

Data Sheet

Sight glass
Type **LLG 185 - 1550**

For industrial and marine refrigeration installations.



LLG are sight glasses in ductile steel which meets the strictest requirements on industrial and marine refrigeration installations.

The sight glasses are offered in 3 different versions:

- with welding nipples (LLG)
- with stop valves equipped with caps (LLG S)
- with stop valves and sight adapter in acrylic glass ready for insulation on site (LLG SF)

The range of sight glasses is based on 3 basic sight glasses: LLG 185, LLG 335 and LLG 740. The other standard lengths are combined by using variations of basic glass lengths.

LLG produce sufficient flow areas to secure the highest possible degree of synchronous operation, and have a specially hardened reflection glass for quick reading. The front and the base frame are mounted together from the front with countersunk allen screws. This ensures easy insulation on site as well as easy inspection and service, if any.

All sight glasses are equipped as standard with a built-in safety system (non return device). If a glass is damaged, the pressure of the refrigerant will activate the safety system and refrigerant loss will be limited to an absolute minimum.

Features

- Refrigerants
 - Applicable to HCFC, HFC and R717 (Ammonia).
- Temperature range:
 - $-10/+100\text{ }^{\circ}\text{C}$ ($-14/+212\text{ }^{\circ}\text{F}$) or
 - $-50/+30\text{ }^{\circ}\text{C}$ ($-58/+86\text{ }^{\circ}\text{F}$)
- Maximum operating pressure
 - 25 bar g (363 psi g)
- Equipped with boron silicate glass, hardened by an accurately controlled heat treatment process
- Classification: CRN, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company.

Product specification

Technical data

Refrigerants

Applicable to HCFC, HFC and R717 (Ammonia). For further information please see installation instruction for LLG. Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.

Temperature range

The sight glasses are applicable to the above mentioned refrigerants within the temperature range of:

- $-10/+100\text{ }^{\circ}\text{C}$ ($+14/+212\text{ }^{\circ}\text{F}$) for the LLG types with safety system with welding nipples and the LLG S types with safety system with stop valves.
- $-50/+30\text{ }^{\circ}\text{C}$ ($-58/+86\text{ }^{\circ}\text{F}$) for the LLG SF types with safety system with stop valves and sight adapter (acrylic glass) and the LLG F types with safety system and sight adapter (acrylic glass).

Pressure range

All LLG types are designed for:

Max. operating pressure 25 bar g (363 psi g)

Strength test: 50 bar g (725 psi g)

Leakage test: at 25 bar g (363 psi g)

Design

Glass

LLG's are equipped with a boronsilicate glass, hardened by an accurately controlled heat treatment process. All glasses are according to DIN 7081.

Gaskets

The glasses are equipped with a special nonasbestos carbon compound gasket which provides superior mechanical characteristics and a long time guarantee against service leakage.

Connectors

LLG 590, LLG 995, LLG 1145 and LLG 1550 are joined together by 2 basic LLG's by means of a connector. The connector holds the two basic glasses together by means of screws and guiding pins, which ensures a rigid construction.

Stop Valves/Nipples

The glasses are connected to the refrigeration system by means of welding nipples or stop valves. Which ever system is used, the nipples or stop valves are screwed into a flange, which is located in the correct position and subsequently tightened with a seal gasket and 4 screws.

Installation

Install the glasses on a bracket using the 4 screws supplied with the glass.

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Use the threaded holes on the back of the frame to mount the glass on a bracket (not of Danfoss supply). Always connect the piping after mounting on the bracket. Please note the importance of a minimum of stress in the sight glasses from the connected pipes. Please also make sure that there is sufficient space behind the the sight glasses to ensure proper insulation, service and inspection, etc.

For installations below $-10\text{ }^{\circ}\text{C}$ ($+14\text{ }^{\circ}\text{F}$) it is recommended to add the sight adapter to enable reading after insulation has been applied. For installations below $-10\text{ }^{\circ}\text{C}$ ($+14\text{ }^{\circ}\text{F}$) in R717 plants it is recommended to use an oil column as described in the following pages. There will be no formation of bubbles or ice build-up in oilfilled sight glasses, which may be the case in the refrigerant-filled glasses.

The sight glasses are designed to withstand high internal pressures. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

i NOTE:

The LLG sight glass can only be placed in CE approved applications with the stop valves in front.

Frostproof sight glasses

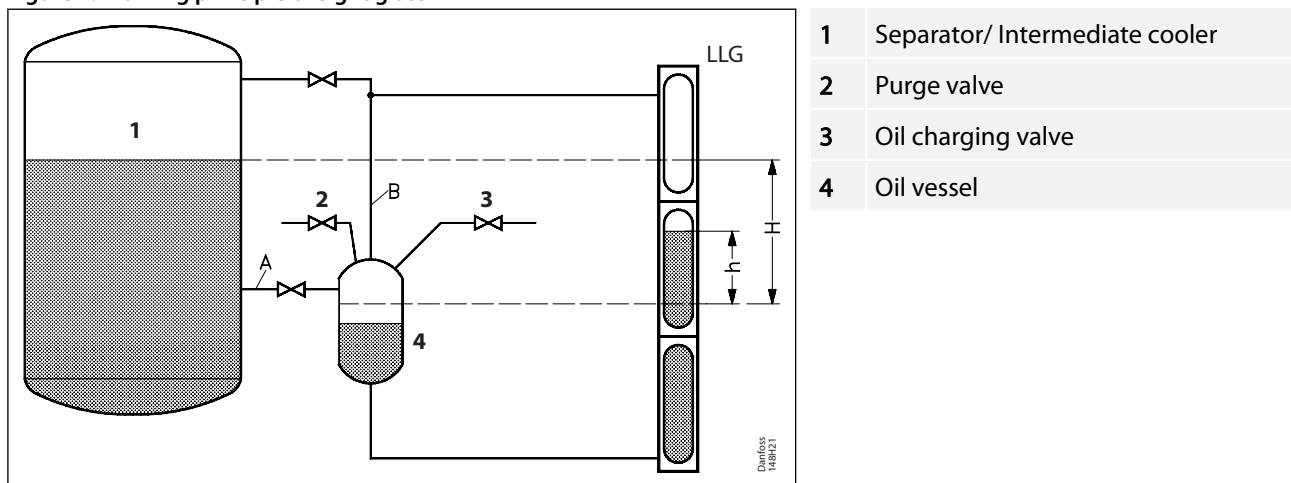
Example 1

Refrigerant: R717 (ammonia)

Temperature: Recommended for temperatures below $-10\text{ }^{\circ}\text{C}$ ($+14\text{ }^{\circ}\text{F}$).

The principle shown in **Figure 1** can be used in connection with low temperature liquid separators or intermediate coolers when the refrigerant is R717 (ammonia). As the liquid level in the R717 separator varies the oil level will change simultaneously.

Figure 1: Working principle of sight glass



Oil changing

The system is charged with synthetic oil type SHC 226 with a specific weight, differing from that of R717, and (h) must be multiplied by approximately 1.35 (the ratio of density oil to density R717) to calculate H.

Charge the oil vessel (volume approximate 10 litres) to a level just below the lower balancing pipe (A) through the oil charging valve. Close the oil charging valve.

The oil will show in the sight glass at a level equal to the level in the oil vessel. When R717 is filled into the separator or intermediate cooler it will enter the oil vessel and press down the oil surface.

The R717 will also rise into the upper balance pipe (B) to a level equal to the level in the separator or intermediate cooler. As the oil surface in the oil vessel is pressed down, the oil will rise into the sight glass.

i NOTE:

It is important to use an oil which is not likely to mix with R717. The oil must have a high viscosity index to ensure easy flowing at low temperatures. Mobil SHC 226 of the synthetic polyalphaolefin type has proven suitable for this purpose.

Example 2

Refrigerant: R717 (ammonia)

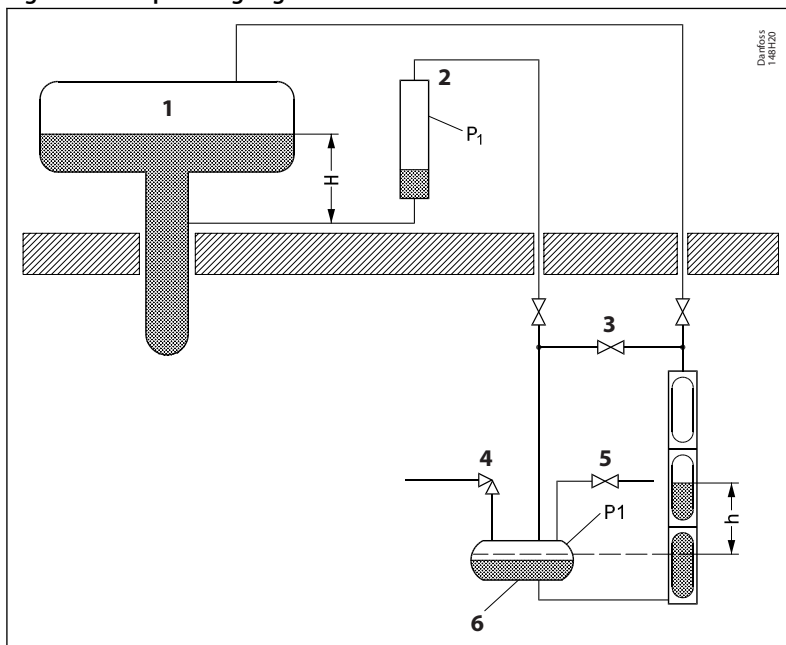
Temperature: Recommended for temperatures below $-10\text{ }^{\circ}\text{C}$ ($+14\text{ }^{\circ}\text{F}$).

Figure 2 shows a frostproof sight glass for an R717 liquid separator which is placed above ground level. The arrangement is called a Hampsonmeter.

Due to the evaporation taking place in the uninsulated balance pipe (ND 80/3 in.) the pressure in this pipe will be equal to $P_1 = P_0 + H \times \rho \times g$.

P_0	Separator pressure – [N/m ²]
H	R717 liquid level, see fig. 2 – [m]
ρ	R717 density – [kg/m ³]
g	Acceleration due to gravity 9.81 – [m/s ²]

Figure 2: Frostproof sight glass



1	Separator pressure P_0
2	Uninsulated
3	Bypass
4	Oil charging valve
5	Purge valve
6	Oil vessel

Oil Charging

The pressure will act on the oil surface in the oil vessel and cause the oil to rise in the sight glasses which are installed in a length of e.g. 2 in. pipe, the top of which is connected to the top of the separator which is at pressure P_0 .

The oil will rise to a level h and H can then be calculated by multiplying h by 1.35 (the ratio of density oil to density R717).

Charge the oil vessel through the oil charging valve to a level of approximately $\frac{3}{4}$ of full level. The level will show in the lower sight glass.

Take care that the volume of the oil vessel is sufficient to allow the oil to rise into the sight glasses. When the system is operating keep the bypass valve closed.

NOTE:

It is important to use an oil not likely to mix with R717, and having a high viscosity index to ensure easy oil movements at low temperatures. Mobil SHC 226 of the synthetic polyalphaolefin type has proven suitable for this purpose.

Material specification

Figure 3: LLG

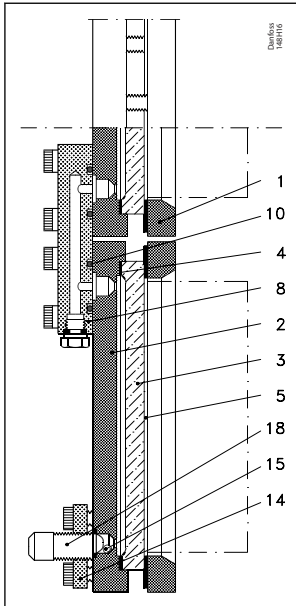


Figure 4: LLG S and LLG SF

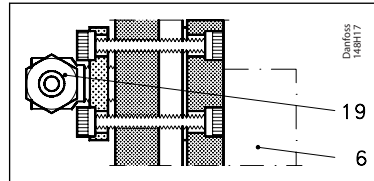


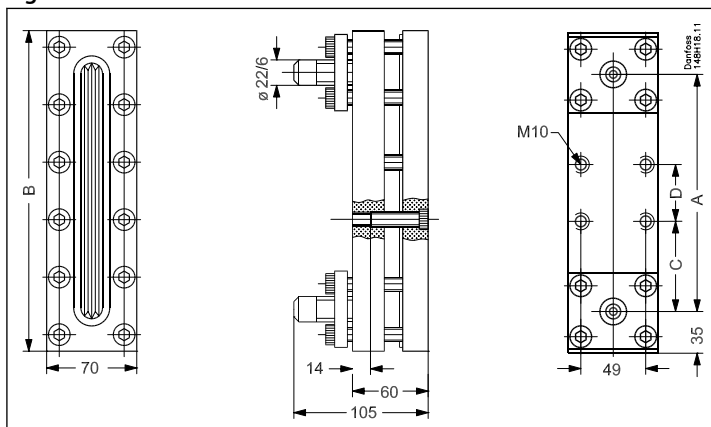
Table 1: Material specification

No.	Part	Material	DIN	ISO	ASTM
1	Front frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
2	Back frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
3	Sight glass	Glass			
4	Gasket	Non-asbestos			
5	Protective coating for sight glass	Non-asbestos			
6	Sight adapter	PMMA-acrylic			
8	Connecting piece	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
10	O-ring	Cloroprene (Neoprene)			
14	Flange	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
15	Balls	Stainless steel			
18	Welding nipple	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
19	Stop valve (SNV-ST ⁽¹⁾)	Steel			

⁽¹⁾ See **Technical data** for SNV-ST valves.

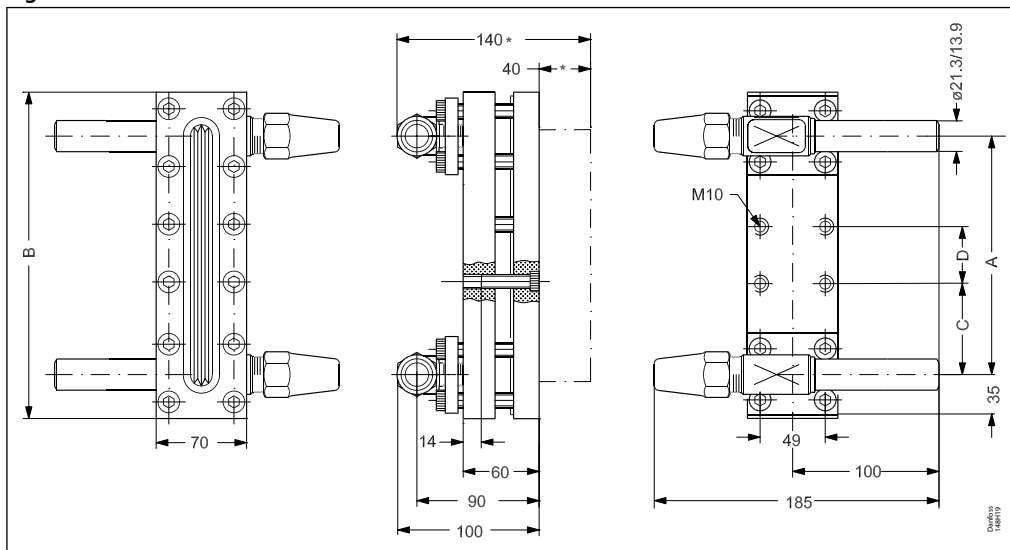
Dimensions and weights

Figure 5: LLG



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Figure 6: LLG S and LLG SF



* Only for LLG SF with sight adapter

Table 2: LLG 185 - 1550

Type	Unit	A	B	C	D	Weight
LLG 185	mm	185	255	69	48	4.2 kg ⁽¹⁾
	in	7¼	10	2¾	2	5.8 kg ⁽²⁾
LLG 335	mm	335	405	63	42	7.5 kg ⁽¹⁾
	in	13¼	16	2½	1¾	9.2 kg ⁽²⁾
LLG 590	mm	590	660	69 + 63	48 + 42	13.2 kg ⁽¹⁾
	in	23¼	26	2¾ + 2½	2 + 1¾	15.1 kg ⁽²⁾
LLG 740	mm	740	810	63	42	16.5 kg ⁽¹⁾
	in	29¼	32	2½	1¾	18.5 kg ⁽²⁾
LLG 995	mm	995	1065	69 + 63	48 + 42	22.5 kg ⁽¹⁾
	in	39¼	42	2¾ + 2½	2 + 1¾	24.7 kg ⁽²⁾
LLG 1145	mm	1145	1215	63	42 + 42	25.7 kg ⁽¹⁾
	in	45	47¾	2½	1¾ + 1¾	28.0 kg ⁽²⁾
LLG 1150	mm	1550	1620	63	42	33.5 kg ⁽¹⁾
	in	61	63¾	2½	1¾	36.1 kg ⁽²⁾

⁽¹⁾ Type LLG

⁽²⁾ Type LLG S and LLG SF

NOTE:

- Specified weights are approximate values only
- LLG 740 consist of one back piece and 2 front sight glasses.

Ordering

How to order

The table below is used to identify sight glasses required.

i NOTE:

The type codes only serve to identify the sight glasses, some of which may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Type codes

Example for type codes: **LLG 740 SF**

Table 3: Type codes

Valve type	LLG	Sight glass	
Nominal size in mm		Combined by:	
	185	DN 185	
	335	DN 335	
	590	DN 590	LLG 185 + LLG 335
	740	DN 740	LLG 740 consist of one back piece and 2 front sight glasses
	995	DN 995	LLG 185 + LLG 740
	1145	DN 1145	LLG 335 + LLG 740
	1550	DN 1550	LLG 740 + LLG 740
Equipment	-	Safety system and welding nipples	
	F	Safety system and sight adapter	
	S	Safety system and stop valves (SNV-ST)	
	SF	Safety system, stop valves (SNV-ST) and sight adapter	

Sight glasses - LLG

Table 4: With safety system and welding nipples

Length		Type	Code no.
mm	in		
185	7¼	LLG 185	2512+049
335	13¼	LLG 335	2512+050
590	23¼	LLG 590	2512+051
740	29¼	LLG 740	2512+052
995	39¼	LLG 995	2512+053
1145	45	LLG 1145	2512+054
1550	61	LLG 1550	2512+055

Sight glasses - LLG S

Table 5: With safety system and stop valves (SNV-ST)

Length		Type	Code no.
mm	in		
185	7¼	LLG 185 S	2512+056
335	13¼	LLG 335 S	2512+057
590	23¼	LLG 590 S	2512+058
740	29¼	LLG 740 S	2512+059
995	39¼	LLG 995 S	2512+060
1145	45	LLG 1145 S	2512+061
1550	61	LLG 1550 S	2512+062

Sight glasses for insulating - LLG F

Table 6: With safety system and sight adapter

Length		Type	Code no.
mm	in		
185	7¼	LLG 185 F	2512+078
335	13¼	LLG 335 F	2512+079
590	23¼	LLG 590 F	2512+080
740	29¼	LLG 740 F	2512+081
995	39¼	LLG 995 F	2512+082
1145	45	LLG 1145 F	2512+083
1550	61	LLG 1550 F	2512+084

Sight glasses for insulating - LLG SF

Table 7: With safety system, stop valves (SNV-ST) and sight adapter

Length		Type	Code no.
mm	in		
185	7¼	LLG 185 SF	2512+066
335	13¼	LLG 335 SF	2512+067
590	23¼	LLG 590 SF	2512+068
740	29¼	LLG 740 SF	2512+069
995	39¼	LLG 995 SF	2512+070
1145	45	LLG 1145 SF	2512+071
1550	61	LLG 1550 SF	2512+072

! IMPORTANT:

Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Table 8: LLG 185 and LLG 1550

File name	Document type	Document topic	Approvals Authority
MD 033F0691.AE	Manufacturers Declaration	RoHS	Danfoss
MD 033F0686.AH	Manufacturers Declaration	PED	Danfoss
RMRS 19.10327.266	Marine - Safety Certificate		RMRS
TSSA CRN.0F2997.7123456890YTN	Pressure - Safety Certificate	CRN	TSSA

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