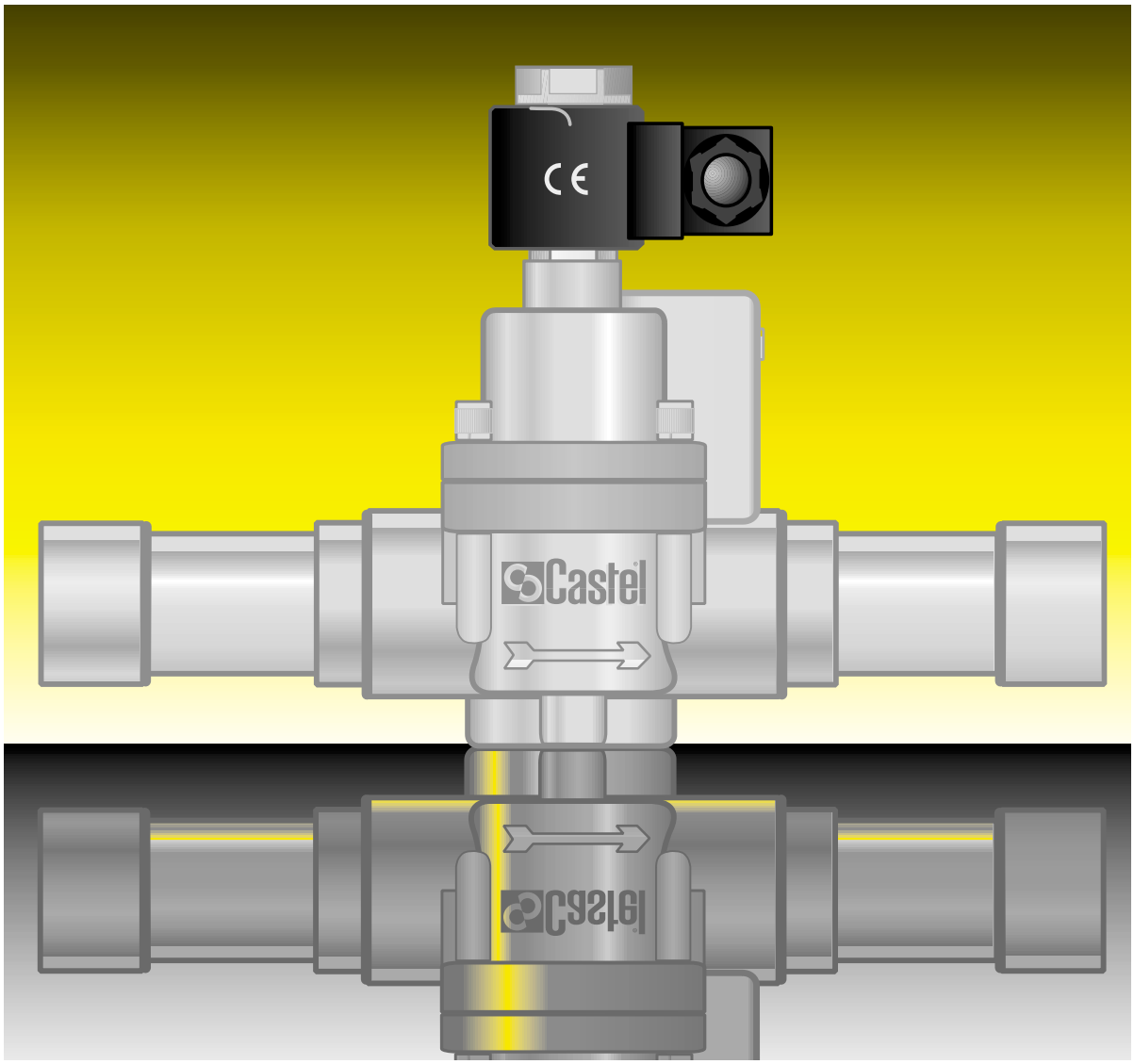
SOLENOID VALVES



Castel®

SOLENOID VALVES FOR REFRIGERATING SYSTEMS

APPLICATIONS

The solenoid valves, shown in this chapter, are classified “Pressure accessories” in the sense of the Pressure Equipment Directive 97/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.
They are designed for installation on commercial refrigerating systems and on civil and industrial conditioning plants, which use refrigerant fluids proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC).

OPERATION

The valves series 1020; 1028; 1064; 1068; 1070; 1078; 1079; 1090; 1098; 1099 are normally closed.
NC = when the coil is de-energised the plunger stops the refrigerant flow.
The valves series 1164; 1168; 1170; 1178; 1179; 1190; 1198 are normally open.
NO = when the coil is energised the plunger stops the refrigerant flow.
The valves series 1020 and 1028 are direct acting, while the valves of all the other series are pilot operated, with diaphragm or piston.
The NC valves are supplied either without coil (S type) or with coil (example: A6 type with coil HM2–220 Vac).
The NO valves are supplied only without coil (S type).
N.B.: the NO valve visually differs from the corresponding NC model by means of the red ring installed below the yellow nut that fastens the coil.

CONSTRUCTION

The main parts of the valves are made with the following materials:
- hot forged brass EN 12420 – CW 617N for body and cover;
- copper tube EN 12449 – Cu-DHP for solder connections;
- austenitic stainless steel EN 10088-2 – 1.4303 for enclosure where the plunger moves;
- ferritic stainless steel EN 10088-3 – 1.4105 for plunger:
- austenitic stainless steel EN ISO 3506 – A2-70 for tightening screws between body and cover;
- chloroprene rubber (CR) for outlet seal gaskets;
- P.T.F.E. for seat gaskets.

INSTALLATION

The valves can be installed in all sections of a refrigerating system, in compliance with the limits and capacities indicated in Tables 3 and 6.
Tables 1 and 4 show the following functional characteristics of a solenoid valve:
- PS;
- TS;
- Kv factor;
- minimum Opening Pressure Differential (minOPD), that is the minimum pressure differential between inlet and outlet at which a solenoid valve, pilot operated, can open and stay opened;
- maximum Opening Pressure Differential (MOPD according to ARI STANDARD 760: 2001), that is the maximum pressure differential between inlet and outlet at which a solenoid valve, pilot operated, can open.

Before connecting the valve to the pipe it is advisable to make sure that the refrigerating system is clean. In fact the valves with P.T.F.E. gaskets are particularly sensitive to dirt and debris.
Furthermore check that the flow direction in the pipe corresponds to the arrow stamped on the body of the valve.
All valves can be mounted in whatever position except with the coil pointing downwards.
The brazing of valves with solder connections should be carried out with care, using a low melting point filler material. It is not necessary to disassemble the valves before brazing but it’s 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.
Before connecting a valve to the electrical system, be sure that the line voltage and frequency correspond to the values marked on the coil.
The NO valves have been designed to work only with direct current coils.
To use them with an alternate current supply it’s necessary to mate the NO valve with the

following components:

– voltage 24 Vac:
  Coil 9120/RD2 + Connector 9150/R44;
– voltage 220 Vac:
  Coil 9120/RD6 + Connector 9150/R45.

TABLE 1: General Characteristics of NC valves (normally closed)

Catalogue Number	Coil Type	Connections			Seat size nominal Ø [mm]	Kv Factor [m³/h]	Operating Principles	Opening Pressure Differential [bar]			TS [°C]		PS [bar]	Risk Category according to PED
		SAE Flare	ODS					min OPD	MOPD		min.	max.		
			Ø [in.]	Ø [mm]					A.C. Coils	D.C. Coils				
1020/2	HM2 (A.C.) - CM2 (A.C.) - HM3 (D.C.)	1/4"	–	–	2,5	0,175	Ditect Acting	0	21	19	– 35	+105 (1)	32	Art. 3.3
1020/3		3/8"	–	–	3	0,23								
1028/2		–	1/4"	–	2,2	0,15								
1028/2E		–	1/4"	–	3	0,23								
1028/3		–	3/8"	–										
1028/M10		–	–	10										
1064/3		3/8"	–	–	7	0,80	Diaphragm Pilot Operated	0,05						
1064/4		1/2"	–	–										
1068/3		–	3/8"	–										
1068/M10		–	–	10										
1068/M12		–	–	12										
1068/4		–	1/2"	–										
1070/4		1/2"	–	–	12,5	2,20				18				
1070/5		5/8"	–	–		2,61								
1078/M12		–	–	12		2,20								
1078/4		–	1/2"	–										
1078/5		–	5/8"	16		2,61								
1079/7		–	7/8"	22										
1090/5		5/8"	–	–	16,5	3,80				13				
1090/6		3/4"	–	–		4,80								
1098/5		–	5/8"	16		3,80								
1098/6		–	3/4"	–		4,80								
1098/7		–	7/8"	22		5,70								
1099/9		–	1.1/8"	–										
1078/9		–	1.1/8"	–	25,5	10				19				
1079/11		–	1.3/8"	35										
1098/9		–	1.1/8"	–	25	10	Piston Pilot Operated	0,07				+110 (2)		
1099/11		–	1.3/8"	35										
1078/11		–	1.3/8"	35	27	16								
1079/13		–	1.5/8"	–										
1079/M42		–	–	42										

(1) Temperature peaks of 120 °C are allowed during defrosting.

(2) Temperature peaks of 130 °C are allowed during defrosting.

SOLENOID VALVES FOR REFRIGERATING SYSTEMS

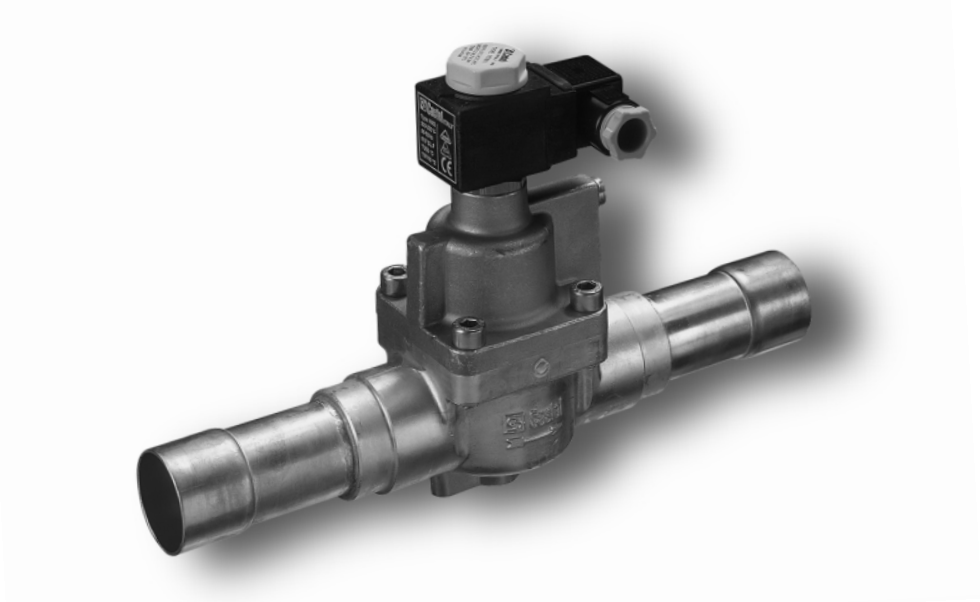
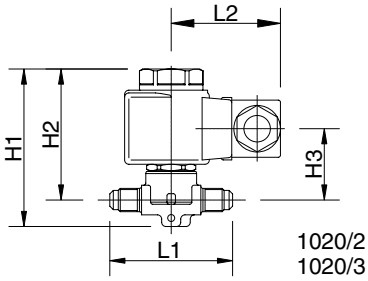


TABLE 2: Dimensions and Weights of NC valves with 9100 coil (1)

Catalogue Number	Dimensions [mm]						Weight [g]
	H_1	H_2	H_3	L_1	L_2	Q	
1020/2	75	62,5	34	58	50	–	340
1020/3				65			355
1028/2				125			350
1028/2E				125			350
1028/3				125			365
1028/M10				125			365
1064/3	82	69,5	40	68		–	400
1064/4				72			415
1068/3				111			400
1068/M10				111			395
1068/M12				127			420
1068/4				127			420
1070/4	91	75	47	100		45	710
1070/5				106			755
1078/M12				127			690
1078/4				127			680
1078/5				175			775
1079/7				190			765
1090/5	106	78	50	120		57	1035
1090/6				124			1365
1098/5				175			995
1098/6				175			1185
1098/7				180			1170
1099/9				216			1225
1078/9	115	96	72	250		80	2565
1079/11				292			2620
1098/9	157	127	99	235		68	2050
1099/11				277			2130
1078/11	172	138	110	278		68	2710
1079/13							2750
1079/M42							2750

(1) With coil type 9120 the dimension L_2 is equal to 64 mm and the valves weights must be increased of 305 g.



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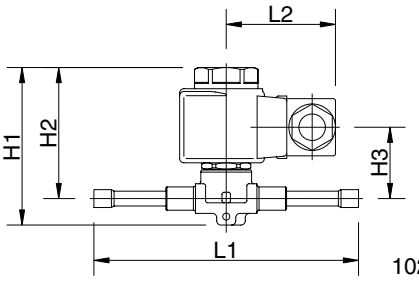
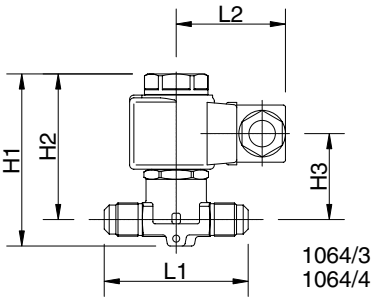
1020/3



1028/2
1028/2E
1028/3
1028/M10



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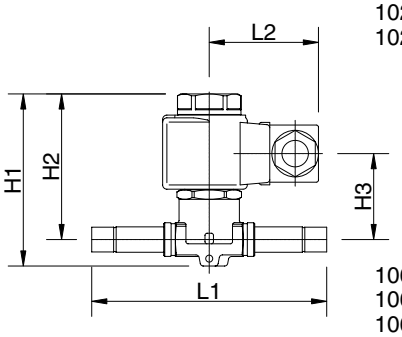
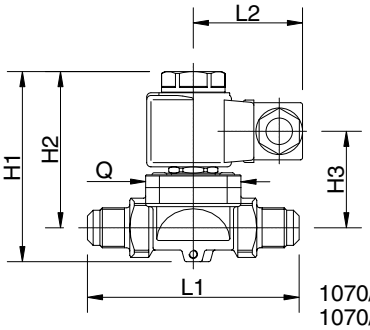
1064/4



1068/3
1068/4
1068/M10
1068/M12



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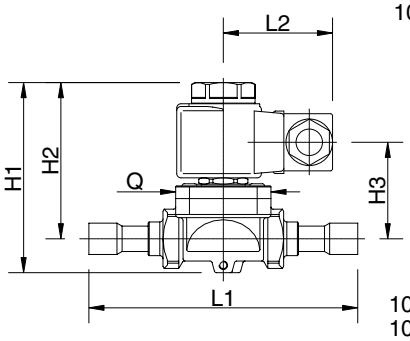
1070/5



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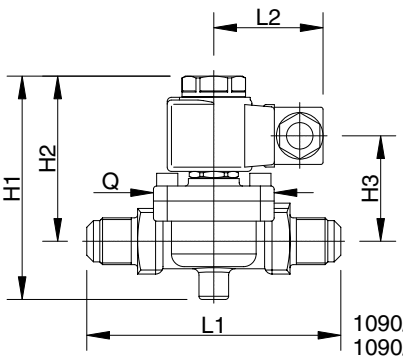
1078/5
1079/7



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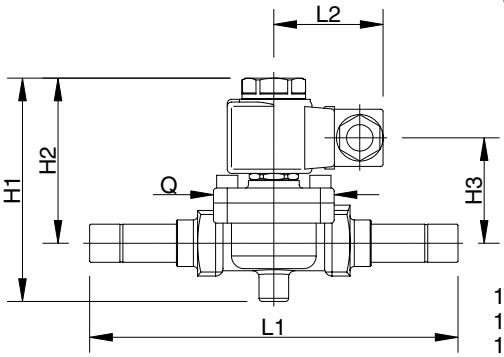
1090/6



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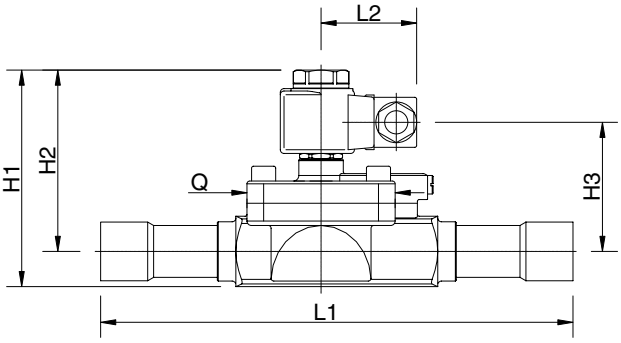
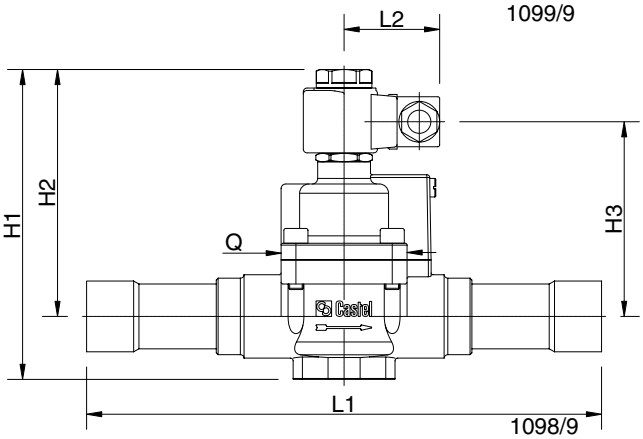
1098/7
1099/9



1078/9
1079/11



1098/9
1099/11
1078/11
1079/13
1079/M42

Connectors are not included in the boxes and have to be ordered separately.

SOLENOID VALVES FOR REFRIGERATING SYSTEMS

TABLE 3: Refrigerant Flow Capacity of NC valves

Catalogue Number	Refrigerant Flow Capacity [kW]											
	Liquid				Vapour				Hot Gas			
	R134a	R22	R407C	R404A	R134a	R22	R407C	R404A	R134a	R22	R407C	R404A
1020/2	2,95	3,15	3,28	2,08	–	–	–	–	1,49	2,05	2,03	1,75
1020/3	3,88	4,14	4,31	2,74					1,96	2,69	2,67	2,30
1028/2	2,53	2,70	2,81	1,79					1,28	1,76	1,74	1,50
1028/2E	3,88	4,14	4,31	2,74					1,96	2,69	2,67	2,30
1028/3												
1028/M10												
1064/3	13,5	14,4	15,0	9,5	1,73	2,16	2,14	1,81	6,8	9,4	9,3	8,0
1064/4												
1068/3												
1068/M10												
1068/M12												
1068/4												
1070/4	37,1	39,6	41,2	26,2	4,75	5,94	5,90	4,97	18,7	25,7	25,6	22,0
1070/5	44,0	47,0	48,9	31,1	5,64	7,05	6,99	5,90	22,2	30,5	30,3	26,1
1078/M12	37,1	39,6	41,2	26,2	4,75	5,94	5,90	4,97	18,7	25,7	25,6	22,0
1078/4												
1078/5	44,0	47,0	48,9	31,1	5,64	7,05	6,99	5,90	22,2	30,5	30,3	26,1
1079/7												
1090/5	64,0	68,4	71,2	45,2	8,2	10,3	10,2	8,6	32,3	44,5	44,2	38,0
1090/6	80,9	86,4	90,0	57,1	10,4	13,0	12,9	10,8	40,8	56,2	55,8	48,0
1098/5	64,0	68,4	71,2	45,2	8,2	10,3	10,2	8,6	32,3	44,5	44,2	38,0
1098/6	80,9	86,4	90,0	57,1	10,4	13,0	12,9	10,8	40,8	56,2	55,8	48,0
1098/7	96,0	102,6	106,8	67,8	12,3	15,4	15,3	12,9	48,5	66,7	66,2	57,0
1099/9												
1078/9	168,5	180,0	187,4	119,0	21,6	27,0	26,8	22,6	85,0	117,0	116,2	100,0
1079/11												
1098/9	168,5	180,0	187,4	119,0	21,6	27,0	26,8	22,6	85,0	117,0	116,2	100,0
1099/11												
1078/11	269,6	288,0	299,8	190,4	34,6	43,2	42,9	36,2	136,0	187,2	185,9	160,0
1079/13												
1079/M42												

Refrigerant flow capacity referred to the following operating conditions:
- *Evaporating temperature: + 4 °C*
- *Condensing temperature: + 38 °C*
- *Pressure drop: 0,15 bar*

Particularly for hot gas:
- *Suction temperature: + 18 °C*
- *Pressure drop: 1 bar*

TABLE 4: General Characteristics of NO valves (normally open)

Catalogue Number	Coil Type	Connections			Seat size nominal Ø [mm]	Kv Factor [m³/h]	Operating Principles	Opening Pressure Differential [bar]		TS [°C]		PS [bar]	Risk Category according to PED
		SAE Flare	ODS					min OPD	MOPD	min.	max.		
			Ø [in.]	Ø [mm]									
1164/3	HM3 (D.C.)	3/8"	–	–	7	0,80	Diaphragm Pilot Operated	0,05	21	– 35	+105 (1)	32	Art. 3.3
1168/3		–	3/8"	–									
1168/M10		–	–	10									
1170/4		1/2"	–	–	12,5	2,20							
1170/5		5/8"	–	–		2,61							
1178/M12		–	–	12		2,20							
1178/4		–	1/2"	–									
1178/5		–	5/8"	16		2,61							
1190/5		5/8"	–	–	16,5	3,80			19				
1190/6		3/4"	–	–		4,80							
1198/5		–	5/8"	16		3,80							
1198/6		–	3/4"	–		4,80							
1198/7		–	7/8"	22		5,70							
1178/9		–	1.1/8"	–	25,5	10							
1198/9		–	1.1/8"	–	25	10	Piston Pilot Operated	0,07			+110 (2)		
1178/11		–	1.3/8"	35	27	16							

(1) Temperature peaks of 120 °C are allowed during defrosting.

(2) Temperature peaks of 130 °C are allowed during defrosting.

SOLENOID VALVES FOR REFRIGERATING SYSTEMS

TABLE 5: Dimensions and Weights of NO valves with 9120 coil

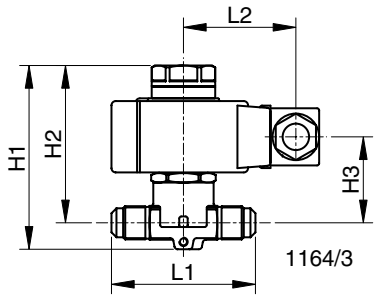
Catalogue Number	Dimensions [mm]						Weight [g]
	H_1	H_2	H_3	L_1	L_2	Q	
1164/3	87	74,5	40	68	64	–	705
1168/3				111			705
1168/M10				111			700
1170/4	96	80	47	100		45	1015
1170/5				106			1060
1178/M12				127			995
1178/4				127			985
1178/5				175			1080
1190/5	111	83	50	120		57	1340
1190/6				124			1670
1198/5				175			1300
1198/6				175			1490
1198/7				180			1475
1178/9	120	101	72	250		80	2870
1198/9	162	132	99	235		68	2355
1178/11	177	143	110	278		68	3015

TABLE 6: Refrigerant Flow Capacity of NO valves

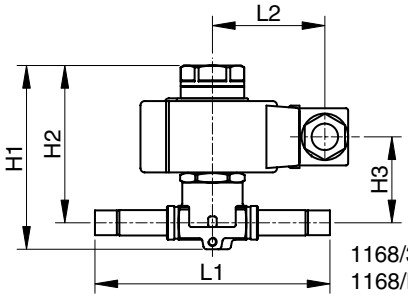
Catalogue Number	Refrigerant Flow Capacity [kW]											
	Liquid				Vapour				Hot Gas			
	R134a	R22	R407C	R404A	R134a	R22	R407C	R404A	R134a	R22	R407C	R404A
1164/3	13,5	14,4	15,0	9,5	1,73	2,16	2,14	1,81	6,8	9,4	9,3	8,0
1168/3												
1168/M10												
1170/4	37,1	39,6	41,2	26,2	4,75	5,94	5,90	4,97	18,7	25,7	25,6	22,0
1170/5	44,0	47,0	48,9	31,1	5,64	7,05	6,99	5,90	22,2	30,5	30,3	26,1
1178/M12	37,1	39,6	41,2	26,2	4,75	5,94	5,90	4,97	18,7	25,7	25,6	22,0
1178/4												
1178/5	44,0	47,0	48,9	31,1	5,64	7,05	6,99	5,90	22,2	30,5	30,3	26,1
1190/5	64,0	68,4	71,2	45,2	8,2	10,3	10,2	8,6	32,3	44,5	44,2	38,0
1190/6	80,9	86,4	90,0	57,1	10,4	13,0	12,9	10,8	40,8	56,2	55,8	48,0
1198/5	64,0	68,4	71,2	45,2	8,2	10,3	10,2	8,6	32,3	44,5	44,2	38,0
1198/6	80,9	86,4	90,0	57,1	10,4	13,0	12,9	10,8	40,8	56,2	55,8	48,0
1198/7	96,0	102,6	106,8	67,8	12,3	15,4	15,3	12,9	48,5	66,7	66,2	57,0
1178/9	168,5	180,0	187,4	119,0	21,6	27,0	26,8	22,6	85,0	117,0	116,2	100,0
1198/9	168,5	180,0	187,4	119,0	21,6	27,0	26,8	22,6	85,0	117,0	116,2	100,0
1178/11	269,6	288,0	299,8	190,4	34,6	43,2	42,9	36,2	136,0	187,2	185,9	160,0

Refrigerant flow capacity referred to the following operating conditions:
- *Evaporating temperature: + 4 °C*
- *Condensing temperature: + 38 °C*
- *Pressure drop: 0,15 bar*

Particularly for hot gas:
- *Suction temperature: + 18 °C*
- *Pressure drop: 1 bar*



1164/3



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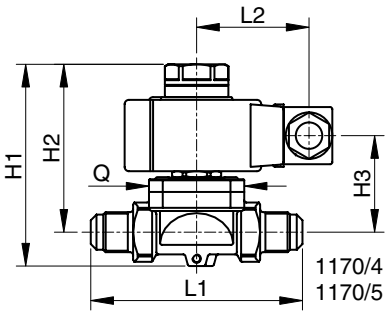
1168/M10



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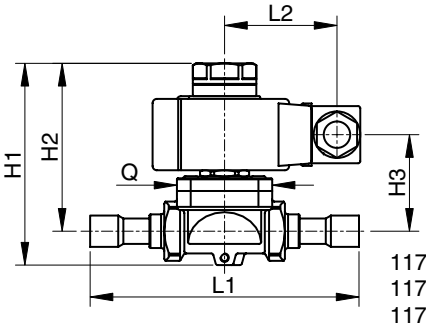

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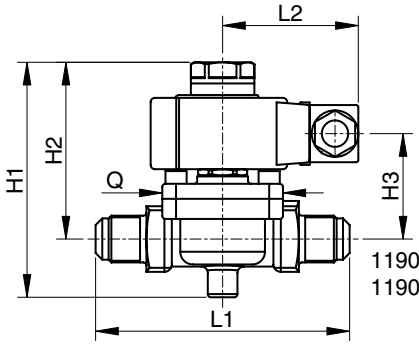
1178/5



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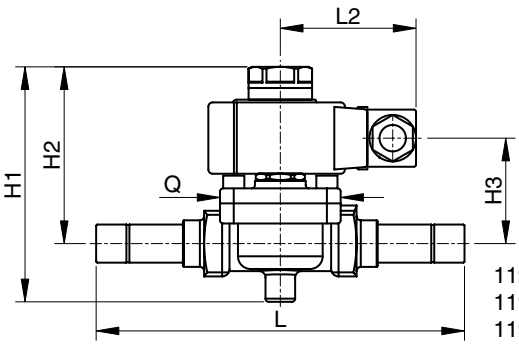
1190/6



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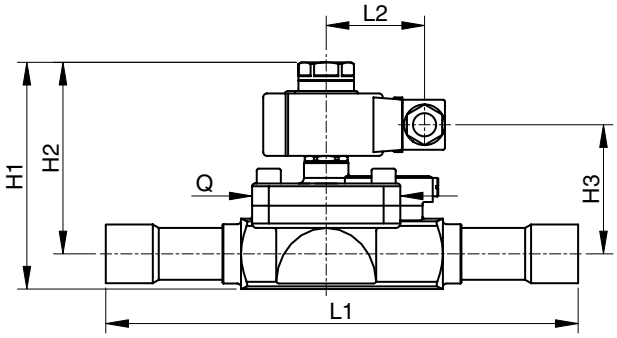
1198/7



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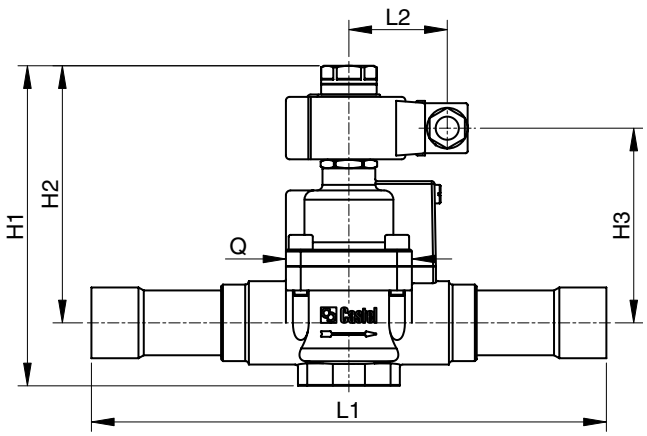

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Connectors and coils are not included in the boxes and have to be ordered separately.

COILS

APPLICATION

For the normally closed solenoid valves, previously shown in this Handbook, Castel puts the following types of coils at disposal of its own customers:

- coils series HM2, only for A.C. (catalogue number 9100);
- coils series CM2, only for A.C. (catalogue number 9110);
- coils series HM3, only for D.C. (catalogue number 9120).

For the normally open solenoid valves, always shown in this Handbook, the customer's selection must compulsorily apply to the coils series HM3.
For applications of the NO solenoid valves with a voltage supply of 220 VAC, Castel has designed a specific coil at 220 V RAC (code 9120/RD6) that must be used solely with the 220 VAC connector/rectifier circuit (code 9150/R45).
For applications of the same NO valves with a voltage supply of 24 VAC, Castel suggests to the user the 24 VDC coil (code 9120/RD2) with the 24 VAC connector/rectifier circuit (code 9150/R44).

CONSTRUCTION

Coils HM2, CM2 and HM3 are class F in compliance with IEC 85 standard and their construction is in compliance with EN 60730-1 and EN 60730-2-8 standards.
The windings are made with copper wire, insulation class H 180 °C, in compliance with IEC 85 standard. The outer casing is provided with dielectric and waterproof resins that assure a reinforced insulation making the coils suitable for all assemblies.
Protection against electric contacts is class I. Therefore, for safety purposes, coils must be effectively connected to an earthing system. Rubber gaskets on the upper and lower ends of coil ensure moisture protection of winding; protection degree of the complete system coil + connector is IP-65 according to EN 60529.
The terminals of the coils series HM2 and HM3 consist of two Faston line connections plus one Faston earthing connection, positioned so as to receive the DIN 43650 junction box connector. Coil type CM2 has a pre-assembled cable (length 1 meter).
The coils are designed for continuous use. The solid construction of these coils is suitable for heavy-duty applications in refrigerant systems. The maximum ambient temperature for all coils is 50 °C.

ELECTRIC TYPE APPROVAL

HM2 and CM2 coils, 220/230V-50/60Hz and 240V-50/60Hz, are approved by the leading European registration bodies such as VDE (Germany), IMQ (Italy). Consequently, they guarantee maximum safety to both people and facilities. Moreover, HM2 and CM2 coils, 110V-50/60Hz and 220/230V-50/60Hz, are manufactured according to Low Voltage Directives EC 73/23, EC 93/68 and to EMC Directives 89/336, EC 92/31, EC 93/68.

TABLE 1: General Characteristics of coils

Coil Type	Catalogue Number	Voltage [V]	Voltage tollerance [%]	Frequecy [Hz]	Connections	Weight [g]
HM2	9100/RA2	24 A.C.	+10 / -10	50 / 60	Junction box DIN 43650	165
	9100/RA4	110 A.C.				
	9100/RA6	220/230 A.C.	+6 / -10			
	9100/RA7	240 A.C.	+10 / -10			
	9100/RA8	380 A.C.				
CM2	9110/RA2	24 A.C.	+10 / -10	50 / 60	three wire cable	230
	9110/RA4	110 A.C.				
	9110/RA6	220/230 A.C.	+6 / -10			
	9110/RA7	240 A.C.	+10 / -10			
HM3	9120/RD1	12 D.C.	+10 / -5	–	Junction box DIN 43650	470
	9120/RD2	24 D.C.				
	9120/RD4	48 D.C.				
	9120/RD6	220 RAC				

TABLE 2: Coils Consumptions

Catalogue Number	Consumption with NC valves (at 20 °C) [mA]						Consumption with NO valves (at 20 °C) [mA]					
	Start			Working			Start			Working		
	50 [Hz]	60 [Hz]	D.C.	50 [Hz]	60 [Hz]	D.C.	50 [Hz]	60 [Hz]	D.C.	50 [Hz]	60 [Hz]	D.C.
9100/RA2	920	825	–	500	375	–	1355	1226	–	706	505	–
9100/RA4	230	205		128	95		302	277		156	117	
9100/RA6	120	105		68	48		156	145		85	65	
9100/RA7	100	87		57	41		128	120		68	54	
9100/RA8	58	51		32	23		80	76		44	36	
9110/RA2	920	825	–	500	375	–	1355	1226	–	706	505	–
9110/RA4	230	205		128	95		302	277		156	117	
9110/RA6	120	105		68	48		156	145		85	65	
9110/RA7	100	87		57	41		128	120		68	54	
9120/RD1	–	–	1835	–	–	1835	–	–	1835	–	–	1835
9120/RD2			930			930			930			930
9120/RD4			450			450			450			450
9120/RD6			–			–			93			93

CONNECTORS

The standard junction box DIN 43650 represents an effective system for the connection of the coil to the supply circuit, thus ensuring safety also in the presence of high humidity values.
The junction box type 9150, according to assembly requirements, allows to choose the position of outer casing compared to inner terminal block. The clamping screw of casing may be PG9 or PG11, which are respectively suitable for cables with an external diameter of 6 ÷ 8 or 8 ÷ 10 mm. Cables sized 3 x 0,75 mm^2 are to be preferred.
The junction box type 9900 is available with cabled core of different length. In this case, it is not possible to change the position of casing compared to terminal block.
Both the two types offer a protection degree IP 65 against dust and water, according to EN 60529, when correctly installed with the proper gaskets which are supplied as standard.
The junction box 9150/R44 and 9150/R45 are equipped with a full-wave bridge rectifier plus VDR for protection.
The VDR device, Voltage e-Dependent-Resistor, is a special type of resistor, placed in parallel to the coil; its purpose is to protect the diodes and the coil from any excessive voltage generated within the ac supply circuit.

TABLE 3: General Characteristics of connectors

Catalogue Number	Supply Voltage [V]		Pg	Cable length [m]	Cable thickness [mm^2]	Standard	Degree of protection	Class of insulation
	Nominal	Maximum						
9150/R01	–	–	9	–	–	DIN 43650	IP 65 EN 60529	Group C VDE 0110-1 / 89
9150/R02			11					
9150/R44	24 A.C.	30 A.C.						
9150/R45	220 A.C.	250 A.C.						
9900/X66	–	–	–	1	3 x 0,75			
9900/X73				2				
9900/X55				3				
9900/X54				5				

SOLENOID VALVES FOR DIFFERENT FLUIDS

Connectors are not included in the boxes and have to be ordered separately.

APPLICATIONS

The solenoid valves, shown in this chapter, are classified “Pressure accessories” in the sense of the Pressure Equipment Directive 97/23/EC, Article 1, Section 2.1.4 and are subject of Article 3, Section 1.3 of the same Directive.
They are designed for the applications specified in Table 1 where the different fluids are indicated with the following symbols, according to an already established code:
- W = Water;
- L = Air;
- B = Secondary coolants (solutions of glycol and water);
- O = Light oils (gas oil).

In short these valves may be used:
- with fluids in the gaseous state proper to the Group II (as defined in Article 9, Section 2.2 of Directive 97/23/EC and referred to in Directive 67/548/EEC);
- with fluids in the liquid state proper to the Group I (as defined in Article 9, Section 2.1 of Directive 97/23/CE and referred to in Directive 67/548/EEC).

OPERATION

All the valves for different fluids are normally closed. NC = when the coil is de-energised the plunger stops the refrigerant flow.
The valves series 1512 and 1522 are direct acting, while the valves series 1132 and 1142 are pilot operated with diaphragm.

CONSTRUCTION

The main parts of the valves are made with the following materials:
- hot forged brass EN 12420 – CW 617N for body and cover;
- austenitic stainless steel EN 10088-2 – 1.4303 for enclosure where the plunger moves;
- ferritic stainless steel EN 10088-3 – 1.4105 for plunger;
- austenitic stainless steel EN ISO 3506 – A2-70 for tightening screws between body and cover;
- fluorocarbon rubber (FPM) for outlet seal gaskets;
- fluorocarbon rubber (FPM) for seat gaskets;
- fluorocarbon rubber (FPM) for diaphragms. Nitril rubber (NBR) for the valves series 1142.

INSTALLATION

Table 1 shows the following functional characteristics of a solenoid valve:
- PS;
- TS;
- Kv factor;
- minimum Opening Pressure Differential (minOPD), that is the minimum pressure differential between inlet and outlet at which a solenoid valve, pilot operated, can open and stay opened;
- maximum Opening Pressure Differential (MOPD according to ARI STANDARD 760: 2001), that is the maximum pressure differential between inlet and outlet at which a solenoid valve, pilot operated, can open.

Before connecting the valve it is advisable to make sure that the piping are clean and that the flow direction in the pipe corresponds to the arrow stamped on the body of the valve.
All valves can be mounted in whatever position except with the coil pointing downwards.
Before connecting a valve to the electrical system, be sure that the line voltage and frequency correspond to the values marked on the coil.

TABELLA 1: General Characteristics

Catalogue Number	Coil Type	Main Use	FTP Connections	Seat Size nominal Ø [mm]	Kv Factor [m³/h]	Operating Principles	Opening Pressure Differential [bar]		TS [°C]		PS [bar]	Risk Category according to PED
							min OPD	MOPD	min.	max.		
1512/01	HM2 (A.C.) - CM2 (A.C.) - HM3 (D.C.)	W.L.O.	G 1/8"	1,5	0,070	Direct Acting	0	30	-15	+105	30	Art. 3.3
1522/02		W.O.	G 1/4"	4,5	0,40			4				
1522/03			G 3/8"									
1522/04			G 1/2"									
1132/03		W.L.O.B.	G 3/8"	12,5	2,10	Diaphragm Pilot Operated	0,1	17				
1132/04			G 1/2"		2,20							
1132/06			G 3/4"	20	5,50		0,15	12			15	
1132/08			G 1"		6,00							
1142/010			G 1.1/4"	38	19,00		0,3	11		+90		
1142/012			G 1.1/2"		21,00							

VISCOSITY

The values of maximum differential pressure specified in Table 1 are suitable for fluids with maximum cinematic viscosity of 12 cSt where:

$1cSt = 10^{-6}\ m^2/sec.$

If the cinematic viscosity of the fluid under consideration is more than 12 cSt it is necessary to multiply the value of the maximum differential pressure by the following reducing factors:

Viscosity cSt	Reducing Factor
12	1
12 ÷ 30	0,8
30 ÷ 45	0,7

When the viscosity of the liquid is expressed as dynamic viscosity, i.e. cP, where:

$1cP = 10^{-3}\ N\ sec/m^2$

the corresponding value of cinematic viscosity in cSt is obtained by the following relation:

$$\nu = \frac{\mu}{\rho}$$

where:
ν = cinematic viscosity [cSt];
μ = dynamic viscosity [cP];
ρ = volumic mass of the fluid at the considered temperature [kg/dm³].

Moreover, the fluid viscosity may remarkably vary according to changes in temperature. Therefore, if the temperature of the fluid does not ensure viscosity values compatible with the correct operation of the valve, the valve may not open.

LIQUIDS CAPACITY

The following ratio applies:

$$Q = kv\ \sqrt{\frac{\Delta p}{\rho}}$$

where:
kv = kv factor of the valve [m³/h];
Q = capacity [m³/h];
Δp = pressure drop through the valve [bar];
ρ = volumic mass of the liquid [kg/dm³].

AIR CAPACITY

Table 2 provides the values of air capacity under the following conditions:

- temperature at valve inlet = 20 °C;
- discharge pressure (absolute) = 1 bar;
- kv of the valve under consideration = 1 m³/h.

The pressures upstream the valve specified in the table are absolute values.

EXAMPLE

Select the valve suitable for use with approximately 200 m³/h of air, assuming an absolute pressure of 8 bars at valve inlet (= 7 bars of relative pressure + 1 bar) and an acceptable pressure drop across the valve of 1,5 bars. In the column of pressures upstream the valve, the value 8 is shown; where this column intersects the horizontal column relating to the pressure drop of 1,5, the value of 87 m³/h is shown. This is the capacity value of a hypothetical valve with kv = 1.

working under the above mentioned conditions.

200 / 87 = 2,29

This is the kv value required in the case under consideration.
In Table 1, select the valve with the kv value nearest to 2,29, rounding off the value and subsequently checking that all the characteristics of the selected valve (max. opening pressure differential, temperature, connections, etc.) are suitable.

TABLE 2 - Air Capacity (kv = 1)

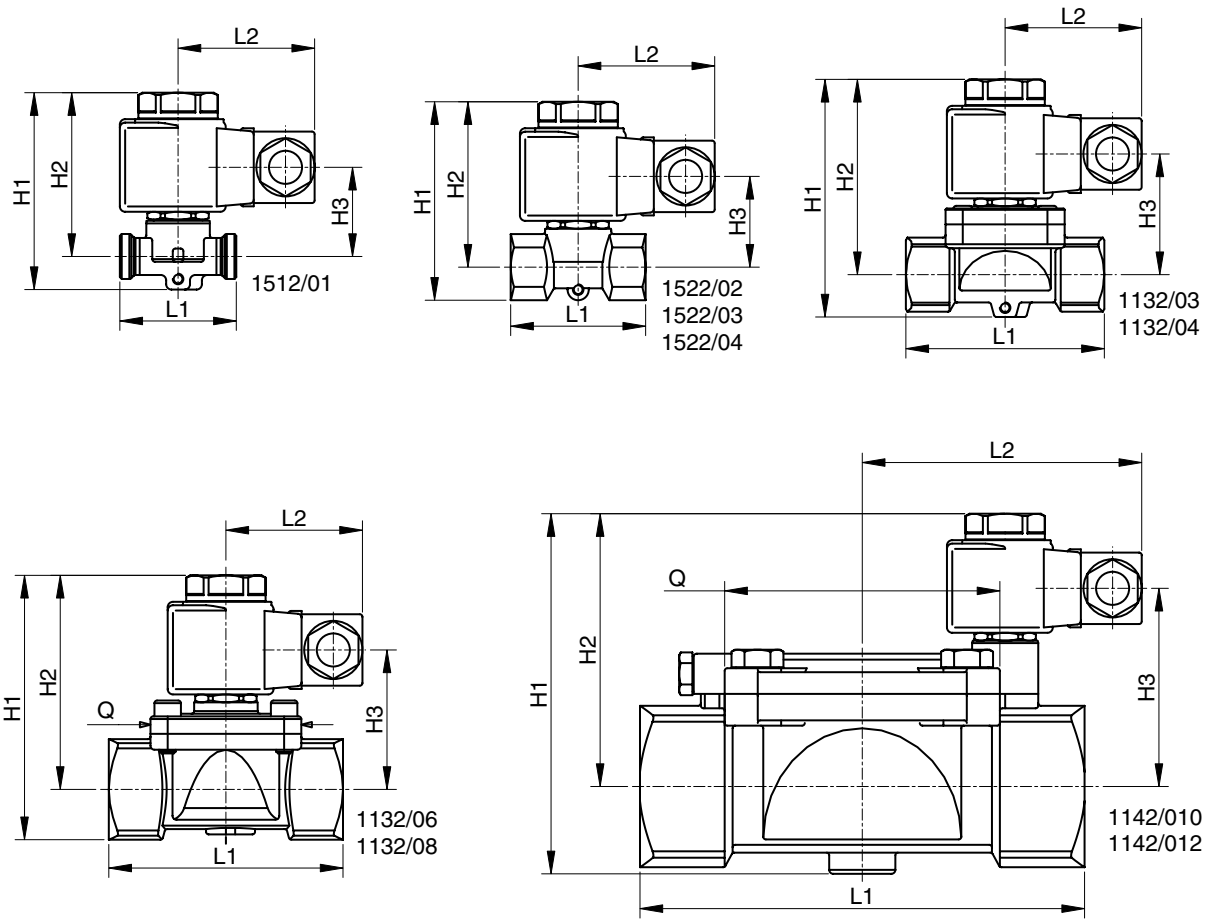
Pressure drop [bar]	Capacity [m³/h] (1) — INLET PRESSURE (absolute) [bar]																								
	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1,5	1,3	1,2	1,1	1,05	1,03	1,015
0,0025																					1,46	1,42	1,40	1,35
0,005																				2,2	2,10	2,00	1,95	1,90
0,010																			3,0	3,0	3,00	2,85	2,80	2,75
0,015																		4,2	3,9	3,7	3,55	3,45	3,40	3,35
0,025																	6,2	5,4	5,0	4,8	4,56	4,45	4,40	
0,05																10,7	8,7	7,5	6,9	6,6	6,40	6,20		
0,10															17,4	15,0	12,2	10,2	9,6	9,2	8,80			
0,15														23,8	21,2	18,3	14,6	12,5	11,5	11,0				
0,25													33,4	30,4	27,0	23,2	18,5	15,6	13,9					
0,5	82,0	80,0	77,0	74,0	72,0	69,5	66,6	63,7	60,6	57,3	54,0	50,0	46,0	41,7	36,8	31,0	24,3	19,6						
1	115,0	111,0	108,0	104,0	100,0	96,0	92,0	88,0	83,0	78,6	73,5	68,0	62,0	55,6	48,0	39,3	27,8							
1,5	138,0	134,0	130,0	125,0	120,0	115,5	110,3	105,0	99,3	93,0	87,0	80,0	72,0	63,7	53,8	41,7								
2	157,0	152,0	147,0	142,0	136,0	130,0	124,0	118,0	111,0	96,0	96,0	88,0	78,0	68,0	55,6									
2,5	173,0	167,5	161,5	155,5	149,0	142,5	135,5	128,0	120,4	112,0	103,0	89,5	82,0	69,5										
3	186,0	180,0	174,0	167,0	160,0	152,0	144,5	136,0	127,0	118,0	108,0	96,0	83,0											
3,5	198,0	191,0	184,0	176,5	168,6	160,3	151,7	142,5	132,6	122,0	110,0	97,0												
4	208,0	200,0	193,0	184,0	176,0	167,0	157,0	147,0	136,0	124,0	111,0													
4,5	216,0	208,6	200,0	191,0	182,0	172,0	161,5	150,4	138,0	125,0														
5	224,0	215,0	206,0	195,5	186,0	176,0	164,5	152,3	139,0															
5,5	230,0	221,0	211,0	201,0	190,0	178,6	166,3	152,9																
6	236,0	226,0	215,0	204,0	192,7	180,0	166,8																	
6,5	240,0	230,0	218,0	206,7	194,0	180,7																		
7	244,0	233,0	220,0	208,0	194,7																			
7,5	246,0	234,0	222,0	208,5																				
8	249,0	236,0	222,5																					
8,5	250,0	236,5																						
9	250,5																							

(1) The table provides air capacity values in m³/h under the following conditions:
– temperature at value inlet: + 20°C
– pressure at outlet (absolute): 1 bar
– kv of the solenoid valve: 1 m³/h

TABLE 3 - Dimensions and Weight (Valves for coils 9100)

Catalogue Number	Dimensions [mm]						Weight [g]
	H_1	H_2	H_3	L_1	L_2	❑	
1132/03	86	70	47	75	50	45	670
1132/04							635
1132/06	101	81	52	88		57	960
1132/08							670
1142/010	136	103	82	168	104	104	4100
1142/012							4000
1512/01	69	57	34	44	50	–	310
1522/02	71	59	36	51		–	385
1522/03							370
1522/04							355

For coils 9120 the dimension L_2 is equal to 64 mm and the weight must be increased of 305 g.



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