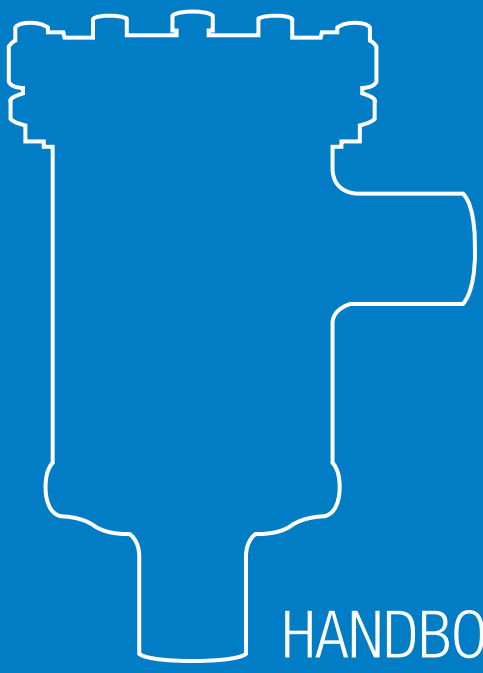


HANDBOOK

REFRIGERATING SYSTEM PROTECTORS

Castel®
Italian technology

Ed. 2017

CHAPTER 6
HERMETIC FILTER DRIERS WITH MOISTURE INDICATOR
CERTIFIED BY UNDERWRITERS LABORATORIES INC.
FOR REFRIGERATION PLANTS THAT USE HCFC, HFC OR HFO REFRIGERANTS

APPLICATIONS
The filters 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, 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.
The filters can be installed on systems that use the following refrigerant 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 filters in series 41 are drying filters for the liquid line with a moisture/liquid indicator brazed directly onto the outlet of the filter. This unit reduces the amount of field brazing required and the potential risk for refrigerant fluid leaks. The indicators ensure fast safe inspection of the conditions of the refrigerant fluid in the circuit regarding regular flow and the presence of moisture. The filter is completely manufactured in steel, with threaded SAE FLARE or ODS soldered connections in copper plated steel. The indicator is manufactured with the glass “lens” directly fused onto a steel metallic ring, with proper surface protection.
The cartridges are made from moulding a dehydrating filler made completely from 3 Å molecular sieves, with a suitable binder. The choice of using only 3 Å molecular sieves as the dehydrating material grants the cartridge extraordinary moisture adsorption capacity while maintaining reasonable deacidifying characteristics. The manufacturing process allows the product to be compact and strong, making it resistant to impact and abrasion.

OPERATION
The moisture/liquid indicators consist of a sensitive ring element that changes colour, from green to yellow, according to the percent moisture in the system.
The moisture content values that correspond to the “green” colour can be considered admissible for the proper operation of the system. When the sensitive element starts to yellow, “Chartreuse green”, the threshold value has been reached and operating conditions could become difficult. When the sensitive element becomes “yellow”, it’s time to replace the filter dryer.
If the charge and operating conditions of the plant are normal, the refrigerant fluid appears perfectly liquid underneath the “lens” of the indicator. The presence of bubbles indicates that the refrigerant fluid is partially evaporating along the liquid line.

INSTALLATION
At start-up, the colour of the sensitive element may be yellow, due to exposure to air humidity or due to moisture in the circuit. When the moisture of the refrigerant is returned to acceptable levels by the filter drier, the indicator colour turns green again. This is evidence that equilibrium has been re-established. If the yellow colour persists, measures must be taken to eliminate moisture. Only when the

sensitive element turns green again, is there evidence that measures adopted were effective. About 12 hours of system operation are required to achieve equilibrium. In any case, the moisture indication is usually read when the plant is in function and the fluid is flowing

Brazing of the filter/indicator with solder connections should be carried out with care, using a low melting point filler material (min. 5% Ag). Avoid direct contact between the torch flame and the indicator body or glass, which could be damaged and compromise the proper functioning of the indicator.

APPROVALS

Filters in series 41 have been approved by the American certification authority Underwriters Laboratories Inc. These filters are certified **UL Listed** for the USA with file SA7054, in compliance with American standard UL 207.

TABLE 27: General characteristics of hermetic filter driers with sight glass

Catalogue Number		International Reference	Block Filtering Surface [cm^2]	Nominal Volume [cm^3]	Connections					PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
					ODS			ODM			min.	max.	min.	max.	
SAE Flare	ODS				SAE Flare	Ø [in.]	Ø [mm]	Ø [in.]	Ø [mm]						
4105/2	–	052	70	80	1/4"	–				45 (1)	– 40	+ 80	– 20	+ 50	Art. 4.3
–	4105/2S	052S			–	1/4"	–	3/8"	–						
4105/3	–	053			3/8"	–									
–	4105/3S	053S			–	3/8"	–	1/2"	–						
4108/2	–	082	103	130	1/4"	–									
–	4108/2S	082S			–	1/4"	–	3/8"	–						
4108/3	–	083			3/8"	–									
–	4108/3S	083S			–	3/8"	–	1/2"	–						
–	4108/M10S	–			–	–	10	–	12						
–	4108/M12S	–			–	–	12	–	14						
4108/4	–	084			1/2"	–									
–	4108/4S	084S			–	1/2"	–	5/8"	16						
4116/3	–	163	155	250	3/8"	–									
–	4116/3S	163S			–	3/8"	–	1/2"	–						
–	4116/M10S	–			–	–	10	–	12						
–	4116/M12S	–			–	–	12	–	14						
4116/4	–	164			1/2"	–									
–	4116/4S	164S			–	1/2"	–	5/8"	16						
4116/5	–	165			5/8"	–									
–	4116/5S	165S			–	5/8"	16	3/4"	–						
41326/6	–	306	255	500	3/4"	–									
–	4132/6S	306S			–	3/4"		7/8"	–						
–	4132/7S	307S			–	7/8"		1.1/8"	–						

(1) : MWP = 435 psi according to UL approval for filters series 4105 , 4132
MWP = 400 psi according to UL approval for filters series 4108 , 4116

TABLE 28: Refrigerant flow capacity of hermetic filter driers with sight glass

Catalogue Number	Pressure drop 0,07 bar (1) [kW]												
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
4105/2	6,6	7,2	31,8	4,7	6,8	7,0	4,6	4,8	5,8	6,3	6,2	5,3	4,8
4105/2S	8,2	8,9	39,3	5,8	8,4	8,6	5,7	5,9	7,2	7,8	7,7	6,5	5,9
4105/3	15,2	16,6	73,2	10,9	15,7	16,1	10,5	11,0	13,4	14,5	14,3	12,2	11,0
4105/3S	19,3	21,0	92,7	13,7	19,8	20,3	13,3	14,0	17,0	18,3	18,1	15,4	13,9
4108/2	6,9	7,5	33,1	4,9	7,1	7,3	4,8	5,0	6,1	6,5	6,5	5,5	5,0
4108/2S	8,4	9,2	40,6	6,0	8,7	8,9	5,8	6,1	7,5	8,0	7,9	6,7	6,1
4108/3	17,9	19,5	86,0	12,8	18,4	18,9	12,4	13,0	15,8	17,0	16,8	14,3	12,9
4108/3S	22,6	24,7	109,0	16,2	23,3	23,9	15,7	16,4	20,0	21,5	21,2	18,1	16,4
4108/M10S	22,6	24,7	109,0	16,2	23,3	23,9	15,7	16,4	20,0	21,5	21,2	18,1	16,4
4108/M12S	28,7	31,3	138,1	20,5	29,6	30,3	19,9	20,8	25,4	27,3	26,9	22,9	20,7
4108/4	23,8	25,9	114,3	16,9	24,5	25,1	16,4	17,2	21,0	22,6	22,3	19,0	17,1
4108/4S	28,7	31,3	138,1	20,5	29,6	30,3	19,9	20,8	25,4	27,3	26,9	22,9	20,7
4116/3	19,5	21,3	94,0	13,9	20,1	20,6	13,5	14,2	17,3	18,6	18,3	15,6	14,1
4116/3S	24,4	26,6	117,4	17,4	25,1	25,8	16,9	17,7	21,5	23,2	22,9	19,5	17,6
4116/M10S	24,4	26,6	117,4	17,4	25,1	25,8	16,9	17,7	21,5	23,2	22,9	19,5	17,6
4116/M12S	33,8	36,9	162,8	24,1	34,9	35,8	23,4	24,5	29,9	32,2	31,7	27,0	24,4
4116/4	28,0	30,5	134,6	19,9	28,8	29,6	19,4	20,3	24,7	26,6	26,2	22,3	20,2
4116/4S	33,8	36,9	162,8	24,1	34,9	35,8	23,4	24,5	29,9	32,2	31,7	27,0	24,4
4116/5	37,2	40,6	179,1	26,6	38,4	39,3	25,8	27,0	32,9	35,4	34,9	29,7	26,9
4116/5S	44,7	48,7	214,9	31,8	46,0	47,2	30,9	32,4	39,4	42,5	41,9	35,6	32,2
4132/6	51,4	56,0	247,1	36,6	52,9	54,3	35,6	37,2	45,4	48,8	48,2	41,0	37,1
4132/6S	62,1	67,7	298,7	44,3	64,0	65,6	43,0	45,0	54,8	59,0	58,2	49,6	44,8
4132/5S	62,1	67,7	298,7	44,3	64,0	65,6	43,0	45,0	54,8	59,0	58,2	49,6	44,8

(1) : Maximum values of the refrigerant flow capacity at which the drier can be used when fluid dehydration is not the a major problem, provided that the original moisture is limited before the installation of the drier.
The maximum refrigerant flow capacities are referred to a total pressure drop of 0,07 bar / 0,14 bar , inlet and outlet connections included, (according to ARI STANDARD 710-2009 - with liquid temperature at + 30 °C and evaporating temperature at - 15 °C)

Continued

NOTE: for temperatures different from standard values use correction factors L1 listed on TABLE 8

TABLE 28: Refrigerant flow capacity of hermetic filter driers with sight glass

Catalogue Number	Pressure drop 0,14 bar (1) [kW]												
	R134a	R22	R32	R404A	R407C	R410A	R507	R1234yf	R1234ze	R448A	R449A	R450A	R452A
4105/2	7,9	8,6	38,1	5,7	8,2	8,4	5,5	5,7	7,0	7,5	7,4	6,3	5,7
4105/2S	10,6	11,6	51,0	7,6	10,9	11,2	7,3	7,7	9,4	10,1	10,0	8,5	7,7
4105/3	19,8	21,6	95,2	14,1	20,4	20,9	13,7	14,4	17,5	18,8	18,6	15,8	14,3
4105/3S	25,0	27,3	120,4	17,9	25,8	26,5	17,3	18,2	22,1	23,8	23,5	20,0	18,1
4108/2	8,9	9,8	43,0	6,4	9,2	9,4	6,2	6,5	7,9	8,5	8,4	7,1	6,5
4108/2S	11,0	12,0	52,8	7,8	11,3	11,6	7,6	8,0	9,7	10,4	10,3	8,8	7,9
4108/3	23,2	25,4	111,8	16,6	24,0	24,6	16,1	16,9	20,5	22,1	21,8	18,6	16,8
4108/3S	29,4	32,1	141,7	21,0	30,3	31,1	20,4	21,4	26,0	28,0	27,6	23,5	21,3
4108/M10S	29,4	32,1	141,7	21,0	30,3	31,1	20,4	21,4	26,0	28,0	27,6	23,5	21,3
4108/M12S	37,3	40,7	179,5	26,6	38,5	39,4	25,8	27,1	33,0	35,5	35,0	29,8	26,9
4108/4	30,9	33,7	148,6	22,0	31,8	32,6	21,4	22,4	27,3	29,4	29,0	24,6	22,3
4108/4S	37,3	40,7	179,5	26,6	38,5	39,4	25,8	27,1	33,0	35,5	35,0	29,8	26,9
4116/3	26,4	28,8	126,9	18,8	27,2	27,9	18,3	19,1	23,3	25,1	24,7	21,0	19,0
4116/3S	32,9	35,9	158,4	23,5	33,9	34,8	22,8	23,9	29,1	31,3	30,9	26,3	23,8
4116/M10S	32,9	35,9	158,4	23,5	33,9	34,8	22,8	23,9	29,1	31,3	30,9	26,3	23,8
4116/M12S	45,7	49,8	219,8	32,6	47,1	48,3	31,6	33,1	40,4	43,4	42,8	36,5	33,0
4116/4	37,8	41,2	181,7	26,9	38,9	39,9	26,1	27,4	33,4	35,9	35,4	30,1	27,3
4116/4S	45,7	49,8	219,8	32,6	47,1	48,3	31,6	33,1	40,4	43,4	42,8	36,5	33,0
4116/5	50,3	54,8	241,8	35,8	51,8	53,1	34,8	36,4	44,4	47,8	47,1	40,1	36,3
4116/5S	60,3	65,7	290,1	43,0	62,1	63,7	41,7	43,7	53,3	57,3	56,5	48,1	43,5
4132/6	71,9	78,4	345,9	51,3	74,1	76,0	49,8	52,1	63,5	68,4	67,4	57,4	51,9
4132/6S	86,9	94,8	418,2	62,0	89,6	91,8	60,2	63,0	76,8	82,6	81,5	69,4	62,7
4132/5S	86,9	94,8	418,2	62,0	89,6	91,8	60,2	63,0	76,8	82,6	81,5	69,4	62,7

(1) : Maximum values of the refrigerant flow capacity at which the drier can be used when fluid dehydration is not the a major problem, provided that the original moisture is limited before the installation of the drier.
The maximum refrigerant flow capacities are referred to a total pressure drop of 0,07 bar / 0,14 bar , inlet and outlet connections included, (according to ARI STANDARD 710-2009 - with liquid temperature at + 30 °C and evaporating temperature at - 15 °C)

NOTE: for temperatures different from standard values use correction factors L1 listed on TABLE 8

TABLE 29: Water capacity and dehydratable charge of hermetic filter driers with sight glass

Catalogue Number	Water Capacity at + 24 °C (1) [g H_2O]					Dehydratable Charge at + 24 °C [kg refrigerant]				
	R134a	R22	R404A R507	R407C	R410A	R134a	R22	R404A R507	R407C	R410A
4105/2	7,7	7,1	7,9	6,3	6,9	8,3	7,6	8,5	6,8	7,4
4105/2S										
4105/3										
4105/3S										
4108/2	12,9	11,8	13,2	10,6	11,5	13,9	12,7	14,2	11,4	12,4
4108/2S										
4108/3										
4108/3S										
4108/M10S										
4108/M12S										
4108/4										
4108/4S										
4116/3	25,2	23,0	25,7	20,6	22,5	27,1	24,7	27,6	22,2	24,2
4116/3S										
4116/M10S										
4116/M12S										
4116/4										
4116/4S										
4116/5										
4116/5S										
4132/6	46,6	42,6	47,6	38,2	41,5	50,1	45,8	51,2	41,1	44,6
4132/6S										
4132/7S										

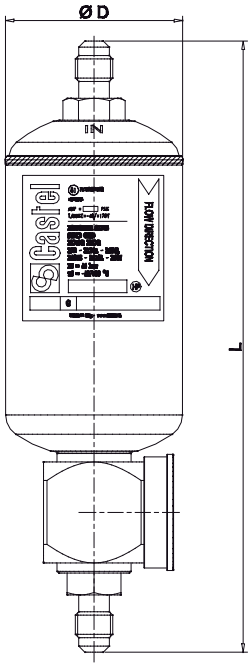
Continued

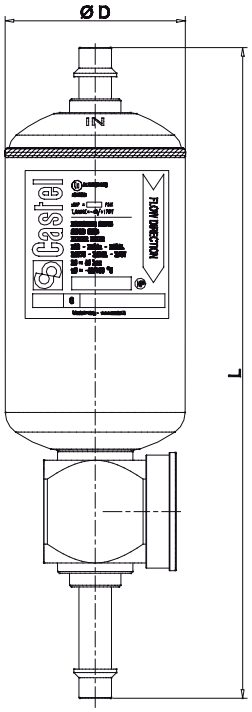
TABLE 29: Water capacity and dehydratable charge of hermetic filter driers with sight glass

Catalogue Number	Water Capacity at + 52 °C (1) [g H_2O]					Dehydratable Charge at + 52 °C [kg refrigerant]				
	R134a	R22	R404A R507	R407C	R410A	R134a	R22	R404A R507	R407C	R410A
4105/2	6,7	5,7	7,3	5,1	5,6	7,2	6,1	7,8	5,5	6,0
4105/2S										
4105/3										
4105/3S										
4108/2	11,1	9,3	12,2	8,5	9,3	11,9	10,0	13,1	9,1	10,0
4108/2S										
4108/3										
4108/3S										
4108/M10S										
4108/M12S										
4108/4										
4108/4S										
4116/3	21,7	18,4	23,9	16,6	18,1	23,3	19,8	25,7	17,8	19,5
4116/3S										
4116/M10S										
4116/M12S										
4116/4										
4116/4S										
4116/5										
4116/5S										
4132/6	40,2	34,1	44,2	30,7	33,4	43,2	36,7	47,5	33,0	35,9
4132/6S										
4132/7S										

(1) : Water capacity values are referred to the following conditions, fixed in ARI STANDARD 710-2004 and DIN 8949:2000:
- Liquid temperatures: 24 °C and 52 °C
- Equilibrium point dryness, EPD: 60 ppm for R22
- Equilibrium point dryness, EPD: 50 ppm for R134a , R404A , R407C , R410A e R507

TABLE 30: Dimensions and weights of fliters with sight glass						
Catalogue Number	Connections			Dimensions [mm]		Weight [g]
	SAE Flare	ODS				
		Ø [in.]	Ø [mm]	Ø D	L	
4105/2	1/4"	–	–	52	155	520
4105/2S	–	1/4"	–		163	520
4105/3	3/8"	–	–		163	550
4105/3S	–	3/8"	–		165	550
4108/2	1/4"	–	–		182	530
4108/2S	–	1/4"	–		190	530
4108/3	3/8"	–	–		192	550
4108/3S	–	3/8"	–		192	530
4108/M10S	–	–	10			
4108/M12S	–	–	12		200	540
4108/4	1/2"	–	–		198	580
4108/4S	–	1/2"	–		200	540
4116/3	3/8"	–	–	73	202	795
4116/3S	–	3/8"	–		204	835
4116/M10S	–	–	10			
4116/M12S	–	–	12		212	850
4116/4	1/2"	–	–		210	880
4116/4S	–	1/2"	–		212	850
4116/5	5/8"	–	–		219	940
4116/5S	–	5/8"	16		221	870
4132/6	3/4"	–	–	91	233	1400
4132/6S	–	3/4"	–		238	1380
4132/7S	–	7/8"	–		238	1400





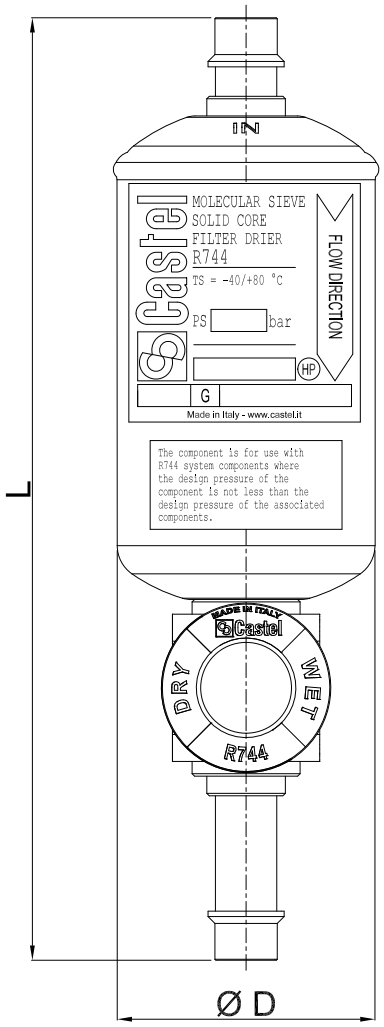
CHAPTER 7
HERMETIC FILTER DRIERS WITH MOISTURE INDICATOR
FOR REFRIGERATION PLANTS THAT USE THE R744 REFRIGERANT

APPLICATIONS
Filters 4108E and 4116E illustrated in this chapter have been developed by Castel for all the applications that use the sub-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.

CONSTRUCTION
The filters in series 4108E and 4116E are drying filters for the liquid line with a moisture/liquid indicator brazed directly onto the outlet of the filter. This unit reduces the amount of field brazing required and the potential risk for refrigerant fluid leaks. The indicators ensure fast safe inspection of the conditions of the refrigerant fluid in the circuit regarding regular flow and the presence of moisture. The filter is completely manufactured from steel with ODS soldering connection in copper-plated steel. The indicator is manufactured with the glass "lens" directly fused onto a steel metallic ring, with proper surface protection.

OPERATION
The moisture/liquid indicators consist of a sensitive ring element that changes colour, from green to yellow, according to the percent moisture in the system.
The moisture content values that correspond to the "green" colour can be considered admissible for the proper operation of the system. When the sensitive element starts to yellow, "Chartreuse green", the threshold value has been reached and operating conditions could become difficult. When the sensitive element becomes "yellow", it's time to replace the filter dryer.
If the charge and operating conditions of the plant are normal, the refrigerant fluid appears perfectly liquid underneath the "lens" of the indicator. The presence of bubbles indicates that the refrigerant fluid is partially evaporating along the liquid line.

4108E
4116E



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