58	16,04	15,51	14,97	14,44	13,90	13,37	12,83
	6	24,07	22,66	21,95	21,24	20,53	19,83	19,12	18,41	17,70	16,99

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

(1) temperature change required to move the valve shutter from "start to open" position to rated opening position

TABLE 5B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,43	1,35	1,28	1,2	1,12	1,03	0,95	0,86	0,76

TABLE 6A: Refrigerant Flow Capacity of capacity regulators 3310 [kW]

Catalogue Number	Evaporator temperature change [°C] (1)	Minimum allowable evaporator temperature at reduced load conditions [°C]									
		8	4,4	0	-5	-10	-15	-20	-25	-30	-35
3310/4 3310/M12S 3310/4S	1	2,88	2,88	2,81	2,74	2,66	2,59	2,52	2,45	2,38	2,30
	2	5,58	5,58	5,44	5,30	5,16	5,02	4,88	4,74	4,60	4,46
	3	7,61	7,61	7,42	7,23	7,04	6,85	6,66	6,47	6,28	6,09
	4	8,53	8,53	8,31	8,10	7,89	7,67	7,46	7,25	7,04	6,82
	5	8,96	8,96	8,74	8,52	8,29	8,07	7,84	7,62	7,40	7,17
	6	10,47	10,47	10,21	9,95	9,68	9,42	9,16	8,90	8,64	8,38
3310/5 3310/5S	1	4,27	4,27	4,16	4,05	3,95	3,84	3,73	3,63	3,52	3,41
	2	7,36	7,36	7,18	6,99	6,81	6,62	6,44	6,26	6,07	5,89
	3	10,22	10,22	9,97	9,71	9,46	9,20	8,95	8,69	8,43	8,18
	4	14,62	14,62	14,25	13,89	13,52	13,15	12,79	12,42	12,06	11,69
	5	17,31	17,31	16,87	16,44	16,01	15,57	15,14	14,71	14,28	13,84
	6	19,66	19,66	19,17	18,67	18,18	17,69	17,20	16,71	16,22	15,73
3310/7S	1	4,25	4,25	4,14	4,04	3,93	3,82	3,72	3,61	3,50	3,40
	2	7,56	7,56	7,37	7,18	6,99	6,80	6,62	6,43	6,24	6,05
	3	9,68	9,68	9,44	9,20	8,96	8,72	8,47	8,23	7,99	7,75
	4	17,20	17,20	16,77	16,34	15,91	15,48	15,05	14,62	14,19	13,76
	5	20,89	20,89	20,37	19,84	19,32	18,80	18,28	17,76	17,23	16,71
	6	27,67	27,67	26,98	26,28	25,59	24,90	24,21	23,52	22,83	22,13

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

(1) temperature change required to move the valve shutter from "start to open" position to rated opening position

TABLE 6B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,3	1,25	1,2	1,14	1,09	1,03	0,97	0,9	0,84

CRANKCASE PRESSURE REGULATORS SERIES 3320

Approved by Underwriters Laboratories Inc.



APPLICATIONS

The crankcase pressure regulators series 3320, shown in this chapter, are classified “Pressure accessories” in the sense of the Pressure Equipment Directive 94/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.

They are designed to operate on refrigerating systems, which use the following refrigerant fluids: R22 , R134a , R404A , R407C , R507 proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

The crankcase pressure regulator is a common accessory added to many low-temperature refrigeration applications. It is designed to prevent the compressor's motor from overloading when its crankcase pressure rises above its designed working pressure. On many low-temperature applications, this can occur during or after a defrost cycle, or after a long shutdown period.

OPERATION

Crankcase pressure regulators series 3320 adjust the flow of gaseous refrigerant according to changes of suction pressure, downstream the regulator. When the suction pressure is above the valve setting, the shutter remain closed. As the suction pressure drops below the valve setting, the shutter begins to open and the amount of its opening is proportional to the change of suction pressure.

As the suction pressure continues to drop, the shutter continues to open farther until the limit of the stroke is reached and the valve is completely open. Once the shutter is fully opened, only an increase in pressure drop across the valve will increase valve capacity. Regulators series 3320 regulate only in dependence on the outlet pressure change, pressure change on the inlet side do not affect the degree of opening since the valve is equipped with an equalization bellow with an effective area equal to valve seat. The factory pressure setting of these valves is 2 bar, this means that until the suction pressure is above the 2 bar the valve remains closed, when the suction pressure drops below the 2 bar the valve begin to open. According to the characteristics of the refrigerating system it can be necessary to change the valve setting adjusting the setting screw on the top of the body; the pressure setting range is from 0,2 bar up to 6 bar.

CONSTRUCTION

The main parts of crankcase pressure regulators series 3320 are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Austenitic stainless steel AISI 321 for bellow
- Austenitic stainless steel AISI 303 for shutter
- Brass bar EN 12164 – CW 614N for setting screw
- Spring steel DIN 17223/84 Class C/D for setting spring
- Chloroprene rubber (CR) for outlet seal gaskets

INSTALLATION

Crankcase pressure regulators series 3320 are installed in the suction line between the evaporator and the compressor. Normally there are no other components installed downstream, between the valve outlet and the compressor. This is to ensure that the outlet of regulator senses the true crankcase pressure of the compressor.

SELECTION

A correct selection of crankcase pressure regulators series 3320 is possible if complete system information are available. The selection involves these basic items:

- 1. Refrigerant**
- 2. Evaporator capacity**, at system working conditions.
- 3. Designed evaporating temperature (saturated pressure) at design load condition.**
- 4. Maximum allowable suction pressure.** Recommended by the compressor or unit manufacturer; this data is the valves setting.

5. Allowable pressure drop across the valves at design load condition

The pressure drop difference between items 3 and 4 determines how much of the valve stroke is utilized. The valve setting should be kept as high as possible without exceeding the recommendation of the compressor manufacturer. When the full stroke of the valve is used, the only thing that will increase the valve capacity is to take more pressure drop across the valve. Since excessive suction line pressure losses penalize system capacity, the pressure drop across the 3320 regulator should be kept to a minimum, the lower the evaporator temperature, the less pressure drop allowed. The refrigerating capacities indicated on tables 3A, 4A, 5A, 6A are based on a reference liquid temperature of 36,7 °C.

With liquid temperature different from 36,7 °C the required capacity of regulator shall be:

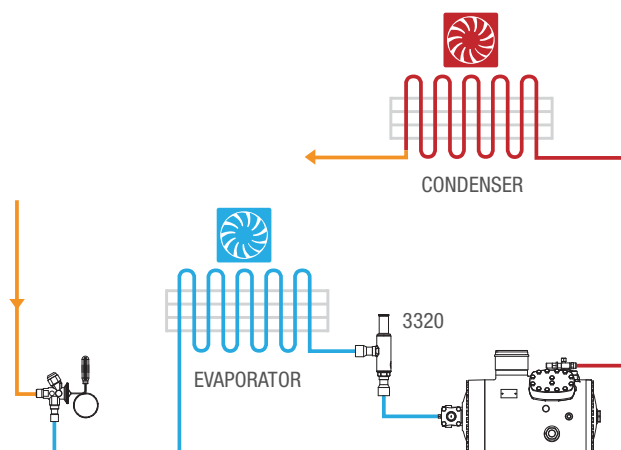
$$\frac{Q_{\text{evap}}}{K_{T \text{ liquid}}} = Q_{\text{valve}}$$

with:

Q_{evap} = Evaporator capacity. [kW]

$K_{T \text{ liquid}}$ = Correction factor for $T_{\text{liquid}} \neq 36,7 \text{ }^{\circ}\text{C}$.

Q_{valve} = Refrigerating capacity requested to regulator [kW]



EXAMPLE

Refrigerant:	R404A
Evaporator capacity:	4,5 [kW]
Designed evaporating temperature:	-25 [°C]
Maximum allowable suction pressure (setting valve):	3,5 [bar]
Allowable pressure drop across the valves:	0,07 [bar]
Liquid temperature:	35 [°C]
Solder connections	

1. Fix, by means of the table 5B, the correction factor for liquid temperature $T_{\text{Liquid}} = 35 \text{ }^{\circ}\text{C}$.

$$K_{T \text{ liquid}} = 1,03$$

2. Calculate the capacity required to the regulator.

$$Q_{\text{valve}} = \frac{Q_{\text{evap}}}{K_{T \text{ liquid}}} = \frac{4,5}{1,03} = 4,36 \text{ kW}$$

3. With the following parameters:

- Minimum capacity = 4,36 KW
- Evaporating temperature = - 25 °C
- Maximum allowable suction pressure = 3,5 bar
- Pressure drop across the valves = 0,07 bar

Choose the proper valve in table 5A.

The select valves are:

- 3320/M12 with solder connections diameter 12 mm
- 3320/4 with solder connections diameter 1/2"

Installation

Refrigerating systems for applications with low evaporation temperatures. The regulator is installed on the suction pipe upstream of the compressor. The regulator opens when suction pressure drops below the calibrated value.

TABELLA 1: General characteristics of crankcase pressure regulators 3320

Catalogue Number	Connections			Kv Factor [m³/h]	Regulating range [bar]		Factory setting [bar]	TS [°C]		PS [bar]	Risk Category according to PED
	SAE Flare	ODS			min.	max.		min.	max.		
		Ø [in.]	Ø [mm]								
3320/4	1/2"	–	–	3,30	0,2	6	2	-40	+110	28	Art. 3.3
3320/M12S	–	–	12								
3320/4S	–	1/2"	–								
3320/5	5/8"	–	–								
3320/5S	–	5/8"	16								
3320/7S	–	7/8"	22								
3320/9S	–	1.1/8"	–	8							
3320/M28S	–	–	28								
3320/11S	–	1.3/8"	35								

TABLE 2: Dimensions and Weights of regulators 3320

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H ₁	H ₂	L ₁	L ₂	D	
3320/4	159	76,5	—	48	—	32	510
3320/M12S	183	100,5	—	64	—		480
3320/4S	183	100,5	—	64	—		480
3320/5	163	80,5	—	52	—		540
3320/5S	183	100,5	—	64	—		480
3320/7S	194	112	—	75,5	—		550
3320/9S	263	151	—	105	—	46	1470
3320/M28S	263	151	—	105	—		1470
3320/11S	263	151	—	105	—		1480

TABLE 3A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			20	15	10	5	0	-5	-10	-15	-20	-25
3320/4 3320/M12S 3320/4S	0,07	0,7	—	—	—	—	—	—	—	2,71	3,06	2,76
		1,4	—	—	—	—	4,38	4,34	3,90	3,51	3,98	3,58
		2,1	—	—	—	6,96	6,26	5,63	5,07	4,56	5,17	4,65
		3,5	—	—	6,89	8,63	7,77	6,99	6,45	5,81	5,23	4,70
		4,2	—	5,57	8,56	9,47	8,52	7,67	6,90	6,21	5,59	5,03
		5,5	—	6,92	8,61	9,49	8,54	7,69	6,92	6,23	5,60	5,04
	0,14	0,7	—	—	—	—	—	—	—	3,87	4,38	3,94
		1,4	—	—	—	—	6,26	6,20	5,58	5,02	5,68	5,11
		2,1	—	—	—	9,94	8,94	8,05	7,24	6,52	7,38	6,64
		3,5	—	—	9,85	12,33	11,10	9,99	9,22	8,30	7,47	6,72
		4,2	—	7,95	12,23	13,53	12,17	10,96	9,86	8,87	7,99	7,19
		5,5	—	9,88	12,29	13,56	12,20	10,98	9,89	8,90	8,01	7,21
	0,21	0,7	—	—	—	—	—	—	—	3,91	4,43	3,99
		1,4	—	—	—	—	6,34	6,27	5,65	5,08	5,75	5,18
		2,1	—	—	—	10,06	9,05	8,15	7,33	6,60	7,47	6,72
		3,5	—	—	9,97	12,48	11,23	10,11	9,33	8,40	7,56	6,80
		4,2	—	8,07	12,38	13,69	12,32	11,09	9,98	8,98	8,08	7,28
		5,5	—	10,03	12,44	13,72	12,35	11,12	10,01	9,00	8,10	7,29
3320/5 3320/5S	0,07	0,7	—	—	—	—	—	—	—	3,37	3,82	3,44
		1,4	—	—	—	—	5,46	5,41	4,87	4,38	4,96	4,46
		2,1	—	—	—	8,67	7,80	7,02	6,32	5,69	6,44	5,80
		3,5	—	—	8,58	10,76	9,68	8,71	8,05	7,24	6,52	5,86
		4,2	—	6,56	10,65	11,80	10,62	9,56	8,60	7,74	6,97	6,27
		5,5	—	8,15	10,71	11,83	10,65	9,58	8,63	7,76	6,99	6,29
	0,14	0,7	—	—	—	—	—	—	—	4,73	5,36	4,82
		1,4	—	—	—	—	8,67	7,59	6,83	6,15	6,96	6,26
		2,1	—	—	—	12,17	10,95	9,86	8,87	7,99	9,04	8,13
		3,5	—	—	12,03	15,10	13,59	12,23	11,29	10,16	9,15	8,23
		4,2	—	9,15	14,95	16,56	14,91	13,42	12,08	10,87	9,78	8,80
		5,5	—	11,37	15,03	16,61	14,95	13,45	12,11	10,90	9,81	8,83
	0,21	0,7	—	—	—	—	—	—	—	4,82	5,45	4,91
		1,4	—	—	—	—	7,80	7,73	6,95	6,26	7,08	6,38
		2,1	—	—	—	12,39	11,15	10,03	9,03	8,13	9,20	8,28
		3,5	—	—	12,25	15,37	13,83	12,45	11,49	10,34	9,31	8,38
		4,2	—	9,37	15,22	16,86	15,17	13,66	12,29	11,06	9,96	8,96
		5,5	—	11,64	15,30	16,90	15,21	13,69	12,32	11,09	9,98	8,98
3320/7S	0,07	0,7	—	—	—	—	—	—	—	5,01	5,67	5,10
		1,4	—	—	—	—	9,18	8,03	7,23	6,51	7,37	6,63
		2,1	—	—	—	12,88	11,59	10,43	9,39	8,45	9,57	8,61
		3,5	—	—	12,84	15,98	14,38	12,94	11,95	10,76	9,68	8,71
		4,2	—	10,04	15,95	17,53	15,78	14,20	12,78	11,50	10,35	9,32
		5,5	—	12,47	16,04	17,57	15,82	14,24	12,81	11,53	10,38	9,34
	0,14	0,7	—	—	—	—	—	—	—	7,08	8,01	7,21
		1,4	—	—	—	—	14,57	11,35	10,22	9,19	10,41	9,37
		2,1	—	—	—	18,20	16,38	14,74	13,27	11,94	13,52	12,16
		3,5	—	—	18,14	22,58	20,32	18,29	16,88	15,20	13,68	12,31
		4,2	—	14,30	22,54	24,77	22,29	20,06	18,06	16,25	14,63	13,16
		5,5	—	17,77	22,66	24,83	22,35	20,11	18,10	16,29	14,66	13,20
	0,21	0,7	—	—	—	—	—	—	—	7,16	8,10	7,29
		1,4	—	—	—	—	13,11	11,48	10,33	9,30	10,52	9,47
		2,1	—	—	—	18,40	16,56	14,90	13,41	12,07	13,66	12,30
		3,5	—	—	18,35	22,83	20,55	18,49	17,07	15,36	13,83	12,45
		4,2	—	14,34	22,79	25,04	22,54	20,29	18,26	16,43	14,79	13,31
		5,5	—	17,81	22,91	25,11	22,60	20,34	18,30	16,47	14,83	13,34

Be continued

TABLE 3A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			20	15	10	5	0	-5	-10	-15	-20	-25
3320/9S 3320/M28S	0,07	0,7	—	—	—	—	—	—	—	8,01	9,07	8,16
		1,4	—	—	—	—	12,98	12,85	11,56	10,41	11,78	10,60
		2,1	—	—	—	20,60	18,54	16,69	15,02	13,52	15,30	13,77
		3,5	—	—	20,38	25,56	23,00	20,70	19,11	17,20	15,48	13,93
		4,2	—	15,58	25,31	28,04	25,24	22,71	20,44	18,40	16,56	14,90
		5,5	—	19,36	25,44	28,11	25,30	22,77	20,49	18,44	16,60	14,94
	0,14	0,7	—	—	—	—	—	—	—	11,25	12,73	11,46
		1,4	—	—	—	—	20,60	18,03	16,23	14,61	16,53	14,88
		2,1	—	—	—	28,91	26,02	23,42	21,08	18,97	21,47	19,32
		3,5	—	—	28,59	35,87	32,29	29,06	26,83	24,14	21,73	19,56
		4,2	—	21,74	35,52	39,35	35,42	31,88	28,69	25,82	23,24	20,91
		5,5	—	27,01	35,70	39,45	35,51	31,96	28,76	25,88	23,30	20,97
	0,21	0,7	—	—	—	—	—	—	—	11,45	12,96	11,66
		1,4	—	—	—	—	18,54	18,36	16,52	14,87	16,83	15,15
		2,1	—	—	—	29,43	26,49	23,84	21,46	19,31	21,86	19,67
		3,5	—	—	29,11	36,52	32,86	29,58	27,31	24,57	22,12	19,91
		4,2	—	22,26	36,16	40,06	36,05	32,45	29,20	26,28	23,65	21,29
		5,5	—	27,65	36,35	40,16	36,14	32,53	29,27	26,35	23,71	21,34
3320/11S	0,07	0,7	—	—	—	—	—	—	—	11,90	13,47	12,13
		1,4	—	—	—	—	21,80	19,09	17,18	15,46	17,50	15,75
		2,1	—	—	—	30,60	27,54	24,79	22,31	20,08	22,72	20,45
		3,5	—	—	30,51	37,97	34,17	30,75	28,39	25,55	23,00	20,70
		4,2	—	23,84	37,90	41,65	37,48	33,74	30,36	27,33	24,59	22,13
		5,5	—	29,62	38,10	41,75	37,58	33,82	30,44	27,39	24,66	22,19
	0,14	0,7	—	—	—	—	—	—	—	16,82	19,04	17,13
		1,4	—	—	—	—	34,61	26,97	24,27	21,84	24,72	22,25
		2,1	—	—	—	43,24	38,91	35,02	31,52	28,37	32,11	28,90
		3,5	—	—	43,11	53,64	48,28	43,45	40,11	36,10	32,49	29,24
		4,2	—	33,98	53,55	58,85	52,96	47,67	42,90	38,61	34,75	31,27
		5,5	—	42,22	53,83	59,00	53,10	47,79	43,01	38,71	34,84	31,35
	0,21	0,7	—	—	—	—	—	—	—	17,01	19,25	17,32
		1,4	—	—	—	—	31,15	27,27	24,54	22,09	25,00	22,50
		2,1	—	—	—	43,72	39,34	35,41	31,87	28,68	32,46	29,22
		3,5	—	—	43,59	54,24	48,81	43,93	40,56	36,50	32,85	29,57
		4,2	—	34,06	54,14	59,50	53,55	48,19	43,38	39,04	35,13	31,62
		5,5	—	42,31	54,43	59,65	53,68	48,32	43,48	39,14	35,22	31,70

Standard rating conditions according to AHRI Standard 770-2007

(1) This value is the valve pressure setting

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 3B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,28	1,23	1,18	1,13	1,08	1,03	0,97	0,92	0,86

TABELLA 4A: Rese frigorifere dei regolatori della pressione di avviamento 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/4 3320/M12S 3320/4S	0,07	0,7	—	—	—	—	—	—	—	—	3,06	2,76
		1,4	—	—	—	—	—	4,09	3,68	3,31	3,98	3,58
		2,1	—	—	5,19	6,55	5,90	5,31	4,78	4,30	5,17	4,65
		3,5	—	5,15	6,44	8,13	7,31	6,58	6,45	5,81	5,23	4,70
		4,2	—	6,38	7,99	8,91	8,02	7,22	6,50	5,85	5,26	4,74
		5,5	—	6,44	8,04	8,93	8,03	7,23	6,51	5,86	5,27	4,74
	0,14	0,7	—	—	—	—	—	—	—	—	4,38	3,94
		1,4	—	—	—	—	—	5,84	5,25	4,73	5,68	5,11
		2,1	—	—	7,42	9,36	8,42	7,58	6,82	6,14	7,38	6,64
		3,5	—	7,35	9,20	11,61	10,45	9,40	9,22	8,30	7,47	6,72
		4,2	—	9,11	11,42	12,73	11,46	10,31	9,28	8,35	7,52	6,77
		5,5	—	9,20	11,48	12,75	11,48	10,33	9,29	8,37	7,53	6,78
	0,21	0,7	—	—	—	—	—	—	—	—	4,41	3,97
		1,4	—	—	—	—	—	5,89	5,30	4,77	5,73	5,16
		2,1	—	—	7,37	9,44	8,50	7,65	6,88	6,19	7,44	6,70
		3,5	—	7,24	9,14	11,71	10,54	9,49	9,30	8,37	7,53	6,78
		4,2	—	8,97	11,35	12,84	11,56	10,40	9,36	8,42	7,58	6,82
		5,5	—	9,06	11,41	12,86	11,57	10,42	9,37	8,44	7,59	6,83
3320/5 3320/5S	0,07	0,7	—	—	—	—	—	—	—	—	3,80	3,42
		1,4	—	—	—	—	—	5,06	4,56	4,10	4,93	4,44
		2,1	—	—	6,44	8,12	7,31	6,58	5,92	5,33	6,40	5,76
		3,5	—	6,16	7,99	10,07	9,07	8,16	8,00	7,20	6,48	5,83
		4,2	—	7,63	9,91	11,04	9,94	8,95	8,05	7,25	6,52	5,87
		5,5	—	7,71	9,96	11,06	9,96	8,96	8,06	7,26	6,53	5,88
	0,14	0,7	—	—	—	—	—	—	—	—	5,34	4,81
		1,4	—	—	—	—	—	7,13	6,41	5,77	6,94	6,24
		2,1	—	—	9,06	11,42	10,28	9,25	8,33	7,50	9,01	8,11
		3,5	—	8,63	11,24	14,17	12,75	11,48	11,25	10,13	9,11	8,20
		4,2	—	10,69	13,95	15,54	13,98	12,58	11,33	10,19	9,17	8,26
		5,5	—	10,80	14,02	15,56	14,01	12,60	11,34	10,21	9,19	8,27
	0,21	0,7	—	—	—	—	—	—	—	—	5,42	4,88
		1,4	—	—	—	—	—	7,24	6,51	5,86	7,04	6,34
		2,1	—	—	9,20	11,60	10,44	9,40	8,46	7,61	9,15	8,23
		3,5	—	8,80	11,41	14,39	12,95	11,66	11,43	10,28	9,26	8,33
		4,2	—	10,90	14,16	15,78	14,20	12,78	11,50	10,35	9,32	8,39
		5,5	—	11,01	14,23	15,80	14,22	12,80	11,52	10,37	9,33	8,40
3320/7S	0,07	0,7	—	—	—	—	—	—	—	—	5,68	5,11
		1,4	—	—	—	—	—	7,58	6,82	6,14	7,38	6,64
		2,1	—	—	9,70	12,15	10,94	9,84	8,86	7,97	9,58	8,62
		3,5	—	8,71	12,02	15,07	13,56	12,21	11,97	10,77	9,69	8,73
		4,2	—	10,79	14,92	16,52	14,87	13,39	12,05	10,84	9,76	8,78
		5,5	—	10,90	15,00	16,55	14,90	13,41	12,07	10,86	9,77	8,80
	0,14	0,7	—	—	—	—	—	—	—	—	7,99	7,19
		1,4	—	—	—	—	—	10,65	9,59	8,63	10,37	9,33
		2,1	—	—	13,63	17,08	15,38	13,84	12,45	11,21	13,47	12,12
		3,5	—	12,17	16,90	21,19	19,07	17,16	16,83	15,15	13,63	12,27
		4,2	—	15,08	20,98	23,23	20,91	18,82	16,94	15,24	13,72	12,35
		5,5	—	15,23	21,09	23,27	20,94	18,85	16,96	15,27	13,74	12,37
	0,21	0,7	—	—	—	—	—	—	—	—	8,11	7,30
		1,4	—	—	—	—	—	10,83	9,74	8,77	10,54	9,48
		2,1	—	—	13,85	17,36	15,62	14,06	12,65	11,39	13,69	12,32
		3,5	—	12,44	17,18	21,53	19,38	17,44	17,10	15,39	13,85	12,46
		4,2	—	15,42	21,32	23,61	21,25	19,12	17,21	15,49	13,94	12,55
		5,5	—	15,57	21,43	23,64	21,28	19,15	17,24	15,51	13,96	12,57

Be continued

TABELLA 4A: Rese frigorifere dei regolatori della pressione di avviamento 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/9S 3320/M28S	0,07	0,7	—	—	—	—	—	—	—	—	9,02	8,12
		1,4	—	—	—	—	—	12,03	10,83	9,75	11,71	10,54
		2,1	—	—	15,30	19,29	17,36	15,63	14,06	12,66	15,21	13,69
		3,5	—	14,63	18,97	23,93	21,54	19,38	19,00	17,10	15,39	13,85
		4,2	—	18,13	23,55	26,24	23,62	21,25	19,13	17,22	15,49	13,94
		5,5	—	18,31	23,67	26,28	23,65	21,29	19,16	17,24	15,52	13,97
	0,14	0,7	—	—	—	—	—	—	—	—	12,69	11,42
		1,4	—	—	—	—	—	16,93	15,23	13,71	16,48	14,83
		2,1	—	—	21,53	27,14	24,43	21,98	19,79	17,81	21,40	19,26
		3,5	—	20,50	26,70	33,66	30,30	27,27	26,73	24,06	21,65	19,49
		4,2	—	25,41	33,14	36,91	33,22	29,90	26,91	24,22	21,80	19,62
		5,5	—	25,66	33,32	36,97	33,27	29,95	26,95	24,26	21,83	19,65
	0,21	0,7	—	—	—	—	—	—	—	—	12,88	11,60
		1,4	—	—	—	—	—	17,19	15,47	13,92	16,73	15,06
		2,1	—	—	21,86	27,56	24,81	22,33	20,09	18,08	21,73	19,56
		3,5	—	20,90	27,10	34,19	30,77	27,69	27,15	24,43	21,99	19,79
		4,2	—	25,90	33,64	37,49	33,74	30,36	27,33	24,59	22,13	19,92
		5,5	—	26,16	33,82	37,54	33,79	30,41	27,37	24,63	22,17	19,95
3320/11S	0,07	0,7	—	—	—	—	—	—	—	—	13,49	12,14
		1,4	—	—	—	—	—	18,00	16,20	14,58	17,53	15,77
		2,1	—	—	23,04	28,87	25,98	23,38	21,04	18,94	22,76	20,48
		3,5	—	20,69	28,56	35,81	32,22	29,00	28,43	25,59	23,03	20,73
		4,2	—	25,64	35,46	39,26	35,33	31,80	28,62	25,76	23,18	20,86
		5,5	—	25,89	35,64	39,32	35,39	31,85	28,66	25,80	23,22	20,90
	0,14	0,7	—	—	—	—	—	—	—	—	18,97	17,08
		1,4	—	—	—	—	—	25,31	22,78	20,50	24,64	22,18
		2,1	—	—	32,39	40,59	36,53	32,87	29,59	26,63	32,00	28,80
		3,5	—	28,91	40,15	50,34	45,31	40,78	39,98	35,98	32,38	29,14
		4,2	—	35,83	49,84	55,20	49,68	44,71	40,24	36,22	32,59	29,33
		5,5	—	36,18	50,11	55,29	49,76	44,78	40,30	36,27	32,65	29,38
	0,21	0,7	—	—	—	—	—	—	—	—	19,28	17,35
		1,4	—	—	—	—	—	25,72	23,15	20,83	25,04	22,53
		2,1	—	—	32,91	41,24	37,11	33,40	30,06	27,06	32,51	29,26
		3,5	—	29,55	40,80	51,15	46,04	41,43	40,62	36,56	32,90	29,61
		4,2	—	36,63	50,65	56,08	50,48	45,43	40,89	36,80	33,12	29,81
		5,5	—	36,99	50,92	56,17	50,56	45,50	40,95	36,85	33,17	29,85

Standard rating conditions according to AHRI Standard 770-2007

(1) This value is the valve pressure setting

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 4B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,23	1,19	1,16	1,11	1,06	1,01	0,98	0,94	0,9

TABLE 5A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/4 3320/M12S 3320/4S	0,07	0,7	—	—	—	—	—	—	—	—	3,06	2,76
		1,4	—	—	—	—	—	3,62	3,26	2,93	3,98	3,58
		2,1	—	—	—	5,81	5,23	4,70	4,23	3,81	5,17	4,65
		3,5	—	3,65	5,72	7,20	6,48	5,83	6,45	5,81	5,23	4,70
		4,2	—	4,53	7,11	7,90	7,11	6,40	5,76	5,18	4,67	4,20
		5,5	—	5,63	7,14	7,92	7,13	6,42	5,77	5,20	4,68	4,21
	0,14	0,7	—	—	—	—	—	—	—	—	4,38	3,94
		1,4	—	—	—	—	—	5,17	4,66	4,19	5,68	5,11
		2,1	—	—	—	8,29	7,46	6,72	6,05	5,44	7,38	6,64
		3,5	—	5,21	8,17	10,29	9,26	8,33	9,22	8,30	7,47	6,72
		4,2	—	6,47	10,15	11,29	10,16	9,14	8,23	7,41	6,67	6,00
		5,5	—	8,04	10,20	11,32	10,18	9,17	8,25	7,42	6,68	6,01
	0,21	0,7	—	—	—	—	—	—	—	—	4,40	3,96
		1,4	—	—	—	—	—	5,20	4,68	4,21	5,72	5,14
		2,1	—	—	—	8,34	7,51	6,76	6,08	5,47	7,42	6,68
		3,5	—	5,16	8,12	10,35	9,32	8,38	9,27	8,35	7,51	6,76
		4,2	—	6,42	10,09	11,35	10,22	9,20	8,28	7,45	6,70	6,03
		5,5	—	7,97	10,14	11,38	10,24	9,22	8,30	7,47	6,72	6,05
3320/5 3320/5S	0,07	0,7	—	—	—	—	—	—	—	—	3,80	3,42
		1,4	—	—	—	—	—	4,49	4,04	3,63	4,93	4,44
		2,1	—	—	—	7,19	6,47	5,83	5,24	4,72	6,40	5,76
		3,5	—	4,39	7,05	8,93	8,03	7,23	8,00	7,20	6,48	5,83
		4,2	—	5,45	8,76	9,79	8,81	7,93	7,14	6,42	5,78	5,20
		5,5	—	6,77	8,80	9,82	8,83	7,95	7,16	6,44	5,80	5,22
	0,14	0,7	—	—	—	—	—	—	—	—	5,32	4,79
		1,4	—	—	—	—	—	6,29	5,66	5,10	6,91	6,22
		2,1	—	—	—	10,09	9,08	8,17	7,36	6,62	8,98	8,08
		3,5	—	6,10	9,87	12,52	11,27	10,14	11,22	10,10	9,09	8,18
		4,2	—	7,58	12,26	13,73	12,36	11,12	10,01	9,01	8,11	7,30
		5,5	—	9,42	12,32	13,77	12,39	11,15	10,04	9,03	8,13	7,32
	0,21	0,7	—	—	—	—	—	—	—	—	5,42	4,88
		1,4	—	—	—	—	—	6,41	5,77	5,19	7,04	6,34
		2,1	—	—	—	10,28	9,25	8,32	7,49	6,74	9,14	8,23
		3,5	—	6,27	10,07	12,75	11,48	10,33	11,42	10,28	9,25	8,33
		4,2	—	7,78	12,51	13,99	12,59	11,33	10,20	9,18	8,26	7,43
		5,5	—	9,67	12,58	14,02	12,62	11,36	10,22	9,20	8,28	7,45
3320/7S	0,07	0,7	—	—	—	—	—	—	—	—	5,68	5,11
		1,4	—	—	—	—	—	6,71	6,04	5,44	7,38	6,64
		2,1	—	—	—	10,76	9,69	8,72	7,85	7,06	9,58	8,62
		3,5	—	6,71	10,66	13,36	12,02	10,82	11,97	10,77	9,69	8,72
		4,2	—	8,33	13,24	14,65	13,19	11,87	10,68	9,61	8,65	7,79
		5,5	—	10,35	13,31	14,69	13,22	11,90	10,71	9,64	8,67	7,81
	0,14	0,7	—	—	—	—	—	—	—	—	7,96	7,16
		1,4	—	—	—	—	—	9,41	8,47	7,62	10,34	9,30
		2,1	—	—	—	15,09	13,58	12,22	11,00	9,90	13,43	12,08
		3,5	—	9,35	14,92	18,72	16,85	15,16	16,77	15,10	13,59	12,23
		4,2	—	11,62	18,54	20,54	18,48	16,63	14,97	13,47	12,13	10,91
		5,5	—	14,43	18,64	20,59	18,53	16,68	15,01	13,51	12,16	10,94
	0,21	0,7	—	—	—	—	—	—	—	—	8,11	7,30
		1,4	—	—	—	—	—	9,59	8,63	7,77	10,54	9,48
		2,1	—	—	—	15,38	13,84	12,46	11,21	10,09	13,68	12,32
		3,5	—	9,58	15,23	19,08	17,17	15,45	17,10	15,39	13,85	12,46
		4,2	—	11,91	18,92	20,93	18,84	16,95	15,26	13,73	12,36	11,12
		5,5	—	14,79	19,02	20,98	18,88	17,00	15,30	13,77	12,39	11,15

Be continued

TABLE 5A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/9S 3320/M28S	0,07	0,7	—	—	—	—	—	—	—	—	9,02	8,11
		1,4	—	—	—	—	—	10,66	9,59	8,63	11,71	10,54
		2,1	—	—	—	17,09	15,38	13,84	12,46	11,21	15,21	13,69
		3,5	—	10,42	16,75	21,20	19,08	17,17	19,00	17,10	15,39	13,85
		4,2	—	12,95	20,80	23,26	20,93	18,84	16,96	15,26	13,74	12,36
		5,5	—	16,08	20,91	23,32	20,99	18,89	17,00	15,30	13,77	12,39
	0,14	0,7	—	—	—	—	—	—	—	—	12,65	11,38
		1,4	—	—	—	—	—	14,95	13,46	12,11	16,43	14,78
		2,1	—	—	—	23,97	21,58	19,42	17,48	15,73	21,33	19,20
		3,5	—	14,50	23,45	29,74	26,77	24,09	26,65	23,99	21,59	19,43
		4,2	—	18,02	29,13	32,63	29,37	26,43	23,79	21,41	19,27	17,34
		5,5	—	22,38	29,28	32,71	29,44	26,50	23,85	21,46	19,32	17,38
	0,21	0,7	—	—	—	—	—	—	—	—	12,88	11,59
		1,4	—	—	—	—	—	15,23	13,70	12,33	16,73	15,06
		2,1	—	—	—	24,41	21,97	19,78	17,80	16,02	21,72	19,55
		3,5	—	14,89	23,93	30,29	27,26	24,54	27,14	24,43	21,98	19,79
		4,2	—	18,49	29,72	33,23	29,91	26,92	24,22	21,80	19,62	17,66
		5,5	—	22,97	29,88	33,31	29,98	26,98	24,28	21,86	19,67	17,70
3320/11S	0,07	0,7	—	—	—	—	—	—	—	—	13,49	12,14
		1,4	—	—	—	—	—	15,95	14,36	12,92	17,52	15,77
		2,1	—	—	—	25,57	23,02	20,72	18,64	16,78	22,76	20,48
		3,5	—	15,94	25,33	31,73	28,56	25,70	28,43	25,59	23,03	20,73
		4,2	—	19,80	31,46	34,81	31,33	28,19	25,38	22,84	20,55	18,50
		5,5	—	24,60	31,63	34,90	31,41	28,27	25,44	22,89	20,61	18,54
	0,14	0,7	—	—	—	—	—	—	—	—	18,91	17,02
		1,4	—	—	—	—	—	22,36	20,12	18,11	24,56	22,10
		2,1	—	—	—	35,85	32,26	29,04	26,13	23,52	31,90	28,71
		3,5	—	22,22	35,46	44,47	40,03	36,02	39,85	35,86	32,28	29,05
		4,2	—	27,60	44,05	48,79	43,91	39,52	35,57	32,01	28,81	25,93
		5,5	—	34,28	44,28	48,91	44,02	39,62	35,66	32,09	28,88	25,99
	0,21	0,7	—	—	—	—	—	—	—	—	19,28	17,35
		1,4	—	—	—	—	—	22,79	20,51	18,46	25,03	22,53
		2,1	—	—	—	36,54	32,88	29,59	26,63	23,97	32,51	29,26
		3,5	—	22,77	36,18	45,33	40,80	36,72	40,62	36,55	32,90	29,61
		4,2	—	28,29	44,95	49,73	44,75	40,28	36,25	32,63	29,36	26,43
		5,5	—	35,14	45,18	49,85	44,87	40,38	36,34	32,71	29,44	26,49

Standard rating conditions according to AHRI Standard 770-2007

(1) This value is the valve pressure setting

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 5B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,43	1,35	1,28	1,2	1,12	1,03	0,95	0,86	0,76

TABLE 6A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/4 3320/M12S 3320/4S	0,07	0,7	—	—	—	—	—	—	—	—	3,06	2,76
		1,4	—	—	—	—	—	4,18	3,77	3,39	3,98	3,58
		2,1	—	—	5,20	6,71	6,04	5,43	4,89	4,40	5,17	4,65
		3,5	—	4,71	6,45	8,32	7,49	6,74	6,45	5,81	5,23	4,70
		4,2	5,22	5,85	8,01	9,13	8,22	7,40	6,66	5,99	5,39	4,85
		5,5	6,49	7,27	8,05	9,15	8,24	7,41	6,67	6,01	5,40	4,86
	0,14	0,7	—	—	—	—	—	—	—	—	4,38	3,94
		1,4	—	—	—	—	—	5,98	5,38	4,84	5,68	5,11
		2,1	—	—	7,42	9,58	8,63	7,76	6,99	6,29	7,38	6,64
		3,5	—	6,73	9,21	11,89	10,70	9,63	9,22	8,30	7,47	6,72
		4,2	7,46	8,36	11,44	13,04	11,74	10,57	9,51	8,56	7,70	6,93
		5,5	9,27	10,38	11,50	13,08	11,77	10,59	9,53	8,58	7,72	6,95
	0,21	0,7	—	—	—	—	—	—	—	—	4,41	3,96
		1,4	—	—	—	—	—	6,02	5,42	4,87	5,72	5,15
		2,1	—	—	7,34	9,65	8,68	7,81	7,03	6,33	7,43	6,69
		3,5	—	6,65	9,11	11,97	10,77	9,70	9,28	8,35	7,52	6,77
		4,2	7,37	8,26	11,32	13,13	11,82	10,64	9,57	8,62	7,75	6,98
		5,5	9,15	10,26	11,38	13,16	11,85	10,66	9,60	8,64	7,77	7,00
3320/5 3320/5S	0,07	0,7	—	—	—	—	—	—	—	—	3,80	3,42
		1,4	—	—	—	—	—	5,19	4,67	4,20	4,93	4,44
		2,1	—	—	6,62	8,32	7,48	6,74	6,06	5,46	6,40	5,76
		3,5	—	5,85	8,22	10,32	9,29	8,36	8,00	7,20	6,48	5,83
		4,2	6,27	7,27	10,21	11,32	10,19	9,17	8,25	7,43	6,68	6,02
		5,5	7,79	9,03	10,26	11,35	10,21	9,19	8,27	7,44	6,70	6,03
	0,14	0,7	—	—	—	—	—	—	—	—	5,33	4,80
		1,4	—	—	—	—	—	7,28	6,56	5,90	6,93	6,23
		2,1	—	—	9,30	11,68	10,51	9,46	8,51	7,66	8,99	8,09
		3,5	—	8,19	11,54	14,49	13,04	11,74	11,24	10,11	9,10	8,19
		4,2	8,76	10,18	14,33	15,90	14,31	12,88	11,59	10,43	9,39	8,45
		5,5	10,88	12,64	14,40	15,94	14,34	12,91	11,62	10,46	9,41	8,47
	0,21	0,7	—	—	—	—	—	—	—	—	5,42	4,88
		1,4	—	—	—	—	—	7,41	6,67	6,00	7,04	6,34
		2,1	—	—	9,46	11,88	10,69	9,62	8,66	7,79	9,15	8,23
		3,5	—	8,35	11,74	14,74	13,27	11,94	11,43	10,29	9,26	8,33
		4,2	8,96	10,38	14,58	16,17	14,55	13,10	11,79	10,61	9,55	8,59
		5,5	11,13	12,89	14,66	16,21	14,59	13,13	11,82	10,64	9,57	8,61
3320/7S	0,07	0,7	—	—	—	—	—	—	—	—	5,68	5,11
		1,4	—	—	—	—	—	7,76	6,98	6,28	7,38	6,64
		2,1	—	—	9,94	12,44	11,20	10,08	9,07	8,16	9,58	8,62
		3,5	—	8,86	12,33	15,44	13,89	12,50	11,97	10,77	9,69	8,73
		4,2	9,61	11,00	15,32	16,93	15,24	13,72	12,34	11,11	10,00	9,00
		5,5	11,94	13,67	15,40	16,97	15,28	13,75	12,37	11,14	10,02	9,02
	0,14	0,7	—	—	—	—	—	—	—	—	7,97	7,17
		1,4	—	—	—	—	—	10,89	9,80	8,82	10,35	9,32
		2,1	—	—	14,09	17,46	15,71	14,14	12,73	11,45	13,44	12,10
		3,5	—	12,54	17,48	21,66	19,49	17,54	16,80	15,12	13,60	12,24
		4,2	13,59	15,58	21,71	23,76	21,38	19,25	17,32	15,59	14,03	12,63
		5,5	16,88	19,35	21,82	23,82	21,44	19,29	17,37	15,63	14,07	12,66
	0,21	0,7	—	—	—	—	—	—	—	—	8,11	7,30
		1,4	—	—	—	—	—	11,08	9,98	8,98	10,54	9,48
		2,1	—	—	14,20	17,77	16,00	14,40	12,96	11,66	13,69	12,32
		3,5	—	12,65	17,61	22,05	19,85	17,86	17,10	15,39	13,85	12,46
		4,2	13,73	15,72	21,88	24,19	21,77	19,59	17,63	15,87	14,28	12,85
		5,5	17,05	19,52	21,99	24,25	21,82	19,64	17,68	15,91	14,32	12,89

Be continued

TABLE 6A: Refrigerant Flow Capacity of crankcase pressure regulators 3320 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Max allowable suction pressure [bar] (1)	Design evaporator temperature [°C]									
			4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3320/4 3320/M12S 3320/4S	0,07	0,7	—	—	—	—	—	—	—	—	9,02	8,12
		1,4	—	—	—	—	—	12,32	11,09	9,98	11,72	10,54
		2,1	—	—	15,73	19,76	17,78	16,00	14,40	12,96	15,22	13,69
		3,5	—	13,89	19,52	24,51	22,06	19,86	19,01	17,11	15,40	13,86
		4,2	14,90	17,26	24,25	26,89	24,20	21,78	19,60	17,64	15,88	14,29
		5,5	18,51	21,44	24,37	26,96	24,26	21,84	19,65	17,69	15,92	14,33
	0,14	0,7	—	—	—	—	—	—	—	—	12,67	11,40
		1,4	—	—	—	—	—	17,31	15,57	14,02	16,45	14,81
		2,1	—	—	22,09	27,75	24,97	22,47	20,23	18,20	21,37	19,23
		3,5	—	19,46	27,41	34,42	30,98	27,88	26,69	24,02	21,62	19,46
		4,2	20,81	24,18	34,04	37,76	33,99	30,59	27,53	24,78	22,30	20,07
		5,5	25,85	30,03	34,22	37,86	34,07	30,67	27,60	24,84	22,35	20,12
	0,21	0,7	—	—	—	—	—	—	—	—	12,89	11,60
		1,4	—	—	—	—	—	17,60	15,84	14,26	16,74	15,06
		2,1	—	—	22,47	28,23	25,40	22,86	20,58	18,52	21,74	19,56
		3,5	—	19,85	27,88	35,02	31,52	28,37	27,15	24,44	22,00	19,80
		4,2	21,29	24,66	34,64	38,42	34,57	31,12	28,00	25,20	22,68	20,42
		5,5	26,44	30,63	34,82	38,51	34,66	31,19	28,07	25,27	22,74	20,47
3320/5 3320/5S	0,07	0,7	—	—	—	—	—	—	—	—	13,49	12,15
		1,4	—	—	—	—	—	18,43	16,59	14,93	17,53	15,77
		2,1	—	—	23,61	29,56	26,60	23,94	21,55	19,39	22,76	20,48
		3,5	—	21,04	29,29	36,67	33,00	29,70	28,44	25,59	23,03	20,73
		4,2	22,83	26,13	36,39	40,23	36,20	32,58	29,33	26,39	23,75	21,38
		5,5	28,35	32,47	36,58	40,33	36,29	32,67	29,40	26,46	23,81	21,43
	0,14	0,7	—	—	—	—	—	—	—	—	18,94	17,04
		1,4	—	—	—	—	—	25,87	23,28	20,95	24,59	22,13
		2,1	—	—	33,47	41,48	37,33	33,60	30,24	27,21	31,94	28,75
		3,5	—	29,79	41,52	51,46	46,31	41,68	39,90	35,91	32,32	29,09
		4,2	32,28	37,01	51,58	56,45	50,81	45,72	41,15	37,04	33,33	30,00
		5,5	40,10	45,97	51,85	56,59	50,93	45,84	41,26	37,13	33,42	30,08
	0,21	0,7	—	—	—	—	—	—	—	—	19,28	17,35
		1,4	—	—	—	—	—	26,33	23,70	21,33	25,04	22,53
		2,1	—	—	33,73	42,22	38,00	34,20	30,78	27,70	32,52	29,26
		3,5	—	30,05	41,85	52,39	47,15	42,43	40,62	36,56	32,90	29,61
		4,2	32,61	37,34	51,98	57,47	51,72	46,55	41,89	37,70	33,93	30,54
		5,5	40,51	46,38	52,25	57,61	51,85	46,66	42,00	37,80	34,02	30,62

Standard rating conditions according to AHRI Standard 770-2007

(1) This value is the valve pressure setting

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 6B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,3	1,25	1,2	1,14	1,09	1,03	0,97	0,9	0,84

EVAPORATING PRESSURE REGULATORS SERIES 3330

Approved by Underwriters Laboratories Inc.



APPLICATIONS

The evaporating pressure regulators series 3330, shown in this chapter, are classified "Pressure accessories" in the sense of the Pressure Equipment Directive 94/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.

They are designed to operate on refrigerating systems, which use the following refrigerant fluids: R22 , R134a , R404A , R407C , R507 proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

The evaporating pressure regulator is an accessory designed to maintain a constant evaporating pressure and thereby a constant surface temperature on the evaporator under varying evaporator load. This valve prevents too low evaporating pressure and therefore protects against freezing in water chiller or against coil icing in air evaporators. The 3330 regulators are also used to differentiate the evaporating pressures in two or more evaporators in systems with one compressor.

OPERATION

Evaporating pressure regulators series 3330 adjust the flow of gaseous refrigerant according to changes of suction pressure, upstream the regulator. When the evaporating pressure is below the valve setting, the shutter remain closed. As the evaporating pressure rises above the valve setting, the shutter begins to open and the amount of its opening is proportional to the change of evaporating pressure. As the evaporating pressure continues to rise, the shutter continues to open farther

until the limit of the stroke is reached and the valve is completely open. Once the shutter is fully opened, only an increase in pressure drop across the valve will increase valve capacity. Regulators series 3330 regulate only in dependence on the inlet pressure change, pressure change on the outlet side do not affect the degree of opening since the valve is equipped with an equalization bellow with an effective area equal to valve seat. The factory pressure setting of these valves is 2 bar, this means that until the evaporating pressure is below the 2 bar the valve remains closed, when the evaporating pressure rise above the 2 bar the valve begin to open. According to the characteristics of the refrigerating system it can be necessary to change the valve setting adjusting the setting screw on the top of the body; the pressure setting range is from 0 bar up to 5,5 bar.

CONSTRUCTION

The main parts of evaporating pressure regulators series 3330 are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Austenitic stainless steel AISI 321 for bellow
- Austenitic stainless steel AISI 303 for shutter
- Brass bar EN 12164 – CW 614N for setting screw
- Spring steel DIN 17223/84 Class C/D for setting spring
- Chloroprene rubber (CR) for outlet seal gaskets

INSTALLATION

Evaporating pressure regulators series 3330 are installed in the suction line between the evaporator and the compressor. There are two common types of installation:

- Refrigerating system with one compressor serving two or more evaporators in parallel, where the same evaporating temperature is required. In this case the 3330 regulator is installed on the common suction line.
- Refrigerating system with one compressor serving two or more evaporators in parallel, where different evaporating temperature are required. In this case the 3330 regulator is installed downstream the evaporator with the highest temperature. Downstream the evaporators with the lower temperature it is necessary to install a check valve to avoid condensing refrigerant during compressor stops.

SELECTION

A correct selection of evaporating pressure regulators series 3330 is possible if complete system information are available. The selection involves these basic items:

1. Refrigerant
2. Designed evaporator capacity

3. Designed evaporating temperature

4. Minimum evaporating temperature. This data is the valves setting.

5. Allowable pressure drop across the valves at design load condition

6. Liquid temperature

The refrigerating capacities indicated on tables 3A, 4A, 5A, 6A are based on:

- a reference liquid temperature of 36,7 °C.
- an allowable change of evaporating pressure of 0,56 bar

With liquid temperature different from 36,7 °C and evaporating pressure change different from 0,56 bar the required capacity of regulator shall be:

$$\frac{Q_{\text{evap}}}{K_{T \text{ liquid}} \times K_{\Delta P \text{ evap}}} = Q_{\text{valve}}$$

with:

Q_{evap} = Evaporator capacity. [kW]

$K_{T \text{ liquid}}$ = Correction factor for $T_{\text{liquid}} \neq 36,7 \text{ °C}$.

$K_{\Delta P \text{ evap}}$ = Correction factor for $\Delta P_{\text{valve}} \neq 0,56 \text{ bar}$.

Q_{valve} = Refrigerating capacity requested to regulator [kW]

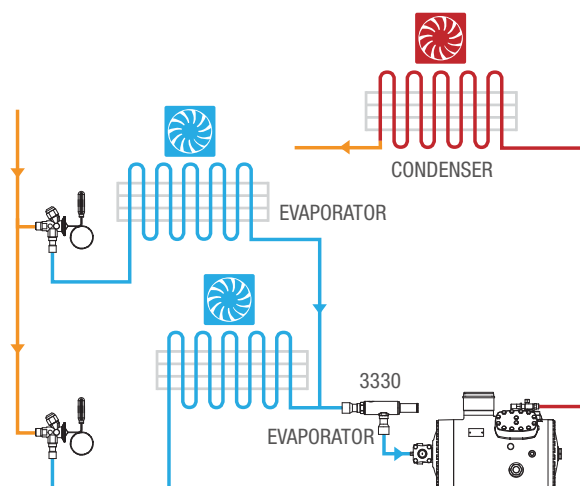
EXAMPLE

Refrigerant: R404A

Evaporator capacity: 4 [kW]

Designed evaporating temperature: 0 [°C]

(corresp. to 5 [bar])



Installation (1)

Refrigerating systems with a single compressor serving multiple evaporators in parallel, where the same evaporation pressure is required. The valve is installed on the common suction pipe.

Minimum allowable suction temperature

(setting valve): -5 [°C]

(corresp. to 4,2 [bar])

Allowable pressure drop across the valves: 0,42 [bar]

Liquid temperature: 40 [°C]

Solder connections

1. Fix, by means of the table 5B, the correction factor for liquid temperature $T_{\text{Liquid}} = 40 \text{ °C}$.

$$K_{T \text{ liquido}} = 0,95$$

2. Fix, by means of the table 5C, the correction factor for the evaporating pressure change:

$$K_{T \text{ liquido}} \times K_{\Delta P \text{ evap}} = 5 - 4,2 = 0,8 \text{ bar}$$

$$K_{\Delta P \text{ evap}} = 1,3$$

3. Calculate the capacity required to the regulator.

$$Q_{\text{valve}} = \frac{Q_{\text{evap}}}{K_{T \text{ liquido}} \times K_{\Delta P \text{ evap}}} = \frac{4}{0,95 \times 1,3} = 3,23 \text{ kW}$$

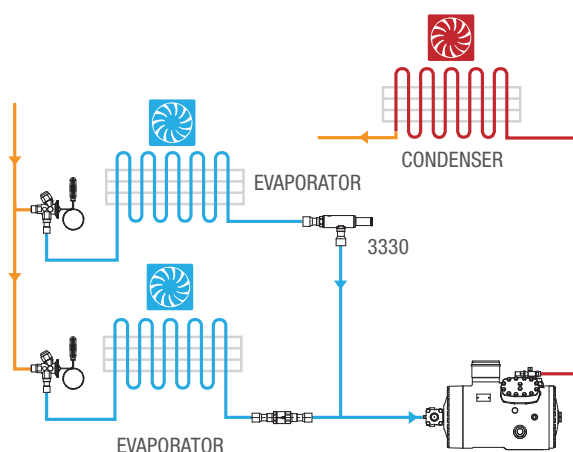
4. With the following parameters:

- Minimum capacity = 3,23 KW
- Evaporating temperature = 0 °C
- Pressure drop across the valves = 0,42 bar

Choose the proper valve in table 5A.

The select valves are:

- 3330/M12 with solder connections diameter 12 mm
- 3330/4 with solder connections diameter 1/2"



Installation (2)

Refrigerating systems with multiple evaporators which work with different evaporation pressures. The regulator is installed downstream of the evaporator with the highest pressure.

TABLE 1: General characteristics of evaporator pressure regulators 3330

Catalogue Number	Connections			Kv Factor [m³/h]	Regulating range [bar]		Factory setting [bar]	TS [°C]		PS [bar]	Risk Category according to PED
	SAE Flare	ODS			min.	max.		min.	max.		
		Ø [in.]	Ø [mm]								
3330/4	1/2"	–	–	2,70	0,2	5,5	2	-40	+110	28	Art. 3.3
3330/M12S	–	–	12								
3330/4S	–	1/2"	–								
3330/5	5/8"	–	–								
3330/5S	–	5/8"	16								
3330/7S	–	7/8"	22								
3330/9S	–	1.1/8"	–	8,4	0,2	5,5	2	-40	+110	28	Art. 3.3
3330/M28S	–	–	28								
3330/11S	–	1.3/8"	35								

TABLE 2: Dimensions and Weights of regulators 3330

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H ₁	H ₂	L	L ₁	D	
3330/4	159	76,5	45,5	48	37	32	510
3330/M12S	183	100,5	69,5	64			480
3330/4S	183	100,5	69,5	64			480
3330/5	163	80,5	49,5	52			540
3330/5S	183	100,5	69,5	64			500
3330/7S	194	112	81	75,5			560
3330/9S	263	151	111	105	44	46	1450
3330/M28S	263	151	111	105			1450
3330/11S	263	151	111	105			1460

TABLE 3A: Refrigerant Flow Capacity of evaporator pressure regulators 3330 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Design evaporator temperature [°C]									
		20	15	10	5	0	-5	-10	-15	-20	-25
3330/4 3330/M12S 3330/4S	0,07	—	—	1,10	0,99	0,88	0,77	0,67	0,57	—	—
	0,14	—	—	2,27	2,03	1,79	1,55	1,34	1,13	—	—
	0,21	—	—	3,70	3,26	2,83	2,39	2,01	1,63	—	—
	0,35	—	—	5,62	4,91	4,21	3,50	2,88	2,26	—	—
	0,42	—	—	7,17	6,18	5,18	4,18	3,44	—	—	—
	0,56	—	—	10,16	8,63	7,10	5,58	4,59	—	—	—
3330/5 3330/5S	0,07	—	—	1,42	1,28	1,15	1,01	0,89	0,77	—	—
	0,14	—	—	2,89	2,60	2,32	2,04	1,80	1,56	—	—
	0,21	—	—	4,37	3,93	3,50	3,07	2,70	2,33	—	—
	0,35	—	—	6,08	5,47	4,87	4,27	3,74	3,21	—	—
	0,42	—	—	8,02	7,20	6,38	5,56	4,87	—	—	—
	0,56	—	—	10,80	9,67	8,54	7,41	6,50	—	—	—
3330/7S	0,07	—	—	1,42	1,27	1,13	0,99	0,86	0,73	—	—
	0,14	—	—	2,92	2,61	2,30	1,99	1,72	1,45	—	—
	0,21	—	—	5,27	4,64	4,00	3,37	2,59	2,26	—	—
	0,35	—	—	7,63	6,67	5,71	4,75	3,91	3,07	—	—
	0,42	—	—	10,81	9,28	7,74	6,21	4,74	—	—	—
	0,56	—	—	13,99	11,88	9,78	7,68	6,32	—	—	—
3330/9S 3330/M28S	0,07	—	—	4,47	4,03	3,60	3,16	2,80	2,43	—	—
	0,14	—	—	9,07	8,18	7,29	6,40	5,65	4,91	—	—
	0,21	—	—	13,71	12,35	11,00	9,64	8,48	7,32	—	—
	0,35	—	—	19,09	17,20	15,30	13,40	11,75	10,09	—	—
	0,42	—	—	25,18	22,60	20,03	17,45	15,30	—	—	—
	0,56	—	—	33,93	30,38	26,83	23,29	20,41	—	—	—
3330/11S	0,07	—	—	4,34	3,90	3,46	3,02	2,64	2,25	—	—
	0,14	—	—	8,94	7,99	7,05	6,10	5,27	4,45	—	—
	0,21	—	—	16,17	14,22	12,28	10,33	7,94	6,93	—	—
	0,35	—	—	23,39	20,45	17,51	14,57	11,99	9,42	—	—
	0,42	—	—	33,15	28,45	23,75	19,05	14,54	—	—	—
	0,56	—	—	42,90	36,45	29,99	23,54	19,38	—	—	—

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

Nominal evaporator pressure change

($T_{\text{design evap}} - T_{\text{min evap}}$) : 8 psi (0,56 bar)

TABLE 3B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,28	1,23	1,18	1,13	1,08	1,03	0,97	0,92	0,86

TABLE 3C: Correction factor for evaporator pressure change different from nominal value

Evaporator pressure change [bar]							
0,14	0,28	0,42	0,56	0,7	0,84	0,98	1,12
0,3	0,6	0,8	1	1,2	1,3	1,4	1,5

TABLE 4A: Refrigerant Flow Capacity of evaporator pressure regulators 3330 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Design evaporator temperature [°C]									
		4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3330/4 3330/M12S 3330/4S	0,07	1,29	1,18	1,06	0,95	0,83	0,77	0,70	0,64	0,58	–
	0,14	2,66	2,41	2,15	1,90	1,65	1,52	1,39	1,26	1,13	–
	0,21	4,68	4,20	3,71	3,26	2,80	2,50	2,20	1,90	1,60	–
	0,35	7,51	6,70	5,88	5,13	4,37	3,82	3,26	2,71	2,16	–
	0,42	9,72	8,56	7,40	6,30	5,21	4,55	3,90	3,24	2,58	–
	0,56	13,85	12,07	10,30	8,61	6,92	6,06	5,19	4,32	3,45	–
3330/5 3330/5S	0,07	1,64	1,49	1,34	1,21	1,07	1,00	0,92	0,85	0,78	–
	0,14	3,30	2,99	2,69	2,42	2,15	2,00	1,85	1,70	1,55	–
	0,21	5,01	4,55	4,08	3,67	3,26	3,02	2,79	2,55	2,31	–
	0,35	7,00	6,35	5,69	5,11	4,53	4,20	3,86	3,53	3,20	–
	0,42	9,30	8,41	7,53	6,75	5,96	5,50	5,05	4,59	4,13	–
	0,56	12,58	11,38	10,17	9,09	8,01	7,38	6,75	6,12	5,49	–
3330/7S	0,07	1,62	1,47	1,32	1,18	1,04	0,96	0,88	0,80	0,72	–
	0,14	3,45	3,11	2,78	2,46	2,14	1,97	1,80	1,63	1,46	–
	0,21	6,04	5,41	4,79	4,20	3,61	3,22	2,84	2,45	2,06	–
	0,35	10,09	9,00	7,90	6,89	5,88	5,13	4,39	3,64	2,89	–
	0,42	13,41	11,81	10,21	8,70	7,19	6,28	5,38	4,47	3,56	–
	0,56	19,44	16,95	14,47	12,09	9,72	8,50	7,28	6,07	4,85	–
3330/9S 3330/M28S	0,07	5,14	4,67	4,21	3,79	3,37	3,14	2,90	2,67	2,44	–
	0,14	10,35	9,40	8,45	7,60	6,76	6,29	5,81	5,34	4,86	–
	0,21	15,75	14,28	12,82	11,52	10,23	9,49	8,75	8,01	7,27	–
	0,35	22,00	19,94	17,88	16,06	14,24	13,19	12,14	11,09	10,04	–
	0,42	29,20	26,43	23,65	21,19	18,72	17,28	15,85	14,42	12,98	–
	0,56	39,52	35,73	31,94	28,55	25,16	23,18	21,20	19,22	17,24	–
3330/11S	0,07	4,96	4,51	4,05	3,63	3,20	2,95	2,70	2,45	2,20	–
	0,14	10,57	9,55	8,52	7,54	6,56	6,04	5,52	5,00	4,48	–
	0,21	18,53	16,60	14,68	12,88	11,07	9,88	8,70	7,51	6,33	–
	0,35	30,94	27,59	24,24	21,13	18,02	15,73	13,45	11,16	8,88	–
	0,42	41,12	36,22	31,31	26,68	22,04	19,27	16,49	13,71	10,93	–
	0,56	59,63	51,99	44,36	37,09	29,81	26,08	22,34	18,60	14,87	–

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature 100 °F (37,8 °C)
 Liquid temperature 98 °F (36,7 °C)
 Subcooling 2 °R (1,1 °K)

Evaporating temperature 40 °F (4,4 °C)
 Suction temperature 65 °F (18,3 °C)
 Superheating 25 °R (13,9 °K)

Discharge temperature 150 °F (65,6 °C)

Nominal evaporator pressure change

 $(T_{\text{design evap}} - T_{\text{min evap}}) : 8 \text{ psi (0,56 bar)}$

TABLE 4B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,23	1,19	1,16	1,11	1,06	1,01	0,98	0,94	0,9

TABLE 4C: Correction factor for evaporator pressure change different from nominal value

Evaporator pressure change [bar]							
0,14	0,28	0,42	0,56	0,7	0,84	0,98	1,12
0,3	0,6	0,8	1	1,2	1,3	1,4	1,5

TABLE 5A: Refrigerant Flow Capacity of evaporator pressure regulators 3330 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Design evaporator temperature [°C]									
		4,4	0	-5	-10	-15	-20	-25	-30	-35	-40
3330/4 3330/M12S 3330/4S	0,07	1,24	1,11	0,99	0,87	0,75	0,69	0,62	0,56	0,50	—
	0,14	2,50	2,23	1,96	1,73	1,49	1,37	1,24	1,11	0,98	—
	0,21	4,08	3,63	3,17	2,76	2,35	2,12	1,90	1,67	1,44	—
	0,35	6,16	5,46	4,76	4,11	3,47	3,10	2,74	2,38	2,02	—
	0,42	8,38	7,34	6,30	5,35	4,40	3,88	3,37	2,85	2,33	—
	0,56	12,49	10,83	9,17	7,68	6,19	5,39	4,60	3,80	3,00	—
3330/5 3330/5S	0,07	1,56	1,40	1,24	1,09	0,93	0,87	0,80	0,74	0,68	—
	0,14	3,18	2,85	2,53	2,21	1,90	1,76	1,63	1,50	1,37	—
	0,21	4,79	4,30	3,81	3,32	2,84	2,64	2,44	2,24	2,04	—
	0,35	6,67	5,99	5,30	4,62	3,94	3,66	3,38	3,10	2,82	—
	0,42	8,86	7,93	7,01	6,09	5,18	4,80	4,42	4,04	3,66	—
	0,56	11,95	10,69	9,43	8,18	6,93	6,42	5,90	5,38	4,86	—
3330/7S	0,07	1,72	1,55	1,38	1,21	1,05	0,96	0,87	0,78	0,69	—
	0,14	3,56	3,18	2,80	2,46	2,13	1,94	1,76	1,58	1,40	—
	0,21	5,79	5,14	4,50	3,92	3,34	3,02	2,69	2,37	2,05	—
	0,35	8,67	7,69	6,70	5,79	4,88	4,37	3,86	3,35	2,84	—
	0,42	11,56	10,12	8,69	7,38	6,07	5,35	4,64	3,93	3,22	—
	0,56	17,22	14,93	12,65	10,59	8,53	7,44	6,34	5,24	4,14	—
3330/9S 3330/M28S	0,07	4,89	4,40	3,91	3,41	2,92	2,72	2,52	2,32	2,12	—
	0,14	9,98	8,95	7,93	6,95	5,96	5,54	5,13	4,71	4,30	—
	0,21	15,05	13,50	11,96	10,44	8,93	8,30	7,67	7,04	6,40	—
	0,35	20,96	18,80	16,64	14,51	12,38	11,50	10,62	9,74	8,86	—
	0,42	27,82	24,91	22,01	19,14	16,26	15,07	13,88	12,69	11,50	—
	0,56	37,54	33,59	29,63	25,70	21,78	20,15	18,52	16,90	15,27	—
3330/11S	0,07	5,29	4,75	4,22	3,71	3,21	2,94	2,66	2,39	2,12	—
	0,14	10,90	9,74	8,57	7,55	6,52	5,96	5,40	4,85	4,29	—
	0,21	17,75	15,78	13,81	12,02	10,24	9,25	8,26	7,27	6,28	—
	0,35	26,59	23,57	20,55	17,75	14,96	13,40	11,83	10,27	8,71	—
	0,42	35,46	31,05	26,64	22,62	18,60	16,42	14,24	12,05	9,87	—
	0,56	52,80	45,80	38,80	32,48	26,17	22,80	19,44	16,07	12,70	—

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

Nominal evaporator pressure change
($T_{\text{design evap}} - T_{\text{min evap}}$) : 8 psi (0,56 bar)

TABLE 5B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,43	1,35	1,28	1,2	1,12	1,03	0,95	0,86	0,76

TABLE 5C: Correction factor for evaporator pressure change different from nominal value

Evaporator pressure change [bar]							
0,14	0,28	0,42	0,56	0,7	0,84	0,98	1,12
0,3	0,6	0,8	1	1,2	1,3	1,4	1,5

TABLE 6A: Refrigerant Flow Capacity of evaporator pressure regulators 3330 [kW]

Catalogue Number	Pressure drop across regulator [bar]	Design evaporator temperature [°C]									
		15	10	4,4	0	-5	-10	-15	-20	-25	-30
3330/4 3330/M12S 3330/4S	0,07	–	1,07	0,96	0,91	0,85	0,81	0,76	0,65	–	–
	0,14	–	2,19	1,96	1,84	1,72	1,63	1,53	1,29	–	–
	0,21	–	3,55	3,13	2,92	2,71	2,55	2,38	1,93	–	–
	0,35	–	5,27	4,60	4,27	3,94	3,69	3,44	2,70	–	–
	0,42	–	6,88	5,92	5,45	4,97	4,58	4,20	3,30	–	–
	0,56	–	9,74	8,27	7,54	6,81	6,21	5,60	4,40	–	–
3330/5 3330/5S	0,07	–	1,37	1,24	1,17	1,11	1,05	0,99	0,86	–	–
	0,14	–	2,77	2,50	2,37	2,23	2,11	1,99	1,73	–	–
	0,21	–	4,19	3,77	3,57	3,36	3,18	3,00	2,59	–	–
	0,35	–	5,71	5,14	4,85	4,57	4,33	4,08	3,51	–	–
	0,42	–	7,71	6,92	6,52	6,13	5,79	5,45	4,68	–	–
	0,56	–	10,37	9,29	8,74	8,20	7,73	7,26	6,24	–	–
3330/7S	0,07	–	1,37	1,23	1,16	1,09	1,03	0,97	0,83	–	–
	0,14	–	2,80	2,50	2,35	2,20	2,08	1,96	1,65	–	–
	0,21	–	5,00	4,40	4,10	3,80	3,33	2,87	2,48	–	–
	0,35	–	7,24	6,33	5,87	5,42	5,07	4,72	3,71	–	–
	0,42	–	10,35	8,88	8,15	7,42	6,61	5,81	4,56	–	–
	0,56	–	13,46	11,43	10,42	9,41	8,58	7,74	6,08	–	–
3330/9S 3330/M28S	0,07	–	4,32	3,90	3,69	3,48	3,29	3,11	2,70	–	–
	0,14	–	8,71	7,86	7,43	7,00	6,63	6,25	5,43	–	–
	0,21	–	13,15	11,85	11,20	10,55	9,99	9,43	8,13	–	–
	0,35	–	17,92	16,14	15,25	14,36	13,59	12,83	11,02	–	–
	0,42	–	24,20	21,72	20,48	19,24	18,17	17,11	14,70	–	–
	0,56	–	32,57	29,17	27,46	25,76	24,28	22,81	19,60	–	–
3330/11S	0,07	–	4,19	3,76	3,55	3,34	3,16	2,98	2,55	–	–
	0,14	–	8,58	7,67	7,21	6,76	6,38	6,00	5,06	–	–
	0,21	–	15,34	13,49	12,57	11,65	10,22	8,79	7,61	–	–
	0,35	–	22,20	19,40	18,01	16,61	15,55	14,49	11,38	–	–
	0,42	–	31,74	27,24	24,99	22,74	20,27	17,81	13,98	–	–
	0,56	–	41,27	35,06	31,96	28,86	26,30	23,74	18,65	–	–

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature 100 °F (37,8 °C)
 Liquid temperature 98 °F (36,7 °C)
 Subcooling 2 °R (1,1 °K)

Evaporating temperature 40 °F (4,4 °C)
 Suction temperature 65 °F (18,3 °C)
 Superheating 25 °R (13,9 °K)

Discharge temperature 150 °F (65,6 °C)

Nominal evaporator pressure change

 $(T_{\text{design evap}} - T_{\text{min evap}}) : 8 \text{ psi (0,56 bar)}$

TABLE 6B: Correction factor for liquid temperature different from nominal value

Liquid temperature [°C]								
10	15	20	25	30	35	40	45	50
1,3	1,25	1,2	1,14	1,09	1,03	0,97	0,9	0,84

TABLE 6C: Correction factor for evaporator pressure change different from nominal value

Evaporator pressure change [bar]							
0,14	0,28	0,42	0,56	0,7	0,84	0,98	1,12
0,3	0,6	0,8	1	1,2	1,3	1,4	1,5

CONDENSING PRESSURE REGULATORS SERIES 3340

Approved by Underwriters Laboratories Inc.



APPLICATIONS

The condensing pressure regulators series 3340, shown in this chapter, are classified “Pressure accessories” in the sense of the Pressure Equipment Directive 94/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.

They are designed to operate on refrigerating systems, which use the following refrigerant fluids: R22 , R134a , R404A , R407C , R507 proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

The design of air conditioning and refrigerating system utilizing air cooled condensing units that will be subject to wide range of ambient temperature it is very important to foresee an accurate control of condenser capacity. As the condensing unit, properly sized, will operate satisfactorily during high ambient temperature, it follows that the capacity control needs at low ambient temperature. Good condensing pressure control during low ambient temperature avoids problems during running cycle of system and helps the start-up. Particularly this control maintain a minimum pressure differential across the orifice of the thermostatic expansion valve so that the TEV's capacity can match the evaporator load. Condensing pressure regulators series 3340, together with differential valves series 3136, are the solution to this control need. The 3340 regulator restricts the liquid flow from the condenser to the receiver, thus reducing the active condenser surface and raising the condensing pressure. The 3136 differential

valve by-passes hot gas from the compressor discharge to the receiver thus raising liquid pressure in the receiver.

OPERATION

Condensing pressure regulators series 3340 adjust the flow of liquid refrigerant (hot gas) according to changes of condensing (compressor discharge) pressure, upstream the regulator. When the condensing (discharge) pressure is below the valve setting, the shutter remain closed. As the condensing (discharge) pressure rises above the valve setting, the shutter begins to open and the amount of its opening is proportional to the change of condensing (discharge) pressure. As the condensing (discharge) pressure continues to rise, the shutter continues to open farther until the limit of the stroke is reached and the valve is completely open. Once the shutter is fully opened, only an increase in pressure drop across the valve will increase valve capacity. Regulators series 3340 regulate only in dependence on the inlet pressure change, pressure change on the outlet side do not affect the degree of opening since the valve is equipped with an equalization bellow with an effective area equal to valve seat. The factory pressure setting of these valves is 8 bar, this means that until the condensing (discharge) pressure is below the 8 bar the valve remains closed, when the condensing (discharge) pressure rise above the 8 bar the valve begin to open. According to the characteristics of the refrigerating system it can be necessary to change the valve setting adjusting the setting screw on the top of the body; the pressure setting range is from 3 bar up to 20 bar. The 3136 valves adjust the flow of hot gas to the liquid receiver according to the differential pressure between compressor discharge and liquid receiver. These valves begin to open when the differential pressure reaches 1,4 bar and are fully open when differential pressure is 3 bar.

CONSTRUCTION

The main parts of condensing pressure regulators series 3340 are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Austenitic stainless steel AISI 321 for bellow
- Austenitic stainless steel AISI 303 for shutter
- Brass bar EN 12164 – CW 614N for setting screw
- Spring steel DIN 17223/84 Class C/D for setting spring
- Chloroprene rubber (CR) for outlet seal gaskets

INSTALLATION

Condensing pressure regulators series 3340 can be mounted in two locations of the refrigerating system:

- In the liquid line between the condenser and the liquid receiver (for regulator selection see tables 3A, 4A, 5A, 6A related to liquid line). The 3136 valve is mounted

between the compressor discharge and the inlet of liquid receiver. This choice need a regulator with smaller size because it is controlling liquid refrigerant , but it is more suitable in temperate climate

- In the discharge line between the compressor and the condenser (for regulator selection see tables 3B, 4B, 5B, 6B related to hot gas line). The 3136 valve is mounted between the compressor discharge and the inlet of liquid receiver and it is also necessary to install a 3132 check valve between condenser outlet and receiver inlet to prevent liquid migration during an off cycle.. This choice need a regulator with bigger size because it is controlling gaseous refrigerant, but it is more suitable in very cold climate

SELECTION

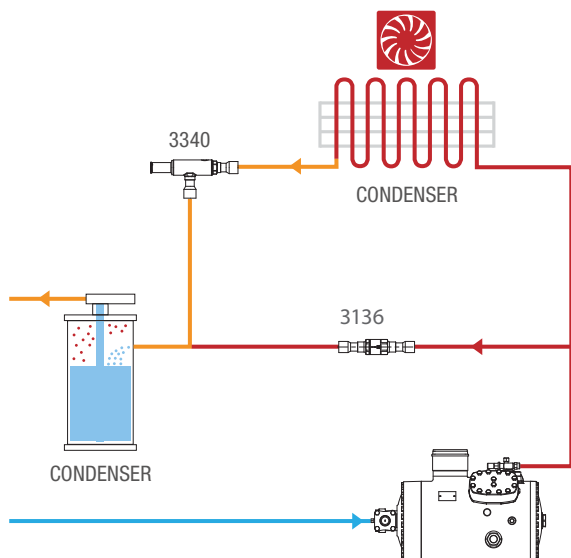
A correct selection of condensing pressure regulators series 3340 is possible if complete system information are available. The selection involves these basic items:

1. Refrigerant
2. Designed evaporator (system) capacity
3. Evaporating temperature
4. Condensing temperature
5. Allowable condensing pressure change
6. Allowable pressure drop across the valves

The refrigerating capacities indicated on tables 3A, 3B, 4A, 4B, 5A, 5B, 6A,6B are based on a reference evaporating temperature of 4,4 °C.

With evaporating temperature different from 4,4 °C the required capacity of regulator shall be:

$$\frac{Q_{\text{evap}}}{K_{T \text{ liquid}}} = Q_{\text{valve}}$$



Installation (1)

Refrigerating systems with air condensers. The regulator is installed at the condenser outlet on the liquid line, before the liquid receiver. Injection valve 3136 guarantees sufficiently high pressure under variable conditions (min. diff. 1.4 bar / max 3 bar).

with:

Q_{evap} = Evaporator capacity. [kW]

$K_{T \text{ evap}}$ = Correction factor for $T_{\text{evap}} \neq 4,4 \text{ °C}$.

Q_{valve} = Refrigerating capacity requested to regulator [kW]

EXAMPLE

Refrigerant:	R404A
Evaporator capacity:	20 [kW]
Designed evaporating temperature:	0 [°C]
Condensing temperature:	40 [°C]
Allowable condensing pressure change:	1,5 [bar]
Allowable pressure drop across the valves:	0,31 [bar]
Solder connections	

1. Fix, by means of the table 5C, the correction factor for evaporating temperature $T_{\text{evap}} = 0 \text{ °C}$.

$$K_{T \text{ evap}} = 1,02$$

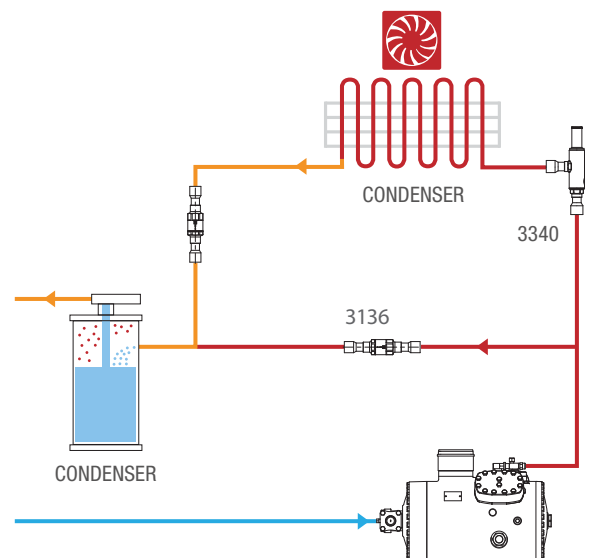
2. Calculate the capacity required to the regulator.

$$Q_{\text{valve}} = \frac{Q_{\text{evap}}}{K_{T \text{ evap}}} = \frac{20}{1,02} = 19,60 \text{ kW}$$

3. With the following parameters:

- Minimum capacity = 19,60 KW
- Condensing temperature = 40 °C
- Condensing pressure change = 1,5 bar
- Pressure drop across the valves = 0,31 bar

Choose the proper valve in table 5A. The select valve is 3340/5S



Installation (2)

Refrigerating systems with air condenser and receiver installed in very cold environments.

The regulator is installed upstream of the condenser.

Injection valve 3136 ensures that the receiver has sufficiently high pressure.

TABLE 1A: General characteristics of condensing pressure regulators 3340

Catalogue Number	Connections			Kv Factor [m³/h]	Regulating range [bar]		Factory setting [bar]	TS [°C]		PS [bar]	Risk Category according to PED
	SAE Flare	ODS			min.	max.		min.	max.		
		Ø [in.]	Ø [mm]								
3340/4	1/2"	–	–	2,70	3	20	8	-40	+110	28	Art. 3.3
3340/M12S	–	–	12								
3340/4S	–	1/2"	–								
3340/5	5/8"	–	–								
3340/5S	–	5/8"	16								
3340/7S	–	7/8"	22								
3340/9S	–	1.1/8"	–	8,4							
3340/M28S	–	–	28								
3340/11S	–	1.3/8"	35								

TABLE 1B: General characteristics of differential valves 3136

Catalogue Number	Connections		Kv Factor [m³/h]	Working range [bar]		TS [°C]		PS [bar]	Risk Category according to PED	
	SAE Flare	ODS		min.	max.	min.	max.			
		Ø [in.]								Ø [mm]
3136/M12	—	—	12	1,50	1,4	3	-40	+110	45	Art. 3.3
3136/4	—	1/2"	—							

TABLE 2: Dimensions and Weights of regulators 3340

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H ₁	H ₂	L	L ₁	D	
3340/4	159	76,5	45,5	48	37	32	510
3340/M12S	183	100,5	69,5	64			506
3340/4S	183	100,5	69,5	64			506
3340/5	163	80,5	49,5	52			550
3340/5S	183	100,5	69,5	64			506
3340/7S	194	112	81	75,5			570
3340/9S	263	151	111	105	44	46	1520
3340/M28S	263	151	111	105			1520
3340/11S	263	151	111	105			1530

TABLE 3A: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Liquid line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	17,93	17,05	16,07	15,19	14,30	13,15	12,00	11,30	10,59
		0,14	26,22	24,80	23,24	21,81	20,38	18,75	17,10	16,06	15,02
		0,31	45,70	43,03	40,12	37,44	34,75	32,22	29,67	27,59	25,49
		0,65	61,82	57,92	53,71	49,82	45,90	42,56	39,19	36,35	33,50
		1,03	77,67	72,46	66,84	61,63	56,38	52,27	48,14	44,55	40,94
		1,68	106,45	99,02	91,04	83,60	76,12	69,90	63,65	58,62	53,55
	3	0,7	32,36	31,29	28,60	27,53	26,36	25,12	23,78	22,70	21,55
		0,14	46,39	44,80	40,90	39,31	37,57	35,86	34,01	32,41	30,71
		0,31	73,39	70,82	64,60	62,03	59,22	56,43	53,41	51,00	48,43
		0,65	104,52	100,74	91,77	87,99	83,86	80,04	75,91	72,36	68,57
		1,03	128,57	123,78	112,61	107,82	102,58	98,07	93,18	88,67	83,87
		1,68	174,27	167,14	151,46	144,34	136,59	129,93	122,73	116,69	110,26
3340/5 3340/5S	1,5	0,7	29,89	28,42	26,79	25,32	23,84	21,92	20,00	18,83	17,66
		0,14	43,71	41,33	38,73	36,36	33,97	31,24	28,50	26,77	25,03
		0,31	76,17	71,72	66,86	62,40	57,92	53,70	49,46	45,98	42,49
		0,65	103,03	96,54	89,51	83,03	76,50	70,93	65,32	60,59	55,83
		1,03	129,46	120,76	111,40	102,71	93,96	87,12	80,23	74,25	68,23
		1,68	177,42	165,03	151,73	139,34	126,87	116,51	106,08	97,70	89,26
	3	0,7	53,93	52,15	47,67	45,89	43,94	41,87	39,63	37,83	35,91
		0,14	77,32	74,67	68,17	65,52	62,62	59,77	56,69	54,02	51,18
		0,31	122,31	118,03	107,66	103,38	98,70	94,05	89,02	85,00	80,71
		0,65	174,21	167,90	152,96	146,65	139,77	133,41	126,52	120,59	114,29
		1,03	214,29	206,29	187,69	179,69	170,97	163,45	155,30	147,78	139,78
		1,68	290,44	278,57	252,43	240,56	227,64	216,55	204,55	194,48	183,76
3340/7S	1,5	0,7	38,91	38,73	34,68	34,50	34,10	32,83	31,29	30,71	30,02
		0,14	56,59	55,99	49,84	49,25	48,29	46,51	44,32	43,39	42,29
		0,31	89,88	88,50	78,39	77,00	75,01	72,82	70,06	67,90	65,40
		0,65	128,43	125,80	110,83	108,19	104,63	101,57	97,71	94,48	90,75
		1,03	158,18	154,18	135,14	131,13	125,92	122,23	117,59	113,44	108,67
		1,68	209,46	203,51	177,77	171,83	164,21	157,88	150,17	144,17	137,31
	3	0,7	60,79	60,70	53,51	53,42	52,88	51,95	50,58	49,56	48,29
		0,14	86,43	86,19	75,87	75,63	74,72	73,54	71,74	70,17	68,23
		0,31	134,24	133,75	117,64	117,15	115,63	113,60	110,60	108,39	105,65
		0,65	187,42	186,50	163,82	162,90	160,50	157,95	154,08	150,74	146,63
		1,03	226,69	225,29	197,64	196,24	193,03	190,27	185,95	181,62	176,32
		1,68	293,29	290,33	253,67	250,71	245,28	240,57	233,74	228,10	221,22
3340/9S 3340/M28S	1,5	0,07	93,88	89,26	84,14	79,52	74,87	68,86	62,81	59,15	55,46
		0,14	137,28	129,82	121,64	114,18	106,68	98,13	89,52	84,08	78,61
		0,31	239,25	225,25	209,99	195,99	181,91	168,66	155,34	144,42	133,44
		0,65	323,58	303,20	281,14	260,76	240,26	222,76	205,15	190,29	175,34
		1,03	406,59	379,28	349,89	322,59	295,11	273,62	251,99	233,19	214,29
		1,68	557,24	518,31	476,54	437,62	398,45	365,91	333,18	306,84	280,34
	3	0,07	169,38	163,78	149,72	144,13	137,99	131,50	124,48	118,82	112,80
		0,14	242,83	234,51	214,09	205,77	196,66	187,72	178,05	169,66	160,73
		0,31	384,15	370,71	338,14	324,69	309,98	295,38	279,59	266,96	253,50
		0,65	547,14	527,34	480,40	460,60	438,97	418,99	397,36	378,75	358,94
		1,03	673,03	647,92	589,49	564,37	536,97	513,36	487,77	464,15	439,01
		1,68	912,20	874,92	792,82	755,53	714,97	680,12	642,45	610,81	577,15
3340/11S	1,5	0,07	119,33	118,77	106,36	105,80	104,56	100,69	95,94	94,18	92,06
		0,14	173,53	171,70	152,85	151,02	148,10	142,62	135,92	133,08	129,70
		0,31	275,63	271,39	240,38	236,14	230,04	223,31	214,85	208,23	200,56
		0,65	393,87	385,79	339,87	331,79	320,86	311,47	299,65	289,74	278,31
		1,03	485,10	472,83	414,42	402,15	386,15	374,84	360,61	347,88	333,25
		1,68	642,33	624,10	545,17	526,93	503,57	484,18	460,53	442,12	421,09
	3	0,07	186,43	186,16	164,09	163,82	162,15	159,32	155,12	151,98	148,09
		0,14	265,06	264,31	232,67	231,92	229,15	225,53	220,02	215,19	209,25
		0,31	411,67	410,17	360,76	359,26	354,59	348,38	339,18	332,40	323,99
		0,65	574,77	571,94	502,38	499,55	492,21	484,39	472,50	462,27	449,67
		1,03	695,17	690,88	606,09	601,79	591,95	583,49	570,25	556,96	540,71
		1,68	899,42	890,34	777,94	768,85	752,20	737,74	716,80	699,49	678,40

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

TABLE 3B: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Hot gas line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]									
			10	15	20	25	30	35	40	45	50	
3340/4 3340/M12S 3340/4S	1,5	0,7	2,47	2,46	2,47	2,47	2,48	2,49	2,49	2,50	2,51	
		0,14	3,47	3,46	3,47	3,48	3,49	3,50	3,51	3,53	3,54	
		0,31	5,88	5,87	5,88	5,90	5,92	5,93	5,95	5,97	5,99	
		0,65	7,68	7,66	7,68	7,71	7,73	7,75	7,78	7,80	7,82	
		1,03	9,34	9,31	9,34	9,37	9,39	9,42	9,45	9,48	9,50	
	3	1,68	11,86	11,82	11,86	11,89	11,93	11,96	12,00	12,03	12,07	
		0,7	4,50	4,37	4,50	4,62	4,74	4,87	4,99	5,12	5,25	
		0,14	6,35	6,17	6,35	6,52	6,70	6,87	7,05	7,22	7,41	
		0,31	9,99	9,71	9,99	10,26	10,54	10,81	11,09	11,37	11,66	
		0,65	14,01	13,63	14,01	14,40	14,78	15,17	15,55	15,95	16,35	
3340/5 3340/5S	1,5	1,03	16,98	16,51	16,98	17,45	17,91	18,38	18,85	19,32	19,81	
		1,68	21,72	21,12	21,72	22,32	22,91	23,51	24,11	24,72	25,35	
		3	0,7	4,11	4,10	4,11	4,12	4,13	4,15	4,16	4,17	4,18
			0,14	5,79	5,77	5,79	5,81	5,82	5,84	5,86	5,88	5,89
			0,31	9,80	9,78	9,80	9,83	9,86	9,89	9,92	9,95	9,98
	0,65		12,81	12,77	12,81	12,85	12,88	12,92	12,96	13,00	13,04	
	3	1,03	15,56	15,52	15,56	15,61	15,65	15,70	15,75	15,79	15,84	
		1,68	19,76	19,71	19,76	19,82	19,88	19,94	20,00	20,06	20,12	
		0,7	7,50	7,29	7,50	7,70	7,91	8,11	8,32	8,53	8,75	
		0,14	10,58	10,29	10,58	10,87	11,16	11,45	11,74	12,04	12,35	
0,31		16,65	16,19	16,65	17,11	17,56	18,02	18,48	18,95	19,43		
3340/7S	1,5	0,65	23,35	22,71	23,35	23,99	24,64	25,28	25,92	26,58	27,25	
		1,03	28,30	27,52	28,30	29,08	29,85	30,63	31,41	32,21	33,02	
		1,68	36,20	35,21	36,20	37,20	38,19	39,19	40,18	41,20	42,25	
		3	0,7	5,60	5,30	5,60	5,89	6,19	6,48	6,8	7,09	7,41
			0,14	7,84	7,43	7,84	8,26	8,67	9,08	9,5	9,93	10,38
	0,31		12,10	11,46	12,10	12,74	13,37	14,01	14,6	15,32	16,01	
	0,65		16,69	15,81	16,69	17,57	18,45	19,33	20,2	21,13	22,09	
	3	1,03	19,87	18,82	19,87	20,92	21,96	23,01	24,1	25,15	26,30	
		1,68	24,37	23,09	24,37	25,66	26,94	28,23	29,5	30,86	32,26	
		0,7	8,72	8,18	8,72	9,27	9,81	10,35	10,9	11,47	12,07	
0,14		12,21	11,45	12,21	12,97	13,73	14,49	15,3	16,05	16,90		
0,31		18,86	17,69	18,86	20,04	21,21	22,39	23,6	24,80	26,10		
3340/9S 3340/M28S	1,5	0,65	25,94	24,32	25,94	27,55	29,17	30,78	32,4	34,10	35,89	
		1,03	30,90	28,98	30,90	32,83	34,75	36,68	38,6	40,63	42,76	
		1,68	37,73	35,38	37,73	40,08	42,43	44,78	47,1	49,60	52,20	
		3	0,07	12,90	12,87	12,90	12,94	12,98	13,02	13,1	13,10	13,13
			0,14	18,18	18,13	18,18	18,24	18,29	18,34	18,4	18,45	18,51
	0,31		30,79	30,70	30,79	30,88	30,98	31,07	31,2	31,25	31,34	
	0,65		40,23	40,11	40,23	40,35	40,46	40,58	40,7	40,82	40,94	
	3	1,03	48,88	48,73	48,88	49,02	49,17	49,31	49,5	49,60	49,75	
		1,68	62,07	61,89	62,07	62,26	62,44	62,63	62,8	63,00	63,18	
		0,07	23,54	22,89	23,54	24,19	24,83	25,48	26,1	26,79	27,47	
0,14		33,23	32,32	33,23	34,14	35,06	35,97	36,9	37,82	38,78		
0,31		52,29	50,85	52,29	53,72	55,16	56,60	58,0	59,51	61,02		
3340/11S	1,5	0,65	73,34	71,33	73,34	75,36	77,38	79,39	81,4	83,48	85,59	
		1,03	88,88	86,43	88,88	91,32	93,76	96,21	98,6	101,15	103,72	
		1,68	113,70	110,57	113,70	116,82	119,95	123,07	126,2	129,40	132,69	
		3	0,07	17,17	16,26	17,17	18,07	18,98	19,88	20,8	21,74	22,73
			0,14	24,05	22,78	24,05	25,32	26,58	27,85	29,1	30,45	31,83
	0,31		37,10	35,14	37,10	39,06	41,01	42,97	44,9	46,97	49,11	
	0,65		51,18	48,48	51,18	53,88	56,58	59,28	62,0	64,80	67,75	
	3	1,03	60,93	57,72	60,93	64,14	67,36	70,57	73,8	77,14	80,65	
		1,68	74,74	70,80	74,74	78,68	82,62	86,57	90,5	94,63	98,94	
		0,07	26,76	25,09	26,76	28,42	30,09	31,75	33,4	35,17	37,02	
0,14		37,45	35,12	37,45	39,78	42,12	44,45	46,8	49,23	51,82		
0,31		57,85	54,25	57,85	61,45	65,06	68,66	72,3	76,05	80,04		

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 3C: Correction factor for evaporator temperature different from nominal value

Evaporator temperature [°C]								
-40	-30	-20	-15	-10	-5	0	4,4	10
1,2	1,15	1,1	1,08	1,06	1,04	1,02	1	0,98

TABLE 4A: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Liquid line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]									
			10	15	20	25	30	35	40	45	50	
3340/4 3340/M12S 3340/4S	1,5	0,7	12,67	12,16	11,66	11,16	10,66	9,94	9,23	8,51	7,78	
		0,14	18,42	17,63	16,84	16,05	15,26	14,18	13,08	12,06	11,03	
		0,31	31,25	29,40	27,57	25,72	23,86	22,30	20,74	19,24	17,74	
		0,65	45,19	42,42	39,65	36,88	34,08	31,71	29,33	27,21	25,08	
		1,03	56,48	52,88	49,30	45,70	42,08	38,99	35,87	33,27	30,66	
	3	1,68	77,58	71,84	66,13	60,39	54,62	50,99	47,34	43,76	40,16	
		0,7	25,93	24,97	24,10	23,14	22,09	21,04	19,91	19,02	18,06	
		0,14	37,08	35,69	34,43	33,04	31,53	30,02	28,38	27,06	25,65	
		0,31	58,80	56,44	54,28	51,92	49,35	47,05	44,56	42,46	40,23	
		0,65	84,03	80,62	77,51	74,11	70,41	67,08	63,49	60,39	57,09	
3340/5 3340/5S	1,5	1,03	103,26	99,04	95,19	90,98	86,39	82,26	77,79	73,86	69,67	
		1,68	137,60	131,78	126,46	120,64	114,32	108,65	102,55	98,47	94,12	
		3	0,7	21,17	20,33	19,38	18,55	17,71	16,53	15,34	14,13	12,93
			0,14	30,78	29,47	27,99	26,68	25,36	23,56	21,74	20,04	18,32
			0,31	52,22	49,15	45,81	42,74	39,65	37,06	34,46	31,98	29,48
	0,65		75,52	70,90	65,89	61,28	56,63	52,70	48,74	45,22	41,68	
	1,03		94,37	88,39	81,93	75,95	69,93	64,78	59,61	55,29	50,96	
	1,68	129,63	120,09	109,90	100,36	90,76	84,73	78,67	72,72	66,74		
	3	0,7	44,32	42,79	39,06	37,53	35,86	34,18	32,37	30,91	29,36	
		0,14	63,37	61,16	55,80	53,60	51,19	48,76	46,14	43,98	41,68	
0,31		100,49	96,73	87,99	84,22	80,11	76,42	72,43	69,02	65,39		
0,65		143,60	138,17	125,64	120,21	114,29	108,96	103,19	98,15	92,79		
1,03		176,46	169,74	154,29	147,57	140,24	133,61	126,44	120,05	113,25		
3340/7S	1,5	1,68	235,12	225,84	204,97	195,68	185,57	176,49	166,68	160,05	152,98	
		3	0,7	29,23	29,42	26,65	26,84	26,90	26,28	25,47	24,47	23,33
			0,14	42,10	42,22	38,10	38,22	38,14	37,09	35,76	34,36	32,75
			0,31	70,67	69,56	61,59	60,48	58,89	57,64	55,99	54,16	52,05
			0,65	100,94	99,08	87,48	85,63	83,06	80,92	78,19	75,62	72,66
	1,03		125,22	122,60	107,96	105,34	101,80	98,74	94,90	91,78	88,17	
	1,68	167,69	162,21	141,04	135,56	128,68	125,78	121,98	117,54	112,45		
	3	0,7	50,98	50,83	44,73	44,58	44,04	43,28	42,15	41,32	40,29	
		0,14	72,37	72,12	63,45	63,20	62,40	61,29	59,64	58,36	56,77	
		0,31	113,17	112,45	98,63	97,91	96,28	94,70	92,32	90,30	87,81	
0,65		158,86	157,79	138,35	137,28	134,94	132,64	129,20	126,14	122,40		
1,03		194,11	192,75	168,94	167,57	164,64	161,73	157,43	153,41	148,54		
1,68	251,39	249,24	218,11	215,96	211,73	207,62	201,68	198,77	195,01			
3340/9S 3340/M28S	1,5	0,7	66,48	63,86	60,88	58,26	55,62	51,90	48,16	44,39	40,60	
		0,14	96,67	92,55	87,91	83,79	79,65	73,99	68,29	62,93	57,55	
		0,31	164,01	154,37	143,86	134,22	124,52	116,40	108,24	100,44	92,60	
		0,65	237,19	222,69	206,95	192,45	177,86	165,51	153,08	142,03	130,91	
		1,03	296,40	277,62	257,31	238,53	219,63	203,47	187,20	173,66	160,04	
	3	1,68	407,13	377,17	345,16	315,20	285,06	266,12	247,07	228,39	209,60	
		0,7	139,19	134,39	122,67	117,87	112,62	107,35	101,65	97,08	92,22	
		0,14	199,03	192,10	175,27	168,34	160,76	153,14	144,90	138,13	130,92	
		0,31	315,63	303,79	276,34	264,51	251,59	240,01	227,47	216,77	205,37	
		0,65	451,00	433,96	394,60	377,56	358,96	342,21	324,09	308,26	291,42	
3340/11S	1,5	1,03	554,21	533,10	484,59	463,48	440,45	419,64	397,13	377,04	355,67	
		1,68	738,46	709,30	643,75	614,60	582,83	554,31	523,49	502,68	480,47	
		3	0,7	89,64	90,23	81,72	82,31	82,48	80,59	78,12	75,06	71,55
			0,14	129,09	129,47	116,84	117,22	116,95	113,74	109,67	105,36	100,43
			0,31	216,72	213,31	188,88	185,47	180,60	176,77	171,70	166,09	159,62
	0,65		309,54	303,85	268,28	262,59	254,72	248,17	239,77	231,91	222,83	
	1,03		384,02	375,98	331,08	323,03	312,20	302,81	291,04	281,45	270,38	
	1,68	514,24	497,45	432,51	415,72	394,62	385,71	374,07	360,47	344,86		
	3	0,7	156,34	155,87	137,18	136,71	135,04	132,72	129,26	126,71	123,54	
		0,14	221,93	221,17	194,57	193,82	191,36	187,94	182,91	178,97	174,10	
0,31		347,07	344,86	302,47	300,26	295,27	290,42	283,11	276,91	269,29		
0,65		487,16	483,89	424,27	421,00	413,81	406,75	396,22	386,82	375,35		
1,03		595,28	591,09	518,09	513,90	504,90	495,97	482,77	470,46	455,52		
1,68	770,93	764,32	668,88	662,27	649,30	636,70	618,48	609,57	598,03			

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

TABLE 4B: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Hot gas line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	2,23	2,23	2,23	2,24	2,25	2,25	2,26	2,27	2,27
		0,14	3,15	3,14	3,15	3,16	3,17	3,18	3,19	3,20	3,21
		0,31	4,97	4,96	4,97	4,99	5,00	5,02	5,03	5,05	5,06
		0,65	7,00	6,98	7,00	7,02	7,04	7,06	7,08	7,10	7,12
		1,03	8,52	8,49	8,52	8,54	8,57	8,60	8,62	8,65	8,67
	3	1,68	10,94	10,91	10,94	10,98	11,01	11,04	11,07	11,11	11,14
		0,7	4,36	4,24	4,36	4,48	4,60	4,72	4,84	4,96	5,08
		0,14	6,15	5,98	6,15	6,32	6,49	6,66	6,83	7,00	7,18
		0,31	9,70	9,43	9,70	9,96	10,23	10,50	10,76	11,04	11,32
		0,65	13,68	13,31	13,68	14,06	14,43	14,81	15,19	15,57	15,97
		1,03	16,60	16,15	16,60	17,06	17,52	17,97	18,43	18,90	19,38
		1,68	21,39	20,80	21,39	21,97	22,56	23,15	23,74	24,34	24,96
		0,7	3,72	3,71	3,72	3,73	3,74	3,75	3,77	3,78	3,79
		0,14	5,25	5,24	5,25	5,27	5,28	5,30	5,31	5,33	5,35
		0,31	8,29	8,26	8,29	8,31	8,34	8,36	8,39	8,41	8,43
		0,65	11,67	11,63	11,67	11,70	11,73	11,77	11,80	11,84	11,87
		1,03	14,20	14,16	14,20	14,24	14,28	14,33	14,37	14,41	14,45
		1,68	18,24	18,18	18,24	18,29	18,35	18,40	18,46	18,51	18,56
3340/5 3340/5S	1,5	0,7	3,72	3,71	3,72	3,73	3,74	3,75	3,77	3,78	3,79
		0,14	5,25	5,24	5,25	5,27	5,28	5,30	5,31	5,33	5,35
		0,31	8,29	8,26	8,29	8,31	8,34	8,36	8,39	8,41	8,43
		0,65	11,67	11,63	11,67	11,70	11,73	11,77	11,80	11,84	11,87
		1,03	14,20	14,16	14,20	14,24	14,28	14,33	14,37	14,41	14,45
	3	1,68	18,24	18,18	18,24	18,29	18,35	18,40	18,46	18,51	18,56
		0,7	7,26	7,06	7,26	7,46	7,66	7,86	8,06	8,26	8,47
		0,14	10,25	9,97	10,25	10,53	10,81	11,10	11,38	11,67	11,96
		0,31	16,16	15,72	16,16	16,61	17,05	17,49	17,94	18,39	18,86
		0,65	22,80	22,18	22,80	23,43	24,06	24,68	25,31	25,95	26,61
		1,03	27,67	26,91	27,67	28,43	29,20	29,96	30,72	31,50	32,30
		1,68	35,64	34,66	35,64	36,62	37,60	38,58	39,56	40,57	41,60
		0,7	5,70	5,40	5,70	6,00	6,30	6,60	6,90	7,22	7,55
		0,14	7,97	7,55	7,97	8,39	8,81	9,23	9,65	10,09	10,54
		0,31	12,42	11,76	12,42	13,07	13,73	14,38	15,04	15,72	16,44
		0,65	17,26	16,35	17,26	18,17	19,08	19,99	20,90	21,85	22,85
		1,03	20,85	19,75	20,85	21,95	23,05	24,15	25,25	26,40	27,60
		1,68	26,09	24,71	26,09	27,46	28,84	30,21	31,59	33,02	34,53
3340/7S	1,5	0,7	9,13	8,56	9,13	9,70	10,27	10,84	11,41	12,01	12,64
		0,14	12,80	12,00	12,80	13,59	14,39	15,19	15,99	16,82	17,71
		0,31	19,89	18,66	19,89	21,13	22,37	23,61	24,85	26,15	27,53
		0,65	27,57	25,86	27,57	29,29	31,01	32,72	34,44	36,25	38,15
		1,03	33,27	31,20	33,27	35,35	37,42	39,49	41,56	43,74	46,04
	3	1,68	41,65	39,06	41,65	44,24	46,84	49,43	52,02	54,75	57,63
		0,7	11,69	11,65	11,69	11,72	11,76	11,79	11,8	11,86	11,90
		0,14	16,49	16,44	16,49	16,54	16,59	16,64	16,7	16,74	16,79
		0,31	26,03	25,95	26,03	26,10	26,18	26,26	26,3	26,41	26,49
		0,65	36,64	36,53	36,64	36,75	36,86	36,96	37,1	37,18	37,29
		1,03	44,60	44,46	44,60	44,73	44,86	44,99	45,1	45,26	45,39
		1,68	57,28	57,11	57,28	57,45	57,62	57,79	58,0	58,13	58,31
		0,7	22,81	22,18	22,81	23,43	24,06	24,69	25,3	25,96	26,62
		0,14	32,19	31,31	32,19	33,08	33,96	34,85	35,7	36,64	37,57
		0,31	50,76	49,36	50,76	52,15	53,55	54,94	56,3	57,77	59,24
		0,65	71,62	69,65	71,62	73,59	75,56	77,52	79,5	81,51	83,58
		1,03	86,92	84,53	86,92	89,31	91,69	94,08	96,5	98,92	101,43
		1,68	111,95	108,87	111,95	115,03	118,10	121,18	124,3	127,41	130,65
3340/9S 3340/M28S	1,5	0,7	17,48	16,56	17,48	18,41	19,33	20,25	21,2	22,14	23,14
		0,14	24,43	23,14	24,43	25,72	27,01	28,29	29,6	30,93	32,34
		0,31	38,08	36,07	38,08	40,09	42,10	44,11	46,1	48,21	50,41
		0,65	52,93	50,14	52,93	55,72	58,51	61,30	64,1	67,01	70,06
		1,03	63,95	60,58	63,95	67,32	70,69	74,06	77,4	80,96	84,65
	3	1,68	79,99	75,78	79,99	84,21	88,43	92,65	96,9	101,28	105,89
		0,7	28,01	26,26	28,01	29,75	31,50	33,24	35,0	36,82	38,75
		0,14	39,25	36,80	39,25	41,69	44,13	46,58	49,0	51,59	54,30
		0,31	61,01	57,21	61,01	64,81	68,61	72,41	76,2	80,20	84,41
		0,65	84,56	79,29	84,56	89,82	95,09	100,35	105,6	111,16	116,99
		1,03	102,04	95,69	102,04	108,39	114,75	121,10	127,5	134,14	141,18
		1,68	127,73	119,77	127,73	135,68	143,64	151,59	159,5	167,91	176,72
3340/11S	1,5	0,7	17,48	16,56	17,48	18,41	19,33	20,25	21,2	22,14	23,14
		0,14	24,43	23,14	24,43	25,72	27,01	28,29	29,6	30,93	32,34
		0,31	38,08	36,07	38,08	40,09	42,10	44,11	46,1	48,21	50,41
		0,65	52,93	50,14	52,93	55,72	58,51	61,30	64,1	67,01	70,06
		1,03	63,95	60,58	63,95	67,32	70,69	74,06	77,4	80,96	84,65
	3	1,68	79,99	75,78	79,99	84,21	88,43	92,65	96,9	101,28	105,89
		0,7	28,01	26,26	28,01	29,75	31,50	33,24	35,0	36,82	38,75
		0,14	39,25	36,80	39,25	41,69	44,13	46,58	49,0	51,59	54,30
		0,31	61,01	57,21	61,01	64,81	68,61	72,41	76,2	80,20	84,41
		0,65	84,56	79,29	84,56	89,82	95,09	100,35	105,6	111,16	116,99
		1,03	102,04	95,69	102,04	108,39	114,75	121,10	127,5	134,14	141,18
		1,68	127,73	119,77	127,73	135,68	143,64	151,59	159,5	167,91	176,72

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

R22

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 4C: Correction factor for evaporator temperature different from nominal value

Evaporator temperature [°C]								
-40	-30	-20	-15	-10	-5	0	4,4	10
1,12	1,08	1,05	1,04	1,03	1,02	1,01	1	0,99

TABLE 5A: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Liquid line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	11,30	10,61	9,87	9,19	8,50	8,06	7,62	6,95	6,27
		0,14	16,16	15,20	14,15	13,19	12,23	11,59	10,94	9,95	8,96
		0,31	26,31	24,64	22,83	21,16	19,48	18,14	16,79	15,55	14,30
		0,65	37,42	35,08	32,55	30,21	27,86	25,94	24,00	22,17	20,33
		1,03	46,04	43,21	40,14	37,31	34,46	32,08	29,68	27,35	25,00
		1,68	62,48	58,40	53,99	49,90	45,79	42,63	39,45	36,42	33,38
	3	0,7	22,15	21,52	19,77	19,14	18,45	17,64	16,76	15,81	14,80
		0,14	31,76	30,83	28,30	27,36	26,33	25,21	24,00	22,63	21,17
		0,31	52,00	50,22	45,85	44,07	42,12	40,07	37,86	35,75	33,51
		0,65	74,00	71,40	65,12	62,52	59,68	56,86	53,81	50,79	47,58
		1,03	91,29	88,00	80,19	76,90	73,31	69,94	66,29	62,55	58,57
		1,68	120,77	116,30	105,84	101,36	96,47	92,37	87,92	82,97	77,71
3340/5 3340/5S	1,5	0,7	18,83	17,69	16,45	15,32	14,17	13,44	12,70	11,58	10,45
		0,14	26,93	25,33	23,59	21,99	20,38	19,31	18,24	16,59	14,93
		0,31	43,85	41,07	38,05	35,27	32,47	30,23	27,99	25,92	23,84
		0,65	62,36	58,46	54,25	50,35	46,43	43,23	40,00	36,95	33,88
		1,03	76,73	72,02	66,90	62,19	57,44	53,47	49,47	45,58	41,67
		1,68	104,14	97,33	89,98	83,17	76,32	71,05	65,75	60,71	55,63
	3	0,7	36,91	35,86	32,95	31,91	30,75	29,40	27,94	26,35	24,67
		0,14	52,94	51,38	47,16	45,60	43,89	42,02	40,00	37,71	35,29
		0,31	86,67	83,70	76,41	73,45	70,20	66,79	63,10	59,59	55,86
		0,65	123,33	119,00	108,53	104,20	99,46	94,76	89,68	84,65	79,31
		1,03	152,15	146,67	133,64	128,17	122,18	116,57	110,49	104,25	97,62
		1,68	201,29	193,83	176,39	168,93	160,78	153,95	146,53	138,28	129,52
3340/7S	1,5	0,7	28,72	28,08	27,66	27,02	26,18	25,92	25,54	24,27	22,84
		0,14	40,68	39,83	39,28	38,43	37,29	36,92	36,35	34,47	32,34
		0,31	65,85	64,14	62,93	61,22	59,00	57,39	55,38	53,46	51,26
		0,65	91,91	89,64	88,06	85,79	82,83	80,55	77,71	74,83	71,53
		1,03	111,82	109,20	107,41	104,79	101,34	98,54	95,04	91,29	87,00
		1,68	149,30	145,06	142,00	137,76	132,34	128,71	124,17	119,50	114,16
	3	0,7	45,07	45,08	45,42	45,43	45,11	44,34	43,22	41,84	40,20
		0,14	64,02	63,96	64,37	64,31	63,77	62,76	61,27	59,30	56,95
		0,31	104,06	103,33	103,44	102,71	101,15	98,91	95,86	92,91	89,39
		0,65	145,90	144,72	144,73	143,55	141,17	138,25	134,20	130,02	125,03
		1,03	177,91	176,28	176,13	174,50	171,39	168,07	163,40	158,25	152,10
		1,68	230,21	227,79	227,32	224,90	220,54	217,05	211,92	205,27	197,33
3340/9S 3340/M28S	1,5	0,07	59,14	55,56	51,68	48,10	44,51	42,20	39,88	36,36	32,82
		0,14	84,57	79,54	74,08	69,05	64,00	60,65	57,28	52,11	46,90
		0,31	137,72	128,98	119,52	110,78	101,98	94,96	87,89	81,40	74,87
		0,65	195,86	183,62	170,37	158,14	145,83	135,76	125,64	116,05	106,41
		1,03	241,00	226,19	210,12	195,31	180,40	167,92	155,37	143,16	130,87
		1,68	327,08	305,69	282,61	261,21	239,69	223,15	206,51	190,66	174,72
	3	0,07	115,93	112,64	103,50	100,21	96,57	92,34	87,75	82,77	77,49
		0,14	166,26	161,37	148,12	143,23	137,85	131,99	125,62	118,45	110,83
		0,31	272,20	262,88	240,00	230,68	220,48	209,77	198,19	187,15	175,43
		0,65	387,36	373,75	340,88	327,28	312,39	297,63	281,66	265,86	249,08
		1,03	477,86	460,66	419,74	402,54	383,74	366,10	347,01	327,41	306,60
		1,68	632,19	608,76	554,00	530,56	504,98	483,51	460,21	434,30	406,78
3340/11S	1,5	0,07	88,08	86,12	84,82	82,87	80,27	79,50	78,32	74,44	70,05
		0,14	124,76	122,15	120,45	117,85	114,35	113,21	111,46	105,70	99,17
		0,31	201,93	196,69	192,98	187,74	180,95	176,00	169,83	163,96	157,20
		0,65	281,85	274,89	270,05	263,09	254,00	247,02	238,30	229,47	219,34
		1,03	342,92	334,88	329,39	321,35	310,77	302,17	291,45	279,94	266,79
		1,68	457,86	444,86	435,46	422,46	405,85	394,70	380,77	366,48	350,09
	3	0,07	138,21	138,24	139,29	139,32	138,34	135,96	132,53	128,31	123,29
		0,14	196,34	196,15	197,41	197,22	195,56	192,46	187,89	181,84	174,64
		0,31	319,11	316,88	317,22	314,99	310,18	303,34	293,98	284,94	274,14
		0,65	447,42	443,80	443,84	440,22	432,94	423,97	411,55	398,73	383,43
		1,03	545,59	540,59	540,12	535,12	525,59	515,41	501,11	485,29	466,44
		1,68	705,98	698,57	697,12	689,70	676,33	665,63	649,87	629,48	605,16

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

TABLE 5B: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Hot gas line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	2,08	2,07	2,08	2,08	2,09	2,10	2,10	2,11	2,11
		0,14	2,94	2,93	2,94	2,95	2,96	2,97	2,98	2,99	3,00
		0,31	4,64	4,62	4,64	4,65	4,66	4,68	4,69	4,70	4,72
		0,65	6,54	6,52	6,54	6,55	6,57	6,59	6,61	6,63	6,65
		1,03	7,97	7,95	7,97	8,00	8,02	8,04	8,07	8,09	8,11
		1,68	10,24	10,21	10,24	10,27	10,30	10,33	10,36	10,39	10,42
	3	0,7	4,26	4,14	4,26	4,38	4,49	4,61	4,73	4,85	4,97
		0,14	6,04	5,87	6,04	6,20	6,37	6,54	6,70	6,87	7,05
		0,31	9,52	9,26	9,52	9,78	10,04	10,31	10,57	10,84	11,11
		0,65	13,40	13,03	13,40	13,77	14,14	14,51	14,87	15,25	15,64
3340/5 3340/5S	1,5	1,03	16,35	15,90	16,35	16,80	17,25	17,70	18,15	18,61	19,08
		1,68	21,01	20,43	21,01	21,59	22,16	22,74	23,32	23,91	24,52
		0,7	3,46	3,45	3,46	3,47	3,48	3,49	3,50	3,51	3,52
		0,14	4,90	4,89	4,90	4,92	4,93	4,95	4,96	4,98	4,99
		0,31	7,73	7,70	7,73	7,75	7,77	7,80	7,82	7,84	7,86
		0,65	10,89	10,86	10,89	10,92	10,96	10,99	11,02	11,05	11,09
	3	1,03	13,29	13,25	13,29	13,33	13,37	13,41	13,45	13,49	13,52
		1,68	17,06	17,01	17,06	17,11	17,16	17,21	17,26	17,31	17,37
		0,7	7,10	6,90	7,10	7,29	7,49	7,68	7,88	8,08	8,28
		0,14	10,06	9,79	10,06	10,34	10,62	10,89	11,17	11,45	11,74
3340/7S	1,5	0,31	15,87	15,43	15,87	16,30	16,74	17,18	17,61	18,06	18,52
		0,65	22,33	21,72	22,33	22,95	23,56	24,18	24,79	25,42	26,06
		1,03	27,25	26,51	27,25	28,00	28,75	29,50	30,25	31,02	31,81
		1,68	35,01	34,05	35,01	35,98	36,94	37,90	38,86	39,85	40,86
		0,7	5,80	5,49	5,80	6,11	6,41	6,72	7,02	7,34	7,68
		0,14	8,14	7,71	8,14	8,57	9,00	9,43	9,86	10,31	10,78
	3	0,31	12,74	12,07	12,74	13,41	14,08	14,75	15,43	16,13	16,86
		0,65	17,63	16,70	17,63	18,56	19,49	20,42	21,35	22,32	23,34
		1,03	21,27	20,15	21,27	22,39	23,51	24,63	25,76	26,93	28,15
		1,68	26,84	25,43	26,84	28,26	29,67	31,09	32,50	33,98	35,53
3340/9S 3340/M28S	1,5	0,7	9,51	8,92	9,51	10,11	10,70	11,29	11,88	12,51	13,16
		0,14	13,36	12,53	13,36	14,19	15,02	15,85	16,69	17,56	18,48
		0,31	20,89	19,59	20,89	22,19	23,49	24,79	26,09	27,46	28,90
		0,65	28,96	27,16	28,96	30,77	32,57	34,37	36,18	38,08	40,07
		1,03	34,93	32,76	34,93	37,11	39,28	41,46	43,63	45,92	48,33
		1,68	43,88	41,15	43,88	46,62	49,35	52,08	54,82	57,69	60,72
	3	0,07	10,87	10,84	10,87	10,90	10,94	10,97	11,0	11,03	11,07
		0,14	15,40	15,36	15,40	15,45	15,50	15,54	15,6	15,63	15,68
		0,31	24,27	24,19	24,27	24,34	24,41	24,48	24,6	24,63	24,70
		0,65	34,21	34,11	34,21	34,31	34,41	34,52	34,6	34,72	34,82
3340/11S	1,5	1,03	41,73	41,61	41,73	41,86	41,98	42,10	42,2	42,35	42,48
		1,68	53,58	53,42	53,58	53,74	53,90	54,06	54,2	54,38	54,54
		0,07	22,29	21,68	22,29	22,90	23,52	24,13	24,7	25,37	26,02
		0,14	31,60	30,74	31,60	32,47	33,34	34,21	35,1	35,97	36,88
		0,31	49,83	48,46	49,83	51,20	52,57	53,94	55,3	56,72	58,16
		0,65	70,14	68,22	70,14	72,07	74,00	75,93	77,9	79,83	81,86
	3	1,03	85,60	83,25	85,60	87,95	90,31	92,66	95,0	97,42	99,90
		1,68	109,97	106,95	109,97	113,00	116,02	119,04	122,1	125,16	128,34
		0,07	17,79	16,85	17,79	18,73	19,66	20,60	21,5	22,52	23,55
		0,14	24,97	23,66	24,97	26,29	27,61	28,92	30,2	31,62	33,06

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 5C: Correction factor for evaporator temperature different from nominal value

Evaporator temperature [°C]								
-40	-30	-20	-15	-10	-5	0	4,4	10
1,26	1,19	1,13	1,1	1,07	1,05	1,02	1	0,98

TABLE 6A: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Liquid line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	16,01	15,08	14,08	13,15	12,22	11,52	10,82	9,92	9,02
		0,14	23,06	21,75	20,31	19,00	17,68	16,52	15,35	14,11	12,85
		0,31	36,67	34,37	31,87	29,56	27,24	25,65	24,04	22,24	20,44
		0,65	52,65	49,38	45,84	42,58	39,29	36,67	34,03	31,54	29,04
		1,03	65,41	61,41	57,07	53,06	49,04	45,37	41,69	38,71	35,71
	3	1,68	90,55	83,88	76,76	70,09	63,38	59,02	54,62	50,52	46,40
		0,7	30,94	29,86	27,24	26,16	24,97	23,90	22,73	21,65	20,50
		0,14	44,23	42,71	38,99	37,48	35,82	34,21	32,47	30,86	29,16
		0,31	70,70	67,89	61,59	58,78	55,71	53,36	50,81	48,36	45,75
		0,65	100,68	96,74	87,84	83,90	79,62	76,11	72,32	68,70	64,85
		1,03	124,02	119,26	108,37	103,61	98,41	93,92	89,05	84,43	79,51
		1,68	164,06	157,56	142,98	136,49	129,42	123,12	116,32	110,26	103,82
		0,7	26,61	25,07	23,53	21,98	20,43	19,26	18,08	16,58	15,08
		0,14	38,33	36,14	33,95	31,76	29,55	27,61	25,66	23,58	21,48
		0,31	60,96	57,11	53,27	49,42	45,54	42,87	40,19	37,18	34,16
3340/5 3340/5S	1,5	0,65	87,52	82,06	76,63	71,18	65,68	61,29	56,88	52,72	48,54
		1,03	108,73	102,04	95,39	88,70	81,97	75,85	69,69	64,71	59,70
		1,68	150,53	139,38	128,31	117,16	105,95	98,65	91,31	84,45	77,56
	3	0,7	50,28	48,39	46,68	44,79	42,74	40,86	38,84	36,99	35,03
		0,14	71,87	69,23	66,82	64,18	61,29	58,50	55,49	52,74	49,83
		0,31	114,93	110,04	105,55	100,66	95,34	91,25	86,84	82,65	78,19
		0,65	163,66	156,81	150,54	143,69	136,24	130,16	123,59	117,41	110,83
		1,03	201,60	193,30	185,72	177,42	168,41	160,60	152,18	144,28	135,89
		1,68	266,69	255,38	245,04	233,74	221,47	210,55	198,78	188,43	177,42
		0,7	36,90	36,21	35,78	35,08	34,13	33,61	32,90	31,45	29,81
		0,14	52,80	51,86	51,29	50,36	49,06	47,88	46,39	44,44	42,20
		0,31	83,13	81,03	79,57	77,47	74,74	73,50	71,82	69,28	66,35
3340/7S	1,5	0,65	117,75	114,91	112,95	110,10	106,38	103,70	100,31	96,93	93,03
		1,03	144,15	140,83	138,57	135,24	130,85	126,48	121,13	117,25	112,77
		1,68	197,40	189,76	183,85	176,21	166,83	162,27	156,57	150,96	144,52
	3	0,7	59,19	58,72	58,74	58,27	57,33	56,38	55,00	53,77	52,26
		0,14	83,85	83,26	83,35	82,76	81,49	80,00	77,88	75,98	73,68
		0,31	132,79	130,95	130,28	128,44	125,43	123,49	120,61	117,83	114,42
		0,65	185,23	182,82	182,03	179,62	175,60	172,56	168,18	163,98	158,87
		1,03	226,03	223,29	222,49	219,75	215,06	210,95	205,16	199,66	193,00
		1,68	294,35	290,35	288,93	284,93	278,35	272,19	263,77	256,63	248,02
		0,07	83,58	78,73	73,90	69,05	64,16	60,49	56,79	52,08	47,35
		0,14	120,39	113,49	106,64	99,74	92,81	86,72	80,60	74,06	67,47
		0,31	191,47	179,36	167,32	155,21	143,02	134,64	126,21	116,78	107,29
3340/9S 3340/M28S	1,5	0,65	274,88	257,73	240,69	223,54	206,29	192,50	178,63	165,58	152,44
		1,03	341,50	320,49	299,61	278,60	257,46	238,22	218,86	203,23	187,49
		1,68	472,78	437,77	402,98	367,97	332,75	309,83	286,77	265,24	243,59
	3	0,07	157,91	151,99	146,60	140,68	134,22	128,34	121,99	116,18	110,01
		0,14	225,74	217,43	209,88	201,57	192,51	183,74	174,27	165,65	156,49
		0,31	360,98	345,59	331,52	316,13	299,43	286,61	272,73	259,58	245,59
		0,65	514,01	492,49	472,81	451,28	427,90	408,81	388,18	368,75	348,07
		1,03	633,16	607,11	583,30	557,24	528,93	504,42	477,95	453,16	426,79
		1,68	837,61	802,10	769,62	734,11	695,57	661,28	624,33	591,81	557,24
		0,07	113,17	111,05	109,71	107,59	104,68	103,08	100,89	96,46	91,41
		0,14	161,92	159,05	157,30	154,43	150,44	146,84	142,27	136,27	129,43
		0,31	254,94	248,51	244,00	237,57	229,20	225,40	220,25	212,44	203,47
3340/11S	1,5	0,65	361,10	352,38	346,37	337,65	326,23	318,01	307,62	297,25	285,28
		1,03	442,07	431,88	424,95	414,75	401,29	387,87	371,48	359,58	345,83
		1,68	605,37	581,93	563,82	540,38	511,62	497,63	480,15	462,95	443,20
	3	0,07	181,50	180,08	180,14	178,71	175,80	172,90	168,68	164,90	160,26
		0,14	257,13	255,32	255,60	253,79	249,90	245,33	238,83	233,02	225,94
		0,31	407,23	401,59	399,52	393,88	384,65	378,69	369,88	361,34	350,89
		0,65	568,04	560,66	558,22	550,84	538,52	529,19	515,75	502,87	487,22
		1,03	693,17	684,76	682,31	673,90	659,52	646,92	629,17	612,28	591,88
		1,68	902,68	890,41	886,05	873,78	853,60	834,71	808,89	787,00	760,59

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

TABLE 6B: Refrigerant Flow Capacity of condensing pressure regulators 3340 [kW]. Hot gas line

Catalogue Number	Condensing pressure change [bar] (1)	Pressure drop across regulator [bar]	Condensing temperature [°C]								
			10	15	20	25	30	35	40	45	50
3340/4 3340/M12S 3340/4S	1,5	0,7	2,33	2,32	2,33	2,34	2,34	2,35	2,36	2,37	2,37
		0,14	3,29	3,28	3,29	3,30	3,31	3,32	3,33	3,34	3,35
		0,31	5,20	5,18	5,20	5,21	5,23	5,25	5,26	5,28	5,29
		0,65	7,33	7,31	7,33	7,35	7,37	7,39	7,42	7,44	7,46
		1,03	8,94	8,92	8,94	8,97	8,99	9,02	9,05	9,07	9,10
		1,68	11,43	11,40	11,43	11,46	11,50	11,53	11,57	11,60	11,63
	3	0,7	4,55	4,43	4,55	4,68	4,81	4,93	5,06	5,18	5,32
		0,14	6,45	6,27	6,45	6,62	6,80	6,98	7,15	7,34	7,52
		0,31	10,17	9,89	10,17	10,45	10,73	11,01	11,29	11,57	11,87
		0,65	14,34	13,94	14,34	14,73	15,12	15,52	15,91	16,32	16,73
		1,03	17,49	17,01	17,49	17,97	18,45	18,93	19,41	19,90	20,41
3340/5 3340/5S	1,5	1,68	22,37	21,75	22,37	22,98	23,60	24,21	24,83	25,46	26,10
		0,7	3,88	3,87	3,88	3,90	3,91	3,92	3,93	3,94	3,95
		0,14	5,49	5,47	5,49	5,51	5,52	5,54	5,56	5,57	5,59
		0,31	8,67	8,64	8,67	8,69	8,72	8,74	8,77	8,79	8,82
		0,65	12,21	12,18	12,21	12,25	12,29	12,32	12,36	12,40	12,43
		1,03	14,90	14,86	14,90	14,95	14,99	15,04	15,08	15,12	15,17
	3	1,68	19,05	18,99	19,05	19,11	19,16	19,22	19,28	19,33	19,39
		0,7	7,59	7,38	7,59	7,80	8,01	8,22	8,43	8,64	8,86
		0,14	10,74	10,45	10,74	11,04	11,33	11,63	11,92	12,23	12,54
		0,31	16,95	16,48	16,95	17,41	17,88	18,34	18,81	19,29	19,78
3340/7S	1,5	0,65	23,89	23,24	23,89	24,55	25,21	25,86	26,52	27,19	27,88
		1,03	29,15	28,35	29,15	29,95	30,75	31,55	32,35	33,17	34,01
		1,68	37,28	36,26	37,28	38,30	39,33	40,35	41,38	42,43	43,51
		0,7	5,91	5,59	5,91	6,22	6,53	6,84	7,15	7,48	7,82
		0,14	8,29	7,86	8,29	8,73	9,17	9,61	10,04	10,50	10,98
		0,31	12,94	12,26	12,94	13,62	14,31	14,99	15,67	16,38	17,13
	3	0,65	18,00	17,05	18,00	18,95	19,90	20,85	21,80	22,79	23,83
		1,03	21,65	20,51	21,65	22,79	23,93	25,07	26,21	27,41	28,66
		1,68	27,30	25,86	27,30	28,73	30,17	31,61	33,05	34,56	36,13
		0,7	9,55	8,96	9,55	10,15	10,74	11,34	11,93	12,56	13,22
3340/9S 3340/M28S	1,5	0,14	13,40	12,57	13,40	14,23	15,07	15,90	16,74	17,62	18,54
		0,31	20,91	19,61	20,91	22,22	23,52	24,82	26,12	27,50	28,94
		0,65	28,89	27,09	28,89	30,69	32,49	34,29	36,09	37,98	39,97
		1,03	34,92	32,74	34,92	37,09	39,27	41,44	43,61	45,90	48,31
		1,68	43,96	41,22	43,96	46,69	49,43	52,17	54,91	57,79	60,82
		0,07	12,20	12,16	12,20	12,24	12,27	12,31	12,3	12,38	12,42
	3	0,14	17,24	17,19	17,24	17,30	17,35	17,40	17,4	17,50	17,55
		0,31	27,22	27,13	27,22	27,30	27,38	27,46	27,5	27,62	27,70
		0,65	38,36	38,25	38,36	38,47	38,59	38,70	38,8	38,93	39,05
		1,03	46,81	46,67	46,81	46,95	47,08	47,22	47,4	47,50	47,64
3340/11S	1,5	1,68	59,83	59,65	59,83	60,01	60,18	60,36	60,5	60,72	60,90
		0,07	23,84	23,19	23,84	24,50	25,15	25,81	26,5	27,14	27,83
		0,14	33,74	32,82	33,74	34,67	35,60	36,52	37,5	38,40	39,38
		0,31	53,22	51,76	53,22	54,68	56,15	57,61	59,1	60,57	62,11
		0,65	75,04	72,98	75,04	77,11	79,17	81,23	83,3	85,41	87,58
		1,03	91,54	89,03	91,54	94,06	96,57	99,09	101,6	104,19	106,83
	3	1,68	117,09	113,87	117,09	120,31	123,52	126,74	130,0	133,26	136,64
		0,07	18,11	17,16	18,11	19,07	20,02	20,98	21,9	22,93	23,97
		0,14	25,44	24,10	25,44	26,78	28,12	29,46	30,8	32,20	33,67
		0,31	39,69	37,60	39,69	41,78	43,87	45,97	48,1	50,25	52,53

(1) Pressure change required to move the valve shutter from "start to open" position to rated opening position

R407C

Standard rating conditions according to AHRI Standard 770-2007

Condensing temperature	100 °F	(37,8 °C)
Liquid temperature	98 °F	(36,7 °C)
Subcooling	2 °R	(1,1 °K)
Evaporating temperature	40 °F	(4,4 °C)
Suction temperature	65 °F	(18,3 °C)
Superheating	25 °R	(13,9 °K)
Discharge temperature	150 °F	(65,6 °C)

TABLE 6C: Correction factor for evaporator temperature different from nominal value

Evaporator temperature [°C]								
-40	-30	-20	-15	-10	-5	0	4,4	10
1,18	1,13	1,09	1,07	1,05	1,03	1,02	1	0,98

LIQUID RECEIVER PRESSUREREGULATORS SERIES 3350

Approved by Underwriters Laboratories Inc.



by-passes hot gas from the compressor discharge to the receiver thus raising liquid pressure in the receiver.

OPERATION

Receiver pressure regulators series 3350 adjust the flow of hot gas according to changes of liquid receiver pressure, downstream the regulator. When the receiver pressure is above the valve setting, the shutter remain closed. As the receiver pressure drops below the valve setting, the shutter begins to open and the amount of its opening is proportional to the change of receiver pressure. As the receiver pressure continues to drop, the shutter continues to open farther until the limit of the stroke is reached and the valve is completely open. Regulators series 3350 regulate only in dependence on the outlet pressure change, pressure change on the inlet side do not affect the degree of opening since the valve is equipped with an equalization bellow with an effective area equal to valve seat. The factory pressure setting of these valves is 8 bar, this means that until the receiver pressure is above the 8 bar the valve remains closed, when the receiver pressure drops below the 8 bar the valve begin to open. According to the characteristics of the refrigerating system it can be necessary to change the valve setting adjusting the setting screw on the top of the body; the pressure setting range is from 3 bar up to 20 bar.

APPLICATIONS

The receiver pressure regulators series 3350, shown in this chapter, are classified "Pressure accessories" in the sense of the Pressure Equipment Directive 94/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.

They are designed to operate on refrigerating systems, which use the following refrigerant fluids: R22 , R134a , R404A , R407C , R507 proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

The 3350 regulator is used coupled with the 3340 regulator, alternatively to 3136 differential valve. These two valves form a regulating system that maintain constant condensing and receiver pressure in plant with heat recover and air and water condensation. The 3340 regulator restricts the liquid flow from the condenser to the receiver, thus reducing the active condenser surface and raising the condensing pressure. The 3350 regulator

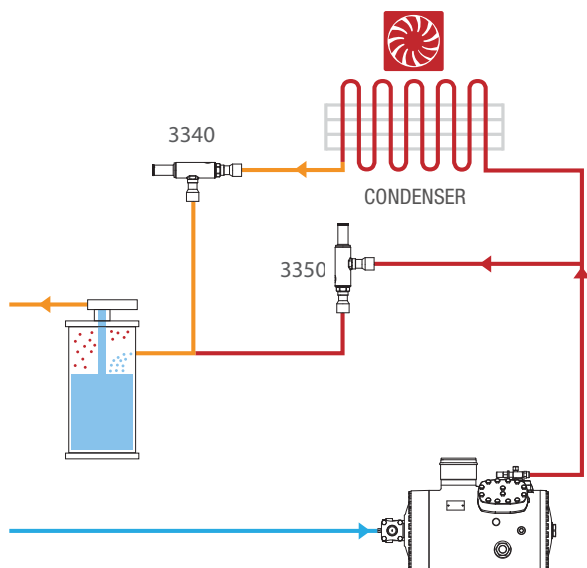
CONSTRUCTION

The main parts of receiver regulators series 3350 are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Austenitic stainless steel AISI 321 for bellow
- Brass bar EN 12164 – CW 614N for shutter
- Brass bar EN 12164 – CW 614N for setting screw
- Spring steel DIN 17223/84 Class C/D for setting spring
- Chloroprene rubber (CR) for outlet seal gaskets

INSTALLATION

While condensing pressure regulators series 3340 is mounted in the liquid line between the condenser and the liquid receiver the receiver pressure regulator series 3350 is mounted between the compressor discharge and the inlet of liquid receiver.



Installation

Refrigerating systems with air condenser. The regulator is installed as a bypass between compressor discharge and the liquid receiver inlet.

TABLE 1: General characteristics of condensing pressure regulators 3340

Catalogue Number	Connections			Kv Factor [m³/h]	Regulating range [bar]		Factory setting [bar]	TS [°C]		PS [bar]	Risk Category according to PED
	SAE Flare	ODS			min.	max.		min.	max.		
		Ø [in.]	Ø [mm]								
3350/4	1/2"	–	–	1,80	3	20	8	-40	+110	28	Art. 3.3
3350/M12S	–	–	12								
3350/4S	–	1/2"	–								
3350/5	5/8"	–	–								
3350/5S	–	5/8"	16								
3350/7S	–	7/8"	22								

TABLE 2: Dimensions and Weights of regulators 3340

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H ₁	H ₂	L	L ₁	D	
3350/4	159	76,5	45,5	48	37	32	510
3350/M12S	183	100,5	69,5	64			500
3350/4S	183	100,5	69,5	64			500
3350/5	163	80,5	49,5	52			560
3350/5S	183	100,5	69,5	64			510
3350/7S	194	112	81	75,5			570



APPLICATIONS

The water regulating valve, employed with condenser fed with either main or well water, keeps the condensation pressure constant at the previously set value by adjusting the water flow so as to ensure a balanced heat exchange under all conditions.

At plant start-up, this adjustment is designed to allow the thermostatic valve rapidly reaches normal operating conditions and subsequently, during the operations, to avoid excessive pressure increases or decreases under different flow conditions. An excessive rise of high pressure affects the refrigerating capacity of the system. On the other side, pressure lowering leads to insufficient refrigerant feeding of the evaporator with consequent increased gas over heating and parallel reduction of gas pressure at the compressor suction. Castel valves are appropriate for refrigerate fluids HCFC and HFC and only for main and well water.

OPERATIONS

The moving elements of the valve are a metal bellows and a shutter. The thrust of the refrigerant condensation pressure outside the bellows favours the opening of the valve and the thrust of the adjustment spring on the shutter acts in the opposite sense. Given a specific setting of the spring, the valve progressively opens in line with the increasing condensation pressure, and closes when this pressure decreases. When the compressor stops, the valve closes: water is no longer fed into the condenser, this

being a notable operating economy.

Valve setting is performed in the works at a pressure of 7.5 bars. Setting is modified by turning the control screw. Three reference notches, marked with letters A, B and C, are present on the spring cover.

Each notch is equivalent to a different spring setting.

The notches are referred to the following condensation pressures:

- Letter A equivalent to about 7.5 bar (valid for R134a at a temperature of condensation of 30°C)
- Letter B equivalent to about 14 bar (valid for R404A, R407C and R507 at a temperature of condensation of 30°C)
- Letter C equivalent to about 20 bar (top limit of working pressure).

MATERIALS

The materials used for the main parts are:

- ST-UNI-EN 12165 - CW 617 N hot-forged brass for the main body;
- Austenitic stainless steel – AISI 303 for the seat;
- Nitril rubber (NBR) for seat gasket;
- NBR coated-fabric for diaphragms.

INSTALLATION

The valve will be mounted on the water outlet side of the condenser, preferably vertically, with the bellows downward. The high-pressure connection to the bellows must show no deflection. The arrow on the valve body shows water flow direction.

EXAMPLE OF VALVE SELECTION

A refrigerating system including a hermetic compressor and a condenser fed with mains water.

- Mains water pressure: 3 bar
- Water temperature at the condenser inlet: 14 °C
- Expected thermal difference: $Dt = 10\text{ °C}$
- Condensation temperature expected on the basis of the water/refrigerant heat exchange in the condenser: approximately 6 °C above the water temperature at the outlet, equivalent to 30 °C (with a corresponding saturation pressure) (fig. 19)
- Refrigeration yield at the level of the evaporator: 18,6 kW under the following conditions:
 - condensation temperature: + 30 °C
 - evaporation temperature: - 15 °C

Thermal power to be disposed of at the level of the condenser (Table 2):

$$18,6 \times 1,325 = 24,65 \text{ [kW]}$$

Water flow rate:

$$(24,65 \times 860)/10 = 2120 \text{ l/h} = 2,12 \text{ [m}^3\text{/h]}$$

The pressure drop corresponding to the water flow rate specified above in the condenser/piping circuit, with the exclusion of the water regulating valve, is about 2,5 bar. The water regulating valve has this pressure differential at its disposal:

$$\Delta p = 3 - 2,5 = 0,5 \text{ bar}$$

At $\Delta p = 0,5 \text{ bar}$ the 3210/04 valve, completely opened, ensures the required flow rate (fig. 2).

When the point of intersection of pressure differential through the valve and flow range is within the area between the curves of two valves, select the valve with larger diameter.

When the valve is completely closed, the pressure must be the same as the refrigerant saturation pressure at the air temperature of the place where the condenser is installed. When the valve begins to open, the pressure is about 0,2 bar above the pressure when the valve is totally closed.

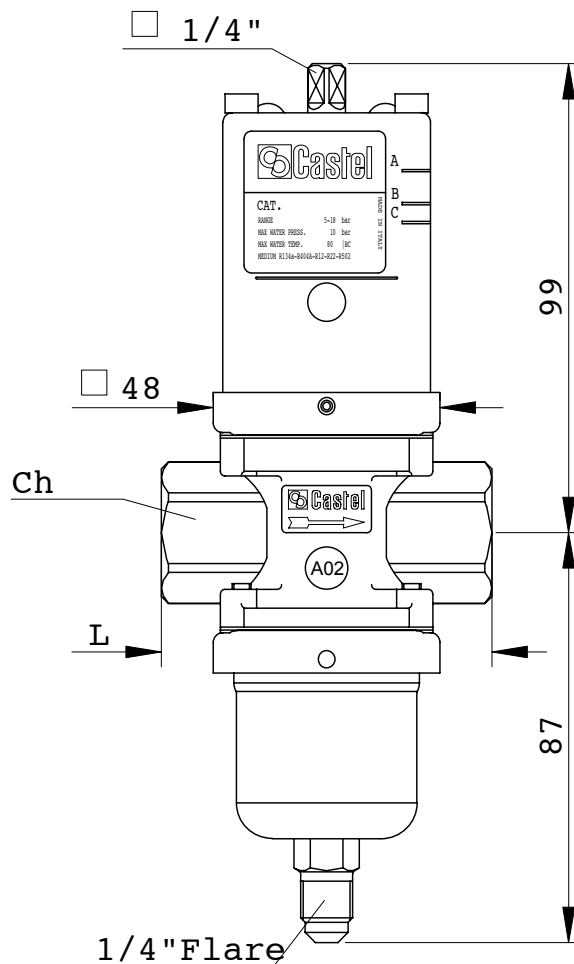


TABLE 1: General Characteristics

Catalogue Number	Connections UNI ISO 228/1	Working pressure [bar]	Maximum water pressure [bar]	Maximum water temperature [°C]	Kv Factor [m³/h]	Refrigerant max working pressure [bar]	Ch	L	Weight [g]
3210/03	G 3/8"	5 - 20	10	80	2	22	27	70	1015
3210/04	G 1/2"				3				985
3210/06	G 3/4"				4,7		32	74	1010

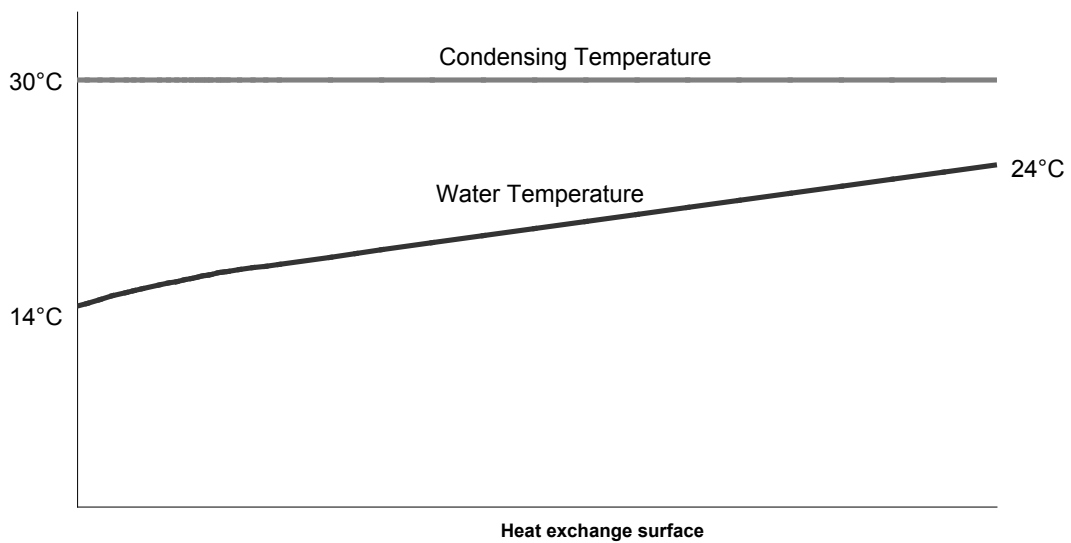


Fig. 1 - Heat exchange pattern in the condenser

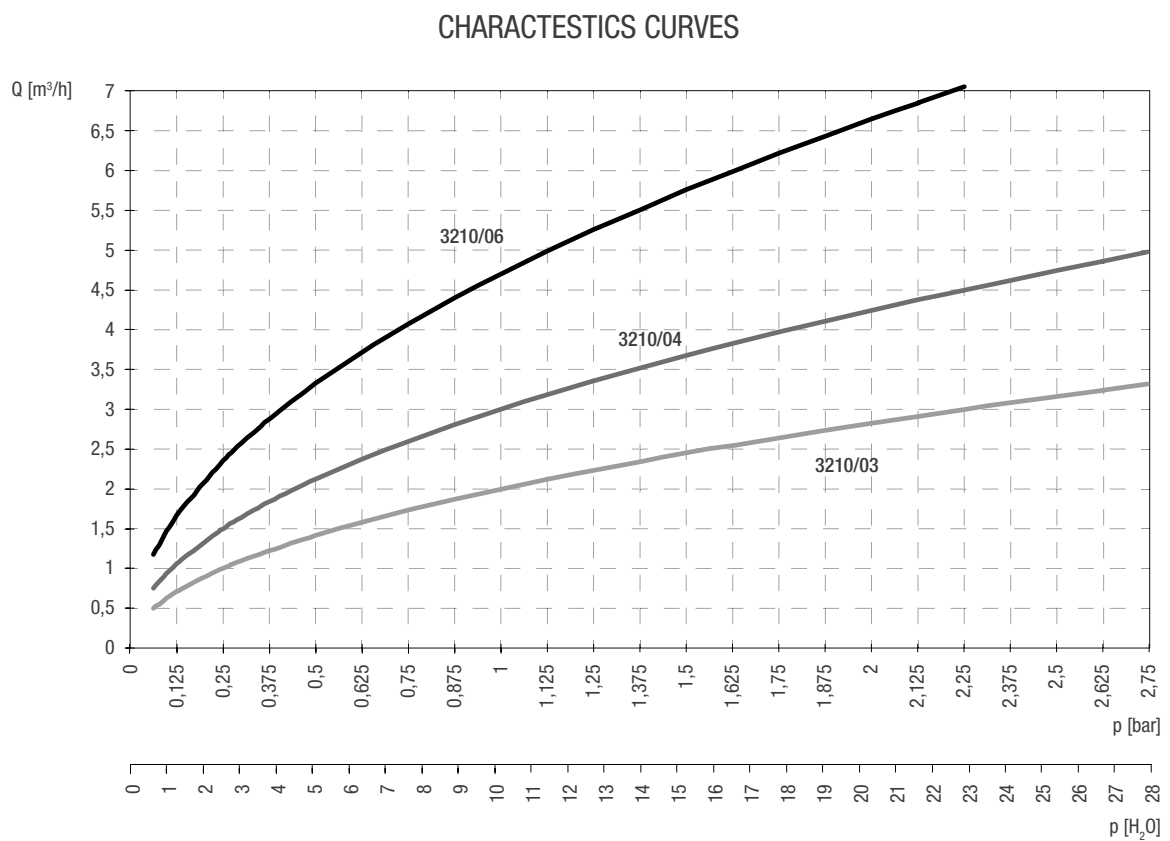


Fig. 2 -Characteristics curves when the valves are completely open

TABLE 2: Thermal factor for hermetic refrigeration compressor. Relationship between the total heat to be disposed of at the level of the condenser and refrigeration capacity at the level of the evaporator

Condensing Temperature [°C]	Evaporating Temperature [°C]									
	-35	-30	-25	-20	-15	-10	-5	0	+5	+10
+30	1,524	1,473	1,421	1,371	1,325	1,281	1,238	1,200	1,163	1,133
+35	1,553	1,503	1,453	1,403	1,355	1,310	1,268	1,228	1,188	1,155
+40	1,578	1,531	1,484	1,435	1,387	1,340	1,295	1,254	1,210	1,175
+45	-	-	1,521	1,475	1,425	1,377	1,330	1,285	1,240	1,200
+50	-	-	-	-	1,468	1,420	1,369	1,320	1,270	1,227
+55	-	-	-	-	1,520	1,465	1,412	1,363	1,304	1,255
+60	-	-	-	-	-	1,526	1,457	1,398	1,338	1,285

TABLE 3: Thermal factor for open compressor (direct or belt driven). Relationship between the total heat to be disposed of at the level of the condenser and refrigeration capacity at the level of the evaporator

Condensing Temperature [°C]	Evaporating Temperature [°C]									
	-35	-30	-25	-20	-15	-10	-5	0	+5	+10
+30	1,460	1,417	1,371	1,330	1,291	1,243	1,213	1,178	1,143	1,114
+35	1,495	1,450	1,405	1,367	1,320	1,279	1,240	1,202	1,168	1,133
+40	1,537	1,530	1,441	1,396	1,350	1,306	1,265	1,224	1,185	1,152
+45	-	-	1,485	1,437	1,390	1,342	1,295	1,252	1,211	1,175
+50	-	-	-	1,482	1,431	1,381	1,334	1,288	1,241	1,120
+55	-	-	-	-	-	1,426	1,369	1,320	1,274	1,228
+60	-	-	-	-	-	1,474	1,410	1,355	1,330	1,255

www.castel.it



ed. 001-RP-ENG

Castel can accept no responsibility for any errors or changes in the catalogues, handbooks, brochures and other printed material. Castel reserves the right to make changes and improvements to its products without notice. All trademarks mentioned are the property of their respective owners.
The name and Castel logotype are registered trademarks of Castel Srl.
All rights reserved.

Castel Srl - Via Provinciale 2-4 - 20060 Pessano con Bornago - MI