

HANDBOOK  
**VALVES**

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Ed. 2017

 **Castel**<sup>®</sup>  
Italian technology



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## THE NATURAL DEVELOPMENT OF QUALITY

Having achieved the goal of fifty-five years working in the Refrigeration and Air Conditioning Industry, Castel's range of quality products is well known and highly appreciated around the world. Quality is the product of our Company philosophy and marks every step of the production cycle. It is certified by the company's Quality Management System (certified by TUV SUD in accordance with the UNI EN ISO 9001:2008 standard), as well as by the various product certifications of compliance with European Directives and European and extra-European Quality Marks.

Product quality is connected with the quality of manufacturing. We produce on high-tech machinery and updated automatic production lines, operating in compliance with the current safety and environmental protection standards.

Castel offers the Refrigeration and Air Conditioning Market and Manufacturers tested certified products suitable for use with the HCF and HFO refrigerants currently used in the Refrigeration & Air Conditioning Industry.

Based on the experience gained in the refrigeration field using fluorinated fluids, Castel is proud to present the Refrigeration and Air Conditioning Market and Manufacturers two complete lines of products developed and proven for use in systems using natural refrigerants: hydrocarbons (HC fluids) and carbon dioxide (R744).





## DIRECTIVE 2014/68/EU ISSUED OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 15 MAY 2014 ON PRESSURE EQUIPMENT

Directive 2014/68/EU (PED Recast) applies to the design, manufacture and evaluation of compliance of pressure equipment and assemblies with a maximum allowable pressure, PS, greater than 0.5 bar excluding the cases listed in Article 1, Paragraph 2 of the Directive.

Directive 2014/68/EU was transposed into the Italian legal system by Legislative Decree No. 26 dated 15 February 2016, published in the Official Journal of the Republic of Italy No. 53 of 4 March 2016.

The revised PED Recast Directive repeals previous Directive 97/23/EC. More specifically:

- Article 13 of the PED Recast Directive, regarding the classification of pressure equipment, came into force as of 1 June 2015 and repeals Article 9 of the previous PED Directive.
- All other articles of the PED Recast Directive are in force as of 19 July 2016, repealing all articles of the previous PED directive.

All valves illustrated in this technical handbook are considered "Pressure Accessories" according to the definition provided in Article 2, Point 5 of said Directive and are subject to the classification indicated in Article 4, Points 1.c) and 3 of the same Directive.

## EXTERNAL LEAKAGE

All the products illustrated in this Handbook individually undergo tightness tests as well as specific functional tests. The allowable external leakage, measurable during the test, complies with the requirements of standards:

- EN 12284: 2003 – Refrigerating systems and heat pumps - Valves - Requirements, testing and marking
- EN 16084:2011 – Refrigerating systems and heat pumps - Qualification of tightness of components and joints

## PRESSURE CONTAINMENT

All the products illustrated in this Handbook, if submitted to hydrostatic testing, guarantee a pressure strength at least equal to  $1.43 \times PS$  in compliance with Directive 2014/68/EU.

All the products illustrated in this Handbook, if submitted to burst test, guarantee a pressure strength at least equal to  $3 \times PS$  according to EN 378-2:2016 Standard.

All the UL-certified products illustrated in this Handbook, if submitted to burst testing, guarantee a pressure strength at least equal to  $5 \times MWP$  in compliance with standard UL 207.

## WEIGHT

The weights of the items listed in this Handbook include packaging and are not binding.

## WARRANTY

All Castel products are covered by a 12-month 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 does not apply if the defect of the Castel product is due to mistakes by the customer or by third parties, such as incorrect installation, use contrary to Castel instructions, or tampering. In the event of defects found in its products, Castel will only replace the defective goods and will not refund damages of any kind. Castel reserves the right to make changes or modifications to its products at any time without prior notice.

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

# CHAPTER 1 ■ VALVES WITH SCREW SHUTTER

FOR REFRIGERATION PLANTS THAT USE HCFC, HFC OR HFO REFRIGERANTS



## APPLICATIONS

All valves illustrated in this chapter are designed for installation on commercial refrigeration systems and on civil and industrial air conditioning plants that use the following refrigerant fluids:

- HCFC (R22)
- HFC (R134a, R404A, R407C, R410A, or R507)
- HFO and HFO/HFC mixtures (R1234ze, R448A, R449A, R450A, or R452A)

belonging to Group 2, as defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

Furthermore, the valves (up to DN 25, for globe taps, model: 6512/9) can also be installed on systems using the following refrigeration fluids:

- HFC (R32)
- HFO (R1234yf)

classified as A2L in the ASHRAE 34-2013 standard, and belonging to Group 1, as defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

## HERMETIC VALVES

The hermetic valves can be divided into two categories:

- Two-way shut-off valves, types 6010/2 and 6012/22
- Three-way valves; two main connections plus a third one for charging, types::
  - 6065, with right charge connection
  - 6075, with left charge connection

Note: the third way must be equipped with a mechanism (for example type 8394/A or other similar ones) to be ordered separately.

The main parts of the hermetic valves are made with the following materials:

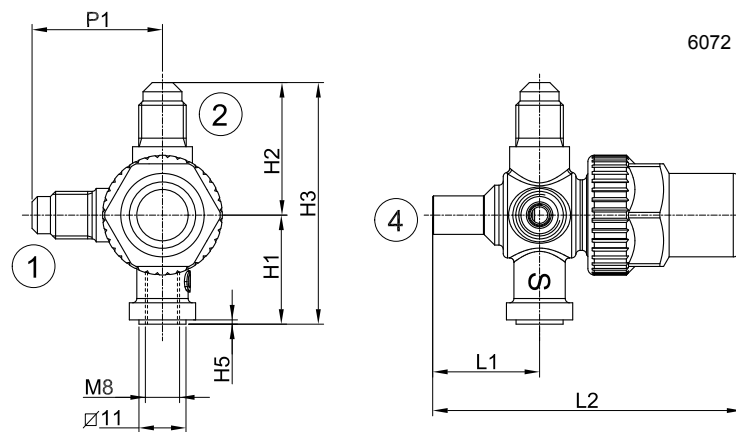
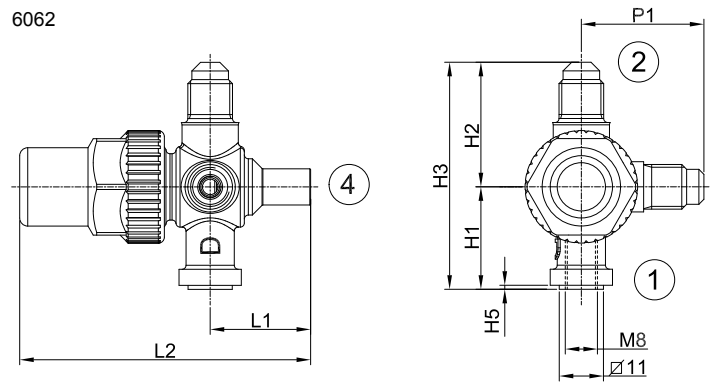
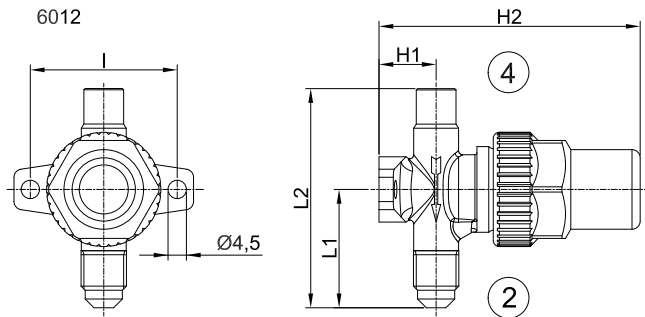
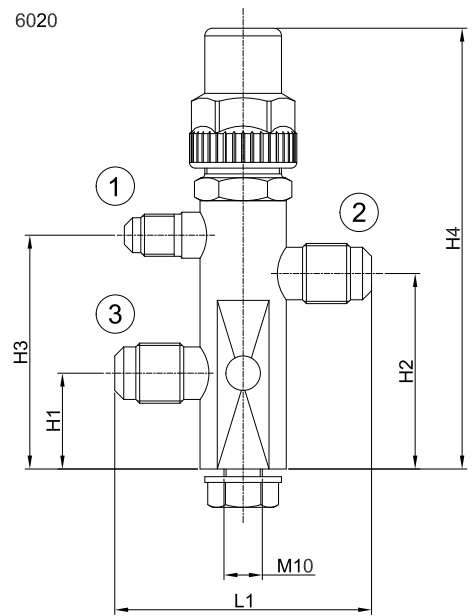
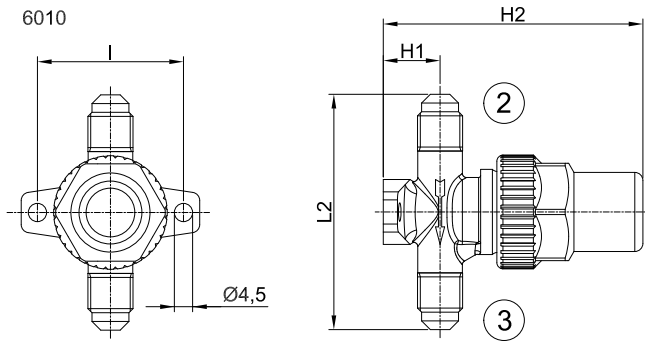
- Hot forged brass EN 12420 – CW 617N for the body.
- Steel, with proper surface protection, or brass for the spindle
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Glass-reinforced PBT for the protective cap that covers the spindle.

TABLE 1: General characteristics of valves for hermetic systems

Catalogue Number	Connections					Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast	
	SAE Flare			ODS				min.	max.	min.	max.		
	(1)	(2)	(3)	Ø [in.]	Ø [mm]								
6010/2	-	1/4"	1/4"	-	-	0,27	45	-40	+130	-40	+50	Art. 4.3	
6012/22		1/4"	-	1/4"									
6020/222	1/4"	1/4"	1/4"	-	-	0,39	45	-40	+110	-40	+50	Art. 4.3	
6020/233		3/8"	3/8"			1,20							
6020/244		1/2"	1/2"			2,20							
6020/255		5/8"	5/8"			2,80							
6062/22M6		1/4"	-			6							0,46
6062/23M10		3/8"				10							1,38
6072/22M6		1/4"				6							0,46
6072/23M8		3/8"				8							1,29
6072/23M10		3/8"				10							1,38
6072/24M12		1/2"				12							2,55
6072/25M16	5/8"	16		3,40									

TABLE 2: Dimensions and weights of valves for hermetic systems

Catalogue Number	Dimensions [mm]									Weight [g]	
	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	H <sub>4</sub>	H <sub>5</sub>	l	L <sub>1</sub>	L <sub>2</sub>	P <sub>1</sub>		
6010/2	14	66	-	-	-	36	-	58	-	-	160
6012/22			29	55,5			145				
6020/222	25	51	61	115	-	-	62	-	-	-	360
6020/233			60				67				370
6020/244	26,5	52	67,5	127	-	-	77	-	-	-	520
6020/255							79				530
6062/22M6	25,5	31	56,5	-	1	-	25	72	30,5	-	205
6062/23M10		33	58,5								200
6072/22M6		31	56,5								205
6072/23M8		33	58,5								210
6072/23M10											220
6072/24M12		29,5	38,5								68
6072/25M16	39,5		69	320							





## RECEIVER VALVES

The receiver valves can be divided into three categories:

- Two-way valves, 90° angle connections, types 6110 and 6120
- Three-way valves; two main connections (90° angle) plus a third one for charging, type 6132. The access connection may be shut off by the back-sealing of the spindle
- Two-way valves, 120° angle connections, type 6140

The main parts of the receiver valves are made with the following materials:

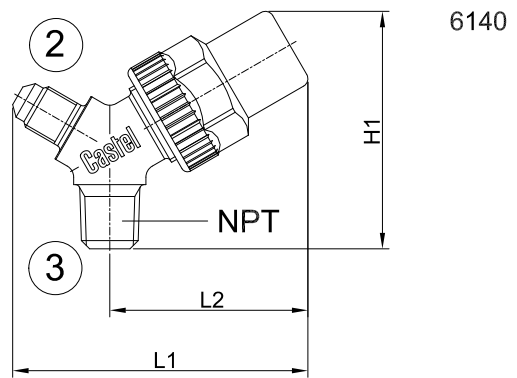
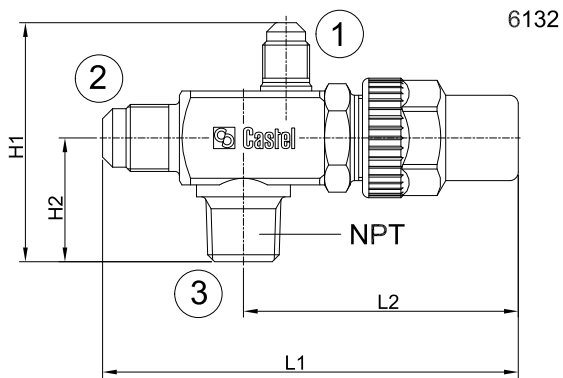
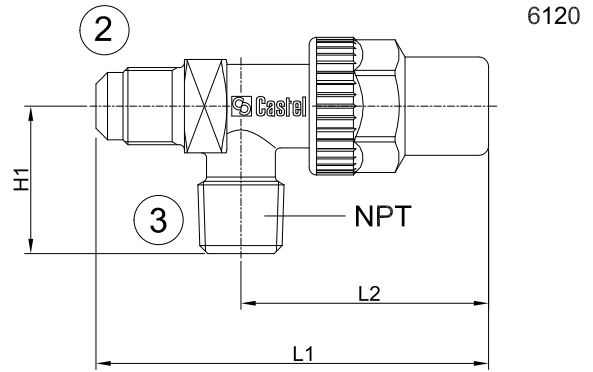
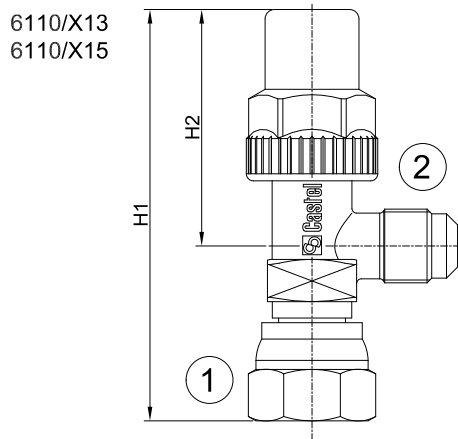
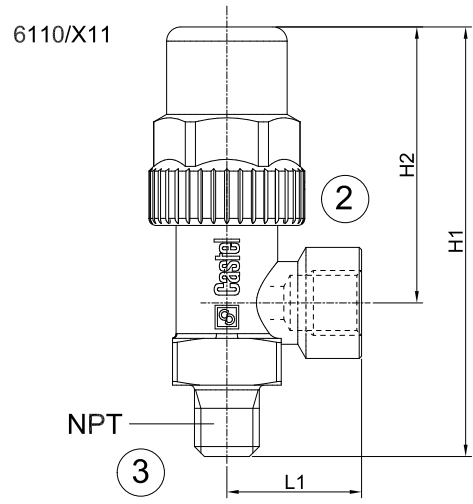
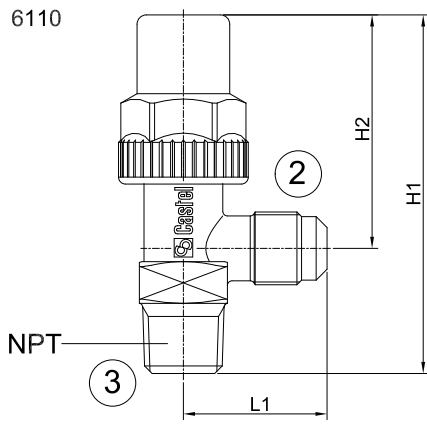
- Hot forged brass EN 12420 – CW 617N for the body.
- Steel, with proper surface protection, for the spindle.
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Glass-reinforced PBT for the protective cap that covers the spindle.

**TABLE 3: General characteristics of receiver valves**

Catalogue Number	Connections			Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare		NPT			min.	max.	min.	max.	
	(1)	(2)	(3)							
6110/21	-	1/4"	1/8"	0,44	45	-40	-40	+50	Art. 4.3	
6110/22		1/4"	1/4"							
6110/X15	1/4" F	1/4"	-							
6110/X11	-	-	1/4" M/F							
6110/23	-	1/4"	3/8"	0,45						
6110/32		3/8"	1/4"	1,35						
6110/33		3/8"	3/8"							
6110/X13		3/8" F	3/8"							-
6110/43	-	1/2"	3/8"							2,40
6110/44		1/2"	1/2"	3,40						
6110/54		5/8"	1/2"							
6110/66		3/4"	3/4"	6,00						
6120/22		1/4"	1/4"	0,44						
6120/23		1/4"	3/8"	0,45						
6120/32		3/8"	1/4"	1,35						
6120/33		3/8"	3/8"	1,35						
6120/43		1/2"	3/8"	2,40						
6120/44		1/2"	1/2"	3,40						
6120/54		5/8"	1/2"							
6120/66		3/4"	3/4"	6,00						
6132/22	1/4"	1/4"	1/4"	0,45						
6132/33		3/8"	3/8"	1,20						
6132/44		1/2"	1/2"	2,20						
6132/54		5/8"	1/2"	3,85						
6140/22	-	1/4"	1/4"	0,36						
6140/23		1/4"	3/8"							

**TABLE 4: Dimensions and weights of receiver valves**

Catalogue Number	Dimensions [mm]				Weight [g]	
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	L <sub>2</sub>		
6110/21	70,5	48	27,5	-	100	
6110/22	72				110	
6110/X15	83				130	
6110/X11	88	55,5	28,5		230	
6110/23	77	50	29		135	
6110/32			31		130	
6110/33			31		140	
6110/X13			87		175	
6110/43	88	55,5	34,5		220	
6110/44	92				235	
6110/54	92			245		
6110/66	128	88	42,5	675		
6120/22	27,5	-	72	48	110	
6120/23	30		77	50	130	
6120/32			80		135	
6120/33			80		140	
6120/43			33	93	55,5	225
6120/44	94			305		
6120/54	40			129,5	88	245
6120/66	40		129,5	88	670	
6132/22	56		29	94	64	240
6132/33				97		250
6132/44	65,5	36	112	75	350	
6132/54			115		365	
6140/22	57	-	69	46	115	
6140/23					125	



## STOP VALVES

Stop valves have a very compact design and a fixing flange that is dimensioned to meet the current market requirements.

Valves 6170 and 6175 must be completed with the following components, which must be ordered separately:

- Internal spring mechanism, part no. 8394/B or external spring mechanism, part nos. 8395/A1 or 8395/A3
- Cap with gasket code 8392/A or 1/4" SAE FLARE blind union part no. 7020/20.

Valves 6176 6176 have been specifically designed to be installed on air conditioning systems that use R410A refrigerant fluid. They must be completed with the

following components, to be ordered separately:

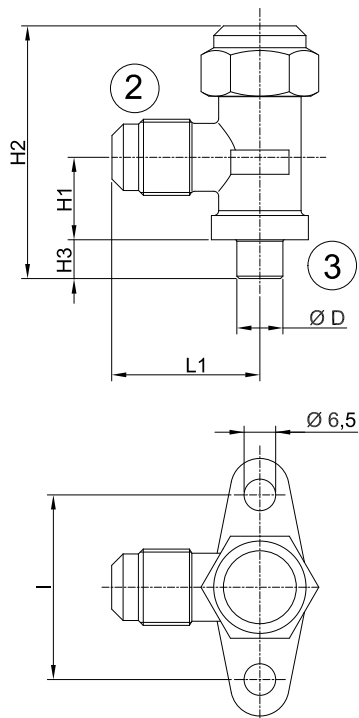
- External spring mechanisms, part no. 8395/A1 and 8395/A3
  - 5/16" SAE FLARE blind union, part no. 7020/X02
- The main parts of the stop valves are made with the following materials:
- Hot forged brass EN 12420 – CW 617N for the body.
  - Brass EN 12164 – CW 614N for spindle and protection cap
  - Chloroprene rubber (CR) for outlet seal gaskets for series 6165, 6175 and 6176
  - Chloroprene rubber (CR) and aramid fibres for gland seal, only for series 6170

TABLE 5: General characteristics of valves for split systems

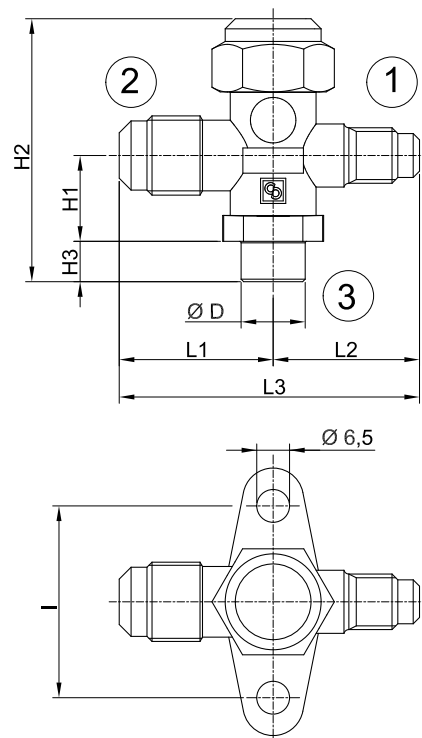
Catalogue Number	Way Nr.	Connections				Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
		SAE Flare		ODS				min.	max.	min.	max.	
		(1)	(2)	Ø [in.]	Ø [mm]							
6165/22	2	-	1/4"	1/4"	-	0,68	45	-20	+110	-20	+50	Art. 4.3
6165/33			3/8"	3/8"		1,70						
6175/33	3	1/4"	3/8"	3/8"	16	1,70						
6175/44			1/2"	1/2"	-	3,40						
6175/55			5/8"	5/8"	16	4,60						
6170/66			3/4"	3/4"	-	9,00						
6170/77			7/8"	7/8"	-	10,80						
6176/44			3	5/16"	1/2"	1/2"						
6176/55	5/8"	5/8"			16	4,60						
6176/66	3/4"	3/4"			-	7,50						

TABLE 6: Dimensions and weights of valves for split systems

Catalogue Number	Dimensions [mm]								Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	D	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	l	
6165/22	17	52	8	9,5	29	-	-	38	113
6165/33				12,7	30,5				120
6175/33				29	59,5	135			
6175/44	20	65	8	15,9	36	31	67	50	225
6175/55				19,0					235
6170/66	28,5	104	12	22,2	47	36	83	50	655
6170/77				28,6					670
6176/44	20	65	8	15,9	36	31	67	38	225
6176/55				19,0					235
6176/66				24	70				22,2



6165



6170  
6175  
6176

## DIAPHRAGM VALVES

Diaphragm valves do not have a gland seal. Thin metal discs (diaphragms), which hermetically isolate the spindle chamber from the fluid flow area, ensure the external sealing.

The main parts of the diaphragm valves are made with the

following materials:

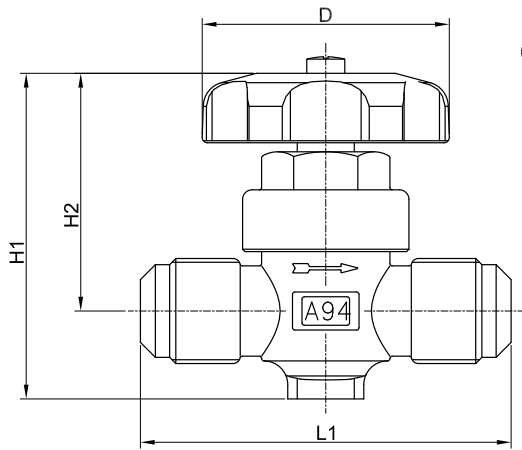
- Hot forged brass EN 12420 – CW 617N for the body.
- Brass EN 12164 – CW 614N for spindle
- Harmonic steel for spring
- Nylon for seat sealing gaskets

TABLE 7: General characteristics of diaphragm valves

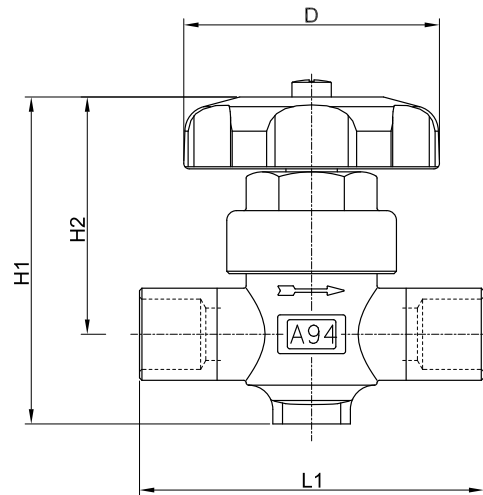
Catalogue Number	Connections		Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast			
	SAE Flare	ODS			min.	max.	min.	max.				
		Ø [in.]								Ø [mm]		
6210/2	1/4"	-	0,28	28	-35	+90	-35	+50	Art. 4.3			
6210/3	3/8"		1,00									
6210/4	1/2"		1,30									
6210/5	5/8"		1,80									
6210/6	3/4"		3,65									
6220/M6	-	-	6							0,28		
6220/2		1/4"	-									
6220/3		3/8"	-								1,00	
6220/M10		-	10								1,30	
6220/4		1/2"	-									
6220/5		5/8"	16									1,80
6220/6		3/4"	-									3,65
6220/7		7/8"	-									

TABLE 8: Dimensions and weights of diaphragm valves

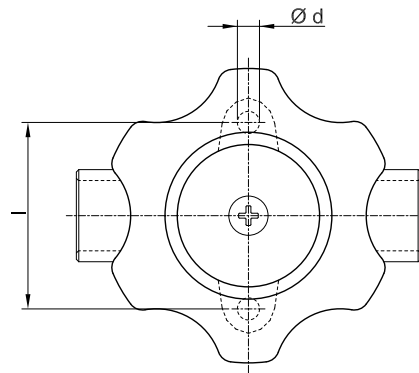
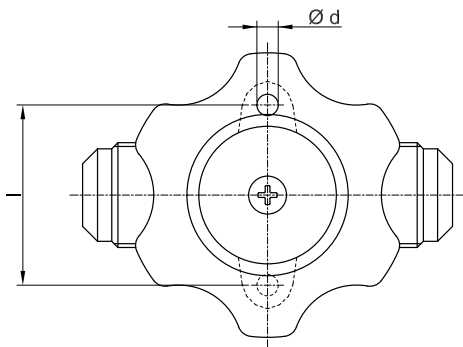
Catalogue Number	Dimensions [mm]						Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	d	l	D	
6210/2	68	53,5	58	4,5	36	52	200
6210/3	72		74		325		
6210/4			78		335		
6210/5			340				
6210/6	86		62,5		98		6,2
6220/M6	68	53,5	53	4,5	36	52	195
6220/2			72		61		38
6220/3	70				305		
6220/M10	71						
6220/4	86		62,5		92		6,2
6220/5		94		645			
6220/6		645					



6210



6220



## ROTALOCK VALVES

Rotalock valves mounted with 7910 fittings and 7990 gaskets, guarantee quick installation and safe sealing. They can be assembled in any direction before tightening the ring.

Furthermore, they have an additional charging connection, which can be excluded by the back sealing of the spindle.

Fittings 7910 and gaskets 7990 must be ordered separately. The main parts of the rotalock valves and their accessories are made with the following materials:

- Ottone forgiato a caldo EN 12420 – CW 617N per il corpo.
- Hot forged brass EN 12420 – CW 617N for the body.
- Steel, with proper surface protection, for the spindle and ring
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Glass-reinforced PBT for the protective cap that covers the spindle.
- Steel bar EN 10277-3 11S Mn Pb 37 + C for 7910 fittings
- PTFE for 7990 gaskets

TABLE 9: General characteristics of rotalock valves

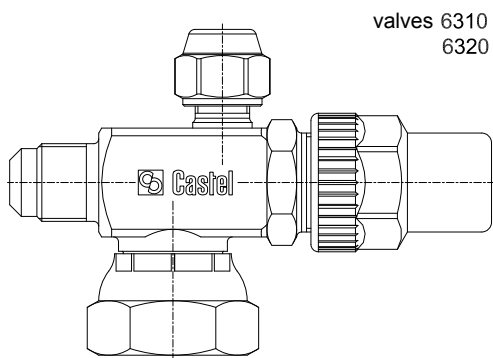
Catalogue Number	Connections			Union code	Gasket code	PS [bar]	Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare		Swivel nut (3)						min.	max.	min.	max.	
	(1)	(2)											
6310/2	1/4"	1/4"	3/4" UNF	7910/6	7990/6	45	0,46	45	-40	+110	-40	+50	Art. 4.3
6310/3		3/8"					1,35						
6310/4		1/2"											
6320/3		3/8"	1" UNS	7910/8	7990/8		1,40						
6320/4		1/2"					3,10						
6320/5		5/8"											
6320/6		3/4"					3,4						

TABLE 10: Dimensions and weights of rotalock valves

Catalogue Number	Dimensions [mm]				Weight [g]	
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	L <sub>2</sub>		
6310/2	68,5	33,5	94	64	290	
6310/3						300
6310/4			97			
6320/3	69,5	34,5			330	
6320/4	72	36,5	114,5	77,5	400	
6320/5			117,5		415	
6320/6					425	

TABLE 11: Dimensions and weights of unions

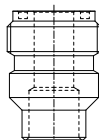
Catalogue number	Connections			L	Weight [g]	Gasket code
	Threaded	Solder [mm]				
		ODF	ODM			
7910/6	3/4" UNF	10	13	26	28	7990/6
7910/8	1" UNS	-	19		47	7990/8



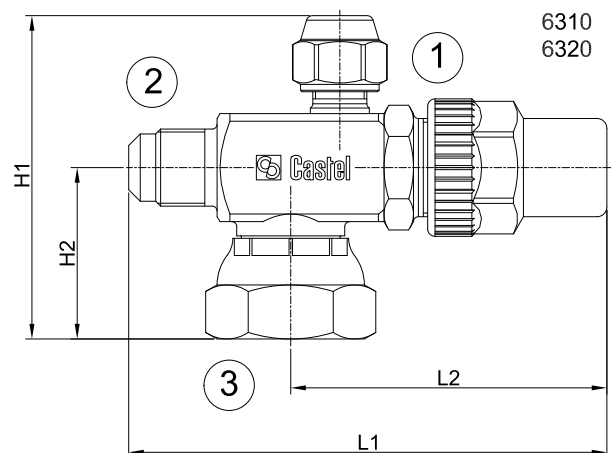
valves 6310  
6320



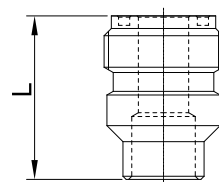
gasket 7990



coupling 7910



6310  
6320



7910

## CAPPED VALVES

The main parts of the capped valves are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, for the spindle.
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Glass-reinforced PBT for the protective cap that covers the spindle.

The brazing of capped valves with solder connections, type 6420, should be carried out with care, using a low melting point filler material. It is necessary to remove the spindle assembly, including the packing gland before brazing the body. It is important to avoid direct contact between the torch flame and the body, which could be damaged and compromise the proper functioning of the valves.

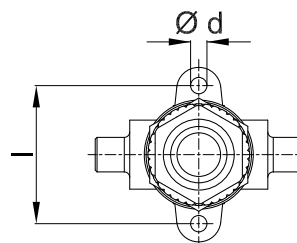
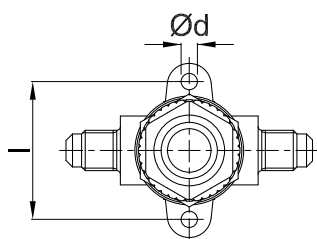
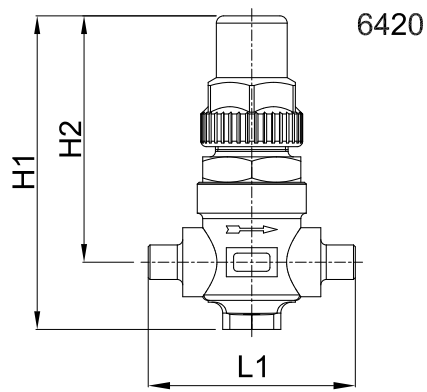
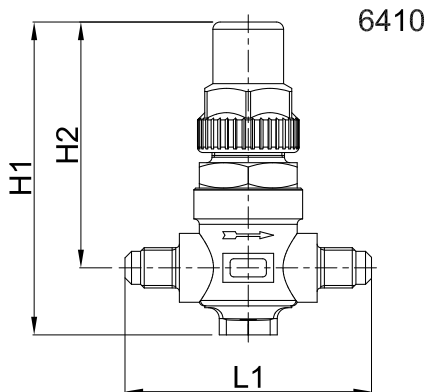
TABLE 12: General characteristics of capped valves

Catalogue Number	Connections			Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	ODS				min.	max.	min.	max.	
		Ø [in.]	Ø [mm]							
6410/2	1/4"	-	-	0,40	45	-40	+110	-40	+50	Art. 4.3
6410/3	3/8"			1,00						
6410/4	1/2"			1,45						
6410/5	5/8"			1,70						
6410/6	3/4"			3,50						
6420/2	1/4"			0,40						
6420/3	3/8"	1,00								
6420/3S3	3/8" - OUT 3/8" - IN									
6420/M10	-	-	10	1,45						
6420/M12		-	12							
6420/4		1/2"	-							
6420/5		5/8"	16							
6420/M18		-	18	3,50						
6420/6		3/4"	-							
6420/M22		-	22							
6420/7		7/8"	-							

TABLE 13: Dimensions and weights of capped valves

Catalogue Number	Dimensions [mm]					Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	d	l	
6410/2	85,5	67	68	4,5	38	305
6410/3			74			325
6410/4			78			330
6410/5						
6410/6	113	89,5	98	6,2	50	695
6420/2	85,5	67	57	4,5	38	300
6420/3			61			305
6420/3S3			67,5			
6420/M10			61			
6420/M12			70			
6420/4			71			
6420/5						
6420/M18			113			89,5
6420/6	94	685				
6420/M22		690				
6420/7						





## GLOBE VALVES

These valves are available in the following two types:

- 6512 with straight solder connections
- 6532 with right-angle solder connections

The main parts of the globe valves are made with the following materials:

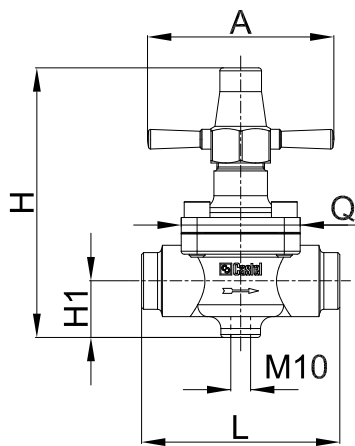
- Hot forged brass EN 12420 – CW 617N for body, cover and cap that covers the spindle
- Steel, with proper surface protection, for the spindle.
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Metal-rubber laminate for outlet seal gaskets
- PTFE for seat gaskets.

TABLE 14: General characteristics of globe valves

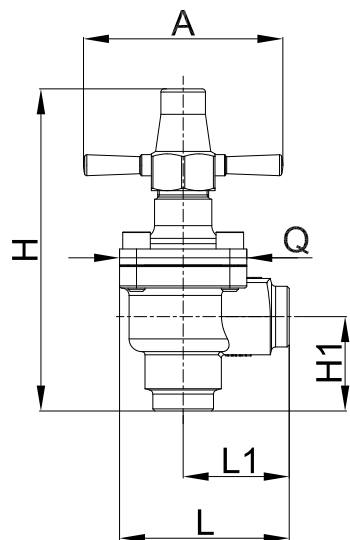
Catalogue Number	Connections				Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	ODS		ODM				min.	max.	min.	max.	
	Ø [in.]	Ø [mm]	Ø [in.]	Ø [mm]							
6512/M22	–	22	–	28	7,1	45	-35	+160	-35	+50	Art. 4.3
6512/7	7/8"	–	1.1/8"	–							
6512/M28	–	28	1.3/8"	35	8,4						
6512/9	1.1/8"	–	1.3/8"	35							
6512/11	1.3/8"	35	1.5/8"	–	15,0						
6512/13	1.5/8"	–	2"	–	25,0						
6512/M42	–	42	2"	–							
6512/17	2.1/8"	54	–	–	40,0						
6532/M22	–	22	–	28	8,2						
6532/7	7/8"	–	1.1/8"	–							
6532/M28	–	28	1.3/8"	35	9,1						
6532/9	1.1/8"	–	1.3/8"	35							
6532/11	1.3/8"	35	1.5/8"	–	18,7						
6532/13	1.5/8"	–	2"	–	38,0						
6532/M42	–	42	2"	–							
6532/17	2.1/8"	54	–	–	48,5						

TABLE 15: Dimensions and weights of globe valves

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H1	L	L1	Q	A	
6512/M22	136	28,5	100	-	60	94	1415
6512/7							1310
6512/M28							
6512/9							
6512/11	166	34	118	-	68	126	2020
6512/13	199	37	141	-	88	138	3500
6512/M42							5050
6512/17	215	42,5	173	-	104	-	
6532/M22	147	44,5	80	50	60	94	1350
6532/7							1290
6532/M28							
6532/9							
6532/11	165	52,5	93	59	68	126	1910
6532/13	238	65	139	86,5	104	138	4920
6532/M42							4765
6532/17							



6512



6532

## GAUGE MOUNTING VALVES

The valves are equipped with:

- A small flange for fixing the tap to the control panel
- A threaded SAE Flare connection for joining it to the copper pipe with a union.
- A threaded NPT (type 8320) or a swivel union SAE Flare (8321) connection for mounting the gauge

The main parts of the gauge mounting valves are made with the following materials:

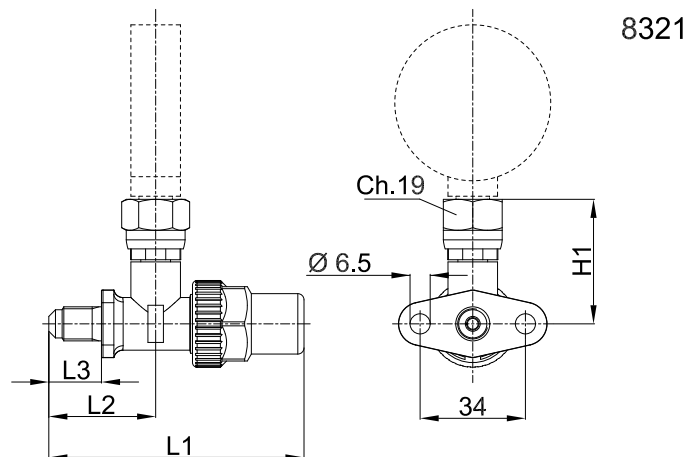
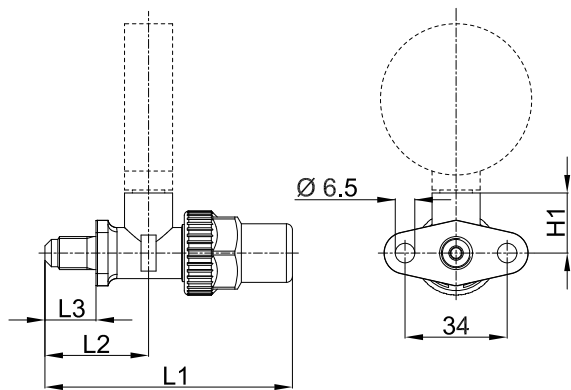
- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, for the spindle.
- Chloroprene rubber (CR) and aramid fibres for gland seal
- Glass-reinforced PBT for the protective cap that covers the spindle.

**TABLE 16: General characteristics of gauge mounting valves**

Catalogue Number	Connections			Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	NPT	SAE Flare			min.	max.	min.	max.	
8320/21	1/4"	1/8"	–	0,44	45	-40	+130	-40	+50	Art. 4.3
8320/22	1/4"	1/4"	–							
8321/22	1/4"	–	1/4" f							

**TABLE 17: Dimensions and weight of gauge mounting valves**

Catalogue Number	Dimensions [mm]				Weight [g]
	H1	L1	L2	L3	
8320/21	19	83	35	17	140
8320/22	37				186
8321/22	40				



## LINE PIERCING VALVE

The piercing valve is a fast, economic means of providing a charging, purging or gauge inlet point in the refrigeration system. It can be applied on copper pipes with a 6 mm to 10 mm diameter, and can be installed in any position on the system.

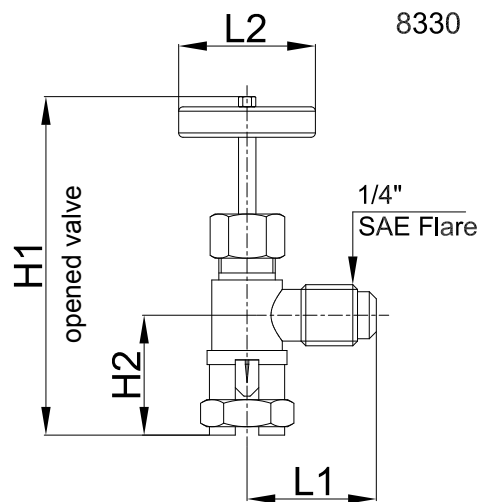
The main parts of the piercing valve are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Hardened steel for the needle
- Chloroprene rubber (CR) for the outlet seal gaskets

Install the threaded fork astride of the copper pipe, fix the valve to the pipe, tightening the lower nut. Then, as the needle advances, it pierces the pipe. The hole connects the inside of the pipe with the 1/4" SAE Flare connection of the valve as shown in Figures 1 and 2.

**TABLE 18: General characteristics and dimensions of line piercing valve**

Catalogue Number	Connections		Dimensions [mm]				Weight [g]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	Pipe Diameter [mm]	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	L <sub>2</sub>			min.	max.	min.	max.	
8330/A	1/4"	6 - 10	72	25,5	29	36	104	25	-10	+70	-10	+50	Art. 4.3



# CHAPTER 2

## VALVES WITH SCREW SHUTTER

### FOR REFRIGERATION PLANTS THAT USE HC REFRIGERANTS

this chapter cannot be installed with mineral oils or alkylbenzenes.

#### RECEIVER VALVES

Receiver valves for HC are two-way valves with 90° connections, type 6110N.

The main parts are manufactured with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, for the spindle.
- Hydrogenated nitrile butadiene rubber (HNBR) and aramid fibres for packing gland seal.
- Glass-reinforced PBT for the protective cap that covers the spindle.



#### APPLICATIONS

The valves illustrated in this chapter have been developed by Castel for all those refrigeration applications that use the following HC refrigeration fluids: R290, R600, R600a, belonging to Group 1, defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

**CAUTION!** Valves with screw shutter illustrated in

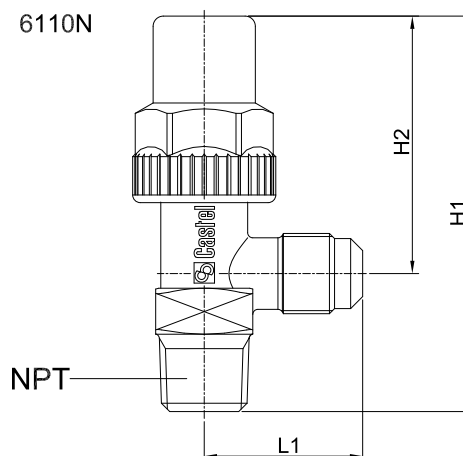


TABLE 19: General characteristics of receiver valves for HC refrigerants

Catalogue Number	Connections		Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	NPT			min.	max.	min.	max.	
6110N/22	1/4"	1/4"	0,44	45	-40	+150	-40	+50	Art. 4.3
6110N/33	3/8"	3/8"	1,35						
6110N/43	1/2"	3/8"	2,40						

TABLE 20: Dimensions and weights of receiver valves for HC refrigerants

Catalogue Number	Dimensions [mm]			Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	
6110N/22	72	48	27,5	110
6110N/33	77	50	31	140
6110N/43	88	55,5	34,5	220

# CHAPTER 3

## VALVES WITH SCREW SHUTTER

### FOR REFRIGERATION PLANTS THAT USE THE R744 REFRIGERANT

#### APPLICATIONS

The valves illustrated in this chapter have been developed by Castel for all the applications that use the sub-critical or transcritical R744 refrigeration fluid belonging to Group 2, defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

**CAUTION!:** Valves with screw shutter illustrated in this chapter cannot be used with other refrigerant fluids.

#### HERMETIC VALVES

Hermetic valves for CO<sub>2</sub> are two-way shut-off taps, type 6010E/2 and 6012E/22

The main parts are manufactured with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, or brass for the spindle
- EPDM (ethylene propylene rubber) and aramid fibres for packing gland seal.
- Glass-reinforced PBT for the protective cap that covers the spindle.

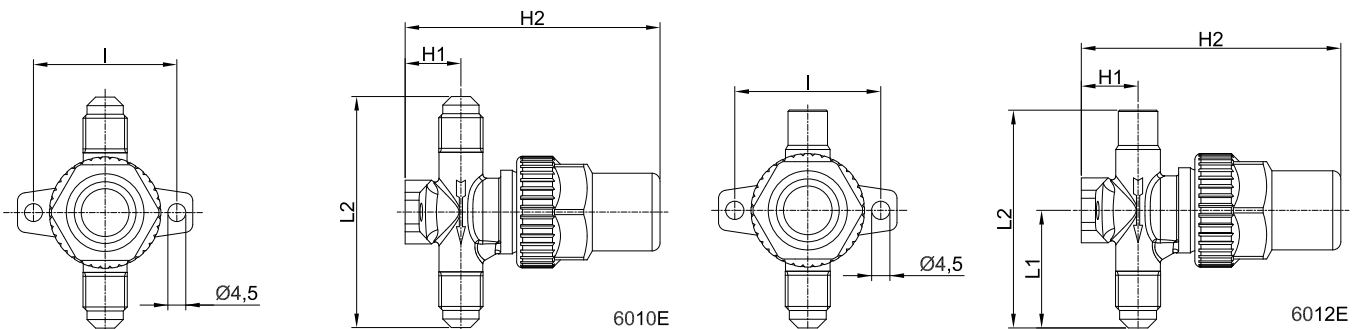


TABLE 21: General characteristics of valves for hermetic systems for R744

Catalogue Number	Connections			Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare		ODS			min.	max.	min.	max.	
			Ø [in.]							
6010E/2	1/4"	1/4"	–	0,27	120	-40	+130	-40	+50	Art. 4.3
6012E/22	1/4"	–	1/4"							

TABLE 22: Dimensions and weights of valves for hermetic systems for R744

Catalogue Number	Dimensions [mm]					Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	l	L <sub>1</sub>	L <sub>2</sub>	
6010E/2	14	66	36	–	58	160
6012E/22				29	55,5	



## RECEIVER VALVES

Receiver valves for CO<sub>2</sub> are two-way valves with 90° connections, types 6110E and 6120E.

The main parts are manufactured with the following materials:

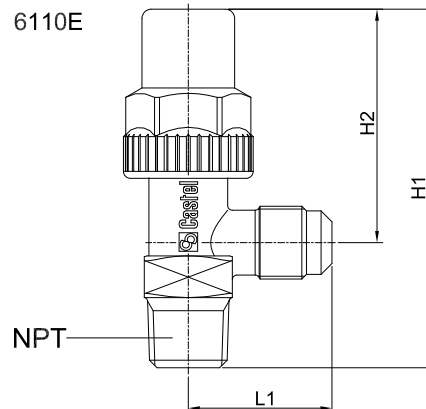
- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, for the spindle.
- EPDM (ethylene propylene rubber) and aramid fibres for packing gland seal.
- Glass-reinforced PBT for the protective cap that covers the spindle.

TABLE 23: General characteristics of receiver valves for R744

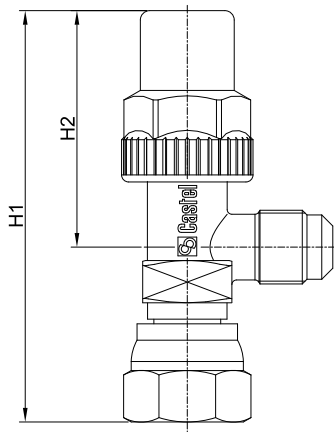
Catalogue Number	Connections		Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	NPT			min.	max.	min.	max.	
6110E/22	-	1/4"	1/4"	120	-40	+130	-40	+50	Art. 4.3
6110E/X15	1/4" F	1/4"	-						
6110E/33	-	3/8"	3/8"						
6110E/X13	3/8" F	3/8"	-						
6110E/44	-	1/2"	1/2"						
6120E/22	-	1/4"	1/4"						
6120E/33	-	3/8"	3/8"						
6120E/44	-	1/2"	1/2"						

TABLE 24: Dimensions and weights of receiver valves for R744

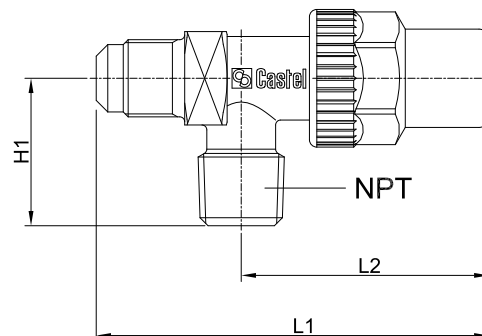
Catalogue Number	Dimensions [mm]				Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	L <sub>2</sub>	
6110E/22	72	48	27,5	-	110
6110E/X15	83				
6110E/33	77	50	31		140
6110E/X13	87				
6110E/44	92	55,5	34,5		235
6120E/22	27,5	-	72	48	110
6120E/33	30		80	50	140
6120E/44	33		93	55,5	305



6110E/X13  
6110E/X15



6120E



## CAPPED VALVES

The main parts of the capped valves are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Steel, with proper surface protection, for the spindle.
- EPDM (ethylene propylene rubber) and aramid fibres for packing gland seal.
- Glass-reinforced PBT for the protective cap that covers the spindle.

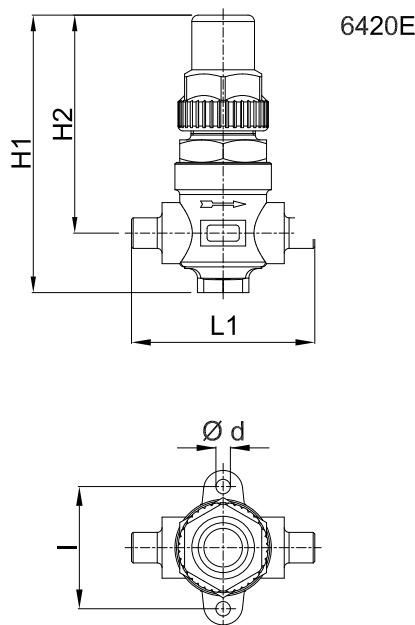
The brazing of capped valves, type 6420E, should be carried out with care, using a low melting point filler material. It is necessary to remove the spindle assembly, including the packing gland before brazing the body. It is important to avoid direct contact between the torch flame and the body, which could be damaged and compromise the proper functioning of the valve.

TABLE 25: General characteristics of capped valves for R744

Catalogue Number	Connections		Kv Factor [m <sup>3</sup> /h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	ODS Ø [in.]			min.	max.	min.	max.	
6420E/2	-	1/4"	0,40	120	120	+110	-40	+110	Art. 4.3
6420E/3		3/8"	1,00						
6420E/3S3	3/8" - OUT	3/8" - IN	1,00						
6420E/4	-	1/2"	1,45						

TABLE 26: Dimensions and weights of capped valves for R744

Catalogue Number	Dimensions [mm]					Weight [g]
	H <sub>1</sub>	H <sub>2</sub>	L <sub>1</sub>	d	l	
6420E/2	85,5	67	57	4,5	38	300
6420E/3			61			305
6420E/3S3			67,5			
6420E/4			70			





# CHAPTER 4 ■ VALVES WITH BALL SHUTTER

## FOR REFRIGERATION PLANTS THAT USE HCFC, HFC OR HFO REFRIGERANTS



### APPLICATIONS

The 2-ways valves with ball shutter illustrated in this chapter are designed for installation on commercial refrigeration systems and on civil and industrial air conditioning plants that use the following refrigerant fluids:

- HCFC (R22)
- HFC (R134a, R404A, R407C, R410A, or R507)
- HFO and HFO/HFC mixtures (R1234ze, R448A, R449A, R450A, or R452A)

belonging to Group 2, as defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

Furthermore, the same valves with ball shutter, up to DN 25, that is models 6570/9 and 6571/11, can also be installed on systems using the following refrigeration fluids:

- HFC (R32)
- HFO (R1234yf)

classified as A2L in the ASHRAE 34-2013 standard, and belonging to Group 1, as defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

### CONSTRUCTION

The specific design of Castel valves with ball shutter:

- ensures the internal pressure equilibrium when the valve is closed,
- permits the two-directional flow of the refrigerant
- prevents any risk of ejection or explosion of the spindle.

The electric welding of the body and the seal gaskets, assembled on the spindle, ensure perfect hermetic seal of the valve.

Valves with ball shutter are available in the following two types:

- Valves in series 6570 - 6590 (full port) and in series 6571 - 6591 (reduced port) without access fitting.
- Valves in series 6570/A - 6590/A (full port) and in series 6571/A - 6591/A (reduced port) with access

fitting. These taps are equipped with mechanism 8395/A1 and cap 8392/A.

The main parts of the valves with ball shutter are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Hot forged brass EN 12420 – CW 617N, chromium plated, for the ball
- Copper pipe EN 12735-1 – Cu--DHP for solder connections
- Steel, with proper surface protection, for the spindle.
- Chloroprene rubber (CR) for outlet seal gaskets
- P.T.F.E. for the ball seat gaskets
- Hot forged brass EN 12420 – CW 617N for the protective cap of the spindle,

### INSTALLATION

The valves with ball shutter can be installed in all sections of a refrigerating system, in compliance with the limits and capacities indicated in Table 28. Table 27 shows the following functional characteristics of a valve with ball shutter.

- PS
- TS
- Kv factor

Brazing of the valves with ball shutter with solder connections should be carried out with care, using a low melting point filler material (min. 5% Ag). It is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper functioning of the entire valve.

### CERTIFICATIONS

Valves with ball shutter in series: 6570, 6571, 6590, and 6591 (with the exclusion of models 6570(M64A and greater and models 6571/24A and greater) have been approved by the American certification authority, Underwriters Laboratories Inc. These taps are **UL Listed** certified for the USA with file SA33319, in compliance with American standard UL 207.

TABLE 27: General characteristics of ball valves, UL approved

Catalogue Number		Connections		Ball Port Ø [mm]	Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast		
without access fitting	with access fitting	ODS					min.	max.	min.	max.			
		Ø [in.]	Ø [mm]										
6570/M6	6570/M6A	–	6	10	0,8	45 (1)	-40	+150	-40	+50	Art. 4.3		
6570/2	6570/2A	1/4"	–										
6570/3	6570/3A	3/8"	–										
6570/M10	6570/M10A	–	10		3								
6570/M12	6570/M12A	–	12		5								
6570/4	6570/4A	1/2"	–	15	17								
6570/M15	6570/M15A	–	15										
6570/5	6570/5A	5/8"	16										
6570/M18	6570/M18A	–	18										
6570/6	6570/6A	3/4"	–	19	29								
6570/7	6570/7A	7/8"	22	25	51								
6570/M28	6570/M28A	–	28	32	86								
6570/9	6570/9A	1.1/8"	–	38	117								
6590/11	6590/11A	1.3/8"	35	50	214								
6590/13	6590/13A	1.5/8"	–	60	380								
6590/M42	6590/M42A	–	42										
6570/M64 (2)	6570/M64A (2)	–	64										
–	6570/21A (2)	2.5/8"	–										
	6570/24A (2)	3"	76			73	550						
	6570/25A (2)	3.1/8"	80	82	710								
	6570/28A (2)	3.1/2"	89										
6570/29A (2)	3.5/8"	92											
6571/5	–	5/8"	16	10	5	45 (1)	-40	+150	-40	+50	Art. 4.3		
6571/7		7/8"	22	15	17								
6571/M28		–	28	19	29								
6571/9		1.1/8"	–	25	51								
6571/11		1.3/8"	35	32	86								
6591/13		1.5/8"	–	38	117								
6591/M42		–	42	50	214								
6591/17		2.1/8"	54										
6591/M64	6591/M64A	–	64	50	214								
6591/21	6591/21A	2.5/8"	–	60	380								
–	6571/24A (2)	3"	76										
	6571/25A (2)	3.1/8"	80									73	550
	6571/28A (2)	3.1/2"	89									82	660
	6571/29A (2)	3.5/8"	92										
	6571/33A (2)	4.1/8"	105										
6571/34A (2)	4.1/4"	108											

(1) : MWP = 500 psi for 6570/.. and 6590/.. - MWP = 435 psi for 6571/.. and 6591/.. according to UL approval  
 (2) : not UL approved

**TABLE 28: Refrigerant flow capacity of ball valves [kW]**

Catalogue Number		Liquid line												
without access fitting	with access fitting	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
6570/M6	6570/M6A	13,6	14,6	20,1	9,5	13,8	13,7	9,2	10,1	12,0	12,5	12,6	12,7	9,7
6570/2	6570/2A													
6570/3	6570/3A	51	55	75	36	52	52	35	38	45	47	47	48	36
6570/M10	6570/M10A													
6570/M12	6570/M12A	85	92	126	60	86	86	58	63	75	78	79	80	61
6570/4	6570/4A													
6571/5	–													
6570/M15	6570/M15A	289	311	427	202	293	292	196	214	256	266	267	270	206
6570/5	6570/5A													
6570/M18	6570/M18A													
6570/6	6570/6A													
6571/7	–													
6570/7	6570/7A	493	531	729	345	500	498	334	365	436	454	456	461	352
6571/M28	–													
6571/9	–													
6570/M28	6570/M28A	867	933	1282	607	879	876	587	642	767	798	802	811	619
6570/9	6570/9A													
6571/11	–													
6590/11	6590/11A	1462	1574		1023	1482	1477	989		1293	1346	1352	1368	1043
6591/13	–													
6591/M42	–													
6590/13	6590/13A	1989	2141		1392	2016	2009	1346		1760	1831	1839	1861	1419
6590/M42	6590/M42A													
6591/17	–													
6590/17	6590/17A	3638	3916		2547	3687	3674	2461		3219	3349	3364	3405	2596
6591/M64	6591/M64A													
6591/21	6591/21A													
6570/M64	6570/M64A	6460	6954		4522	6547	6525	4370		5715	5947	5974	6046	4609
–	6570/21A													
	6571/24A													
	6571/25A													
	6570/24A	9350	10065		6545	9477	9444	6325		8272	8608	8646	8751	6672
	6570/25A													
	6571/28A													
6571/29A														
6570/28A	12070	12993		8449	12233	12191	8165		10678	11112	11161	11296	8612	
6570/29A														
6571/33A	11220	12078		7854	11372	11332	7590		9926	10329	10375	10501	8006	
6571/34A														

Standard rating conditions according to AHRI Standard 760-2007

Continued

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

TABLE 28: Refrigerant flow capacity of ball valves [kW]

Catalogue Number		Suction line												
without access fitting	with access fitting	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
6570/M6	6570/M6A	1,5	2,0	3,4	1,8	1,8	2,6	1,8	1,2	1,1	1,9	1,8	1,3	1,7
6570/2	6570/2A													
6570/3	6570/3A	5,5	7,7	12,8	6,6	6,8	9,9	6,7	4,4	4,3	7,2	6,6	4,8	6,3
6570/M10	6570/M10A													
6570/M12	6570/M12A	9,1	12,8	21,3	11,0	11,4	16,5	11,2	7,4	7,1	12,0	11,0	8,0	10,6
6570/4	6570/4A													
6571/5	–													
6570/M15	6570/M15A	31	43	72	37	39	56	38	25	24	41	37	27	36
6570/5	6570/5A													
6570/M18	6570/M18A													
6570/6	6570/6A													
6571/7	–													
6570/7	6570/7A	53	74	123	64	66	96	65	43	41	70	64	46	61
6571/M28	–													
6571/9	–													
6570/M28	6570/M28A	93	130	217	112	116	168	114	75	72	122	112	81	108
6570/9	6570/9A													
6571/11	–													
6590/11	6590/11A	157	219		189	195	284	192		122	206	189	137	181
6591/13	–													
6591/M42	–													
6590/13	6590/13A	213	298		257	266	386	261		166	281	257	186	247
6590/M42	6590/M42A													
6591/17	–													
6590/17	6590/17A	389	546		471	486	706	477		304	514	471	340	452
6591/M64	6591/M64A													
6591/21	6591/21A													
6570/M64	6570/M64A	692	969		836	863	1254	847		540	912	836	604	802
	6570/21A													
	6571/24A													
	6571/25A	1001	1403		1210	1249	1815	1227		781	1320	1210	875	1161
	6570/24A													
	6570/25A													
	6571/28A													
	6571/29A	1292	1811		1562	1612	2343	1583		1008	1704	1562	1129	1498
	6570/28A													
	6570/29A													
	6571/33A	1201	1683		1452	1498	2178	1472		937	1584	1452	1049	1393
	6571/34A													

Standard rating conditions according to AHRI Standard 760-2007

Continued

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

**TABLE 28: Refrigerant flow capacity of ball valves [kW]**

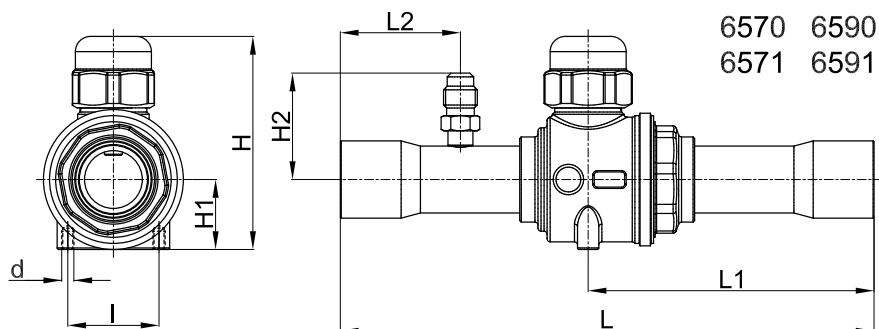
Catalogue Number		Hot Gas line													
without access fitting	with access fitting	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A	
6570/M6	6570/M6A	6,8	9,0	14,5	7,7	9,5	10,9	7,6	5,3	5,5	9,4	8,6	6,1	8,0	
6570/2	6570/2A														
6570/3	6570/3A	26	34	54	29	36	41	29	20	21	35	32	23	30	
6570/M10	6570/M10A														
6570/M12	6570/M12A	43	56	91	48	60	68	48	33	34	59	54	38	50	
6570/4	6570/4A														
6571/5	–														
6570/M15	6570/M15A	145	190	309	163	202	231	162	113	116	201	183	130	170	
6570/5	6570/5A														
6570/M18	6570/M18A														
6570/6	6570/6A														
6571/7	–	247	325	527	278	345	394	277	193	199	342	313	222	289	
6570/7	6570/7A														
6571/M28	–														
6571/9	–	434	571	926	490	607	694	487	339	349	602	550	390	509	
6570/M28	6570/M28A														
6570/9	6570/9A														
6571/11	–	731	963		826	1023	1170	820		589	1015	927	658	858	
6590/11	6590/11A														
6591/13	–														
6591/M42	–	995	1310		1123	1392	1591	1116		801	1381	1261	895	1168	
6590/13	6590/13A														
6590/M42	6590/M42A														
6591/17	–	1819	2397		2054	2547	2910	2042		1466	2525	2307	1637	2136	
6590/17	6590/17A														
6591/M64	6591/M64A														
6591/21	6591/21A	3230	4256		3648	4522	5168	3625		2603	4484	4096	2907	3792	
6570/M64	6570/M64A														
–	6571/24A														
–	6571/25A	4675	6160		5280	6545	7480	5247		3768	6490	5929	4208	5489	
–	6570/24A														
–	6570/25A														
–	6571/28A	6035	7952		6816	8449	9656	6773		4864	8378	7654	5432	7086	
–	6571/29A														
–	6570/28A	5610	7392		6336	7854	8976	6296		4521	7788	7115	5049	6587	
–	6570/29A														
–	6571/33A														
–	6571/34A														

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

TABLE 29: Dimensions and weights of ball valves

Catalogue Number		Dimensions [mm]							Weight [g]						
		H	H <sub>1</sub>	H <sub>2</sub>	L	L <sub>1</sub>	L <sub>2</sub>	l		d					
6570/M6	6570/M6A	48	15	29	121	65	25	18	M4	198					
6570/2	6570/2A									201					
6570/3	6570/3A														
6570/M10	6570/M10A														
6570/M12	6570/M12A														
6570/4	6570/4A														
6571/5	-			-	138	73,5	-			208					
6570/M15	6570/M15A	55	19	32	139	73	30	25,5	M4	311					
6570/5	6570/5A														
6570/M18	6570/M18A														
6570/6	6570/6A														
6571/7	-			-	175	90,5	-			360					
6570/7	6570/7A	70	23	34	175	94	40	30	M6	570					
6571/M28	-			206	109	-	601								
6571/9	-														
6570/M28	6570/M28A	79	27	37	204	109	45	30	M6	708					
6570/9	6570/9A														
6571/11	-										-	245	130	-	840
6590/11	6590/11A										45	210	112	43	1518
6591/13	-	117	37	-	-										
6591/M42	-														
6590/13	6590/13A	127	44	45	239	126	48	30	M6	2470					
6590/M42	6590/M42A														
6591/17	-										-	253	133	-	4360
6590/17	6590/17A	148	54	53	275	149	58	30	M6	4400					
6591/M64	6591/M64A														
6591/21	6591/21A														
6570/M64	6570/M64A	150	55	57	343	186	68	75	M8	6000					
-	6570/21A				6240										
-	6571/24A				6410										
-	6571/25A				6580										
-	6570/24A	186,5	70	64	365,5	196,5	69	89	M8	10735					
-	6570/25A				10790										
-	6571/28A				381,5	204,5	77			11012					
-	6571/29A				11013										
-	6570/28A	195	75	68	373	197,5	70,5	75	M8	12789					
-	6570/29A				12807										
-	6571/33A				405	213,5	86,5			13223					
-	6571/34A				13257										



# CHAPTER 5

## VALVES WITH BALL SHUTTER

### FOR REFRIGERATION PLANTS THAT USE HC REFRIGERANTS



#### APPLICATIONS

The valves with ball shutter illustrated in this chapter have been developed by Castel for all those refrigeration applications that use the following HC refrigeration fluids: R290, R600, and R600a, belonging to Group 1, defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

**CAUTION! The valves with ball shutter illustrated in this chapter cannot be used with mineral oils or alkylbenzenes.**

#### CONSTRUCTION

The specific design of Castel valves with ball shutter:

- ensures the internal pressure equilibrium when the tap is closed,

- permits the two-directional flow of the refrigerant
  - prevents any risk of ejection or explosion of the spindle.
- The electric welding of the body and the seal gaskets, assembled on the spindle, ensure perfect hermetic seal of the valve. The valves with ball shutter in series 6570N are full port without charge access.

The main parts of the valves with ball shutter are made with the following materials:

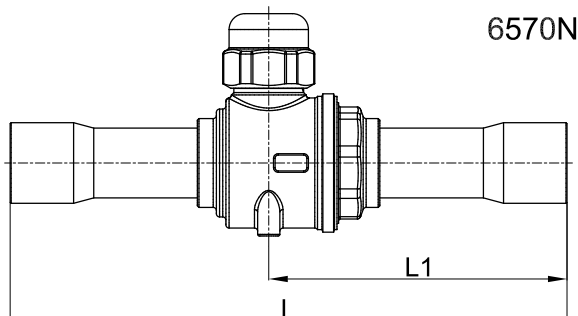
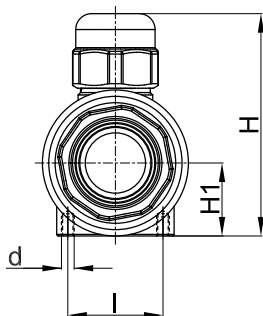
- Hot forged brass EN 12420 – CW 617N for the body
- Hot forged brass EN 12420 – CW 617N, chromium plated, for the ball
- Copper pipe EN 12735-1 – Cu--DHP for solder connections
- Steel, with proper surface protection, for the spindle.
- Hydrogenated nitrile butadiene rubber (HNBR) for outlet seal gaskets.
- P.T.F.E. for the ball seat gaskets
- Hot forged brass EN 12420 – CW 617N for the protective cap of the spindle

#### INSTALLATION

The valves with ball shutter can be installed in all sections of a refrigerating system, in compliance with the limits and capacities indicated in Table 31. Table 30 shows the following functional characteristics of a valve with ball shutter.

- PS
- TS
- Kv factor

Brazing of the valves with ball shutter with solder connections should be carried out with care, using a low melting point filler material (min. 5% Ag). It is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper functioning of the entire valve.



**TABLE 30: General characteristics of ball valves for HC refrigerants**

Catalogue Number	Connections		Ball Port Ø [mm]	Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	ODS					min.	max.	min.	max.	
	Ø [in.]	Ø [mm]								
6570N/M6	–	6	10	0,8	45	-40	+150	-40	+50	Art. 4.3
6570N/2	1/4"	–								
6570N/3	3/8"	–								
6570N/M10	–	10								
6570N/M12	–	12								
6570N/4	1/2"	–	5							
6570N/5	5/8"	16								
6570N/M18	–	18	17							
6570N/6	3/4"	–								
6570N/7	7/8"	22	19	29						
6570N/M28	–	28	25	51						
6570N/9	1.1/8"	–								

**TABLE 31: Refrigerant flow capacity of ball valves for HC refrigerants [kW]**

Catalogue Number	Liquid line			Suction line			Hot Gas line		
	R290	R600	R600a	R290	R600	R600a	R290	R600	R600a
6570N/M6	16,3	19,1	17,0	2,4	1,0	1,3	10,2	5,2	6,0
6570N/2									
6570N/3	61	72	64	9,2	3,9	4,7	38	19	22
6570N/M10									
6570N/M12	102	120	106	15,3	6,5	7,9	64	32	37
6570N/4									
6570N/5	346	406	360	52	22	27	217	110	126
6570N/M18									
6570N/6									
6570N/7	591	693	615	88	37	46	370	187	216
6570N/M28	1039	1219	1081	156	66	81	651	329	379
6570N/9									

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

**TABLE 32: Dimensions and weights of ball valves for HC refrigerants**

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H <sub>1</sub>	L	L <sub>1</sub>	l	d	
6570N/M6	48	15	121	65	18	M4	198
6570N/2							
6570N/3							
6570N/M10							
6570N/M12							
6570N/4	55	19	139	73	25,5		311
6570N/5							
6570N/M18							
6570N/6	70	23	175	94	30		570
6570N/7							
6570N/M28							
6570N/9	79	27	204	109	30	708	



# CHAPTER 6

## VALVES WITH BALL SHUTTER

### FOR REFRIGERATION PLANTS THAT USE THE R744 REFRIGERANT



#### APPLICATIONS

The valves with ball shutter illustrated in this chapter have been developed by Castel for all the applications that use the sub-critical or trans-critical R744 refrigeration fluid belonging to Group 2, defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

The valves with ball shutter for plants that operate using refrigerant fluid R744 are the following:

- Valves in series 6570EL and 6590EL with PS = 60 bar, equipped with copper connections for sub-critical plants.
- Valves in series 6570E and 6590E with PS = 80 bar, equipped with copper connections for trans-critical plants, low and medium pressure sides.
- Valves in series 6577E and 6597E with PS = 120 bar equipped with reinforced copper connections (K65) for trans-critical plants, high pressure side.
- Valves in series 6578E and 6598E with PS = 140 bar equipped with reinforced stainless steel connections for trans-critical plants, high-pressure side.

**CAUTION! The valves with ball shutter in this chapter cannot be used with other refrigerant fluids.**

#### CONSTRUCTION

The specific design of Castel valves with ball shutter:

- ensures the internal pressure equilibrium when the tap is closed,
- permits the two-directional flow of the refrigerant
- prevents any risk of ejection or explosion of the spindle.

The electric welding of the body and the seal gaskets, assembled on the spindle, ensure perfect hermetic seal of the valve. Valves with ball shutter in series: 6570EL, 6590EL, 6570E, 6590E, 6577E, 6597E, 6578E, 6598E are full port with no charge access.

The main parts of the valves with ball shutter are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body

- Hot forged brass EN 12420 – CW 617N, chromium plated, for the ball
- Steel, with proper surface protection, for the spindle.
- Ethylene propylene rubber (EPDM) for outlet seal gaskets
- PTFE for the ball seat gaskets
- Hot forged brass EN 12420 – CW 617N for the protective cap of the spindle
- Copper pipe EN 12735-1 – Cu-DHP for solder connections in series 6570EL, 6590EL, 6570E and 6590E.
- Copper pipe EN 12735-1 – CuFe2P (K65) for welded connections in series 6577E, and 6597E
- Stainless steel pipe AISI 304 for welded connections in series 6578E and 6598E.

#### INSTALLATION

The valves with ball shutter can be installed in all sections of a refrigerating system, in compliance with the limits and capacities indicated in Table 34. Table 33 shows the following functional characteristics of a valve with ball shutter.

- PS
- TS
- Kv factor

**Copper connections:** The brazing of valves with solder connections should be carried out with care, using a low melting point filler material (min.5 Ag). It is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper functioning of the entire valve.

**Steel connectors:** TIG welding recommended, to be performed as quickly as possible according to the method shown in the product instruction sheet. The connection material is AISI 304: it is only possible to use AISI 308 filler material if welding to pipes made from the same type of material. For pipes made from other materials, please contact your welding supplies supplier.

**TABLE 33: General characteristics of ball valves for R744**

Catalogue Number	Connections			Ball Port Ø [mm]	Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast								
	ODS		W				min.	max.	min.	max.									
	Ø [in.]	Ø [mm]	Ø [mm]																
6570EL/M6	-	-	-	10	0,8	60	-40	+150	-40	+50	Art. 4.3								
6570EL/2	1/4"	1/4"			3														
6570EL/3	3/8"	3/8"			5														
6570EL/M10	-	-			15							17							
6570EL/M12	-	-										19	29						
6570EL/4	1/2"	1/2"		25	51														
6570EL/5	5/8"	5/8"		32	86														
6570EL/M18	-	-		38	117														
6570EL/6	3/4"	3/4"			50							214							
6570EL/7	7/8"	7/8"		-	10							0,8	80	-40	+150	-40	+50	Art. 4.3	
6570EL/M28	-	-										3							
6570EL/9	1.1/8"	1.1/8"										5							
6590EL/11	-	-										15							17
6590EL/13	1/4"	1/4"																	19
6590EL/M42	3/8"	3/8"			25							51							
6590EL/17	-	-			32							86							
6570E/M6	-	6			38							117							
6570E/2	1/4"	-	50			214													
6570E/3	3/8"	-	-		10	0,8	80	-40	+150	-40	+50	Art. 4.3							
6570E/M10	-	10				3													
6570E/M12	-	12				5													
6570E/4	1/2"	-				15													17
6570E/5	5/8"	16																	19
6570E/M18	-	18			25	51													
6570E/6	3/4"	-			32	86													
6570E/7	7/8"	22			38	117													
6570E/M28	-	28		50		214													
6570E/9	1.1/8"	-		-	10	0,8							80	-40	+150	-40	+50	Art. 4.3	
6590E/11	1.3/8"	35				3													
6590E/13	1.5/8"	-				5													
6590E/M42	-	42				15													17
6590E/17	2.1/8"	54																	19
					25	51													
					32	86													
					38	117													
			50			214													

Continued

**TABLE 33: General characteristics of ball valves for R744**

Catalogue Number	Connections			Ball Port Ø [mm]	Kv Factor [m³/h]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast	
	ODS		W				min.	max.	min.	max.		
	Ø [in.]	Ø [mm]	Ø [mm]									
6577E/2	1/4"	–	–	10	0,8	120	-40	+150	-40	+50	Art. 4.3	
6577E/3	3/8"	–			3							
6577E/4	1/2"	–			5							
6577E/5	5/8"	16		15	17							
6577E/6	3/4"	–										
6597E/7	7/8"	22		19	29							
6597E/9	1.1/8"	–		25	51							
6597E/11	1.3/8"	35		32	86							
6597E/13	1.5/8"	–		38	117							
6597E/17	2.1/8"	54		50	214							I
6578E/M6	–	–	6	10	0,8	140	-40	+150	-40	+50	Art. 4.3	
6578E/M10			10		3							
6578E/M12			12		5							
6578E/M16			16	15	17							
6578E/M18			18									
6598E/M22			22	19	29							
6598E/M28			28	25	51							
6598E/M35			33,4	32	86							
6598E/M42			42,2	38	117							I

**TABLE 34: Refrigerant flow capacity of ball valves for R744 [kW]**

Catalogue Number	Subcritical system			Transcritical system		
	Liquid line	Suction line	Hot gas line	Gas cooler line	Suction line	Hot gas line
6570EL/M6	21	4,2	16			
6570EL/2						
6570EL/3	80	16	61			
6570EL/M10						
6570EL/M12	134	27	101			
6570EL/4						
6570EL/5	456	90	343			
6570EL/M18						
6570EL/6						
6570EL/7	777	154	585			
6570EL/M28	1367	270	1029			
6570EL/9						
6590EL/11	2305	456	1735			
6590EL/13	3136	620	2361			
6590EL/M42						
6590EL/17	5735	1134	4319			

Standard rating conditions according to AHRI Standard 760-2007 for subcritical system

Condensing temperature	30 °F (- 1,2 °C)	Evaporator superheating	10 °R (5,5 °K)
Liquid temperature	20 °F (- 6,7 °C)	Suction line temperature	- 5 °F (-15 °C)
Subcooling	10 °R (5,5 °K)	Suction superheating	15 °R (8,4 °K)
Evaporating temperature	- 20 °F (- 28,9 °C)	Discharge temperature	80 °F (26,6 °C)
Evaporator outlet temperature	- 10 °F (- 23,4 °C)		

Continued

Standard rating conditions according to AHRI Standard 760-2007 for transcritical system

Gas-cooler outlet temperature	95 °F (35 °C)	Suction line temperature	32 °F (0 °C)
Evaporating temperature	14 °F (- 10 °C)	Suction superheating	9 °R (5 °K)
Evaporator outlet temperature	23 °F (- 5 °C)	Discharge temperature	212 °F (110 °C)
Evaporator superheating	9 °R (5 °K)		

**TABLE 34: Refrigerant flow capacity of ball valves for R744 [kW]**

Catalogue Number	Subcritical system			Transcritical system		
	Liquid line	Suction line	Hot gas line	Gas cooler line	Suction line	Hot gas line
6570E/M6	21	4,2	16		3,7	
6570E/2						
6570E/3	80	16	61		14	
6570E/M10						
6570E/M12	134	27	101		23	
6570E/4						
6570E/5	456	90	343		79	
6570E/M18						
6570E/6						
6570E/7	777	154	585		134	
6570E/M28	1367	270	1029		236	
6570E/9						
6590E/11	2305	456	1735		398	
6590E/13	3136	620	2361		542	
6590E/M42						
6590E/17	5735	1134	4319		991	
6577E/2				21	3,7	15
6577E/3				79	14	56
6577E/4				131	23	93
6577E/5				447	79	318
6577E/6						
6597E/7				762	134	542
6597E/9				1340	236	953
6597E/11				2259	398	1607
6597E/13				3074	542	2187
6597E/17				5622	991	4000
6578E/M6				21	3,7	15
6578E/M10				79	14	56
6578E/M12				131	23	93
6578E/M16				447	79	318
6578E/M18						
6598E/M22				762	134	542
6598E/M28				1340	236	953
6598E/M35				2259	398	1607
6598E/M42				3074	542	2187

Standard rating conditions according to AHRI Standard 760-2007 for subcritical system

Condensing temperature	30 °F	(- 1,2 °C)	Evaporator superheating	10 °R	(5,5 °K)
Liquid temperature	20 °F	(- 6,7 °C)	Suction line temperature	- 5 °F	(-15 °C)
Subcooling	10 °R	(5,5 °K)	Suction superheating	15 °R	(8,4 °K)
Evaporating temperature	- 20 °F	(- 28,9 °C)	Discharge temperature	80 °F	(26,6 °C)
Evaporator outlet temperature	- 10 °F	(- 23,4 °C)			

Standard rating conditions according to AHRI Standard 760-2007 for transcritical system

Gas-cooler outlet temperature	95 °F	(35 °C)	Suction line temperature	32 °F	(0 °C)
Evaporating temperature	14 °F	(- 10 °C)	Suction superheating	9 °R	(5 °K)
Evaporator outlet temperature	23 °F	(- 5 °C)	Discharge temperature	212 °F	(110 °C)
Evaporator superheating	9 °R	(5 °K)			

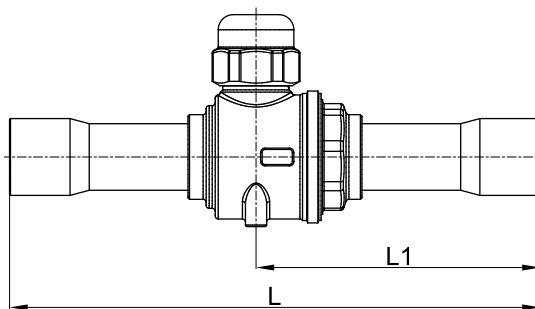
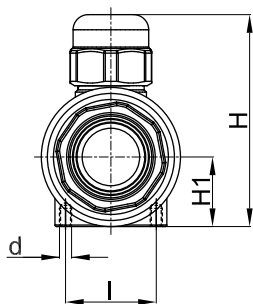
TABLE 35: Dimensions and weights of ball valves for R744

Catalogue Number	Dimensions [mm]						Weight [g]	
	H	H <sub>1</sub>	L	L <sub>1</sub>	l	d		
6570EL/M6	48	15	121	65	18	M4	216	
6570EL/2								
6570EL/3								
6570EL/M10								
6570EL/M12								
6570EL/4								
6570EL/5	55	19	139	73	25,5		333	
6570EL/M18								
6570EL/6								
6570EL/7	70	23	175	94	30		M6	610
6570EL/M28	79	27	204	109		834		
6570EL/9								
6590EL/11	108	37	210	112		M6		1421
6590EL/13	120	44	239	126				2695
6590EL/M42								
6590EL/17	153	54	275	149	4260			
6570E/M6	48	15	121	65	18	M4	216	
6570E/2								
6570E/3								
6570E/M10								
6570E/M12								
6570E/4								
6570E/5	55	19	139	73	25,5		333	
6570E/M18								
6570E/6								
6570E/7	70	23	175	94	30		M4	610
6570E/M28	79	27	204	109		834		
6570E/9								
6590E/11	117	37	210	112		M6		1421
6590E/13	127	44	239	126				2695
6590E/M42								
6590E/17	148	54	275	149	4260			

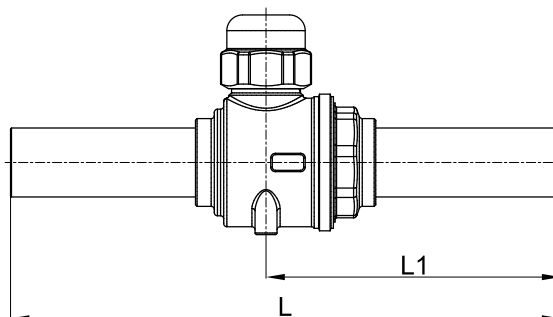
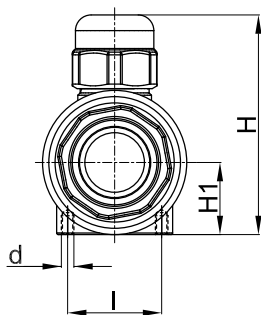
Continued

TABLE 35: Dimensions and weights of ball valves for R744

Catalogue Number	Dimensions [mm]						Weight [g]
	H	H <sub>1</sub>	L	L <sub>1</sub>	l	d	
6577E/2	47	15	115	65	18	M4	216
6577E/3			122				
6577E/4			120				
6577E/5	54	19	126	70	25,5	M4	333
6577E/6			126				
6597E/7	80	28	175	93	18	M5	780
6597E/9	86	30	207	110	30	M6	1092
6597E/11	108	37	210	112			1734
6597E/13	120	44	239	126			2682
6597E/17	153	54	275	149			4236
6578E/M6	47	15	117	66	18	M4	216
6578E/M10			123				
6578E/M12			121				
6578E/M16	54	19	142	74	25,5	M4	333
6578E/M18			139				
6598E/M22	80	28	175	93	18	M5	770
6598E/M28	86	30	207	110	30	M6	1092
6598E/M35	108	37	210	112			1760
6598E/M42	120	44	239	126			2668



6570EL 6590EL  
6570E 6590E  
6577E 6597E



6578E  
6598E

# CHAPTER 7 ■ 3-WAY MOTORIZED VALVES WITH BALL SHUTTERS

## FOR REFRIGERATION PLANTS THAT USE HCFC, HFC OR HFO REFRIGERANTS



### APPLICATIONS

The 3-way valves with ball shutter illustrated in this chapter are designed for installation on commercial refrigeration systems and on civil and industrial air conditioning plants that use the following refrigerant fluids:

- HCFC (R22)
- HFC (R134a, R404A, R407C, R410A, or R507)
- HFO and HFO/HFC mixtures (R1234ze, R448A, R449A, R450A, or R452A)

belonging to Group 2, as defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

Furthermore, the same valves, up to DN 25, that is models 6690M/9A2 and 6690M/9A6, can also be installed on systems using the following refrigeration fluids:

- HFC (R32)
- HFO (R1234yf)

classified as A2L in the ASHRAE 34-2013 standard, and belonging to Group 1, as defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

### CONSTRUCTION

The specific design of the 3-way valves with ball shutter in series 6690M:

- Fixing flange with 4 holes
- Extended spindle
- No mechanical stops on the spindle rotation (OPEN and CLOSED positions)

makes them suitable for operating only when coupled with actuators in series 9700 and 9720. For this reason, valves in series 6690M are always sold including the actuator and relative fixing plate in versions with suffix A2 (24 VAC) or suffix A6 (230 VAC).

**3-way valves in series 6690M cannot be used without an actuator.**

The electric welding of the body and the seal gaskets, assembled on the spindle, ensure perfect hermetic seal of the valves. The spindle construction eliminates the danger of explosion/expulsion.

The main parts of these valves are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Hot forged brass EN 12420 – CW 617N, chromium plated, for the ball
- Copper pipe EN 12735-1 – Cu--DHP for solder connections
- Stainless steel EN 10088-3 – 1.4305 for spindles
- Chloroprene rubber (CR) for outlet seal gaskets
- PTFE for the ball seat gaskets

### INSTALLATION

The 3-way valves with ball shutter in series 6690M act as changeover valves, not allowing for bi-direction flow of the refrigerant fluid. The input is always in the centre position, and the two outputs in the lateral positions. These valves are coupled directly to actuators and do not require a flanged adapter between the two parts. The actuator can be mounted on the valve in four different positions, oriented at 90° to each other.

The 3-way valves in series 6690M can be mounted:

- With horizontal output connections and vertical input connection, facing downward.
- With vertical output connections and horizontal input connection.

The actuator for the 3-way valves can never be mounted:

- Upside-down, oriented facing downward
- Vertically, with the cable oriented upwards

Once the valve / actuator has been coupled, remote movement of the valve is possible. In the event power is cut-off, the valve can be operated manually, excluding the actuator with a release clutch. **All of the actuators can be equipped with auxiliary contacts in series 9750, sold separately. For more information on the actuators in series 9700 and 9720, please see Chapter 9.**

The brazing of 3-way valves should be carried out with care, using a low melting point filler material (min. 5% Ag). It is important to avoid direct contact between the torch

flame and the valve body, which could be damaged and compromise the proper functioning of the entire valve.

**TABLE 36: General characteristics of 3-ways motorized valves**

Catalogue Number	Connections		Ball Port Ø [mm]	Kv Factor [m³/h]	Torque [Nm]	Running Time [sec]	Rotation Angle	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	ODS								min.	max.	min.	max.	
	Ø [in.]	Ø [mm]											
6690M/7A2	7/8"	22	19	11	10	60	90°	45	-40	+150	-20	+50	Art. 4.3
6690M/7A6													
6690M/M28A2	-	28	24	16									
6690M/M28A6													
6690M/9A2	1.1/8"	-	24	16									
6690M/9A6													
6690M/11A2	1.3/8"	35	28	20,5									
6690M/11A6													
6690M/13A2	1.5/8"	-	37	39	30	120						I	
6690M/13A6													
6690M/M42A2	-	42	37	39									
6690M/M42A6													

**TABLE 37: Electrical characteristics of 3-ways motorized valves**

Catalogue Number	Voltage [V]	Voltage tolerance [%]	Frequency [Hz]	Active Power [W]		Apparent Power [VA]		Cable	Wiring Connections		Protection Degree	TA [°C]	
				Operation	Stand-still	Operation	Stand-still		Switching output 2 point (Open/ Close)	Continuous output (0 - 10V)		min.	max.
6690M/7A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm² 1,2	YES	YES	IP 54	-20	+50
	24 D.C.	+20 / -20	-										
6690M/7A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		
6690M/M28A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm² 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	-										
6690M/M28A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		
6690M/9A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm² 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	-										
6690M/9A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		
6690M/11A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm² 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	-										
6690M/11A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		
6690M/13A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm² 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	-										
6690M/13A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		
6690M/M42A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm² 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	-										
6690M/M42A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm² 1,2 m	YES	NO	IP 43		



**TABLE 38: Refrigerant flow capacity of 3-ways motorized valves [kW]**

Catalogue Number	Liquid line												
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
6690M/7AX	187	201	276	131	190	189	127	138	165	172	173	175	133
6690M/M28AX	272	293	402	190	276	275	184	201	241	250	252	255	194
6690M/9AX													
6690M/11AX	349	375		244	353	352	236		308	321	322	326	249
6690M/13AX	663	714		464	672	670	449		587	610	613	620	473
6690M/M42AX													

Continued

**TABLE 38: Refrigerant flow capacity of 3-ways motorized valves [kW]**

Catalogue Number	Suction line												
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
6690M/7AX	20	28	47	24	25	36	25	16	16	26	24	17	23
6690M/M28AX	29	41	68	35	36	53	36	24	23	38	35	25	34
6690M/9AX													
6690M/11AX	37	52		45	47	68	46		29	49	45	33	43
6690M/13AX	71	99		86	89	129	87		55	94	86	62	82
6690M/M42AX													

Continued

**TABLE 38: Refrigerant flow capacity of 3-ways motorized valves [kW]**

Catalogue Number	Hot Gas line												
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
6690M/7AX	94	123	200	106	131	150	105	73	75	130	119	84	110
6690M/M28AX	136	179	291	154	190	218	153	106	110	189	172	122	160
6690M/9AX													
6690M/11AX	174	230		197	244	279	196		140	242	221	157	205
6690M/13AX	332	437		374	464	530	372		267	460	420	298	389
6690M/M42AX													

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

**TABLE 39: Dimensions and weights of 3-ways motorized valves**

Catalogue Number	Figure	Dimensions [mm]						Weight [g]
		H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	Ch	
6690M/7A2	1	188	82	246	172	94	6	2,6
6690M/7A6	2	210		246				2,7
6690M/M28A2	1	210	100	268	208	111		3,5
6690M/M28A6	2	231		268				3,6
6690M/9A2	1	210	100	268	208	111		3,5
6690M/9A6	2	231		268				3,6
6690M/11A2	2	240	103	273	211	113	10	4,2
6690M/11A6	2							4,3
6690M/13A2	2	263	121	293	240	127		5,2
6690M/13A6	2							5,3
6690M/M42A2	2	263	121	296	240	127		5,2
6690M/M42A6	2							5,3

(1): total height with optional auxiliary contact

Fig. 1

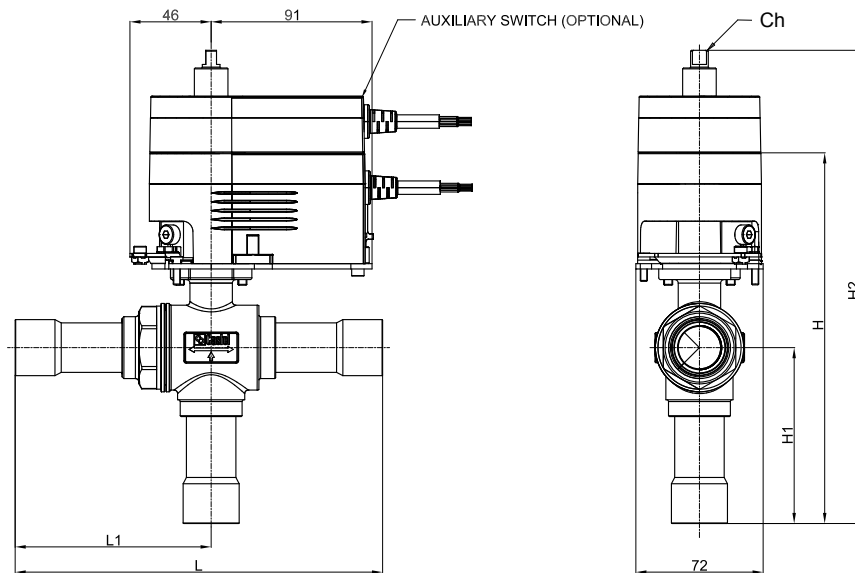
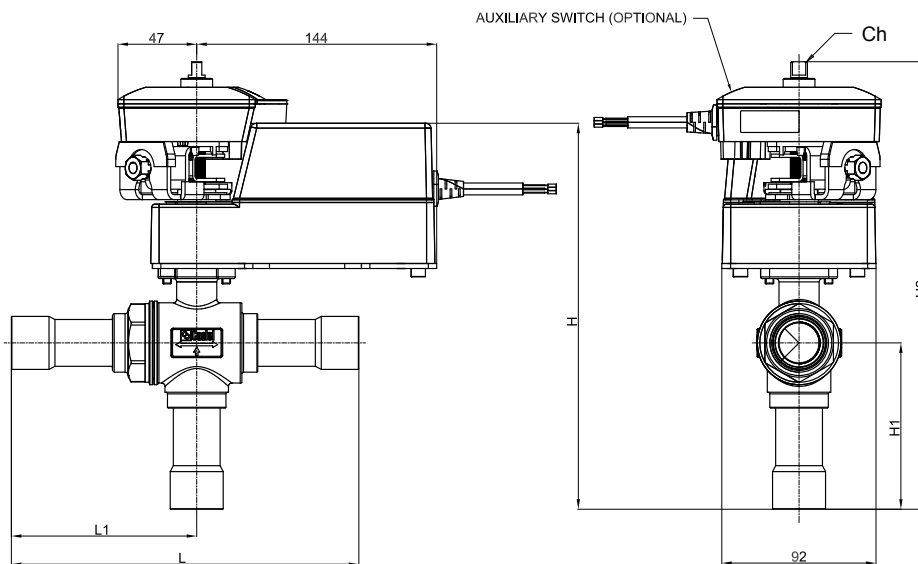


Fig. 2



# CHAPTER 8

## 3-WAY MOTORIZED VALVES WITH BALL SHUTTERS

FOR REFRIGERATION PLANTS THAT USE THE R744 REFRIGERANT



### APPLICATIONS

The 3-way valves with ball shutter illustrated in this chapter have been developed by Castel for all the applications that use the sub-critical or trans-critical R744 refrigeration fluid belonging to Group 2, defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

The 3-way valves for plants that operate using refrigerant fluid R744 are the following:

- valves in series 6690EM with PS = 80 bar, equipped with copper connections for transcritical plants low and medium pressure sides.
- valves in series 6697EM with PS = 120 bar equipped with reinforced copper connections (K65) for transcritical plants high-pressure side.
- valves in series 6698EM with PS = 140 bar equipped with stainless steel connections for transcritical plants high-pressure side.

**CAUTION! The 3-way valves with ball shutter in this chapter cannot be used with other refrigerant fluids.**

### CONSTRUCTION

The specific design of the 3-way valves with ball shutter in series 6690EM, 6697EM, 6698EM:

- Fixing flange with 4 holes
- Extended spindle
- No mechanical stops on the spindle rotation (OPEN and CLOSED positions)

makes them suitable for operating only when coupled with actuators in series 9700 and 9720. For this reason, these valves are always sold including the actuators and relative fixing plate in versions with suffix A2 (24 VAC) or suffix A6 (230 VAC).

**3-ways valves in series 6690EM, 6697EM, and 6698EM cannot be used without an actuators.**

The electric welding of the body and the seal gaskets, assembled on the spindle, ensure perfect hermetic seal of the valve. The spindle construction eliminates the danger of explosion/expulsion.

The main parts of these valves are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Hot forged brass EN 12420 – CW 617N, chromium plated, for the ball
- Stainless steel EN 10088-3 – 1.4305 for spindles
- Ethylene propylene rubber (EPDM) for outlet seal gaskets
- PTFE for the ball seat gaskets
- Hot forged brass EN 12420 – CW 617N for the protective cap of the spindle
- Copper pipe EN 12735-1 – Cu-DHP for solder connections in series 6690EM
- Copper pipe EN 12735-1 – CuFe2P (K65) for welded connections in series 6697EM
- Stainless steel pipe AISI 304 for welded connections in series 6698EM

### INSTALLATION

The 3-way valves with ball shutter act as changeover valves, not allowing for bi-direction flow of the refrigerant fluid. The input is always in the centre position, and the two outputs in the lateral positions. These valves are coupled directly to actuators and do not require a flanged adapter between the two parts. The actuator can be mounted on the valve in four different positions, oriented at 90° to each other.

The 3-way valves in series: 6690EM, 6697EM, and 6698EM can be mounted:

- With horizontal output connections and vertical input connection, facing downward.
- With vertical output connections and horizontal input connection.

The actuator for the 3-way valves can never be mounted:

- Upside-down, oriented facing downward
- Vertically, with the cable oriented upwards

Once the valve / actuator has been coupled, remote movement of the valve is possible. In the event power is cut-off, the valve can be operated manually, excluding the actuator with a release clutch. **All of the actuators can be equipped with auxiliary contacts in series 9750, sold**

separately. For more information on the actuators in series 9700 and 9720, please see Chapter 9.

Copper connections: The brazing of valves with solder connections should be carried out with care, using a low melting point filler material (min.5 Ag). It is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper

functioning of the entire valve.

Steel connectors: TIG welding recommended, to be performed as quickly as possible according to the method shown in the product instruction sheet. The connection material is AISI 304: it is only possible to use AISI 308 filler material if welding to pipes made from the same type of material. For pipes made from other materials, please contact your welding supplies supplier.

TABLE 40: General characteristics of 3-ways motorized valves for R744

Catalogue Number	Connections			Ball Port Ø [mm]	Kv Factor [m³/h]	Torque [Nm]	Run-ning Time [sec]	Rota-tion Angle	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast		
	ODS		W							min.	max.	min.	max.			
	Ø [in.]	Ø [mm]	Ø [mm]													
6690EM/7A2	7/8"	22	-	19	11	10	60	90°	80	-40	+150	-20	+50	Art. 4.3		
6690EM/7A6																
6690EM/M28A2	-	28		24	16											
6690EM/M28A6																
6690EM/9A2	1.1/8"	-		24	16											
6690EM/9A6																
6690EM/11A2	1.3/8"	35		28	20,5											
6690EM/11A6																
6690EM/13A2	1.5/8"	-		37	39	30	120		I							
6690EM/13A6																
6690EM/M42A2	-	42		37	39											
6690EM/M42A6																
6697EM/7A2	7/8"	22	-	19	11	10	60	90°	120	-40	+150	-20	+50	Art. 4.3		
6697EM/7A6																
6697EM/9A2	1.1/8"	-		24	16											
6697EM/9A6																
6697EM/11A2	1.3/8"	35		28	20,5	30	120		I							
6697EM/11A6																
6697EM/13A2	1.5/8"	-		37	39											
6697EM/13A6																
6698EM/M22A2	-	-		22	19	11	10		60	90°	140	-40	+150	-20	+50	Art. 4.3
6698EM/M22A6																
6698EM/M28A2				28	24	16										
6698EM/M28A6																
6698EM/M35A2			33,4	28	20,5	30	120	I								
6698EM/M35A6																
6698EM/M42A2			42,2	37	39											
6698EM/M42A6																

**TABLE 41: Electrical characteristics of 3-ways motorized valves for R744**

Catalogue Number	Voltage [V]	Voltage tolerance [%]	Frequency [Hz]	Active Power [W]		Apparent Power [VA]		Cable	Wiring Connections		Protection Degree	TA [°C]	
				Operation	Standstill	Operation	Standstill		Switching output 2 point (Open/Close)	Continuous output (0 - 10V)		min.	max.
6690EM/7A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54	-20	+50
	24 D.C.	+20 / -20	—										
6690EM/7A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6690EM/M28A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6690EM/M28A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6690EM/9A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6690EM/9A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6690EM/11A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6690EM/11A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6690EM/13A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6690EM/13A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6690EM/M42A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6690EM/M42A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6697EM/7A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54	-20	+50
	24 D.C.	+20 / -20	—										
6697EM/7A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6697EM/9A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6697EM/9A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6697EM/11A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6697EM/11A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6697EM/13A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										

Continued

**TABLE 41: Electrical characteristics of 3-ways motorized valves for R744**

Catalogue Number	Voltage [V]	Voltage tolerance [%]	Frequency [Hz]	Active Power [W]		Apparent Power [VA]		Cable	Wiring Connections		Protection Degree	TA [°C]	
				Operation	Stand-still	Operation	Stand-still		Switching output 2 point (Open/Close)	Continuous output (0 - 10V)		min.	max.
6698EM/M22A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54	-20	+50
	24 D.C.	+20 / -20	—										
6698EM/M22A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6698EM/M28A2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6698EM/M28A6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6698EM/M35A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6698EM/M35A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
6698EM/M42A2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
	24 D.C.	+20 / -20	—										
6698EM/M42A6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		

**TABLE 42: Refrigerant flow capacity of 3-ways motorized valves for R744 [kW]**

Catalogue Number	Subcritical system			Transcritical system		
	Liquid line	Suction line	Hot gas line	Gas cooler line	Suction line	Hot gas line
6690EM/7AX	295	58,3	222		50,9	
6690EM/M28AX	429	84,8	323		74,1	
6690EM/9AX	429	84,8	323		74,1	
6690EM/11AX	549	108,7	414		94,9	
6690EM/13AX	1045	206,7	787		180,6	
6690EM/M42AX	1045	206,7	787		180,6	
6697EM/7AX				289	50,9	206
6697EM/9AX				420	74,1	299
6697EM/11AX				539	94,9	383
6697EM/13AX				1025	180,6	729
6698EM/M22AX				289	50,9	206
6698EM/M28AX				420	74,1	299
6698EM/M35AX				539	94,9	383
6698EM/M42AX				1025	180,6	729

Standard rating conditions according to AHRI Standard 760-2007 for subcritical system

Condensing temperature	30 °F (- 1,2 °C)	Evaporator superheating	10 °R (5,5 °K)
Liquid temperature	20 °F (- 6,7 °C)	Suction line temperature	- 5 °F (-15 °C)
Subcooling	10 °R (5,5 °K)	Suction superheating	15 °R (8,4 °K)
Evaporating temperature	- 20 °F (- 28,9 °C)	Discharge temperature	80 °F (26,6 °C)
Evaporator outlet temperature	- 10 °F (- 23,4 °C)		

Standard rating conditions according to AHRI Standard 760-2007 for transcritical system

Gas-cooler outlet temperature	95 °F (35 °C)	Suction line temperature	32 °F (0 °C)
Evaporating temperature	14 °F (- 10 °C)	Suction superheating	9 °R (5 °K)
Evaporator outlet temperature	23 °F (- 5 °C)	Discharge temperature	212 °F (110 °C)
Evaporator superheating	9 °R (5 °K)		

TABLE 43: Dimensions and weights of 3-ways motorized valves for R744

Catalogue Number	Figure	Dimensions [mm]						Weight [g]	
		H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	Ch		
6690EM/7A2	1	188	82	246	172	94	6	2,6	
6690EM/7A6	2	210		246				2,7	
6690EM/M28A2	1	210	100	268	208	111		3,5	
6690EM/M28A6	2	231		268				3,6	
6690EM/9A2	1	210	100	268	208	111		3,5	
6690EM/9A6	2	231		268				3,6	
6690EM/11A2	2	240	103	273	211	113	10	4,2	
6690EM/11A6	2							4,3	
6690EM/13A2	2	263	121	296	240	127		5,2	
6690EM/13A6	2							5,3	
6690EM/M42A2	2	263	121	296	240	127		5,2	
6690EM/M42A6	2							5,3	
6697EM/7A2	1	188	82	246	172	94	6	2,8	
6697EM/7A6	2	210		246				3,0	
6697EM/9A2	1	210	100	268	208	111		3,7	
6697EM/9A6	2	231		268				3,9	
6697EM/11A2	2	240	103	273	211	113		10	4,5
6697EM/11A6	2								4,6
6697EM/13A2	2	263	121	296	240	127	5,5		
6697EM/13A6	2						5,6		
6698EM/M22A2	3	188	82	246	172	94	6		2,8
6698EM/M22A6	4	210		246					3,0
6698EM/M28A2	3	210	100	268	208	111		3,7	
6698EM/M28A6	4	231		268				3,9	
6698EM/M35A2	4	240	103	273	211	113		10	4,5
6698EM/M35A6	4								4,6
6698EM/M42A2	4	263	121	296	240	127	5,5		
6698EM/M42A6	4						5,6		

(1): total height with optional auxiliary contact

6690EM  
6697EM

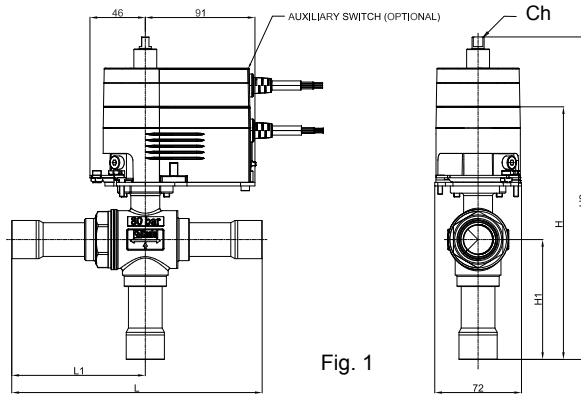


Fig. 1

6690EM  
6697EM

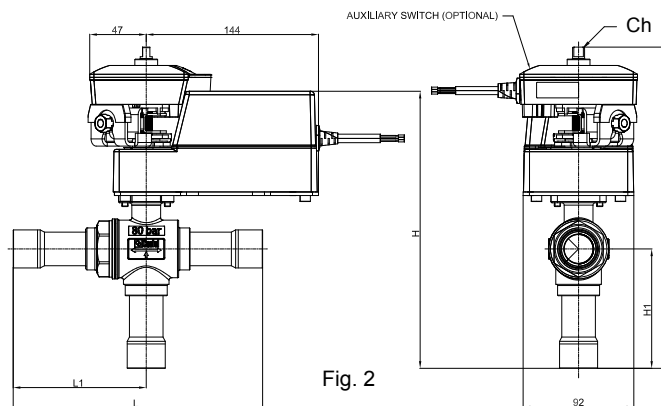


Fig. 2

6698EM

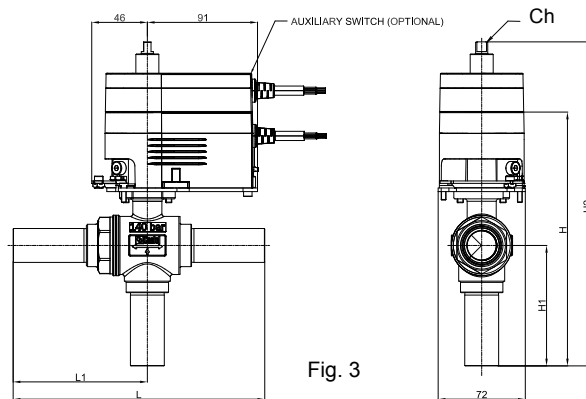


Fig. 3

6698EM

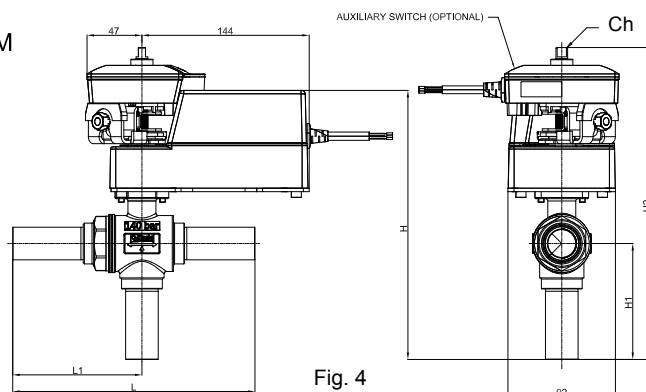


Fig. 4





## APPLICATIONS

The actuators in series 9700, 9720, and 9730 can be assembled using suitable flanged connections, to be purchased separately, to Castel 2-way valves with ball shutter in series:

- 6570, 6571, 6590, and 6591 for refrigerant fluids HCFC, HFC, HFO (see Chapter 4)
- 6570N for HC refrigerant fluids (see Chapter 5)
- 6570EL, 6590EL, 6570E, 6590E, 6577E, 6597E, 6578E, and 6598E for R744 refrigerant fluid (see Chapter 6)

Once this coupling has been performed, the valves can be opened or closed remotely. Alternatively, the actuator can be excluded and the valve operated manually.

The actuators in series 9700 and 9720 are included in the package for Castel 3-way valve with ball shutter in series:

- 6690M for HCFC, HFC, and HFO refrigerant fluids (see Chapter 7)
- 6690EM, 6697EM, and 6698EM for R744 refrigerant fluid (see Chapter 8)

Once the valve / actuator coupling has been performed, without the need for any flanged connector, the valve can be opened or closed remotely.

## CONSTRUCTION

**Actuators in series 9700 and 9720:** Casing in two parts of self-extinguishing synthetic material, lower part black, upper part blue. The upper part of the casing holds the actual motor (step or synchronous) and all control and cutout electronics based on the torque. The lower part of the casing holds the gear reducer, which requires no maintenance, and the self-centring fixing system for the spindle.

**Note: If the casing is opened and tampered with, any and all the guarantees by Castel will be null and void.**

In the event of a power outage to the actuator, the gear reducer can be disengaged using the specific lever or a button to permit manual use of the valve. The actuator can be assembled either on the 2-way valve adapter or on the 3-way valve flange using a dedicated plate and screws.

**Actuators in series 9730:** Casing in two parts of self-extinguishing synthetic black material with light gray cover. Inside the enclosure is contained the actual motor (step-by-step), the gear reducer, which requires no maintenance, and all control and cut-out electronics based on the torque.

**Note: If the casing is opened and tampered with, any and all the guarantees by Castel will be null and void.**

In the event of a power outage to the actuator, the gear reducer can be disengaged using the specific lever to permit manual use of the valve. The actuator can be assembled either on the 2-way valve adapter or on the 3-way valve flange using a dedicated plate and screws.

All of the actuators have a maximum rotational angle of 95°, allowed by the mechanical construction. Models 9700/RA6, 9720/RA2, 9720/RA6, 9730RA2, and 9730/RA6 are factory set for a maximum stroke of 90°. In model 9700/RA2, the maximum stroke of 90° must be set by the customer, following the instructions.

The housings of actuators 9700/RA2, 9720/RA2, 9730/RA2 and 9730/RA6 have an IP54 protection rating according to EN 60529, and a Class III electric shock protection rating according to EN 60730-1.

The housings of actuators 9700/RA6 and 9720/RA6 have an IP43 protection rating according to EN 60529, and a Class II electric shock protection rating according to EN 60730-1. In the event of outdoor installation, it is recommended that the actuators be protected from the weather.

## OPERATION

To install the actuators on the valves and cable them, follow the instructions provided in the package.

### Actuators part no. 9700/RA2 and 9720/RA2

Actuators part nos. 9700/RA2 and 9720/RA2 are equipped with: step motor, control and cut-out electronics, and can be powered in the following ways:

- 24 VAC power supply, allowing a 2-position switch output - open/closed

- 24 VDC power supply, allowing a 0 to 10 V continuous output with position control.

Connection for 2-position switching output: the OPEN/CLOSED option is performed with two cables. The actuator is connected to the power supply using blue and brown cables. The actuator moves toward the limit position (in the clockwise direction) connecting the power supply to the black cable. Cutting off the power to the black cable, the actuator returns to the other limit switch (in the counter-clockwise direction). The red and grey cables cannot be used or come into contact with the other cables. It is therefore recommended that they be isolated.

Connection for one continuous 0-10 V output: The incorporated positioner controls the actuator according to the output signal from the controller.

Direction of rotation (looking at the spindle fixing system from the actuator):

- Running direction 1 corresponding to 0 V → 0%; 10 V → 100% (mains power on the brown cable); when the positioning signal increases, the spindle turns in a clockwise direction.
- Running direction 2 corresponding to 0 V → 100%; 10 V → 0% (mains power on the black cable); when the positioning signal increases, the spindle turns in a counter-clockwise direction.

The starting point and control interval are fixed. Based on the running direction, only the brown or the black cable can be connected. The other cable must be insulated.

When powered-up, the step motor reaches the two limit switches, one after the other and determines its effective angle of rotation. Thanks to the electronics, steps cannot be missed and the actuator does not require periodic adjustments. In the event of a power outage, that lasts at least 5 minutes, or after manual movement, the actuator adjusts itself automatically. When the angle of rotation is changed, use the manual movement to activate a new adjustment so that the actuator, the control voltage 0-10 V, and the return signal adjusts to the new angle of rotation.

The running time is factory set to the lowest allowed for the specific model, but can be increased using the micro-switches on the upper header of the casing, following the instructions provided. For model 9700/RA2, the microswitches are positioned with this sequence: S1=ON, S2=OFF, S3=ON. For model 9720/RA2, the microswitches are positioned with this sequence: S1=ON, S2=ON, S3=ON.

### Actuators part no.9700/RA6

Actuator part no. 9700/RA6 is equipped with: synchronous motor, control and cut-off electronics, and must be powered with 230 VAC, which allows for a 2-position switching output, open/closed.

Direction of rotation (looking at the spindle fixing system from the servo motor): the actuator is connected to the power supply using blue and brown cables. The actuator moves toward the limit position (in the counter-clockwise

direction) connecting the power supply to the black cable. Cutting off the power to the black cable, the actuator returns to the other limit switch (in the clockwise direction). In the limit switch position, the limit switch electronic detection system is activated. In the event of overload, a magnetic joint protects the gear reducer. The running time is fixed to 120 sec and cannot be set.

### Actuators part no. 9720/RA6

Actuator part no. 9700/RA6 is equipped with: step motor, control and cut-off electronics, and must be powered with 230 VAC, which allows for a 2-position switching output, open/closed.

Direction of rotation (looking at the spindle fixing system from the actuator): the actuator is connected to the power supply using the blue cable. The actuator moves toward the limit position (in the clockwise direction) connecting the power supply to the brown cable. The actuator moves toward the other limit position (in the counter-clockwise direction) connecting the power supply to the black cable. At the limit position, or in the event of overload, the electronic system to cut-off of the motor is activated.

The running time is factory set to 120 secs, but can be increased using the micro-switches on the upper header of the casing, following the instructions provided.

### Actuators part no. 9730/RA2

The actuator part no. 9730 / RA2 is equipped with: step motor, control electronics and switch-off and must be supplied with a 24 VDC voltage that allows a continuous 2 - 10 V output with position control. The direction of rotation (looking at the rod fixing system from the actuator) is factory set to 2 V → 0%; 10 V → 100%, ie when the positioning signal increases the wheel rod clockwise. To change the direction of travel to 2 V → 100%; 10 V → 0%, ie increasing positioning signal and rotating counter clockwise, it is necessary to act on the microswitches located under the cover.

The actuator is powered by the blue and brown cables while the built-in positioner controls the actuator according to the output signal Y through the black cable. The return signal U that returns the actuator position passes through the gray cable. The actuator is protected against overloads, does not require limit switches, and stops automatically when it reaches the stop.

The running time is factory set to 150 sec and can not be changed.

### Actuator part no. 9730/RA6

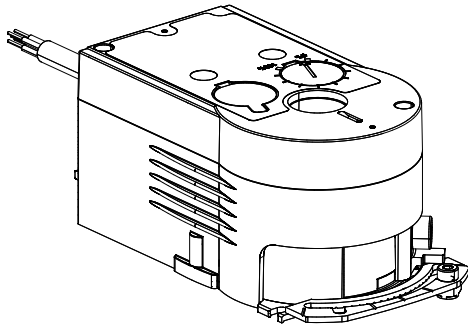
The actuator part no. 9730 / RA6 is equipped with: stepper motor, control electronics and switch-off and must be supplied with a 230 VAC voltage that allows a 2-position, open / closed switching output.

Direction of rotation (looking at the rod fixing system from the actuator): The actuator is connected to the power supply by the blue cable. The actuator moves to a ramp (clockwise) position by connecting the power to the brown cable. The actuator moves to the other end stroke

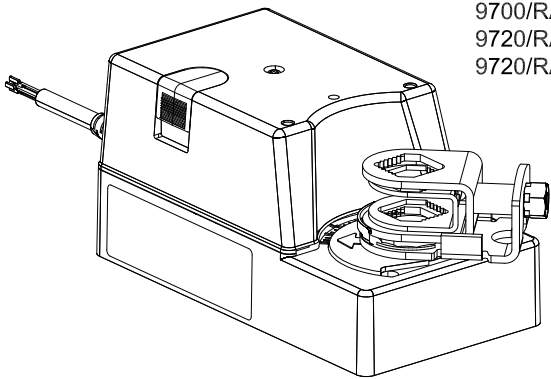
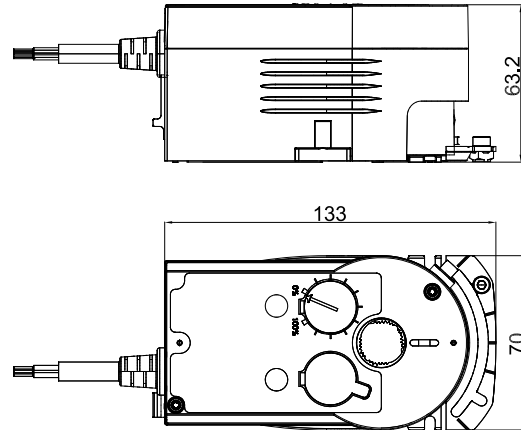
(counter clockwise) by connecting the power to the black cable. At the end of stroke or in the case of overload the electronic engine switch-off system is active. The running time is factory set to 150 sec and can not be changed.

## CERTIFICATIONS

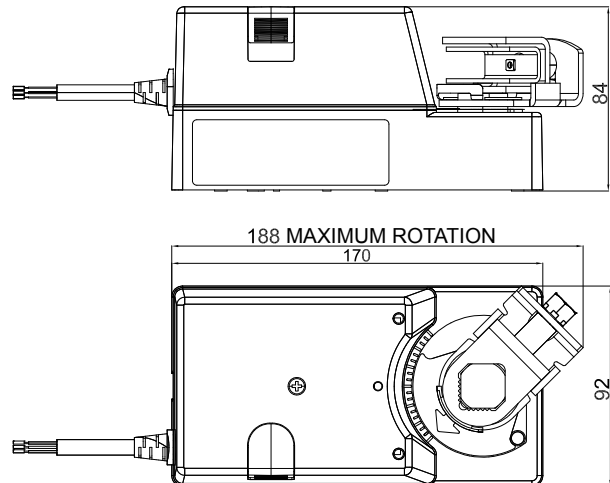
Actuator powered with 230 VAC are compliant with the Low Voltage Directive, 2006/95/EC. All actuators in this chapter comply with the Electromagnetic Compatibility (EMC) Directive (2004/108/EC).



9700/RA2



9700/RA6  
9720/RA2  
9720/RA6



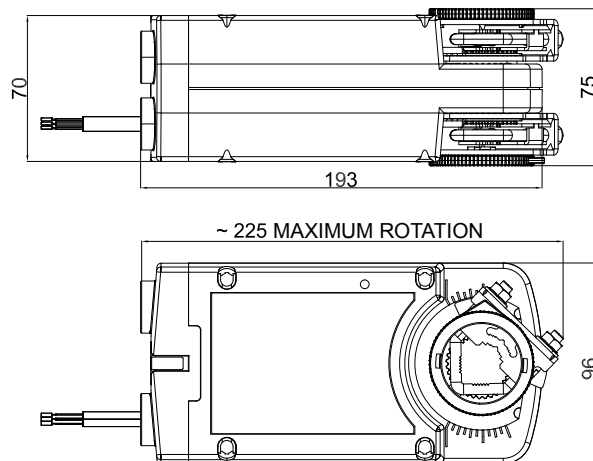
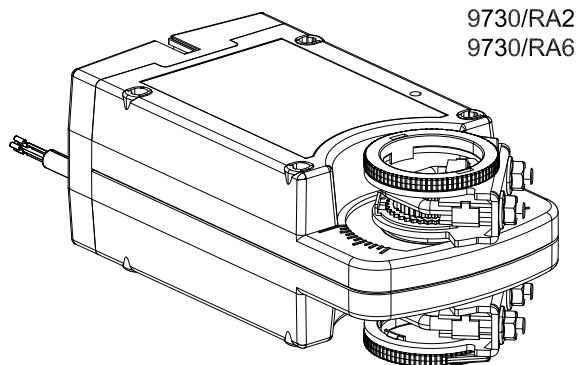


TABLE 44: General characteristics of actuators

Catalogue Number	Voltage [V]	Voltage tolerance [%]	Frequency [Hz]	Active Power [W]		Apparent Power [VA]		Torque [Nm]
				Operation	Standstill	Operation	Standstill	
9700/RA2	24 A.C.	+20 / -20	50 / 60	4,8	1,5	8,7	3	10
	24 D.C.	+20 / -20	–					
9700/RA6	230 A.C.	+15 / -15	50 / 60	2,9	0,5	5,6	5,1	
9720/RA2	24 A.C.	+20 / -20	50 / 60	2,4	0,26	4,3	0,48	
	24 D.C.	+20 / -20	–					
9720/RA6	230 A.C.	+15 / -15	50 / 60	3,7	1,1	4,7	2,7	
9730/RA2	24 A.C.	+20 / -20	50 / 60	13,5	1,5	16,5	ND	
	24 D.C.	+20 / -20	–					
9730/RA6	230 A.C.	+15 / -15	50 / 60	13	2,0	20	ND	

Continued

TABLE 44: General characteristics of actuators

Catalogue Number	Running Time [sec]	Rotation Angle	Cable	Wiring Connections		Protection Degree	TA [°C]	
				Switching output 2 point (Open/Close)	Continuous output (0 - 10V)		min.	max.
9700/RA2	60	90	5 x 0,5 mm <sup>2</sup> 1,2 m	YES	YES	IP 54	-20	+50
9700/RA6			3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
9720/RA2	120		3 x 0,75 mm <sup>2</sup> 1,2 m	YES	YES	IP 54		
9720/RA6			3 x 0,75 mm <sup>2</sup> 1,2 m	YES	NO	IP 43		
9730/RA2	150		4 x 0,75 mm <sup>2</sup> 1 m	NO	YES	IP 54	-30	+50
9730/RA6			4 x 0,75 mm <sup>2</sup> 1 m	YES	NO	IP 54		

# CHAPTER 10 ■ AUXILIARY CONTACTS



## APPLICATIONS

Auxiliary contacts in series 9750 are accessories to be used with actuator in series 9700 and 9720. They are double switching contacts and can be set to any position between 0° and 90°.

## CONSTRUCTION

Casing in two parts of self-extinguishing synthetic material, lower part black, upper part yellow.

**Note: If the casing is opened and tampered with, any and all the guarantees by Castel will be null and void.**

Functional limits of the contacts: admissible load 5A, voltage 250 VAC.

Contact 9750/X01 has an IP54 protection rating according

to EN 60529, and a Type 1C classification for automatic operation according to EN 60730-1.

Contact 9750/X02 has an IP40 protection rating according to EN 60529, and a Type 1C classification for automatic operation according to EN 60730-1.

In the event of outdoor installation, it is recommended that the contacts be protected from the weather.

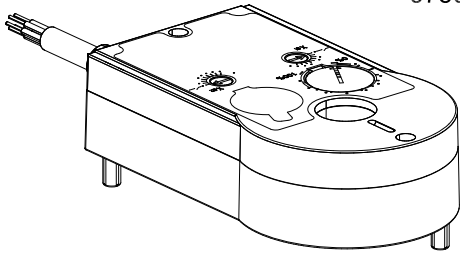
## OPERATION

To install the contacts on the actuators and cable them, follow the instructions provided in the package carefully. The settings for the switching positions must be performed using the two trimmers present on the yellow cover (see the instructions).

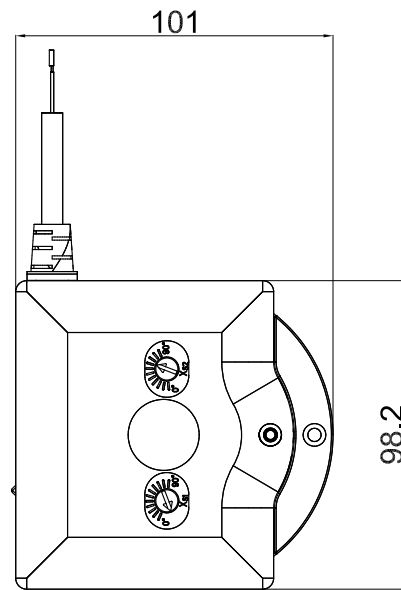
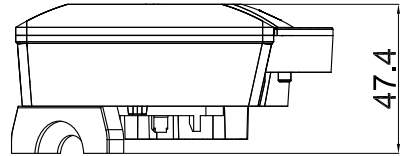
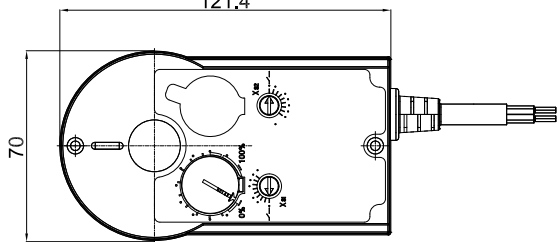
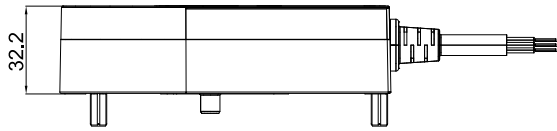
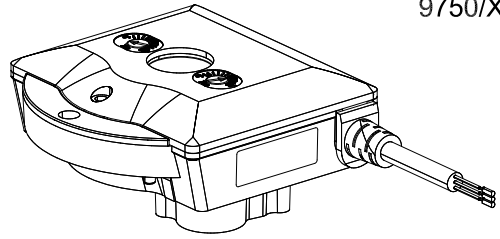
TABLE 45: General characteristics of auxiliary switches

Catalogue Number	Designed for actuator	Contact type	Admissible load	Voltage Range	Cable	Protection Degree	TA [°C]	
							min.	max.
9750/X01	9700/RA2	Double	5(2) A	24 ÷ 230 V	6 x 0,5 mm <sup>2</sup> 1 m	IP 54	-20	+50
9750/X02	9700/RA6 9720/RA2 9720/RA6					IP 40		

9750/X01



9750/X02



## ADAPTERS FOR 2-WAY VALVES WITH BALL SHUTTER



### APPLICATIONS

Castel has constructed the flange adapters in series 9901 for coupling the actuators in series 9700 and 9720 to the 2-way valves with ball shutters in series 6570, 6571, 6590, 6591, 6570EL, 6590EL, 6570E, 6590E, 6577E, 6597E, 6578E, and 6598E, allowing their transformation from a manual to a motorized 2-way valves with ball shutter.

**NOTE: these connectors are not needed for our 3-way valves with ball shutters.**

### CONSTRUCTION

The main parts of the adapters are manufactured with the following materials:

- Hot forged brass EN 12420 – CW 617N for lug and round flange
- Stainless steel AISI 303 for the swivel ring

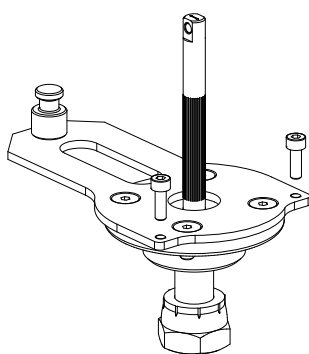
- Stainless steel AISI 303 for the spindle and its extension
- Stainless steel AISI 304 for the motor plate
- Stainless steel for all screws

### OPERATION

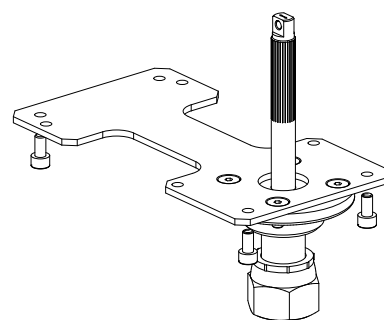
To assemble the adapter on the valve and then the actuator to the adapter, carefully follow the instructions provided:

- On the instruction sheet in the adapter packaging
  - On the instruction sheet in the actuator packaging
- Table 46, 47, 48 indicates for each valve which adapter and which actuator can be assembled on it.

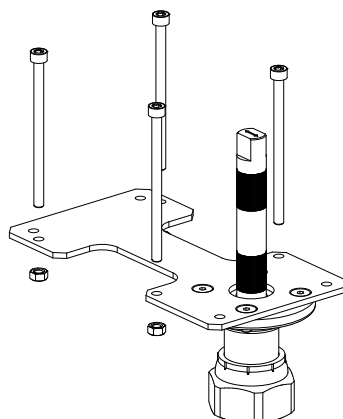
It is a table that customers can use as a guide when choosing components (actuator, auxiliary contacts, and adapter) when they need to motorize a 2-way valve with ball shutter.



9901/X21  
9901/X27  
9901/X30



9901/X22  
9901/X23  
9901/X28  
9901/X38



9901/X37  
9901/X39  
9901/X40



**TABLE 46: Coupling schemes: valve + actuator + adapter + switches**

Ball Valve Catalogue No		Voltage [V]	Actuator Catalogue No	Adapter Catalogue No	Auxiliary switches Catalogue No
6570/3	6570/3A	24	9700/RA2	9901/X30	9750/X01
6570/M10	6570/M10A				
6570/M12	6570/M12A				
6570/4	6570/4A				
6571/5	–				
6570/M15	6570/M15A				
6570/5	6570/5A				
6570/M18	6570/M18A				
6570/6	6570/6A				
6571/7	–				
6570/7	6570/7A	24	9700/RA2	9901/X27	9750/X01
6571/M28	–				
6571/9	–				
6570/M28	6570/M28A				
6570/9	6570/9A				
6571/11	–				
6570/7	6570/7A	230	9700/RA6	9901/X28	9750/X02
6571/M28	–				
6571/9	–				
6570/M28	6570/M28A				
6570/9	6570/9A				
6571/11	–				
6590/11	6590/11A	24	9720/RA2	9901/X23	9750/X02
6591/13	–				
6591/M42	–				
6590/13	6590/13A				
6590/M42	6590/M42A				
6591/17	–				
6590/11	6590/11A	230	9720/RA6	9901/X23	9750/X02
6591/13	–				
6591/M42	–				
6590/13	6590/13A				
6590/M42	6590/M42A				
6591/17	–				
6590/17	6590/17A	24	9720/RA2	9901/X38	9750/X02
6591/M64	6591/M64A				
6591/21	6591/21A				
6590/17	6590/17A	230	9720/RA6	9901/X38	9750/X02
6591/M64	6591/M64A				
6591/21	6591/21A				

Continued



**TABLE 46: Coupling schemes: valve + actuator + adapter + switches**

Ball Valve Catalogue No		Voltage [V]	Actuator Catalogue No	Adapter Catalogue No	Auxiliary switches Catalogue No
6570/M64	6570/M64A	24	9730/RA2	9901/X37	-
-	6570/21A				
	6571/24A				
	6571/25A				
	6570/24A				
	6570/25A				
	6571/28A				
	6571/29A				
	6570/28A				
	6570/29A				
	6571/33A				
	6571/34A				
6570/24A	9901/X40				
6570/M64	6570/M64A	230	9730/RA6	9901/X37	-
-	6570/21A				
	6571/24A				
	6571/25A				
	6570/24A				
	6570/25A				
	6571/28A				
	6571/29A				
	6570/28A				
	6570/29A				
	6571/33A				
	6571/34A				
6570/24A	9901/X40				

**TABLE 47: Coupling schemes: HC(N) valve + actuator + adapter + switches**

Ball Valve Catalogue No	Voltage [V]	Actuator Catalogue No	Adapter Catalogue No	Auxiliary switches Catalogue No
6570N/3	24	9700/RA2	9901/X30	9750/X01
6570N/M10				
6570N/M12				
6570N/4				
6570N/5				
6570N/M18				
6570N/6				
6570N/7	24	9700/RA2	9901/X27	9750/X01
6570N/M28				
6570N/9				
6570N/7	230	9700/RA6	9901/X28	9750/X02
6570N/M28				
6570N/9				

**TABLE 48: Coupling schemes: CO<sub>2</sub>(E) valve + actuator + adapter + switches**

Ball Valve Catalogue No	Voltage [V]	Actuator Catalogue No	Adapter Catalogue No	Auxiliary switches Catalogue No
6570EL/3	24	9700/RA2	9901/X30	9750/X01
6570EL/M10				
6570EL/M12				
6570EL/4				
6570EL/5				
6570EL/M18				
6570EL/6				
6570EL/7	24	9700/RA2	9901/X27	9750/X01
6570EL/M28				
6570EL/9				
6570EL/7	230	9700/RA6	9901/X28	9750/X02
6570EL/M28				
6570EL/9				
6590EL/11	24	9720/RA2	9901/X23	9750/X02
6590EL/13				
6590EL/M42				
6590EL/11	230	9720/RA6	9901/X23	9750/X02
6590EL/13				
6590EL/M42				
6590EL/17	24	9720/RA2	9901/X38	9750/X02
6590EL/17	230	9720/RA6	9901/X38	9750/X02
6570E/3	24	9700/RA2	9901/X30	9750/X01
6570E/M10				
6570E/M12				
6570E/4				
6570E/5				
6570E/M18				
6570E/6				
6570E/7	24	9700/RA2	9901/X27	9750/X01
6570E/M28				
6570E/9				
6570E/7	230	9700/RA6	9901/X28	9750/X02
6570E/M28				
6570E/9				
6590E/11	24	9720/RA2	9901/X23	9750/X02
6590E/13				
6590E/M42				

Continued

**TABLE 48: Coupling schemes: CO<sub>2</sub>(E) valve + actuator + adapter + switches**

Ball Valve Catalogue No	Voltage [V]	Actuator Catalogue No	Adapter Catalogue No	Auxiliary switches Catalogue No
6590E/17	24	9730/RA2	9901/X39	–
6590E/17	230	9730/RA6	9901/X39	–
6577E/3	24	9700/RA2	9901/X30	9750/X01
6577E/4				
6577E/5				
6577E/6				
6597E/7	24	9700/RA2	9901/X21	9750/X01
6597E/9				
6597E/7	230	9700/RA6	9901/X22	9750/X02
6597E/9				
6597E/11	24	9720/RA2	9901/X23	9750/X02
6597E/13				
6597E/11	230	9720/RA6	9901/X23	9750/X02
6597E/13				
6597E/17	24	9730/RA2	9901/X39	–
6597E/17	230	9730/RA6	9901/X39	–
6578E/M10	24	9700/RA2	9901/X30	9750/X01
6578E/M12				
6578E/M16				
6578E/M18				
6598E/M22	24	9700/RA2	9901/X21	9750/X01
6598E/M28				
6598E/M22	230	9700/RA6	9901/X22	9750/X02
6598E/M28				
6598E/M35	24	9720/RA2	9901/X23	9750/X02
6598E/M42				
6598E/M35	230	9720/RA6	9901/X23	9750/X02
6598E/M42				

TABLE 49: Dimensions of ball valves with actuator

Ball Valve Catalogue No		Actuator Catalogue No	H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	I	d	Ch	Figure			
6570/3	6570/3A	9700/RA2	147	15	180	121	65	18	M4	6	1			
6570/M10	6570/M10A													
6570/M12	6570/M12A													
6570/4	6570/4A													
6571/5	–					138	73,5							
6570/M15	6570/M15A		151	19	184	139	73	25,5						
6570/5	6570/5A													
6570/M18	6570/M18A													
6570/6	6570/6A													
6571/7	–					175	90,5							
6570/7	6570/7A	9700/RA2	167	23	199	175	94	30	M4	6				
6571/M28	–					206	109							
6571/9	–					176	27				207	204	109	
6570/M28	6570/M28A		24	130										
6570/9	6570/9A													
6571/11	–		9700/RA6	188	23	210	175				94	30	M4	6
6570/7	6570/7A	206					109							
6571/M28	–	197					27	218	204	109				
6571/9	–			24	130									
6570/M28	6570/M28A													
6570/9	6570/9A	9720/RA2		221	37	243	210	112	30	M6	10			
6591/11	6590/11A		233									44	255	239
6591/13	–						253	133						
6591/M42	–													
6590/13	6590/13A		9720/RA6	221	37	243	210	112				30	M6	10
6590/M42	6590/M42A													
6591/17	–	253					133							
6590/11	6590/11A													
6591/13	–	9720/RA2		256	54	278	275	149	30	M6	10			
6591/M42	–													
6590/13	6590/13A		253				133							
6590/M42	6590/M42A													
6591/17	–		9720/RA6	256	54	278	275	149				30	M6	10
6590/17	6590/17A													
6591/17	6590/17A	253					133							
6591/M64	6591/M64A													
6591/21	6591/21A	9720/RA6		256	54	278	275	149	30	M6	10			
6590/17	6590/17A													
6591/17	6590/17A		253				133							
6591/M64	6591/M64A													
6591/21	6591/21A		9720/RA6	256	54	278	275	149				30	M6	10
6590/17	6590/17A													
6591/17	6590/17A	253					133							
6591/M64	6591/M64A													
6591/21	6591/21A	9720/RA6		256	54	278	275	149	30	M6	10			
6590/17	6590/17A													
6591/17	6590/17A		253				133							
6591/M64	6591/M64A													
6591/21	6591/21A		9720/RA6	256	54	278	275	149				30	M6	10
6590/17	6590/17A													
6591/17	6590/17A	253					133							
6591/M64	6591/M64A													

(1): total height with optional auxiliary contact

Continued

**TABLE 49: Dimensions of ball valves with actuator**

Ball Valve Catalogue No	Actuator Catalogue No	H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	l	d	Ch	Figure
6570/M64	6570/M64A	247	55	-	343	186	75	M8	10	5
-	6570/21A				363	196				
	6571/24A									
	6571/25A	275	70	-	365,5	196,5	89	M8		
	6570/24A				381,5	204,5				
	6570/25A									
	6571/28A	284	75	-	373	197,5	75	M8		
	6571/29A				405	213,5				
	6570/28A									
	6570/29A	284	75	-	373	197,5	75	M8	14	
6571/33A	405				213,5					
6571/34A										
6570/M64	6570/M64A	247	55	-	343	186	75	M8	10	5
-	6570/21A				363	196				
	6571/24A									
	6571/25A	275	70	-	365,5	196,5	89	M8		
	6570/24A				381,5	204,5				
	6570/25A									
	6571/28A	284	75	-	373	197,5	75	M8	14	
	6571/29A				405	213,5				
	6570/28A									
	6570/29A	284	75	-	373	197,5	75	M8	14	
6571/33A	405				213,5					
6571/34A										

(1): total height with optional auxiliary contact

**TABLE 50: Dimensions of ball valves for HC refrigerants with actuator**

Ball Valve Catalogue No	Actuator Catalogue No	H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	l	d	Ch	Figure	
6570N/3	9700/RA2	147	15	180	121	65	18	M4	6	1	
6570N/M10											
6570N/M12											
6570N/4		151	19	184	139	73	25,5	M4	6		
6570N/5											
6570N/M18											
6570N/6	9700/RA2	167	23	199	175	94	30	M4	6		
6570N/7											
6570N/M28		176	27	207	204	109	30	M4	6		
6570N/9											
6570N/7	9700/RA6	167	23	199	175	94	30	M4	10		3
6570N/M28											
6570N/9											

(1): total height with optional auxiliary contact

TABLE 51: Dimensions of ball valves for R744 with actuator

Ball Valve Catalogue No	Actuator Catalogue No	H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	I	d	Ch	Figure	
6570EL/3	9700/RA2	147	15	180	121	65	18	M4	6	1	
6570EL/M10											
6570EL/M12											
6570EL/4											
6570EL/5		151	19	184	139	72	25,5				
6570EL/M18											
6570EL/6											
6570EL/7	9700/RA2							167	23		199
6570EL/M28		176	27	207	204	109					
6570EL/9											
6570EL/7	9700/RA6	167	23	199	175	94	30	M4	6		
6570EL/M28		176	27	207	204	109					
6570EL/9											
6590EL/11	9720/RA2	221	37	243	210	112	30	M4	10		3
6590EL/13		233	44	255	239	126					
6590EL/M42											
6590EL/11	9720/RA6	221	37	243	210	112	30	M4	10		
6590EL/13		233	44	255	239	126					
6590EL/M42											
6590EL/17	9720/RA2	256	54	278	275	149	30	M6	10		
6590EL/17	9720/RA6										
6570E/3	9700/RA2	147	15	180	121	65	18	M4	6	1	
6570E/M10											
6570E/M12											
6570E/4											
6570E/5		151	19	184	139	72	25,5				
6570E/M18											
6570E/6											
6570E/7	9700/RA2							167	23		199
6570E/M28		176	27	207	204	109					
6570E/9											
6570E/7	9700/RA6	167	23	199	175	94	30	M4	6		
6570E/M28		176	27	207	204	109					
6570E/9											
6590E/11	9720/RA2	221	37	243	210	112	30	M4	10		3
6590E/13		233	44	255	239	126					
6590E/M42											
6590E/11	9720/RA6	221	37	243	210	112	30	M4	10		
6590E/13		233	44	255	239	126					
6590E/M42											

(1): total height with optional auxiliary contact

Continued

**TABLE 51: Dimensions of ball valves for R744 with actuator**

Ball Valve Catalogue No	Actuator Catalogue No	H	H <sub>1</sub>	H <sub>2</sub> (1)	L	L <sub>1</sub>	l	d	Ch	Figure
6590E/17	9730/RA2	242	54	-	275	149	30	M6	10	5
6590E/17	9730/RA6									
6577E/3	9700/RA2	147	15	180	120	65	18	M4	6	1
6577E/4										
6577E/5		151	19	184	133	70	25,5			
6577E/6										
6597E/7	9700/RA2	167	28	199	175	93	18	M5	6	
6597E/9		176	30	207	207	110	30	M6		
6597E/7	9700/RA6	167	28	199	175	93	18	M5		
6597E/9		176	30	207	207	110	30	M6		
6597E/11	9720/RA2	221	37	243	210	112	30	M6	10	3
6597E/13		233	44	255	239	126				
6597E/11	9720/RA6	221	37	243	210	112	30	M6		
6597E/13		233	44	255	239	126				
6597E/17	9730/RA2	242	54	-	275	149	30	M6	10	5
6597E/17	9730/RA6									
6578E/M10	9700/RA2	147	15	180	119	64	18	M4	6	2
6578E/M12										
6578E/M16		151	19	184	142	74	25,5			
6578E/M18										
6598E/M22	9700/RA2	167	28	199	175	93	18	M5	6	
6598E/M28		176	30	207	207	110	30	M6		
6598E/M22	9700/RA6	167	28	199	175	93	18	M5		
6598E/M28		176	30	207	207	110	30	M6		
6598E/M35	9720/RA2	221	37	243	210	112	30	M6	10	4
6598E/M42		233	44	255	239	126				
6598E/M35	9720/RA6	221	37	243	210	112	30	M6		
6598E/M42		233	44	255	239	126				

(1): total height with optional auxiliary contact

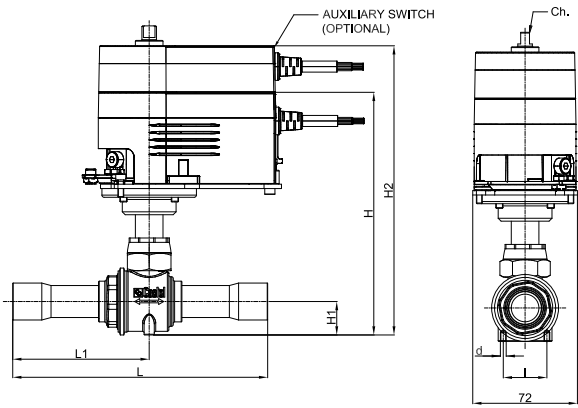


FIG. 1

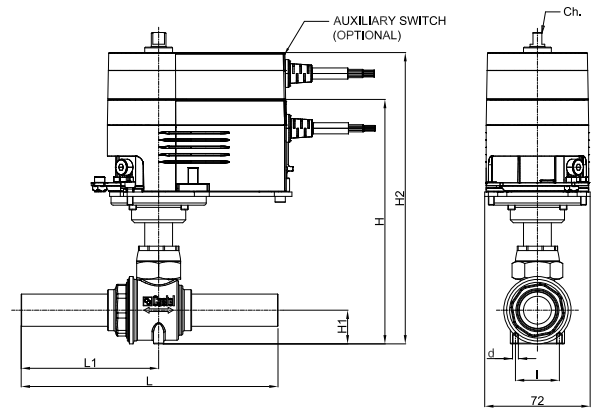


FIG. 2

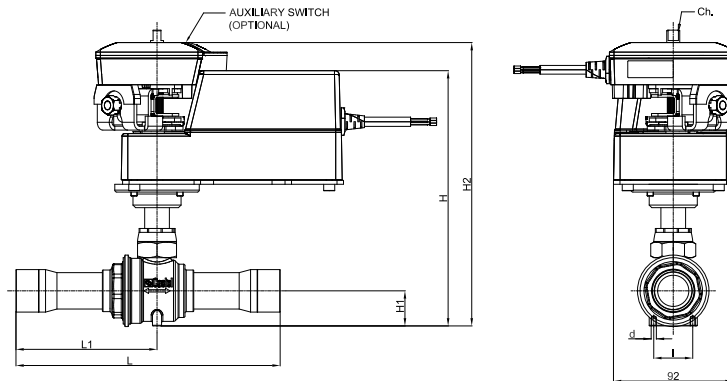


FIG. 3

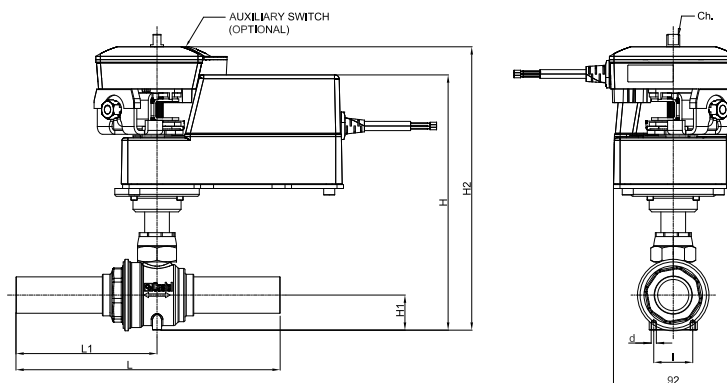


FIG. 4

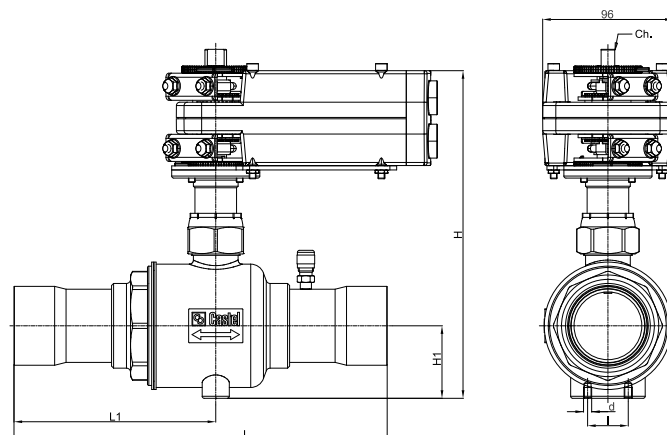


FIG. 5



# CHAPTER 12 ■ HERMETIC CHECK VALVES

## FOR REFRIGERATION PLANTS THAT USE HCFC, HFC, HFO, OR HC REFRIGERANTS



### APPLICATIONS

The check valves illustrated in this chapter are designed for installation on commercial refrigeration systems and on civil and industrial air conditioning plants that use the following refrigerant fluids:

- HCFC (R22)
- HFC (R134a, R404A, R407C, R410A, or R507)
- HFO and HFO/HFC mixtures (R1234ze, R448A, R449A, R450A, or R452A)

belonging to Group 2, as defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

Furthermore, the same check valves, up to DN 25, that is models 3144W/9, 3145W/9, 3184W/9, 3185W/9 can also be installed on systems using the following:

- HFC (R32)
- HFO (R1234yf)
- HC (R290, R600, or R600a)

belonging to Group 1, as defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

### CONSTRUCTION

These check valves are available in the following two types:

- Valve types 3112W, 3132W, 3144W, 3184W (standard spring) with a low opening differential;  $\Delta p = 0.04$  bar.
- Valve types 3113W, 3133W, 3145W, 3185W (reinforced spring) with a high opening differential;  $\Delta p = 0.3$  bar. To be used, for example, with compressors in parallel.

Valves in series 3112W, 3113W, 3132W, 3133W, 3144W, 3145W, 3184W, 3185W are equipped with laser welds between the body and the cover to ensure that the product is sealed hermetically. The main parts of the check valves are made with the following materials:

- Brass bar EN 12164 – CW 614N for body and cover of valves in series 3112W, 3113W, 3132W, and 3133W.
- Hot forged brass EN 12420 – CW 617N for body and cover of valves in series 3144W, 3145W, 3184W, and 3185W.
- Copper pipe EN 12735-1 – Cu--DHP for solder connections
- Austenitic stainless steel AISI 302 for the spring
- Laminated glass fibre fabric and PTFE for gasket seals of valves in series 3112W, 3113W, 3132W, and 3133W.
- PTFE for gasket seals of valves in series 3144W, 3145W, 3184W, and 3185W.

### INSTALLATION

The valves can be installed in any section of a refrigeration system where it is necessary to avoid the consequences from undesirable flow inversion, with respect for the operating limits and the capacities indicated in Table 53. Table 52 shows the following functional characteristics of a check valve:

- PS and TS
- Kv factor
- Minimum opening differential pressure at which the valve can open and remain opened.

Before connecting the valve to the pipe, it is advisable to make sure that the refrigerating system is clean. Valves with laminated fibreglass and PTFE gaskets are particularly sensitive to dirt and debris. Furthermore, check that the flow direction in the pipe corresponds to the arrow stamped on the valve body.

The brazing of valves with solder connections should be carried out with care, using a low melting point filler material (min. 5% Ag). It is not necessary to disassemble the valves before brazing, but it is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper functioning of the valve.

The allowed operating positions are the following:

- 3144W, 3145W: with the piping axis horizontal and valve cover facing upward or to the side, horizontal. With the piping axis vertical and arrow facing either upward or downward. **Note: valves 3144W, 3145W cannot be installed with the valve cover facing downward.**
- 3184W, 3185W: with inlet pipe facing downward and valve cover facing upward. With inlet pipe horizontal and outlet pipe vertical or horizontal. **Note: valves 3184W, and 3185W cannot be installed with the valve input facing upward and the valve cover facing downward.**

Valves 3112W, 3113W, 3132W, 3133W can be installed in any working position.

## CERTIFICATIONS

The American certification authority Underwriters Laboratories Inc. has approved the check valves in series 3112W, 3113W, 3132W, 3133W, 3144W, 3145W, 3184W, 3185W. These valves are certified **UL Listed** for the USA with file SA33319, in compliance with American standard UL 207.

TABLE 52: General characteristics of hermetic check valves, UL approved

Catalogue Number	Connections			Kv Factor [m <sup>3</sup> /h]	Minimum Opening Pressure Differential [bar]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
	SAE Flare	ODS					min.	max.	min.	max.	
		Ø [in.]	Ø [mm]								
3112W/2	1/4"	-	-	0,5	0,04	45 (1)	-40	+150	-40	+50	Art. 4.3
3112W/3	3/8"			1,5							
3112W/4	1/2"			1,8							
3112W/5	5/8"			3,3							
3112W/6	3/4"			5,0							
3113W/2	1/4"			-							
3113W/3	3/8"	1,5									
3113W/4	1/2"	1,8									
3113W/5	5/8"	3,3									
3113W/6	3/4"	5,0									
3132W/2	-	1/4"	-		0,5	0,04	45 (1)	-40	+150	-40	+50
3132W/3		3/8"	-	1,5							
3132W/M10		-	10	1,8							
3132W/M12		-	12								
3132W/4		1/2"	-	3,3							
3132W/5		5/8"	16	5,0							
3132W/M18		-	18								
3132W/6		3/4"	-								
3132W/7		7/8"	22								
3133W/2		-	1/4"	-	0,5						
3133W/3	3/8"		-	1,5							
3133W/M10	-		10	1,8							
3133W/M12	-		12								
3133W/4	1/2"		-	3,3							
3133W/5	5/8"		16	5,0							
3133W/M18	-		18								
3133W/6	3/4"		-								
3133W/7	7/8"		22								

(1) : MWP = 600 psi according to UL approval

Continued

TABLE 52: General characteristics of hermetic check valves, UL approved

Catalogue Number	Connections		Kv Factor [m <sup>3</sup> /h]	Minimum Opening Pressure Differential [bar]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast	
	SAE Flare	ODS				min.	max.	min.	max.		
		Ø [in.]									Ø [mm]
3144W/7	-	7/8"	22	8,1	0,04	45 (1)	- 40	+150	- 40	+50	Art. 4.3
3144W/M28		-	28	10,4							
3144W/9		1.1/8"	-	15,6							
3144W/11		1.3/8"	35	27,0							
3144W/13		1.5/8"	-	39,0							
3144W/M42		-	42								
3144W/17		2.1/8"	54								
3144W/21		2.5/8"	-								
3144W/25		3.1/8"	-								
3145W/7	-	7/8"	22	8,1	0,3	45 (1)	- 40	+150	- 40	+50	Art. 4.3
3145W/M28		-	28	10,4							
3145W/9		1.1/8"	-	15,6							
3145W/11		1.3/8"	35	27,0							
3145W/13		1.5/8"	-	39,0							
3145W/M42		-	42								
3145W/17		2.1/8"	54								
3145W/21		2.5/8"	-								
3145W/25		3.1/8"	-								
3184W/7	-	7/8"	22	9,0	0,04	45 (1)	- 40	+150	- 40	+50	Art. 4.3
3184W/M28		-	28	19,0							
3184W/9		1.1/8"	-	29,0							
3184W/11		1.3/8"	35								
3185W/7	-	7/8"	22	9,0	0,3	45 (1)	- 40	+150	- 40	+50	Art. 4.3
3185W/M28		-	28	19,0							
3185W/9		1.1/8"	-	29,0							
3185W/11		1.3/8"	35								

(1) : MWP = 600 psi according to UL approval

**TABLE 53: Refrigerant flow capacity of hermetic check valves [kW]**

Catalogue Number		Liquid line															
		R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A	R290	R600	R600a
3112W/2	3113W/2	8,50	9,15	12,57	5,95	8,62	8,59	5,75	6,29	7,52	7,83	7,86	7,96	6,07	10,19	11,95	10,60
3112W/3	3113W/3	25,50	27,45	37,70	17,85	25,85	25,76	17,25	18,87	22,56	23,48	23,58	23,87	18,20	30,57	35,85	31,80
3112W/4	3113W/4	30,60	32,94	45,23	21,42	31,01	30,91	20,70	22,64	27,07	28,17	28,30	28,64	21,83	36,68	43,02	38,16
3112W/5	3113W/5	56,10	60,39	82,93	39,27	56,86	56,66	37,95	41,51	49,63	51,65	51,88	52,50	40,03	67,25	78,87	69,96
3112W/6	3113W/6	85,00	91,50	125,65	59,50	86,15	85,85	57,50	62,90	75,20	78,25	78,60	79,55	60,65	101,90	119,50	106,00
3132W/2	3133W/2	8,50	9,15	12,57	5,95	8,62	8,59	5,75	6,29	7,52	7,83	7,86	7,96	6,07	10,19	11,95	10,60
3132W/3	3133W/3	25,50	27,45	37,70	17,85	25,85	25,76	17,25	18,87	22,56	23,48	23,58	23,87	18,20	30,57	35,85	31,80
3132W/M10	3133W/M10																
3132W/M12	3133W/M12	30,60	32,94	45,23	21,42	31,01	30,91	20,70	22,64	27,07	28,17	28,30	28,64	21,83	36,68	43,02	38,16
3132W/4	3133W/4																
3132W/5	3133W/5	56,10	60,39	82,93	39,27	56,86	56,66	37,95	41,51	49,63	51,65	51,88	52,50	40,03	67,25	78,87	69,96
3132W/M18	3133W/M18	85,00	91,50	125,65	59,50	86,15	85,85	57,50	62,90	75,20	78,25	78,60	79,55	60,65	101,90	119,50	106,00
3132W/6	3133W/6																
3132W/7	3133W/7																
3144W/7	3145W/7	137,70	148,23	203,55	96,39	139,56	139,08	93,15	101,90	121,82	126,77	127,33	128,87	98,25	165,08	193,59	171,72
3144W/M28	3145W/M28	176,80	190,32	261,35	123,76	179,19	178,57	119,60	130,83	156,42	162,76	163,49	165,46	126,15	211,95	248,56	220,48
3144W/9	3145W/9																
3144W/11	3145W/11	265,20	285,48		185,64	268,79	267,85	179,40		234,62	244,14	245,23	248,20	189,23			
3144W/13	3145W/13	459,00	494,10		321,30	465,21	463,59	310,50		406,08	422,55	424,44	429,57	327,51			
3144W/M42	3145W/M42																
3144W/17	3145W/17																
3144W/21	3145W/21	663,00	713,70		464,10	671,97	669,63	448,50		586,56	610,35	613,08	620,49	473,07			
3144W/25	3145W/25																
3184W/7	3185W/7	153,00	164,70	226,17	107,10	155,07	154,53	103,50	113,22	135,36	140,85	141,48	143,19	109,17	183,42	215,10	190,80
3184W/M28	3185W/M28	323,00	347,70	477,47	226,10	327,37	326,23	218,50	239,02	285,76	297,35	298,68	302,29	230,47	387,22	454,10	402,80
3184W/9	3185W/9																
3184W/11	3185W/11	493,00	530,70		345,10	499,67	497,93	333,50		436,16	453,85	455,88	461,39	351,77			

Standard rating conditions according to AHRI Standard 760-2007

Continued

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

**TABLE 53: Refrigerant flow capacity of hermetic check valves [kW]**

Catalogue Number		Suction line															
		R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A	R290	R600	R600a
3112W/2	3113W/2	0,91	1,28	2,13	1,10	1,14	1,65	1,12	0,74	0,71	1,20	1,10	0,80	1,06	1,53	0,65	0,79
3112W/3	3113W/3	2,73	3,83	6,38	3,30	3,41	4,95	3,35	2,21	2,13	3,60	3,30	2,39	3,17	4,58	1,94	2,37
3112W/4	3113W/4	3,28	4,59	7,65	3,96	4,09	5,94	4,01	2,65	2,56	4,32	3,96	2,86	3,80	5,49	2,32	2,84
3112W/5	3113W/5	6,01	8,42	14,03	7,26	7,49	10,89	7,36	4,85	4,69	7,92	7,26	5,25	6,96	10,07	4,26	5,21
3112W/6	3113W/6	9,10	12,75	21,25	11,00	11,35	16,50	11,15	7,35	7,10	12,00	11,00	7,95	10,55	15,25	6,45	7,90
3132W/2	3133W/2	0,91	1,28	2,13	1,10	1,14	1,65	1,12	0,74	0,71	1,20	1,10	0,80	1,06	1,53	0,65	0,79
3132W/3	3133W/3	2,73	3,83	6,38	3,30	3,41	4,95	3,35	2,21	2,13	3,60	3,30	2,39	3,17	4,58	1,94	2,37
3132W/M10	3133W/M10																
3132W/M12	3133W/M12	3,28	4,59	7,65	3,96	4,09	5,94	4,01	2,65	2,56	4,32	3,96	2,86	3,80	5,49	2,32	2,84
3132W/4	3133W/4																
3132W/5	3133W/5	6,01	8,42	14,03	7,26	7,49	10,89	7,36	4,85	4,69	7,92	7,26	5,25	6,96	10,07	4,26	5,21
3132W/M18	3133W/M18	9,10	12,75	21,25	11,00	11,35	16,50	11,15	7,35	7,10	12,00	11,00	7,95	10,55	15,25	6,45	7,90
3132W/6	3133W/6																
3132W/7	3133W/7																
3144W/7	3145W/7	14,74	20,66	34,43	17,82	18,39	26,73	18,06	11,91	11,50	19,44	17,82	12,88	17,09	24,71	10,45	12,80
3144W/M28	3145W/M28	18,93	26,52	44,20	22,88	23,61	34,32	23,19	15,29	14,77	24,96	22,88	16,54	21,94	31,72	13,42	16,43
3144W/9	3145W/9																
3144W/11	3145W/11	28,39	39,78		34,32	35,41	51,48	34,79		22,15	37,44	34,32	24,80	32,92			
3144W/13	3145W/13	49,14	68,85		59,40	61,29	89,10	60,21		38,34	64,80	59,40	42,93	56,97			
3144W/M42	3145W/M42																
3144W/17	3145W/17																
3144W/21	3145W/21	70,98	99,45		85,80	88,53	128,70	86,97		55,38	93,60	85,80	62,01	82,29			
3144W/25	3145W/25																
3184W/7	3185W/7	16,38	22,95	38,25	19,80	20,43	29,70	20,07	13,23	12,78	21,60	19,80	14,31	18,99	27,45	11,61	14,22
3184W/M28	3185W/M28	34,58	48,45	80,75	41,80	43,13	62,70	42,37	27,93	26,98	45,60	41,80	30,21	40,09	57,95	24,51	30,02
3184W/9	3185W/9																
3184W/11	3185W/11	52,78	73,95		63,80	65,83	95,70	64,67		41,18	69,60	63,80	46,11	61,19			

Standard rating conditions according to AHRI Standard 760-2007

Continued

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

**TABLE 53: Refrigerant flow capacity of hermetic check valves [kW]**

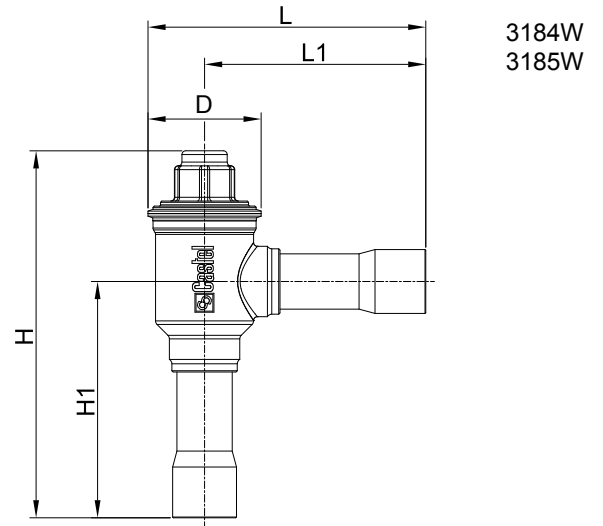
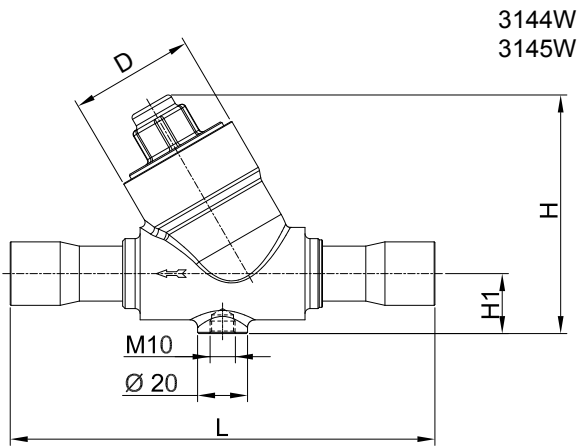
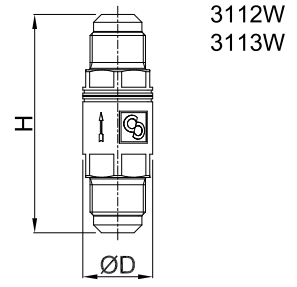
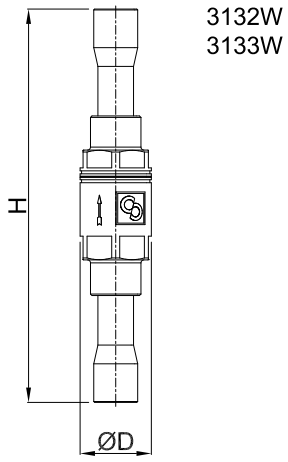
Catalogue Number		Hot Gas line															
		R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A	R290	R600	R600a
3112W/2	3113W/2	4,25	5,60	9,08	4,80	5,95	6,80	4,77	3,32	3,43	5,90	5,39	3,83	4,99	6,38	3,23	3,72
3112W/3	3113W/3	12,75	16,80	27,24	14,40	17,85	20,40	14,31	9,96	10,28	17,70	16,17	11,48	14,97	19,14	9,69	11,16
3112W/4	3113W/4	15,30	20,16	32,69	17,28	21,42	24,48	17,17	11,95	12,33	21,24	19,40	13,77	17,96	22,97	11,63	13,39
3112W/5	3113W/5	28,05	36,96	59,93	31,68	39,27	44,88	31,48	21,91	22,61	38,94	35,57	25,25	32,93	42,11	21,32	24,55
3112W/6	3113W/6	42,50	56,00	90,80	48,00	59,50	68,00	47,70	33,20	34,25	59,00	53,90	38,25	49,90	63,80	32,30	37,20
3132W/2	3133W/2	4,25	5,60	9,08	4,80	5,95	6,80	4,77	3,32	3,43	5,90	5,39	3,83	4,99	6,38	3,23	3,72
3132W/3	3133W/3	12,75	16,80	27,24	14,40	17,85	20,40	14,31	9,96	10,28	17,70	16,17	11,48	14,97	19,14	9,69	11,16
3132W/M10	3133W/M10																
3132W/M12	3133W/M12	15,30	20,16	32,69	17,28	21,42	24,48	17,17	11,95	12,33	21,24	19,40	13,77	17,96	22,97	11,63	13,39
3132W/4	3133W/4																
3132W/5	3133W/5	28,05	36,96	59,93	31,68	39,27	44,88	31,48	21,91	22,61	38,94	35,57	25,25	32,93	42,11	21,32	24,55
3132W/M18	3133W/M18	42,50	56,00	90,80	48,00	59,50	68,00	47,70	33,20	34,25	59,00	53,90	38,25	49,90	63,80	32,30	37,20
3132W/6	3133W/6																
3132W/7	3133W/7																
3144W/7	3145W/7	68,85	90,72	147,10	77,76	96,39	110,16	77,27	53,78	55,49	95,58	87,32	61,97	80,84	103,36	52,33	60,26
3144W/M28	3145W/M28	88,40	116,48	188,86	99,84	123,76	141,44	99,22	69,06	71,24	122,72	112,11	79,56	103,79	132,70	67,18	77,38
3144W/9	3145W/9																
3144W/11	3145W/11	132,60	174,72		149,76	185,64	212,16	148,82		106,86	184,08	168,17	119,34	155,69			
3144W/13	3145W/13	229,50	302,40		259,20	321,30	367,20	257,58		184,95	318,60	291,06	206,55	269,46			
3144W/M42	3145W/M42																
3144W/17	3145W/17	331,50	436,80		374,40	464,10	530,40	372,06		267,15	460,20	420,42	298,35	389,22			
3144W/21	3145W/21																
3144W/25	3145W/25																
3184W/7	3185W/7	76,50	100,80	163,44	86,40	107,10	122,40	85,86	59,76	61,65	106,20	97,02	68,85	89,82	114,84	58,14	66,96
3184W/M28	3185W/M28	161,50	212,80	345,04	182,40	226,10	258,40	181,26	126,16	130,15	224,20	204,82	145,35	189,62	242,44	122,74	141,36
3184W/9	3185W/9																
3184W/11	3185W/11	246,50	324,80		278,40	345,10	394,40	276,66		198,65	342,20	312,62	221,85	289,42			

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

TABLE 54: Dimensions and weights of hermetic check valves

Catalogue Number		Dimensions [mm]						Weight [g]							
		L	L <sub>1</sub>	D	H	H <sub>1</sub>	Ch								
3112W/2	3113W/2	58	-	18	-	-	16	60							
3112W/3	3113W/3	70		22			20	100							
3112W/4	3113W/4	75		24			22	132							
3112W/5	3113W/5	87		29			26	204							
3112W/6	3113W/6	100		35			32	330							
3132W/2	3133W/2	93	-	18	-	-	-	65							
3132W/3	3133W/3	108		22				120							
3132W/M10	3133W/M10			133				24	157						
3132W/M12	3133W/M12	29						220							
3132W/4	3133W/4	165						35	304						
3132W/5	3133W/5							140	-	-					
3132W/M18	3133W/M18							170							
3144W/7	3145W/7	170	-	50	96	24	-	1055							
3144W/M28	3145W/M28	201						56	115	29	1062				
3144W/9	3145W/9										255	67	148	36	1300
3144W/11	3145W/11	232		79	167	44									
3144W/13	3145W/13						285	79	167	44					
3144W/M42	3145W/M42	329		79	167	44									
3144W/17	3145W/17														
3144W/21	3145W/21														
3144W/25	3145W/25														
3184W/7	3185W/7	111	88	45	146	94	-	600							
3184W/M28	3185W/M28	149	123	51	196	141		1010							
3184W/9	3185W/9			56	204			1300							
3184W/11	3185W/11	151													





# CHAPTER 13

## CHECK VALVES

### FOR REFRIGERATION PLANTS THAT USE HCFC, HFC OR HFO REFRIGERANTS



#### APPLICATIONS

The check valves illustrated in this chapter are designed for installation on commercial refrigeration systems and on civil and industrial air conditioning plants that use the following refrigerant fluids:

- HCFC (R22), only valves in series 3122
- HFC (R134a, R404A, R407C, R410A, or R507)
- HFO and HFO/HFC mixtures (R1234ze, R448A, R449A, R450A, or R452A)

belonging to Group 2, as defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

Furthermore, the same check valves, up to DN 25, that is models 3122/9, 3124N/9, 3125N/9 can also be installed on systems using the following refrigeration fluids:

- HFC (R32)
- HFO (R1234yf)

classified as A2L in the ASHRAE 34-2013 standard, and belonging to Group 1, as defined in Article 13, Chapter 1, Point (a) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

#### CONSTRUCTION

These check valves are available in the following two types:

- Valve types 3122, 3124N (standard spring) with a low opening differential;  $\Delta p = 0.04$  bar or 0.1 bar.
- Valve types 3125N (reinforced spring) with a high opening differential;  $\Delta p = 0.3$  bar. To be used, for example, with compressors in parallel.

The main parts of the check valves are made with the following materials:

- Hot forged brass EN 12420 – CW 617N for body and cover.
- Copper pipe EN 12735-1 – Cu--DHP for solder connections
- Austenitic stainless steel AISI 302 for the spring
- Laminated stainless steel / rubber for outlet seal gaskets for valves in series 3122
- Hydrogenated nitrile (HNBR) for outlet seal gaskets for valves in series 3124N, 3125N
- PTFE for seat gaskets

#### INSTALLATION

The valves can be installed in any section of a refrigeration system where it is necessary to avoid the consequences from undesirable flow inversion, with respect for the operating limits and the yields indicated in Table 56. Table 55 shows the following functional characteristics of a check valve:

- PS and TS
- Kv factor
- Minimum opening differential pressure at which the valve can open and remain opened.

Before connecting the valve to the pipe, it is advisable to make sure that the refrigerating system is clean. Valves with PTFE gaskets are particularly sensitive to dirt and debris. Furthermore, check that the flow direction in the pipe corresponds to the arrow stamped on the valve body.

The brazing of valves with solder connections should be carried out with care, using a low melting point filler material (min. 5% Ag). **Before starting to braze the body, it is necessary to disassemble the valves in series 3122, 3124N, 3125N.** It is important to avoid direct contact between the torch flame and the body, which could be damaged and compromise the proper functioning of the entire valve.

The allowed operating positions are the following:

- 3122, 3124N, 3125N: with the piping axis horizontal and valve cover facing upward or to the side, horizontal. With the piping axis vertical and arrow facing either upward or downward. **Note: valves 3122, 3124N, 3125N cannot be installed with the valve cover facing downward.**

**TABLE 55: General characteristics of check valves**

Catalogue Number	Connections		Kv Factor [m³/h]	Minimum Opening Pressure Differential [bar]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast						
	ODS					min.	max.	min.	max.							
	Ø [in.]	Ø [mm]														
3122/M22	–	22	6,6	0,1	45	– 35	+160	– 35	+50	Art. 4.3						
3122/7	7/8"	–														
3122/M28	–	28	8,8													
3122/9	1.1/8"	–														
3122/11	1.3/8"	35	15,2													
3122/13	1.5/8"	–														
3122/M42	–	42	25,0							I						
3122/17	2.1/8"	54									40,0					
3124N/M22	–	22	8,1							0,04	45	-40	+150	-40	+50	Art. 4.3
3124N/7	7/8"	–														
3124N/M28	–	28	10,4													
3124N/9	1.1/8"	–														
3124N/11	1.3/8"	35	15,6													
3124N/13	1.5/8"	–														
3124N/M42	–	42	27,0	I												
3124N/17	2.1/8"	54			39,0											
3125N/M22	–	22	8,1	0,3	45	-40	+150	-40	+50							Art. 4.3
3125N/7	7/8"	–														
3125N/M28	–	28	10,4													
3125N/9	1.1/8"	–														
3125N/11	1.3/8"	35	15,6													
3125N/13	1.5/8"	–														
3125N/M42	–	42	27,0							I						
3125N/17	2.1/8"	54									39,0					

**TABLE 56: Refrigerant flow capacity of check valves [kW]**

Catalogue Number	Liquid line													
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A	
3122/M22	–	112,20	120,78	165,86	78,54	113,72	113,32	75,90	83,03	99,26	103,29	103,75	105,01	80,06
3122/7	–													
3122/M28	–	149,60	161,04	221,14	104,72	151,62	151,10	101,20	110,70	132,35	137,72	138,34	140,01	106,74
3122/9	–													
3122/11	–	258,40	278,16		180,88	261,90	260,98	174,80		228,61	237,88	238,94	241,83	184,38
3122/13	–	425,00	457,50		297,50	430,75	429,25	287,50		376,00	391,25	393,00	397,75	303,25
3122/M42	–													
3122/17	–	680,00	732,00		476,00	689,20	686,80	460,00		601,60	626,00	628,80	636,40	485,20
3124N/M22	3125N/M22	137,70	148,23	203,55	96,39	139,56	139,08	93,15	101,90	121,82	126,77	127,33	128,87	98,25
3124N/7	3125N/7													
3124N/M28	3125N/M28	176,80	190,32	261,35	123,76	179,19	178,57	119,60	130,83	156,42	162,76	163,49	165,46	126,15
3124N/9	3125N/9													
3124N/11	3125N/11	265,20	285,48		185,64	268,79	267,85	179,40		234,62	244,14	245,23	248,20	189,23
3124N/13	3125N/13	459,00	494,10		321,30	465,21	463,59	310,50		406,08	422,55	424,44	429,57	327,51
3124N/M42	3125N/M42													
3124N/17	3125N/17	663,00	713,70		464,10	671,97	669,63	448,50		586,56	610,35	613,08	620,49	473,07

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

Continued

**TABLE 56: Refrigerant flow capacity of check valves [kW]**

Catalogue Number		Suction line												
		R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
3122/M22	–	12,01	16,83	28,05	14,52	14,98	21,78	14,72	9,70	9,37	15,84	14,52	10,49	13,93
3122/7	–													
3122/M28	–	16,02	22,44	37,40	19,36	19,98	29,04	19,62	12,94	12,50	21,12	19,36	13,99	18,57
3122/9	–													
3122/11	–	27,66	38,76		33,44	34,50	50,16	33,90		21,58	36,48	33,44	24,17	32,07
3122/13	–	45,50	63,75		55,00	56,75	82,50	55,75		35,50	60,00	55,00	39,75	52,75
3122/M42	–													
3122/17	–	72,80	102,00		88,00	90,80	132,00	89,20		56,80	96,00	88,00	63,60	84,40
3124N/M22	3125N/M22	14,74	20,66	34,43	17,82	18,39	26,73	18,06	11,91	11,50	19,44	17,82	12,88	17,09
3124N/7	3125N/7													
3124N/M28	3125N/M28	18,93	26,52	44,20	22,88	23,61	34,32	23,19	15,29	14,77	24,96	22,88	16,54	21,94
3124N/9	3125N/9													
3124N/11	3125N/11	28,39	39,78		34,32	35,41	51,48	34,79		22,15	37,44	34,32	24,80	32,92
3124N/13	3125N/13	49,14	68,85		59,40	61,29	89,10	60,21		38,34	64,80	59,40	42,93	56,97
3124N/M42	3125N/M42													
3124N/17	3125N/17	70,98	99,45		85,80	88,53	128,70	86,97		55,38	93,60	85,80	62,01	82,29

Continued

**TABLE 56: Refrigerant flow capacity of check valves [kW]**

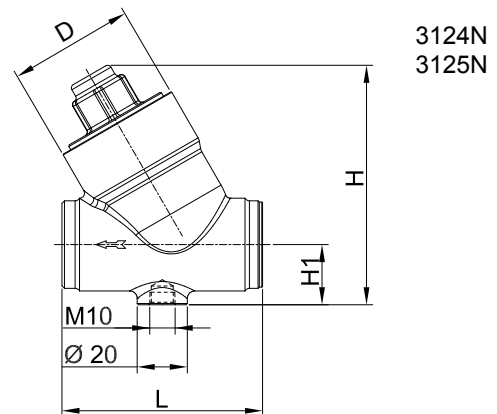
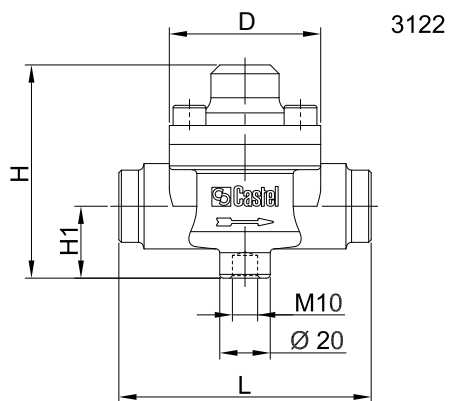
Catalogue Number		Hot Gas line												
		R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
3122/M22	–	56,10	73,92	119,86	63,36	78,54	89,76	62,96	43,82	45,21	77,88	71,15	50,49	65,87
3122/7	–													
3122/M28	–	74,80	98,56	159,81	84,48	104,72	119,68	83,95	58,43	60,28	103,84	94,86	67,32	87,82
3122/9	–													
3122/11	–	129,20	170,24		145,92	180,88	206,72	145,01		104,12	179,36	163,86	116,28	151,70
3122/13	–	212,50	280,00		240,00	297,50	340,00	238,50		171,25	295,00	269,50	191,25	249,50
3122/M42	–													
3122/17	–	340,00	448,00		384,00	476,00	544,00	381,60		274,00	472,00	431,20	306,00	399,20
3124N/M22	3125N/M22	68,85	90,72	147,10	77,76	96,39	110,16	77,27	53,78	55,49	95,58	87,32	61,97	80,84
3124N/7	3125N/7													
3124N/M28	3125N/M28	88,40	116,48	188,86	99,84	123,76	141,44	99,22	69,06	71,24	122,72	112,11	79,56	103,79
3124N/9	3125N/9													
3124N/11	3125N/11	132,60	174,72		149,76	185,64	212,16	148,82		106,86	184,08	168,17	119,34	155,69
3124N/13	3125N/13	229,50	302,40		259,20	321,30	367,20	257,58		184,95	318,60	291,06	206,55	269,46
3124N/M42	3125N/M42													
3124N/17	3125N/17	331,50	436,80		374,40	464,10	530,40	372,06		267,15	460,20	420,42	298,35	389,22

Standard rating conditions according to AHRI Standard 760-2007

Condensing temperature	110 °F	(43,3 °C)	Evaporator outlet temperature	50 °F	(9,9 °C)
Liquid temperature	100 °F	(37,8 °C)	Evaporator superheating	10 °R	(5,5 °K)
Subcooling	10 °R	(5,5 °K)	Suction line temperature	65 °F	(18,3 °C)
Evaporating temperature	40 °F	(4,4 °C)	Suction superheating	15 °R	(8,4 °K)
			Discharge temperature	160 °F	(71,1 °C)

TABLE 57: Dimensions and weights of check valves

Catalogue Number		Dimensions [mm]				Weight [g]
		H	H <sub>1</sub>	L	D	
3122/M22	-	84,5	28,5	100	60	1190
3122/7	-					
3122/M28	-					
3122/9	-					
3122/11	-	101,5	34	118	68	1557
3122/13	-	125,5	37	141	88	2990
3122/M42	-					
3122/17	-	142	42,5	173	104	4665
3124N/M22	3125N/M22	96	24	80	50	855
3124N/7	3125N/7					
3124N/M28	3125N/M28					867
3124N/9	3125N/9					
3124N/11	3125N/11	115	29	92	56	1130
3124N/13	3125N/13	148	36	121	67	
3124N/M42	3125N/M42					
3124N/17	3125N/17	167	44	157	79	



# CHAPTER 14 ■ HERMETIC CHECK VALVES

## FOR REFRIGERATION PLANTS THAT USE THE R744 REFRIGERANT



### APPLICATIONS

The check valves illustrated in this chapter have been developed by Castel for all the applications that use the sub-critical or trans-critical R744 refrigeration fluid belonging to Group 2, defined in Article 13, Chapter 1, Point (b) of Directive 2014/68/EU, with reference to EC Regulation No. 1272/2008.

The check valves for plants that operate using refrigerant fluid R744 are the following:

- Valves in series 3132EW, 3133EW, 3145EW and 3185EW with PS = 80 bar, equipped with copper connections for trans-critical plants low and medium pressure sides.
- Valves in series 3137EW, 3147EW and 3187EW with PS = 120 bar equipped with reinforced copper connections (K65) for trans-critical plants high-pressure side.
- Valves in series 3138EW, 3148EW and 3188EW with PS = 140 bar equipped with reinforced stainless steel connections for trans-critical plants high-pressure side.

**CAUTION! The check valves in this chapter cannot be used with other refrigerant fluids.**

### CONSTRUCTION

Only straight check valves in series 3132EW (standard spring) ensure a low opening differential;  $\Delta p = 0.04$  bar. All of the other check valves for R744 (reinforced spring) ensure a high opening differential;  $\Delta p = 0.3$  bar.

Valves in series 3132EW, 3133EW, 3137EW, 3138EW, 3145EW, 3147EW, 3148EW, 3185EW, 3187EW, 3188EW are equipped with laser welds between the body and the cover to ensure that the product is sealed hermetically. The main parts of the check valves are made with the following materials:

- Brass bar EN 12164 - CW 614N for body and cover of the valves in series 3132EW, 3133EW, 3137EW, 3138EW.
- Hot forged brass EN 12420 - CW 617N for body and cover of the valves in series: 3145EW, 3147EW, 3148EW, 3185EW, 3187EW, 3188EW.
- Austenitic stainless steel AISI 302 for the spring
- Laminated glass fibre fabric and PTFE for seat gaskets of valves in series 3132EW, 3133EW, 3137EW, 3138EW.

- PTFE for seat gaskets of valves in series 3145EW, 3147EW, 3148EW, 3185EW, 3187EW, 3188EW.
- Copper pipe EN 12735-1 – Cu-DHP for welded connections in series 3132EW, 3133EW, 3145EW, 3185EW.
- Copper pipe EN 12735-1 – CuFe2P (K65) for welded connections in series 3137EW, 3147EW, 3187EW
- Stainless steel pipe AISI 304 for welded connections in series 3138EW, 3148EW 3188EW.

### INSTALLATION

The valves can be installed in any section of a refrigeration system where it is necessary to avoid the consequences from undesirable flow inversion, with respect for the operating limits and the yields indicated in Table 59. Table 58 shows the following functional characteristics of a check valve:

- PS and TS
- Kv factor
- Minimum opening differential pressure at which the valve can open and remain opened.

Before connecting the valve to the pipe, it is advisable to make sure that the refrigerating system is clean. Valves with PTFE gaskets are particularly sensitive to dirt and debris. Furthermore, check that the flow direction in the pipe corresponds to the arrow stamped on the valve body. Copper connections: The brazing of valves with copper connections should be carried out with care, using a low melting point filler material (min. 5% Ag). It is not necessary to disassemble the valves, but it is important to avoid direct contact between the torch flame and the valve body, which could be damaged and compromise the proper functioning of the valve.

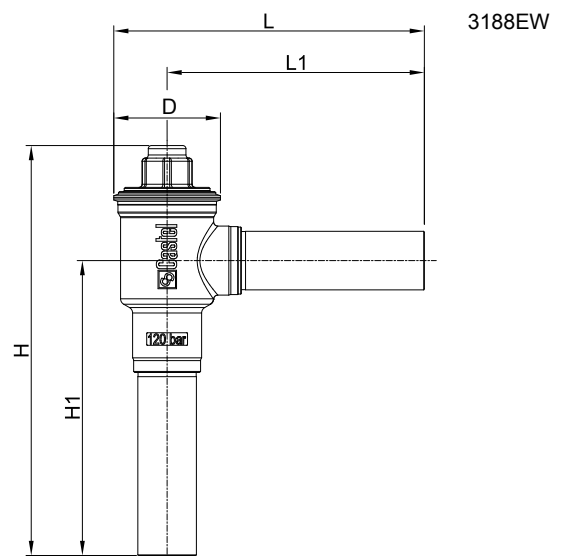
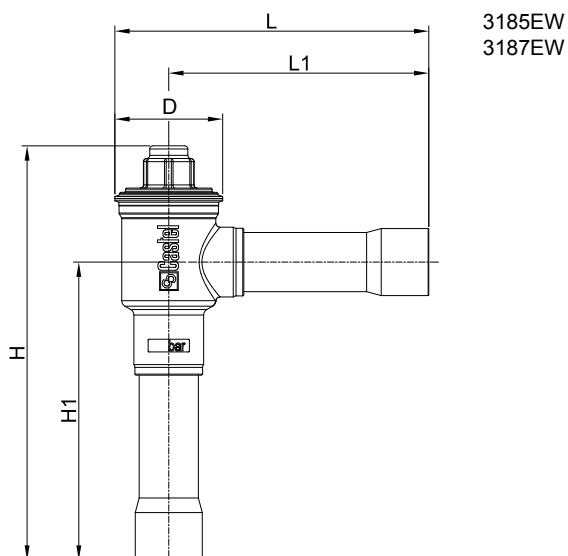
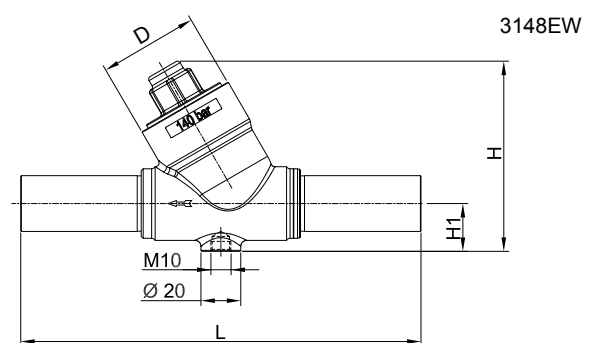
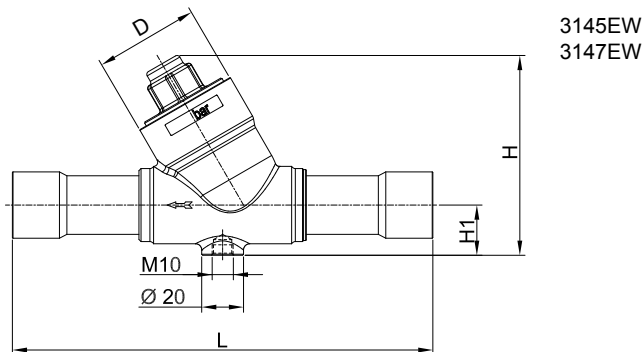
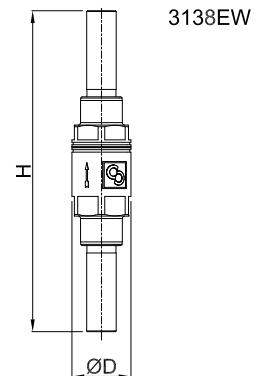
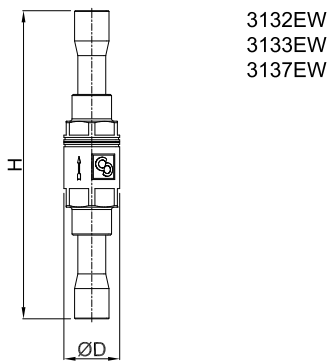
Steel connectors: TIG welding recommended, to be performed as quickly as possible according to the method shown in the product instruction sheet. The connection material is AISI 304: it is only possible to use AISI 308 filler material if welding to pipes made from the same type of material. For pipes made from other materials, please contact your welding supplies supplier.

The allowed operating positions are the following:

- 3145EW, 3147EW, 3148EW: with the piping axis horizontal and valve cover facing upward or to the side, horizontal. With piping axis vertical and arrow facing either upward or downward. **Note: valves 3145EW, 3147EW, 3148EW cannot be installed with the valve cover facing downward.**
- 3185EW, 3187EW, 3188EW: with inlet pipe facing downward and valve cover facing upward. With inlet pipe

horizontal and outlet pipe vertical or horizontal. **Note: valves 3185EW, 3187EW, 3188EW cannot be installed with the valve input facing upward and the valve cover facing downward.**

Valves 3132EW, 3133EW, 3137EW, 3138EW can be installed in any working position.



**TABLE 58: General Characteristics of hermetic check valves for R744**

Catalogue Number	Connections		Kv Factor [m³/h]	Minimum Opening Pressure Differential [bar]	PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast							
	ODS					min.	max.	min.	max.								
	Ø [in.]	Ø [mm]															
3132EW/2	1/4"	–	0,5	0,04	80	– 40	+150	– 40	+50	Art. 4.3							
3132EW/3	3/8"	–	1,5														
3132EW/M10	–	10	1,8														
3132EW/M12	–	12	3,3														
3132EW/4	1/2"	–	5,0														
3132EW/5	5/8"	16	5,0														
3132EW/M18	–	18	5,0														
3132EW/6	3/4"	–	5,0														
3132EW/7	7/8"	22	5,0														
3133EW/2	1/4"	–	0,5								0,3	120	– 40	+150	– 40	+50	Art. 4.3
3133EW/3	3/8"	–	1,5														
3133EW/M10	–	10	1,8														
3133EW/M12	–	12	3,3														
3133EW/4	1/2"	–	5,0														
3133EW/5	5/8"	16	5,0														
3133EW/M18	–	18	5,0														
3133EW/6	3/4"	–	5,0														
3133EW/7	7/8"	22	5,0														
3137EW/2	1/4"	–	0,5	0,3	140	– 40	+150	– 40	+50	Art. 4.3							
3137EW/3	3/8"	–	1,5														
3137EW/4	1/2"	–	3,3														
3137EW/5	5/8"	16	3,3														
3138EW/M10	–	10	1,5	0,3	140	– 40	+150	– 40	+50	Art. 4.3							
3138EW/M12	–	12	3,3														
3138EW/M16	–	16	3,3														
3145EW/7	7/8"	22	8,1	0,3	80	– 40	+150	– 40	+50	Art. 4.3							
3145EW/M28	–	28	10,4														
3145EW/9	1.1/8"	–	15,6														
3145EW/11	1.3/8"	35	27,0														
3145EW/13	1.5/8"	–	27,0														
3145EW/M42	–	42	39,0														
3145EW/17	2.1/8"	54	39,0														
3147EW/7	7/8"	22	8,1	0,3	120	– 40	+150	– 40	+50	Art. 4.3							
3147EW/9	1.1/8"	–	10,4														
3147EW/11	1.3/8"	35	15,6														
3147EW/13	1.5/8"	–	27,0														
3147EW/17	2.1/8"	54	39,0														
3148EW/M22	–	22	8,1	0,3	140	– 40	+150	– 40	+50	Art. 4.3							
3148EW/M28	–	28	10,4														
3148EW/M35	–	33,4	15,6														
3148EW/M42	–	42,2	27,0														
3185EW/7	7/8"	22	9,0	0,3	80	– 40	+150	– 40	+50	Art. 4.3							
3185EW/M28	–	28	19,0														
3185EW/9	1.1/8"	–	29,0														
3185EW/11	1.3/8"	35	29,0														
3187EW/7	7/8"	22	9,0	0,3	120	– 40	+150	– 40	+50	Art. 4.3							
3187EW/9	1.1/8"	–	19,0														
3187EW/11	1.3/8"	35	29,0														
3188EW/M22	–	22	9,0	0,3	140	– 40	+150	– 40	+50	Art. 4.3							
3188EW/M28	–	28	19,0														
3188EW/M35	–	33,4	29,0														

TABLE 59: Refrigerant flow capacity of check valves [kW]

Catalogue Number		Subcritical system			Transcritical system		
		Liquid line	Suction line	Hot gas line	Gas cooler line	Suction line	Hot gas line
3132EW/2	3133EW/2	13,40	2,65	10,09		2,32	
3132EW/3	3133EW/3	40,20	7,95	30,27		6,95	
3132EW/M10	3133EW/M10						
3132EW/M12	3133EW/M12	48,24	9,54	36,32		8,33	
3132EW/4	3133EW/4						
3132EW/5	3133EW/5	88,44	17,49	66,59		15,28	
3132EW/M18	3133EW/M18	134,00	26,50	100,90		23,15	
3132EW/6	3133EW/6						
3132EW/7	3133EW/7						
3137EW/2	–				13,14	2,32	9,35
3137EW/3	3138EW/M10				39,41	6,95	28,04
3137EW/4	3138EW/M12						
3137EW/5	3138EW/M16				86,69	15,28	61,68
–	3145EW/7	217,08	42,93	163,46		37,50	
	3145EW/M28	278,72	55,12	209,87		48,15	
	3145EW/9						
	3145EW/11	418,08	82,68	314,81		72,23	
	3145EW/13	723,60	143,10	544,86		125,01	
	3145EW/M42						
3145EW/17	1045,20	206,70	787,02		180,57		
3147EW/7	3148EW/M22				212,79	37,50	151,39
3147EW/9	3148EW/M28				273,21	48,15	194,38
3147EW/11	3148EW/M35				409,81	72,23	291,56
3147EW/13	–				709,29	125,01	504,63
–	3148EW/M42						
3147EW/17	–				1024,53	180,57	728,91
–	3185EW/7	241,20	47,70	181,62		41,67	
	3185EW/M28	509,20	100,70	383,42		87,97	
	3185EW/9						
	3185EW/11	777,20	153,70	585,22		134,27	
3187EW/7	3188EW/M22				236,43	41,67	168,21
3187EW/9	3188EW/M28				499,13	87,97	355,11
3187EW/11	3188EW/M35				761,83	134,27	542,01



TABLE 60: Dimensions and weights of check valves for R744

Catalogue Number		Dimensions [mm]					Weight [g]			
		H	H <sub>1</sub>	L	L <sub>1</sub>	Ø D				
3132EW/2	3133EW/2	93				18	65			
3132EW/3	3133EW/3	108				22	120			
3132EW/M10	3133EW/M10					133	24	157		
3132EW/M12	3133EW/M12	29					220			
3132EW/4	3133EW/4	146					35	304		
3132EW/5	3133EW/5									
3132EW/M18	3133EW/M18									
3132EW/6	3133EW/6	165				-	-			
3132EW/7	3133EW/7									
3137EW/2		122							22	65
3137EW/3		126	22	120						
3137EW/4		132	24	157						
3137EW/5		146	29	220						
3138EW/M10		126	22	130						
3138EW/M12		132	24	155						
3138EW/M16		146	29	242						
3145EW/7			96	24	170				50	1055
3145EW/M28					201					1062
3145EW/9			115	29	232				56	1300
3145EW/11										
3145EW/13										
3145EW/M42										
3145EW/17	167		44	285	79					
3147EW/7			96	24	170	50	1055			
3147EW/9					201		1062			
3147EW/11			115	29	232	56	1300			
3147EW/13		148	36	255	67					
3147EW/17		167	44	285	79					
3148EW/M22		96	24	170	50					
3148EW/M28				201						
3148EW/M35				232		56				
3148EW/M42				255		67				
3185EW/7		146	94	111	88	45	600			
3185EW/M28	196	141	149	123	51	1010				
3185EW/9										
3185EW/11							204	151	56	1300
3187EW/7	146	94	111	88	45	600				
3187EW/9	196	141	149	123	51	1010				
3187EW/11							204	151	56	1300
3188EW/M22	146	94	111	88	45					
3188EW/M28	196	141	149	123	51					
3188EW/M35						204	151	56		

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