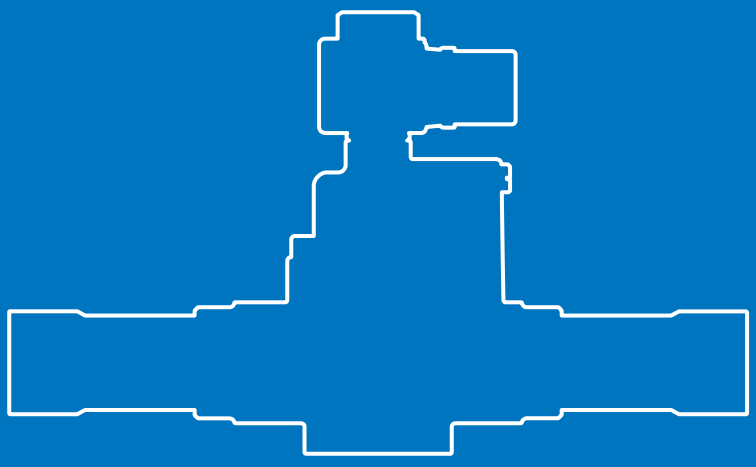

HANDBOOK
SOLENOID VALVES

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Castel®
Italian technology

CHAPTER 3
NORMALLY-CLOSED PULSE SOLENOID VALVES
FOR REFRIGERATION PLANTS THAT USE HFC OR HFO REFRIGERANTS

APPLICATION
The solenoid valves illustrated in this chapter are designed for applications that require a solenoid valve that cycles at high frequencies for a short period, to accurately maintain the regulated temperature of the refrigeration fluid. They can be installed on systems that use the following refrigerant fluids:
- HFC (R134a , R404A , R407C , R410A , 507)
- HFO and HFO/HFC mixtures (R1234ze , R448A , R449A , R450A , and 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 solenoid valves can also be installed on systems that use 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.
CAUTION!: The pulse solenoid valves in this chapter cannot be used with R22, mineral oils, or alkylbenzene oils.

OPERATION
The valves listed in this chapter are normally closed valves (NC). This means that when the coil is not energised, the plunger closes the fluid flow. When the coil is energised, the plunger opens the valve seat connecting the inlet to the outlet.

All the valves are exclusively sold in the model without coil (suffix S). These valves can be coupled with the coils in series 9100, 9110, 9120, 9160, 9300, and 9320.

The valves series 1328N are direct acting valves. Their operation depends only on the magnetic field produced by the current flow into the coil. Opening/closing of main valve seat, the only seat, is directly controlled by the mobile plunger.
These valves can work with zero pressure differential.

The valves in series 1338N are pilot-operated piston solenoid valves. Their operation depends not only on the magnetic field produced by the current flow into the coil, but also on a minimum inlet pressure, which is necessary to:
- open the piston and keep it lifted off the main opening
- close the piston and ensure the tightness on the main opening

Opening/closing of main valve seat is controlled by the piston, while opening/closing of pilot seat is controlled by the mobile plunger of the coil.
These valves cannot work with zero differential pressure.

CONSTRUCTION
The NC pulse solenoid valves are equipped with a specific reinforced magnetic unit (mobile plunger + valve sleeve for holding it), specifically designed to guarantee a very high number of work cycles compared to a normal NC solenoid valve.
The main parts of the solenoid valves described in this chapter are constructed with the following materials:
- Hot forged brass EN 12420 – CW 617N for body and cover
- Copper tube EN 12735-1 – Cu-DHP for solder connections

- Hot forged brass EN 12420 – CW 724R for mobile plunger valve sleeve
- Ferritic stainless steel EN 10088-3 – 1.4105 for the fixed and mobile plungers
- Hydrogenated nitrile butadiene rubber (HNBR) for outlet seal gaskets
- P.T.F.E. for seat gaskets

INSTALLATION

The valve series 1328N and 1338N can be used as either a hot gas by-pass valve between the high and the low pressure sides of a system or as a liquid injection valve, within the limits of use indicated in TABLE 9 and the capacities indicated in TABLE 11.
TABLE 9 shows the following functional characteristics of a solenoid valve:

- Connection dimensions
- PS: maximum allowable pressure of the refrigerant
- TS: maximum / minimum allowable temperature of the refrigerant
- TA: maximum / minimum allowable ambient temperature
- Kv: discharge factor
- minOPD: minimum Opening Pressure Differential. This is the minimum pressure differential between inlet and outlet at which a pilot-operated solenoid valve can open and stay opened or close and maintain the seal.
- MOPD: maximum Opening Pressure Differential according to AHRI STANDARD 760 : 2014. This is the maximum pressure differential between inlet and outlet at which a solenoid valve can open.
- No. of Cycles: useful operational life expected for the valve expressed in the number of operating cycles, considering a complete cycle consisting of an opening and successive closing of the valve.

Before connecting the valve to the pipe, it is advisable to make sure that the refrigerating system is clean. In fact, valves with P.T.F.E. gaskets, and particularly piston valves, are sensitive to dirt and debris. Furthermore, check that the flow direction in the pipe corresponds to the arrow stamped on the valve body. All the valves can be mounted in any position so long as the coil does not point 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 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.
Before connecting a valve to the electrical system, be sure that the line voltage and frequency correspond to the values marked on the coil.

TRACEABILITY

The direct action valves in series 1328N and the pilot-operated solenoid valves in series 1338N are identified by a plastic label fit on the valve enclosure of the mobile plunger. This label includes the following data: valve code, refrigerants, PS, TS, and production lot.

TABLE 9: General Characteristics of NC pulse valves with ODS connections

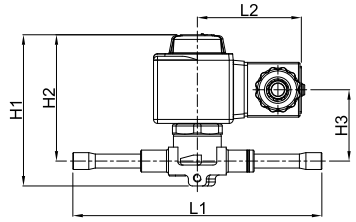
Operating Principles	Catalogue Number	Connections ODS		Seat size nominal Ø [mm]	Kv Factor [m³/h]	Opening Pressure Differential [bar]					PS [bar]	TS [°C]		TA [°C]		Cycles No min	Risk Category according to PED Recast
							MOPD										
							coil series										
		Ø [in.]	Ø [mm]			min OPD	9100 9110 9300 (AC)	9160 (AC)	9120 9320 (AC)	9120 9320 (DC)		min.	max.	min. (2)	max.		
Direct Acting	1328N/2S020 (1)	1/4"	–	2,2	0,15	0	28	30	35	21	45	– 40	+150	– 40	+50	6.000.000	Art. 4.3
	1328N/2S030 (1)	1/4"	–	3	0,23	0	18	21	25	18							
	1328N/3S020 (1)	3/8"	–	2,2	0,15	0	28	30	35	21							
	1328N/3S030 (1)	3/8"	–	3	0,23	0	18	21	25	18							
	1328N/M13S020 (1)	–	10	2,2	0,15	0	28	30	35	21							
	1328N/M13S030 (1)	–	10	3	0,23	0	18	21	25	18							
Piston Pilot Operated	1338N/3S065 (1)	3/8"	–	6,5	1,00	0,05	21	28	35	18	45	– 40	+150	– 40	+50	6.000.000	Art. 4.3
	1338N/M10S065 (1)	–	10														
	1338N/M12S065 (1)	–	12														
	1338N/4S065 (1)	1/2"	–														

(1) NB: No use with R22, mineral and alchylbenzene oils
(2) Check TA_{min} of the chosen coil

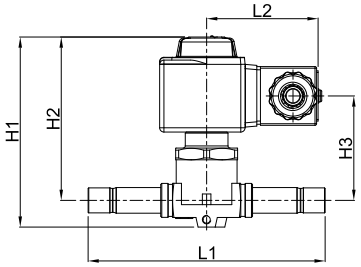
TABLE 10: Dimensions and Weights of NC pulse valves with 9300 coils (1)								
Operating Principles	Catalogue Number	Dimensions [mm]						Weight [g]
		H_1	H_2	H_3	L_1	L_2	Q	
Direct Acting	1328N/2S020 (1)	75	62,5	34	125	52	–	350
	1328N/2S030 (1)							350
	1328N/3S020 (1)							365
	1328N/3S030 (1)							365
	1328N/M13S020 (1)							365
	1328N/M13S030 (1)							365
Piston Pilot Operated	1338N/3S065 (1)	92,5	80	50,5	111	52	–	440
	1338N/M10S065 (1)				111			435
	1338N/M12S065 (1)				127			462
	1338N/4S065 (1)				127			462

(1) : With coil 9320 the dimension L_2 is equal to 65 mm and theweights must be increased of 500 g.

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



1328N/2
1328N/3
1328N/M10



1338N/3
1338N/M10
1338N/M12
1338N/4

TABLE 11: Refrigerant Flow Capacity of NC pulse valves [kW]

Operating Principles	Catalogue Number	Liquid line											
		R134a	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
Direct Acting	1328N/2S020	2,55	3,77	1,79	2,58	2,58	1,73	1,89	2,26	2,35	2,36	2,39	1,82
	1328N/2S030	3,91	5,78	2,74	3,96	3,95	2,65	2,89	3,46	3,60	3,62	3,66	2,79
	1328N/3S020	2,55	3,77	1,79	2,58	2,58	1,73	1,89	2,26	2,35	2,36	2,39	1,82
	1328N/3S030	3,91	5,78	2,74	3,96	3,95	2,65	2,89	3,46	3,60	3,62	3,66	2,79
	1328N/M13S020	2,55	3,77	1,79	2,58	2,58	1,73	1,89	2,26	2,35	2,36	2,39	1,82
	1328N/M13S030	3,91	5,78	2,74	3,96	3,95	2,65	2,89	3,46	3,60	3,62	3,66	2,79
Diaphragm Pilot Operated	1338N/3S065	13,6	20,1	9,5	13,8	13,7	9,2	10,1	12,0	12,5	12,6	12,7	9,7
	1338N/M10S065												
	1338N/M12S065												
	1338N/4S065												

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TABLE 11: Refrigerant Flow Capacity of NC pulse valves [kW]

Operating Principles	Catalogue Number	Hot Gas line											
		R134a	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
Direct Acting	1328N/2S020	1,28	2,72	1,44	1,79	2,04	1,43	1,00	1,03	1,77	1,62	1,15	1,50
	1328N/2S030	1,96	4,18	2,21	2,74	3,13	2,19	1,53	1,58	2,71	2,48	1,76	2,30
	1328N/3S020	1,28	2,72	1,44	1,79	2,04	1,43	1,00	1,03	1,77	1,62	1,15	1,50
	1328N/3S030	1,96	4,18	2,21	2,74	3,13	2,19	1,53	1,58	2,71	2,48	1,76	2,30
	1328N/M13S020	1,28	2,72	1,44	1,79	2,04	1,43	1,00	1,03	1,77	1,62	1,15	1,50
	1328N/M13S030	1,96	4,18	2,21	2,74	3,13	2,19	1,53	1,58	2,71	2,48	1,76	2,30
Diaphragm Pilot Operated	1338N/3S065	6,8	14,5	7,7	9,5	10,9	7,6	5,3	5,5	9,4	8,6	6,1	8,0
	1338N/M10S065												
	1338N/M12S065												
	1338N/4S065												

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Standard rating conditions according to AHRI Standard 760-2007

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

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