

Series LC, LG, LT Gas and Liquid Cooler

LGC-1(S), LGT-2

LC-1(S), LTC-1

Instruction Manual
Version 1.00.01



**Dear customer,**

Thank you for buying our product. In this instruction manual you will find all necessary information about this M&C product. The information in the instruction manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. You will find all the addresses in the appendix of this manual.

For additional information about our products and our company, please go to M&C's website www.mc-techgroup.com. There you will find the data sheets and manuals of our products in German and English.

This Operating Manual does not claim completeness and may be subject to technical modifications.

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With the release of this version all older manual versions will no longer be valid. The German instruction manual is the original instruction manual. In case of arbitration only the German wording shall be valid and binding.

Version: 1.00.01



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1 General Information

The product described in this operating manual has been examined before delivery and left our works in perfect condition related to safety regulations. In order to keep this condition and to guarantee a safe operation, it is important to heed the notes and prescriptions made in this operating manual. Furthermore, attention must be paid to appropriate transportation, correct storage, as well as professional installation and maintenance work.

All necessary information a skilled staff will need for appropriate use of this product are given in this operating manual.

2 Declaration of conformity

The product described in this operating manual complies with the following EU directives:

RoHS Directive

The requirements of the RoHS2 ('Restriction of Hazardous Substances 2') directive 2011/65/EU and its annexes are met.

Simple pressure vessels

The manufacturer warrants that the liquid chillers described herein, have a product $PS \times V$ of not more than 50 bar liters, and therefore have been designed and manufactured in accordance with Directive 2014/29/EU in accordance with engineering practice recognized as sound in an EU Member State.

3 Safety instructions

Follow these basic safety procedures when mounting, commissioning or operating this equipment:

- These instruction manual points out the basic dangers when handling the cooler. Further system-related hazards may occur in individual cases, which the operator must evaluate according to his hazard assessment - and take appropriate measures.
- Read the instruction manual before commissioning and use. The notes and warnings in the operating instructions must be complied with.
- When connecting the cooler, ensure that the correct pressure ranges are used in accordance with the type plate specifications or technical data.
- Before opening the cooler, it must be depressurized. This also applies to any external connections that may be connected.
- Only use the cooler within the permissible temperature and pressure ranges. The permissible temperature and pressure ranges are described in the corresponding technical data.
- Ensure that the device is installed in a weather-protected location. Do not expose directly to rain or liquids.
- The cooler must not be operated in potentially explosive atmospheres; The cooler must only be operated with sample gas according to the analysis questionnaire.
- The cooler must not be operated in potentially explosive atmospheres; The cooler must only be operated with sample gas according to the analysis questionnaire.
- If the cooler is used to cool gases that are harmful to health, appropriate safety measures must be taken in the event of leaks (e.g. leaking connections). The personal protective equipment must be adapted to the hazards at the place of installation and sampling.
- The cooler must be adequately protected against corrosive influences, shocks and impacts to prevent leakage and component failure.
- Inlets and outlets of the cooler must be provided with protective plugs. This measure is necessary to protect the interior from corrosion and to prevent the escape of residual liquid or the ingress of foreign bodies.
- Only gases which cannot react with each other or with the material of the cooler or the connections in any form can be cooled in the cooler.

4 Warranty

If the equipment fails, please contact **M&C** directly or else go through your **M&C** authorised dealer. We offer a one year warranty as of the day of delivery as per our normal terms and conditions of sale, and assuming technically correct operation of the unit. Consumables are hereby excluded. The terms of the warranty cover repair at the factory at no cost or the replacement at no cost of the equipment free ex user location. Reshipments must be sent in a sufficient and proper protective packaging.

5 Used terms and signal indications



The 'Danger' warning sign indicates that death, serious injury and/or significant material damage will be the consequence, if the appropriate precautions should not be taken.



The 'Warning' warning sign indicates that death, serious injury or damage to property may occur if the relevant precautionary measures are not observed.



The 'Caution' warning sign indicates that slight personal injury can occur if the appropriate safety precautions are not observed.

Caution

'Caution' indicates that damage to property can occur if the appropriate safety precautions are not observed.

Attention

'Attention' indicates that an unintended result or situation can occur if the corresponding information is not taken into account.



'Note' indicates important information relating to the product or highlights parts of the documentation for special attention.



Qualified personnel

'Qualified personnel' are experts who are familiar with the installation, commissioning, maintenance, and operation of these types of products. The following knowledge is at least required for the work:

- Trained person in the process engineering field
- Detailed knowledge of the manual and the applicable safety regulations



Hot surface!
Contact may cause burn! Do not touch!



Toxic!
Acute toxicity (oral, dermal, inhalation)! Toxic when in contact with skin, swallowed or inhaled.



Corrosive!
These substances destroy living tissue and equipment upon contact.
Do not breathe vapors; avoid contact with skin and eyes.



Wear protective gloves!
Working with chemicals, sharp objects or extremely high temperatures requires wearing protective gloves.



Wear safety glasses!

Protect your eyes while working with chemicals or sharp objects. Wear safety glasses to avoid getting something in your eyes.



Wear protective clothes!

Working with chemicals, sharp objects or extremely high temperatures requires wearing protective clothes.

6 Introduction

The M&C gas coolers LGC-1 (with cooling coil for sample gas), LGC-1S (with longer cooling coil for sample gas) and LGT-2 (with tube bundle for sample gas) are used in analytical technology to lower the dew point of humid sample gases.

The M&C liquid coolers LC-1 (with cooling coil for liquid sample), LC-1S (with longer cooling coil for liquid sample) and LTC-1 (with tube bundle for liquid sample) are used to reduce the temperature of liquid media.

Water, for example, is used as the coolant. The counterflow principle used ensures maximum cooling effect.

6.1 Serial number

The type plate with the serial number is located at the side panel of the cooler housing. Whenever you call **M&C** regarding questions or orders for the spare parts please give us the serial number of the device.

7 Description

The M&C gas coolers LGC-1 and LGC-1S are designed with a cooling coil fully welded in the jacket tube. The LGC-1S version is equipped with a longer cooling coil.

An integrated separation chamber in the lower part of the gas cooler ensures optimum condensate separation.

In the LGT-2 gas cooler, the sample gas flows through a tube bundle; here, too, there is a separation chamber in the lower part of the gas cooler for condensate separation.

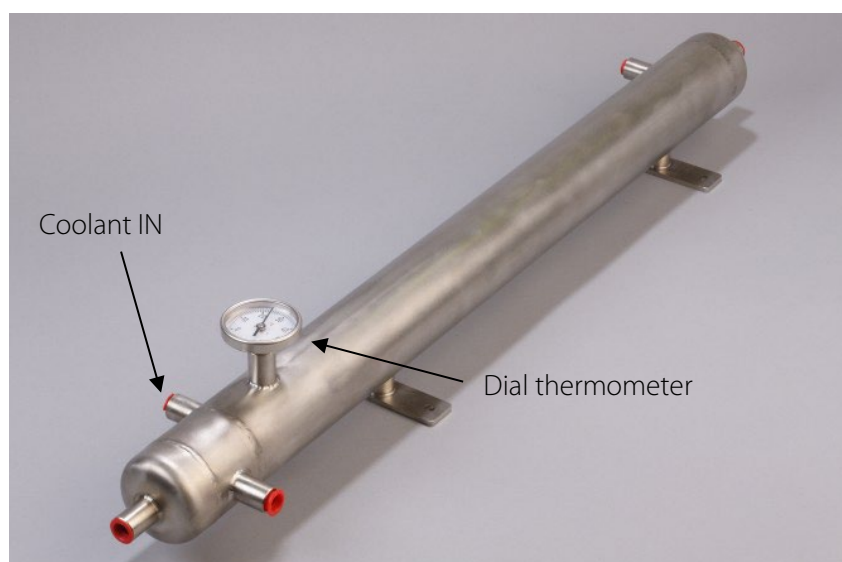


Figure 1 Gas cooler LGT-2 with tube bundle for the sample gas

A dial thermometer is positioned in the coolant inlet of the gas cooler (coolant IN), which can be used to indicate the gas outlet dew point.

The condensate produced is discharged externally by using peristaltic pumps, traps or collecting vessels.

The M&C liquid coolers LC-1 and LC-1S are designed with a cooling coil fully welded in the jacket tube. The LC-1S version is equipped with a longer cooling coil.



Figure 2 Liquid cooler LC-1 with cooling coil for the liquid sample

A dial thermometer is positioned in the coolant inlet of the LC-1 and LC-1S liquid coolers (coolant IN).

In the LTC-1 liquid cooler, the liquid sample flows through a tube bundle. There is a distribution chamber in each of the inlet and outlet areas of the tube bundle. The distribution chamber in the upper part of the tube bundle is screwed to the liquid cooler and can be detached.

The dial thermometer of the LTC-1 liquid cooler is located in the sample outlet (see Figure 6). The dial thermometer can be used to indicate the sample outlet temperature.

The gas and liquid coolers of the LC, LG and LT series operate with low maintenance.

The cooling effect and the stability of the cooling depend, among other things, on the coolant inlet temperature, the coolant quantity, the sample inlet conditions, the aggregate state of the liquid sample to be cooled, ΔT between coolant inlet temperature and sample outlet temperature as well as the ambient temperature.

The existing coolant quality and the liquid sample to be cooled must correspond with the material specification of the cooler.

8 Technical Data

8.1 Gas Cooler

Gas Cooler	LGC-1	LGC-1S	LGT-2
Part No.	04K1000	04K1500	04K4000
Max. cooling capacity approx.	900 kJ/h	1600 kJ/h	3600/6100 kJ/h ¹⁾
Dimension cooling coil	1 x 4/6 mm	1 x 4/6 mm	-
Cooling coil length	3.5 m [≈ 11.5 ft]	6 m [≈ 19.7 ft]	-
Dimension tube bundle	-	-	9 x 6/8 mm
Tube bundle length	-	-	0.6 m [≈ 2.0 ft]
Connection A (Sample gas IN)	Tube ø 6 mm	Tube ø 6 mm	G 3/8" i
Connection B (Sample gas OUT)	G 1/4" i	G 1/4" i	G 3/8" i
Connection C (Condensate OUT)	G 3/8" i	G 3/8" i	G 3/8" i
Connection D/E (Coolant IN/OUT).	G 1/4" i	G 1/4" i	G 3/8" i
Sample flow rate, recommended max.	500 NI/h	500 NI/h	700 NI/h
Max. sample pressure	10 bar	10 bar	10 bar
Max. coolant pressure	10 bar	10 bar	10 bar
Coolant liquid flow rate	50 to 300 l/h, depending on necessary cooling capacity, coolant temperature IN/OUT, etc.		
Differential pressure ΔP sample side	30 mbar at 500 l/h	30 mbar at 500 l/h	< 1 mbar at 500 l/h
Stagnant space sample side	175 ml	210 ml	370/780 ml ¹⁾
Max. sample inlet temperature	300 °C [572 °F]	300 °C [572 °F]	300 °C [572 °F]
Ambient temperature	+2 to +80 °C [35.6 to 176 °F]		
Storage temperature	-40 to +80 °C [-40 to 176 °F]		
Mounting	Wall-mount		
Material of sample gas-contacted parts	Stainless steel 316Ti*		
Dimensions (W x H x D)	110 x 400 x 125 mm [≈ 4.3" x 15.8" x 4.9"]	110 x 700 x 125 mm [≈ 4.3" x 27.6" x 4.9"]	120 x 750 x 125 mm [≈ 4.7" x 29.5" x 4.9"]
Weight	1.8 kg [≈ 4.0 lbs]	3 kg [≈ 6.6 lbs]	3.3 kg [≈ 7.3 lbs]

Options for gas cooler LGT-2 (jacket cooler with tube bundle)	Part No.
Pressure rating PN40 with certificate of conformity	04K9000
Tube bundle: tube diameter 10/12 mm ¹⁾ instead of 6/8 mm	04K9010
Connection A/B/C/D (Sample gas IN/OUT, Condensate OUT, Coolant IN/OUT): G 1/4" i instead of G3/8" i	04K9035
Connection A/B/C/D (Sample gas IN/OUT, Condensate OUT, Coolant IN/OUT): G 1/2" i instead of G3/8" i	04K9040

1) = With option tube bundle diameter 10/12 mm instead of 6/8 mm.

* = Standard, others on request.

Maximum cooling capacity refer to over-heated vapor or liquid and sufficient coolant.

8.2 Liquid Cooler

Liquid cooler	LC-1	LC-1S	LTC-1
Part No.	04K2000	04K2500	04K3000
Max. cooling capacity approx.	900 kJ/h	1600 kJ/h	3600/6100 kJ/h ¹⁾
Dimension cooling coil	1 x 4/6 mm	1 x 4/6 mm	-
Cooling coil length	3.5 m [≈ 11.5 ft]	6 m [≈ 19.7 ft]	-
Dimension tube bundle	-	-	9 x 6/8 mm
Tube bundle length	-	-	0.5 m [≈ 1.6 ft]
Connection A (Liquid sample IN)	Tube ø 6 mm	Tube ø 6 mm	G 1/4" i
Connection B (Liquid sample OUT)	Tube ø 6 mm	Tube ø 6 mm	G 1/4" i
Connection C (Condensate OUT)	-	-	-
Connection D/E (Coolant IN/OUT).	G 3/8" i	G 3/8" i	G 3/8" i
Liquid sample flow rate, recommended max.	60 NI/h	60 NI/h	200 NI/h
Max. sample pressure	50 bar	50 bar	10 bar
Max. coolant pressure	10 bar	10 bar	10 bar
Coolant liquid flow rate	50 to 300 l/h, depending on necessary cooling capacity, coolant temperature IN/OUT, etc.		
Differential pressure ΔP sample side	700 mbar at 60 l/h	700 mbar at 60 l/h	10 mbar at 200 l/h
Stagnant space sample side	44 ml	76 ml	350/740 ml ¹⁾
Max. sample inlet temperature	300 °C [572 °F]	300 °C [572 °F]	300 °C [572 °F]
Ambient temperature	+2 °C bis +80 °C [35.6 to 176 °F]		
Storage temperature	-40 °C bis +80 °C [-40 to 176 °F]		
Mounting	Wall-mount		
Material of liquid sample-contacted parts	Stainless steel 316Ti *		
Dimensions (W x H x D)	110 x 400 x 125 mm [≈ 4.3" x 15.8" x 4.9"]	110 x 700 x 125 mm [≈ 4.33" x 27.6" x 4.9"]	120 x 650 x 125 mm [≈ 4.7" x 25.6" x 4.9"]
Weight	1.8 kg [≈ 4.0 lbs]	3 kg [≈ 6.6 lbs]	3.6 kg [≈ 7.9 lbs]

Options for liquid cooler LTC-1 (jacket cooler with tube bundle)	Part No.
Pressure rating PN40 with certificate of conformity	04K9000
Tube bundle: tube diameter 10/12 mm ¹⁾ instead of 6/8 mm	04K9010
Connection D/E (Coolant IN/OUT): G 1/4" i instead of G 3/8" i	04K9015
Connection D/E (Coolant IN/OUT): G 1/2" i instead of G 3/8" i	04K9020
Connection A/B (Liquid sample IN/OUT): G 3/8" i instead of G 1/4" i	04K9025
Connection A/B (Liquid sample IN/OUT): G 1/2" i instead of G 1/4" i.	04K9030

1) = For tube bundle option: 10/12 mm instead of 6/8 mm.

* = Standard, others on request.

The specified performance values refer to liquid and sufficient coolant.

8.3 Gas Cooler Dimensions

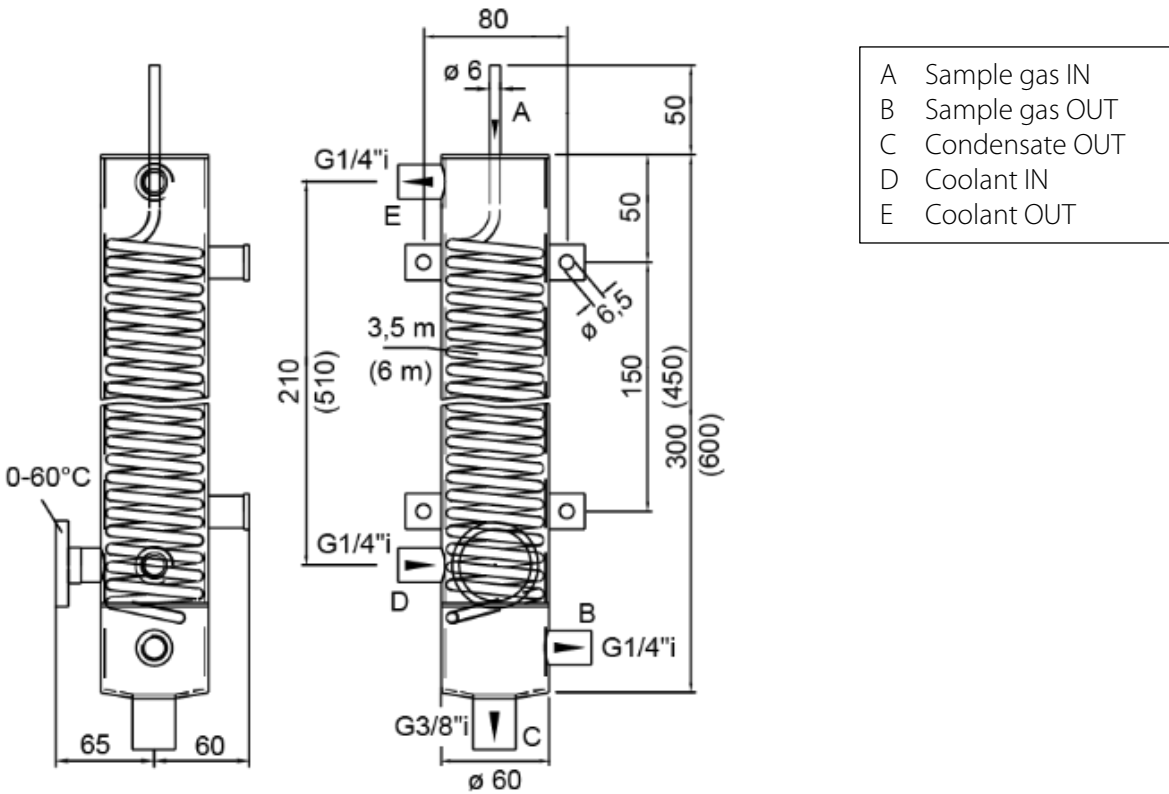


Figure 3 Dimensions: gas cooler LGC-1(S)

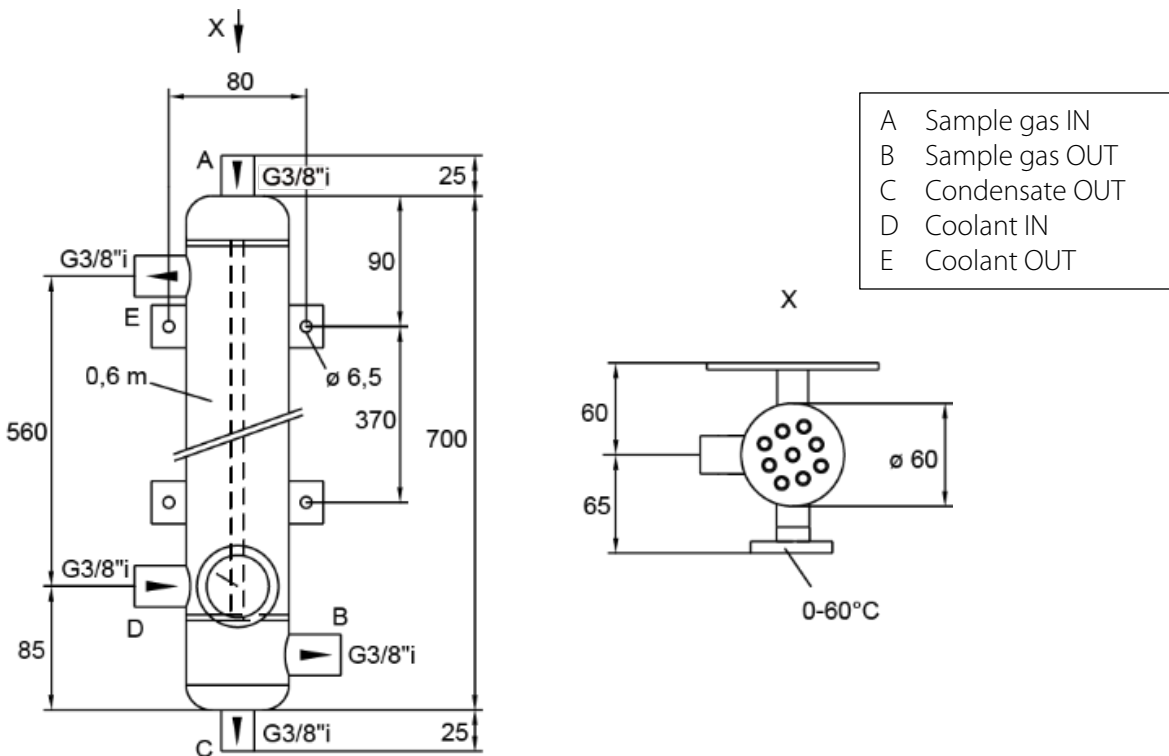


Figure 4 Dimensions: gas cooler LGT-2

8.4 Liquid Cooler Dimensions

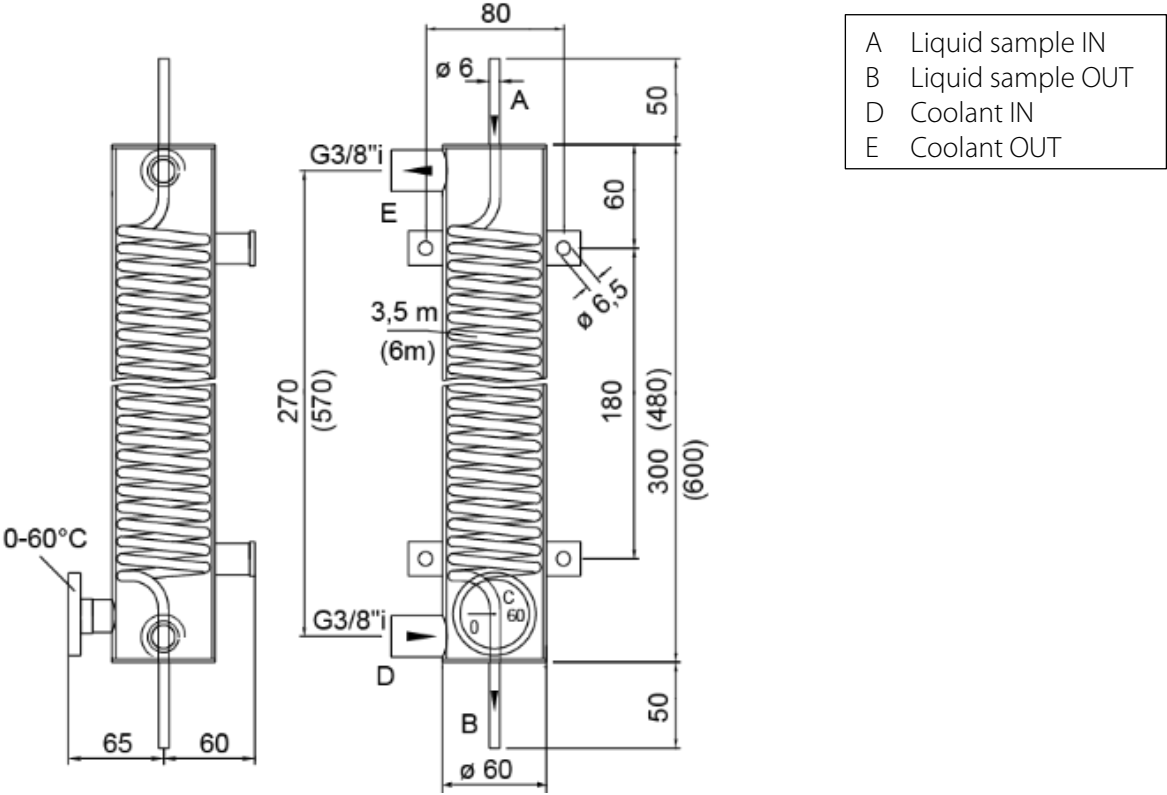


Figure 5 Dimensions: liquid cooler LC-1(S)

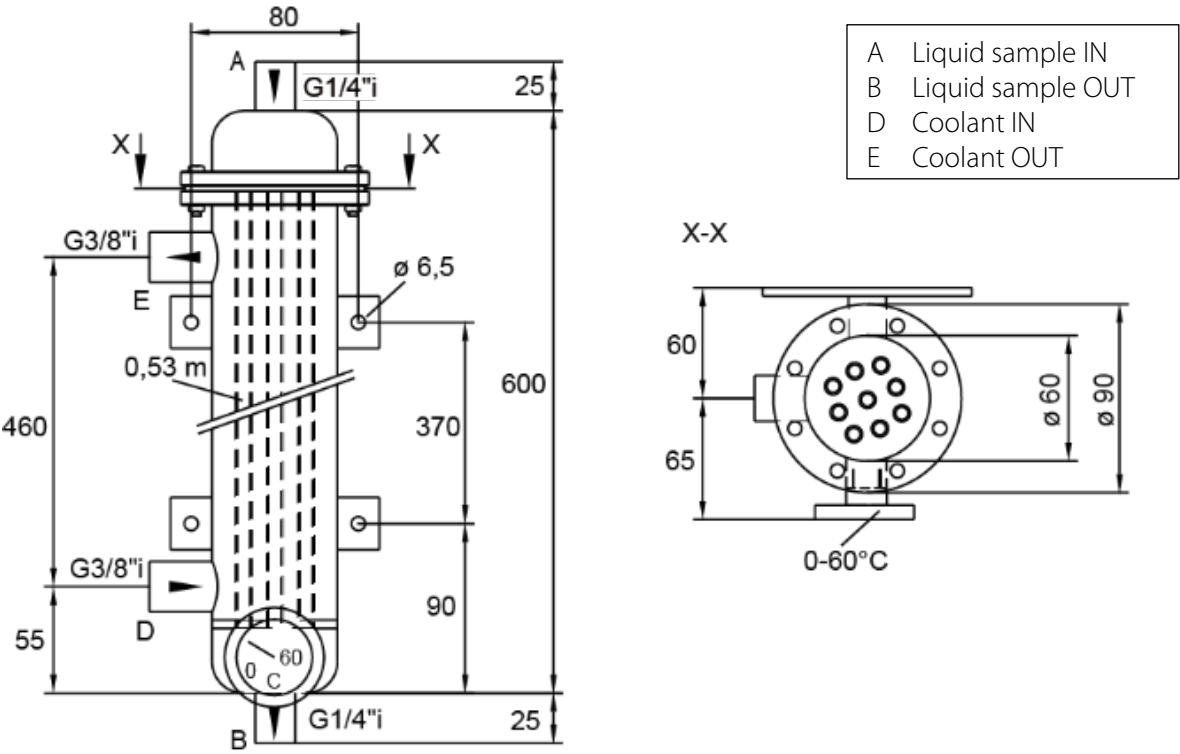


Figure 6 Dimensions: liquid cooler LTC-1

9 Reception and Storage



Note

The cooler must be stored in a weather protected frost-free area!
During transport and storage, the cooler should always be positioned and stored according to the position indicated on the packaging.

10 Preparation for Installation

Select the optimum installation site in accordance with the generally applicable guidelines or consult the responsible authorities. The installation of the cooler must be planned by the installer or operator.

Ensure that the cooler is easily accessible so that any maintenance work that may be necessary later can be carried out without any problems.

11 Mounting the Cooler

The cooler is designed for stationary use and, if properly selected and installed, guarantees long service life and minimum maintenance.

Shut-off control devices must be provided by the customer in the inlet of the coolant and the sample to be cooled.



Note

Ensure the tightness of the tube fitting!
Check the tightness of all tubes after they have been connected.

Do not reduce the specified condensate tubing cross-sections. Reduced cross-sections might impair the condensate drainage (if present).

12 Connecting Coolant and sample to be Cooled



Warning

Incorrect pressure can destroy the cooler.
When connecting, pay attention to the correct pressure specifications according to the technical data and the type plate!

The device must be grounded and the potential equalization with the system must be established.

Connect the coolant and the sample to be cooled according to the technical data and the drawings in chapter 8.

13 Commissioning



Qualified personnel

The work described in this chapter needs to be performed by qualified personnel. The following minimum knowledge is required for the work:

- Instructed person in the process engineering field.
- Detailed knowledge of the operating instructions and the applicable safety regulations.



Note

Check the tightness of the tube fitting!

If necessary, include the tightness of the tube fittings in the maintenance cycle.



Warning

If toxic or oxygen-displacing gases are cooled with the cooler, the gas paths must be purged with inert gas or air before opening the gas-carrying parts. The cooling circuit should always be connected and put into operation first, and then the sample circuit.



Caution hot surfaces possible!

If hot media are fed through the cooler, the operator must check whether the external surfaces are to be marked with the "Caution hot" pictogram.

Furthermore, the work safety regulations of the operator must be observed.

Before commissioning, check that the pressure specification corresponds to the specifications on the type plate.

13.1 Setting the Temperature

To set the desired temperature, proceed in the following order:

1. Apply the coolant.
2. Apply the sample to be cooled.
3. Wait until a stable temperature has been reached.
4. Increase or reduce the coolant quantity to set the desired temperature.



Warning

For temperatures $> 95\text{ }^{\circ}\text{C}$, a sufficient coolant flow must be ensured.

14 Closing Down



Escape of potentially harmful gas from open process connections after disassembly possible.

The relevant safety regulations must be observed for the media to be conveyed.

Before opening flush the lines with a suitable inert gas.

Aggressive condensate possible!

Chemical burns caused by aggressive media possible!

For general electrical and mechanical work on the cooler, wear personal protective equipment (PPE) in accordance with the risk assessment.

Before decommissioning, the cooler should be purged with inert gas or air to prevent condensation of aggressive components from the process gas.

To shut down the cooler, observe the following sequence:

1. Switch off the sample to be cooled.
2. Switch off the coolant.



15 Maintenance

The safety instructions specific to the plant and process are to be consulted prior to any maintenance work!



Qualified personnel

The work described in this chapter needs to be performed by qualified personnel. The following minimum knowledge is required for the work:

- Instructed person in the process engineering field.
- Detailed knowledge of the operating instructions and the applicable safety regulations.



Note

Check the tightness of the tube fitting!
If necessary, include the tightness of the tube fittings in the maintenance cycle.



Warning

If toxic or oxygen-displacing gases are cooled with the cooler, the gas paths must be purged with inert gas or air before opening the gas-carrying parts. Furthermore, the work safety regulations of the operator must be observed.



Aggressive condensate possible!
Chemical burns caused by aggressive media possible!



High surface temperatures possible! Touching the device can cause severe burns!



For general electrical and mechanical work on the cooler, wear personal protective equipment (PPE) in accordance with the risk assessment.



The intervals between servicing are dependent on the process and system conditions in your facility. The facility QA/QC plan should address the frequency for maintenance and should be updated based on your operations.

16 Proper disposal of the device

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

17 Appendix



Further product documentation can be seen and downloaded from our home page:

www.mc-techgroup.com