

HANDBOOK

# REFRIGERATING SYSTEM PROTECTORS

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

# CHAPTER 1 ■ LIQUID INDICATORS & MOISTURE/LIQUID INDICATORS CERTIFIED BY UNDERWRITERS LABORATORIES INC.

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



## APPLICATIONS

The liquid indicators and moisture/liquid indicators illustrated in this chapter ensure fast, safe inspection of the refrigerant fluid conditions in the liquid circuit in terms of its regular flow and the presence of moisture. They 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, 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.

Furthermore, the indicators of the series 3840 and 3940 can also be installed on systems that use the following refrigeration fluids:

- HFC (R32) and HFO (R1234yf), classified as A2L in the ASHRAE 34-2013 standard
- HC (R290, R600, or R600a), classified as A3 in the ASHRAE 34-2013 standard

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.

Note: The indicator series 3680, 3780, and 3781 are excluded from the scope of application of Directive 2014/68/EU as they are piping components.

## 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.

## CONSTRUCTION

The liquid indicators in series 38 and moisture/liquid indicators in series 39 are manufactured in a sealed hermetic unit to avoid any possible refrigerant leaks. The glass “lens”, with suitable gasket, is housed inside the brass body and is fixed in its seat with an edge calking operation. The main parts of these indicators are made from the following materials:

- Hot forged brass EN 12420 – CW 617N for the body
- Copper tube EN 12735-1 – Cu-DHP for solder connections
- Glass for lens
- PTFE for outlet gaskets

Liquid/moisture indicators series 36 and 37 are manufactured with the glass "lens" directly fused onto a steel metallic ring, with proper surface protection. This metallic ring, screwed on the indicator body, is equipped with a gasket:

- Hydrogenated nitrile butadiene (HNBR) for series 36
- Chloroprene (CR) for series 37

## 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 indicators 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.

For indicators in series 3680, 3780 and 3781, the ring must be disassembled before brazing. Note: the PS declared in Table 1 for saddle-type indicators in series 3680 and 3780, refers only to the body plus the ring (with its o-ring), which the customer must tighten to the torque indicated on the product instruction handbook. The aforesaid declaration doesn't cover any possible leakage or malfunctions due to brazing the body on the copper pipe. The customer is totally responsible for the success of this operation.

## APPROVALS

The liquid indicators in series 3810, 3840, and 3850 and the moisture/liquid indicators 3910 3940, and 3950 (excluding indicators p/n 3940/X01 and 3940/X02) are approved by the American certification authority, Underwriters Laboratories Inc. These indicators are certified **UL Listed** for the USA with file SA33318, in compliance with American standard UL 207.

TABLE 1: General characteristics of liquid indicators

Catalogue Nr.	Type	Connections					PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
		SAE Flare	ODS		for pipe			min	max	min	max	
			∅ [in.]	∅ [mm]	∅ [in.]	∅ [mm]						
3810/22	male - male	1/4"	-	-			45 (1)	-40	+120	-40	+50	Art. 4.3
3810/33		3/8"	-	-								
3810/44		1/2"	-	-								
3810/55		5/8"	-	-								
3810/66		3/4"	-	-								
3840/2	brazing	-	1/4"	-	-	-	45 (1)	-40	+120	-40	+50	Art. 4.3
3840/3		-	3/8"	-								
3840/M10		-	-	10								
3840/M12		-	-	12								
3840/4		-	1/2"	-								
3840/5		-	5/8"	16								
3840/M18		-	-	18								
3840/6		-	3/4"	-								
3840/7		-	7/8"	22								
3840/9		-	1.1/8"	-								
3850/22	male - female	1/4"	-	-			45 (1)	-40	+150	-30	50	excluded
3850/33		3/8"	-	-								
3850/44		1/2"	-	-								
3850/55		5/8"	-	-								
3850/66		3/4"	-	-								
3680/7	saddle type	-	-	-	7/8"	22	45	-40	+150	-30	50	excluded
3680/9		-	-	-	1.1/8"	28						
3680/11		-	-	-	1.3/8"	35						

(1) : MWP = 680 psi according to UL approval

TABLE 2: General characteristics of liquid / moisture indicators

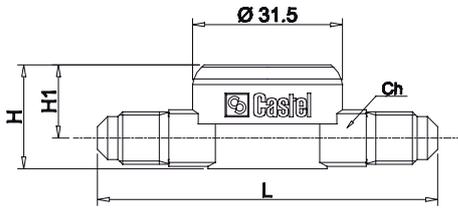
Catalogue Nr.	Type	Connections								PS [bar]	TS [°C]		TA [°C]		Risk Category according to PED Recast
		SAE Flare	ODS		ODM		for pipe				min	max	min	max	
			Ø [in.]	Ø [mm]	Ø [in.]	Ø [mm]	Ø [in.]	Ø [mm]	Hole Ø [mm]						
3910/22	male - male	1/4"	-	-	-	-				45 (1)	-40	+120	-40	+50	Art. 4.3
3910/33		3/8"	-	-	-	-									
3910/44		1/2"	-	-	-	-									
3910/55		5/8"	-	-	-	-									
3910/66		3/4"	-	-	-	-									
3940/2	brazing	-	1/4"	-	-	-				45 (1)	-40	+120	-40	+50	Art. 4.3
3940/3		-	3/8"	-	-	-									
3940/M10		-	-	10	-	-									
3940/M12		-	-	12	-	-									
3940/4		-	1/2"	-	-	-									
3940/5		-	5/8"	16	-	-	-	-	-						
3940/M18		-	-	18	-	-									
3940/6		-	3/4"	-	-	-									
3940/7		-	7/8"	22	-	-									
3940/9		-	1.1/8"	-	-	-									
3940/X01		-	-	-	-	6									
3940/X02		-	-	-	-	6									
3950/22		male - female	1/4"	-	-	-	-								
3950/33	3/8"		-	-	-	-									
3950/44	1/2"		-	-	-	-									
3950/55	5/8"		-	-	-	-									
3950/66	3/4"		-	-	-	-									
3770/M28	soldering	-	-	-	-	28				45 (1)	-30	+110	-30	+50	Art. 4.3
3770/11		-	-	-	1.3/8"	35									I
3770/13		-	-	-	1.5/8"	-									Art. 4.3
3770/M42		-	-	-	-	42									I
3771/11			1.3/8"	35	-	-									
3771/M42			-	42	-	-									
3771/17			2.1/8"	-	-	-									
3780/5	saddle tyoe	-	-	-	-	-	5/8"	16		45 (1)	-30	+110	-30	+50	excluded
3780/M18		-	-	-	-	-	-	18							
3780/7		-	-	-	-	-	7/8"	22							
3780/9		-	-	-	-	-	1.1/8"	28							
3780/11		-	-	-	-	-	1.3/8"	35							
3781/M28	level glass	-	-	-	-	-	-	28							

(1) : MWP = 500 psi according to UL approval

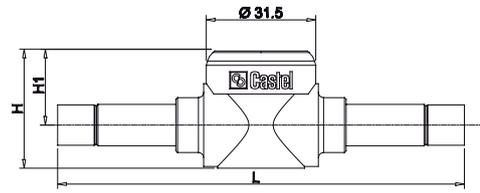
**TABLE 3: Dimensions and weights**

Catalogue Number		Dimensions [mm]				Weight [g]			
Liquid Indicators	Moisture Liquid Indicators	H	H1	L	Ch				
3810/22	3910/22	22	16,5	71,5	12	110			
3810/33	3910/33	26,5	17,5	77,5	17	150			
3810/44	3910/44	30	18,5	81,5	22	196			
3810/55	3910/55	34	21,5	89,5	24	238			
3810/66	3910/66	37,5	23,5	90	28	298			
3840/2	3940/2	22	15,5	113	-	116			
3840/3	3940/3	34	21,5	117		-	185		
3840/M10	3940/M10								
3840/M12	3940/M12								
3840/4	3940/4								
3840/5	3940/5	34	21,5	131			-	195	
3840/M18	3940/M18								
3840/6	3940/6								
3840/7	3940/7	37,5	23,5	151				-	306
3840/9	3940/9	43,5	26	186					501
-	3940/X01	22	15,5	242					155
	3940/X02	-	15,5	121					122
3850/22	3950/22	26,5	17,5	68					17
3850/33	3950/33	30	18,5	74	22				185
3850/44	3950/44	34	21,5	77	24	231			
3850/55	3950/55	37,5	23,5	82	28	288			
3850/66	3950/66	43,5	26	92	35	517			
-	3770/M28	-	38	150	-	300			
	3770/11		41,5	160		349			
	3770/13		45	170		516			
	3770/M42		-	41,5		160	378		
	3771/11			45		170	516		
	3771/M42			-		30	-	550	
	3771/17					31			
	3780/5		33	90					
3780/M18	36								
3680/7	3780/7	39,5							
3680/9	3780/9	-	-	-	-	107			
3680/11	3780/11	-	-	-	-				
-	3781/M28	-	-	-	-				

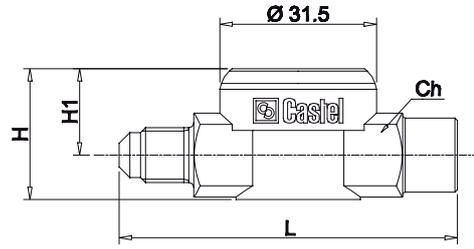
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3910



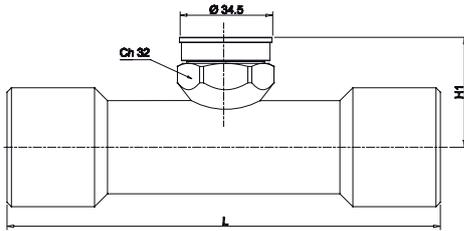
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3940



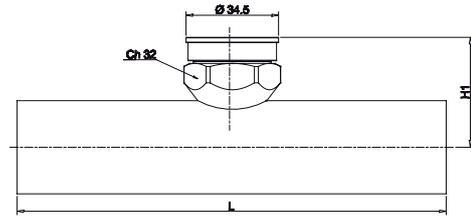
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3950



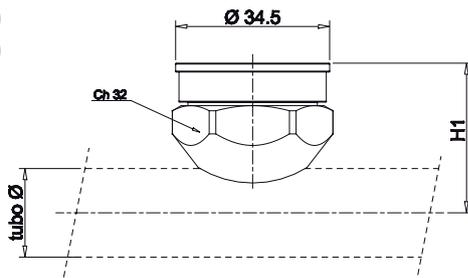
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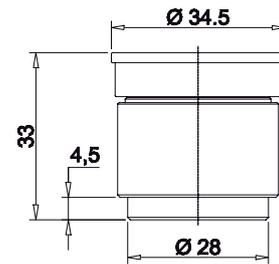
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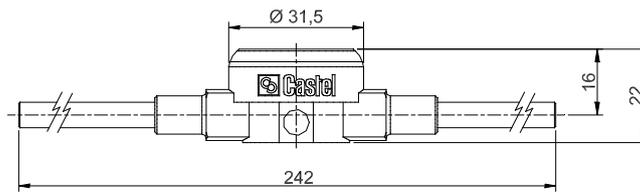
3680  
3780



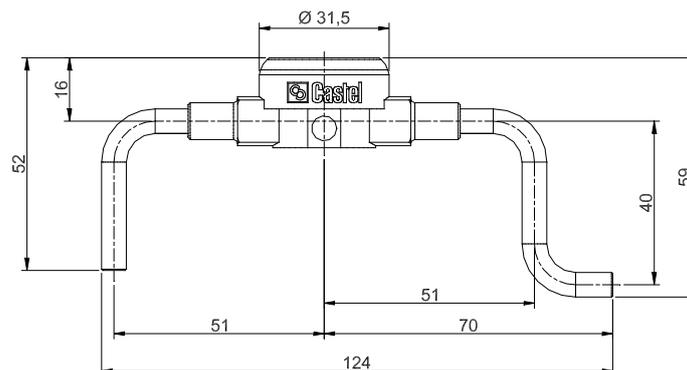
3781



3940/X01



3940/X02



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