HANDBOOK
VALVES

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Castel®
Italian technology

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"									
6570EL/3	3/8"	3/8"			3						
6570EL/M10	–	–									
6570EL/M12	–	–			5						
6570EL/4	1/2"	1/2"									
6570EL/5	5/8"	5/8"		15	17						
6570EL/M18	–	–									
6570EL/6	3/4"	3/4"									
6570EL/7	7/8"	7/8"		19	29						
6570EL/M28	–	–		25	51						
6570EL/9	1.1/8"	1.1/8"									
6590EL/11	–	–		32	86						
6590EL/13	1/4"	1/4"		38	117						I
6590EL/M42	3/8"	3/8"									
6590EL/17	–	–		50	214						
6570E/M6	–	6	–	10	0,8	80	-40	+150	-40	+50	Art. 4.3
6570E/2	1/4"	–									
6570E/3	3/8"	–			3						
6570E/M10	–	10									
6570E/M12	–	12			5						
6570E/4	1/2"	–									
6570E/5	5/8"	16		15	17						
6570E/M18	–	18									
6570E/6	3/4"	–									
6570E/7	7/8"	22		19	29						
6570E/M28	–	28		25	51						
6570E/9	1.1/8"	–									
6590E/11	1.3/8"	35		32	86						
6590E/13	1.5/8"	–		38	117						I
6590E/M42	–	42									
6590E/17	2.1/8"	54		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								
	Ø [in.]	Ø [mm]	Ø [mm]				min.	max.	min.	max.	
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						I
6597E/17	2.1/8"	54		50	214						
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			

Continued

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 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)			

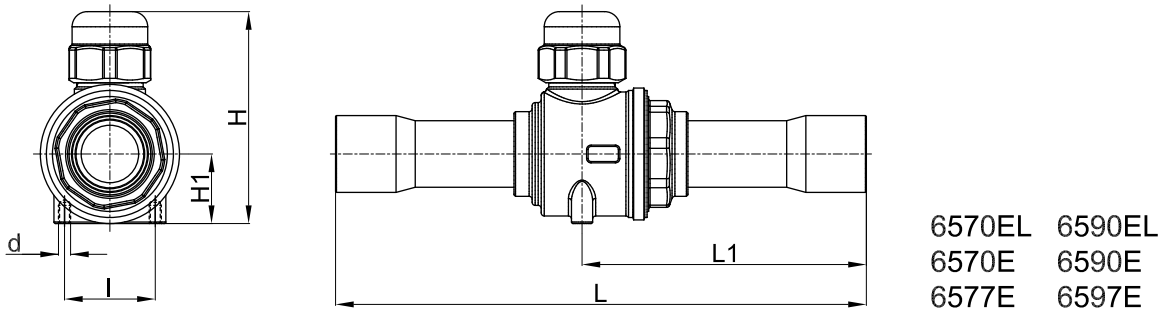
Standard rating conditions according to AHRI Standard 760-2007 for transcritical system

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)			

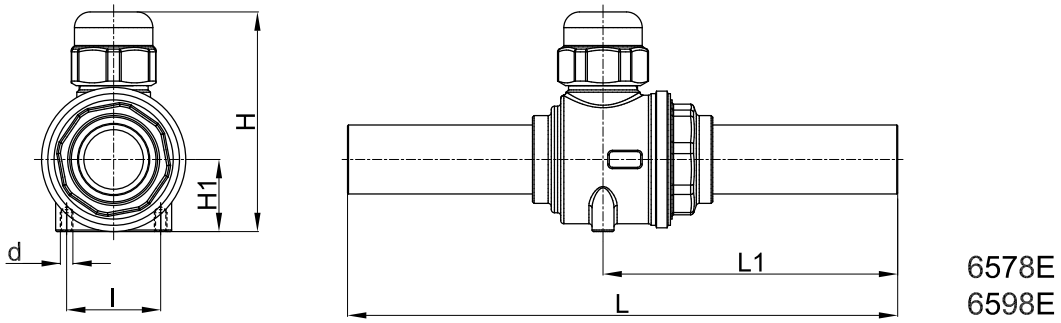
TABLE 35: Dimensions and weights of ball valves for R744							
Catalogue Number	Dimensions [mm]						Weight [g]
	H	H_1	L	L_1	l	d	
6570EL/M6	48	15	121	65	18	M4	216
6570EL/2							
6570EL/3							
6570EL/M10							
6570EL/M12							
6570EL/4							
6570EL/5	55	19	139	73	25,5		333
6570EL/M18							
6570EL/6							
6570EL/7	70	23	175	94	30		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_1	L	L_1	l	d	
6577E/2	47	15	115	65	18	M4	216
6577E/3			122				
6577E/4			120	62			
6577E/5	54	19	126	70	25,5		333
6577E/6							
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	64	18	M4	216
6578E/M10			123	66			
6578E/M12			121				
6578E/M16	54	19	142	74	25,5		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	12	44	239	126			2668



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



6578E
6598E

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