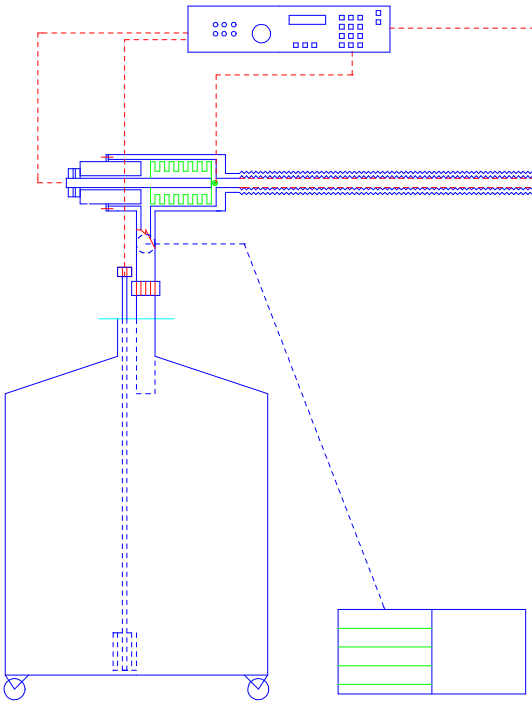
**Karlsruher Glastechnisches Werk**
**ISOTHERM**

**Gablonzer Straße 6**
**D - 76185 Karlsruhe**
**Tel. 0721 / 95897-0**
**Fax. 0721 / 95897-77**
**E-Mail: info.kgw-isotherm.de**
**http://www.kgw-isotherm.com**



# Operating Instructions

## Kaltgas system Type TG-LKF-H
## For direct tempering with a cold gas stream

## Contents



## Separate Manual

# 1. Safety Issues

## A) General Safety Issues

This section describes guidelines for safety when using Kaltgas systems.

When using liquid nitrogen the following safety measures must be adopted. Care should be taken when handling liquid and gaseous nitrogen

Observe the following precautions

- Oxygen deficiency situations in confined spaces high concentrations of nitrogen gas can build up causing an atmosphere that will not support life

- Cryogenic burns. Liquid Nitrogen will freeze flesh resulting in severe frostbite and symptoms similar to burns

- Risk of explosion

- Oxygen enrichment

It is important that users are made aware of safety measures and the risks and dangers of exposure to and use of liquid nitrogen.

## B Safety Details

## B .1 Oxygen deficiency

Air is a gaseous mixture comprising the following components by volume:

| | | |
|---|---|---|
| Oxygen | $O_2$ | 21% |
| Nitrogen | $N_2$ | 78% |
| Argon and other inert gases | Ar | 1% |

Clearly atmospheric gases are not toxic, however, a change in the concentration in particular changes in oxygen concentration effects on will have serious effects on life and combustion processes. It is therefore essential that the atmosphere in which people work is air that contains sufficient oxygen > 19%.

The components of air are odorless and colorless which means that changes in the composition of the atmosphere in the work place can go undetected

## B .1.1 Potential Hazards

Asphyxiation due to normal evaporation of liquid nitrogen due to displacement of oxygen in the air. For example, under normal conditions, 20 °C; 1013 mbar, 1 liter of liquid nitrogen will boil to form 680 liters of nitrogen gas. The critical lower threshold of oxygen concentration is quickly reached.

Oxygen deficiency is dangerous and can cause death by suffocation. The reaction of the body to variation in oxygen supply varies from person to person It is not possible to give accurate and general information on symptoms caused by oxygen deficiency

## B .1.2 Likely instances of oxygen deficiency

Oxygen deficiency can occur due to numerous activities typical in the use of cryogenic fluid like liquid nitrogen

- General presence of nitrogen as a liquid or gas
- Natural evaporation of liquid nitrogen
- Refilling of liquid nitrogen containers and flasks
- Leaks from liquid nitrogen tanks or gaseous nitrogen cyl;inders
- Reduced air supply or insufficient circulation
- Spills

The above list is not exhaustive.

## B .1.3 Recommendations

To prevent the risk of oxygen deficiency it is essential to observe the following:

- Keep the liquid nitrogen storage container upright
- Provide the vessel with suitable insulation
- Protect the vessel from heat sources such as direct sunlight
- Transport the liquid nitrogen container in a suitably equipped vehicle

- Ventilate all work and storage areas

- Protect the liquid nitrogen vessels from damage and rapid movement

- Provide personal with protective equipment; suitable gloves, safety glasses or face shield and safety shoes

- Monitor and control the oxygen content of the working atmosphere continuously

- Ensure all personnel working with liquid nitrogen in closed environments carry oxygen meters

- Provide adequate and complete staff training

This list is not exhaustive.

## B .1.4 Actions in case of accident

The following must be done in the event of an accident

- Secure the environment to prevent secondary accidents

- Act quickly; rescuers must take measures to protect themselves such as using breathing apparatus

- Move injured persons out of the danger area

- Observe emergency operating instructions

- Ventilate the affected premises

- Determine the cause of the accident

This list is not exhaustive.

## C.2 Cryogenic burns

Liquid nitrogen is extremely cold (-196 °C). If th e skin surface is in contact with liquid nitrogen, especially when filling containers, there is a likelihood of cryogenic burns which are similar to frostbite

## C. .2.1 Danger

Cryogenic liquids can:

- Freeze human flesh and skin causing cryogenic burns or frostbite
- Make metal or plastic materials that are not designed for very low temperatures to become brittle potentially causing failure
- Create fog in atmospheres with high relative humidity

## C .2.2 Causes

There are two types of cryogenic burns:

### C .2.2.1 Burns from splashes

When handling samples, and generally in all use of liquid nitrogen, protect against splashes. Splashes of liquid nitrogen on the skin will cause cryogenic burns with severe consequences, especially to the eyes and face.

### C .2.2.2 Burns from contact

Skin contact with very cold material, especially metals, will cause frostbite or cryogenic burns.

Vessel insides or very cold samples should never be touched with bare hands.

## C. .2.3 Recommendation

To prevent cryogenic burns, the following points must be observed:

- Never bring cryogenic liquids into contact with the skin
- Never touch the cold, frosty or un-insulated walls of a cryogenic fluid container
- Always use protective equipment; suitable gloves, safety glasses or face shield and safety shoes

- Keep the vessel vertical

- Used suitable material for connecting flows of cryogenic fluids e.g. corrugated metal tubing or PTFE tubing

- Provide comprehensive staff training

This list is not exhaustive.

## C. .2.4 General rules of conduct for splashes of liquid nitrogen

## C .2.4.1 In the eyes

- Rinse the affected eye for 15 minutes in large quantities of water

- Observe the operating instructions for emergencies

- Consult a physician

## C.2.4.2 On the skin

- Don’t rub the affected area

- Remove or loosen clothing.

- Warm the affected area slowly and progressively.

- Do not apply anything to the burn area

- Observe the emergency operating instructions

- Consult a physician

Neither lists is complete.

## D.3 Explosion

### D .3.1 Hazards

Evaporation of liquid nitrogen can lead to excess pressure in the containing vessel.

### D .3.2 causes

Increase in pressure in the container may be due to:

- Improper setup such as using lid that can be sealed without a safety valve
- Freezing of the container neck and insulating lids

This list is not exhaustive.

### D .3.3 Recommendation

To avoid the risk of explosion:

- Check that the LN2 vessel exhaust port is clear
- Always use filling hoses in order to prevent ice formation on insulating cover
- Place container in a dry and sheltered area
- Monitor humidity of the room
- Check regularly for condensation
- Check regularly for damage to surfaces and materials

This list is not exhaustive.

### D .3.4 General conduct in the case of an accident

See above under 2.1.4 lack of oxygen.

## D 4 Oxygen enrichment

### D .4.1 Hazards

Oxygen enrichment can increase the risk of explosion and fire.

### D .4.2 Causes

Using liquid nitrogen can cause oxygen to condense as a liquid from the air. The boiling point of oxygen is approximately -183 ℃ and of nit rogen -196 ℃ so oxygen is liquefied in the presence of liquid nitrogen

### D .4.3 Recommendation

The following points must be avoided when oxygen enrichment may:

- No smoking
- Keep inflammable materials away from the vessel
- Remove all fire sources such as open flames, lights, spark sources, matches, lighters, etc.
- Ventilated work spaces continuously and adequately
- Clean the floor regularly
- Train staff
- Wear protective equipment
- Check oxygen content continuously
- Always carry an oxygen meter in the work area

This list is not exhaustive.

## E.5 Kaltgas equipment environment

## E .5.1 Location

The room in which the Kaltgas equipment is located, must:

- Allow safe operation.

- Have an adequate and continuous operating ventilation system

- Have flat non-porous floor sufficient to carry the load of the equipment including the storage vessel

- Safety data sheets for liquid nitrogen must be visibly posted

- Secure to prevent unauthorized access

- Allow for the safe filling of the liquid nitrogen vessel

- Provide access to the vessel for inspection, cleaning and maintenance

This list is not exhaustive.

## F.6 EQUIPMENT OPERATION

## F .6.1 Preparation and check list

- After installation and set-up, check all the mechanical and vacuum connections for correct fastening

- Check the overall stability of the Kaltgas system

- During commissioning of the Kaltgas system ensure that for the first few hours of operation of the plant, a qualified the operator is on site and can verify the functionality of the system.

- Thoroughly check the Kaltgas system especially the valves every 24 hours for integrity and correct function.

- The Kaltgas system must not be operated without supervision neither manually nor electronically.

This list is not exhaustive.

# 2. Description and operation of the Kaltgas System

The Kaltgas system type TG-LKF-H is a powerful cooling system for temperature control by means of a cold gas stream. The high cooling capacity of the system is based on the cooling power of liquid nitrogen

Liquid nitrogen is heated in a LN2 reservoir by means of an evaporator (JET). The resulting cold nitrogen gas is passed through a vacuum insulated pipeline to a gas discharge nozzle. In the vacuum insulated pipeline a heat exchanger/heater heats the cold nitrogen gas to a predetermined temperature. The temperature is set on the system control unit. Downstream of the heat exchanger a Pt100 temperature sensor measures the temperature of the gas before it enters the gas discharge nozzle. The performance of the evaporator (JET) determines the cooling capacity; the heater (HEATER) heats the gas to achieve the set temperature. At the gas outlet a temperature controlled gas stream is available, which is stable to a minimum temperature of -170 ℃. The lowest temperature achi evable is approximately -185 ℃ with the JET running at 100% capacity and the highest temperature achievable is 100 ° C with the JET running at 30% capacity

Very good insulation is provided through the use of vacuum insulated components that reduce heat transfer from the ambient environment to the cold gas stream. Vacuum for the vacuum insulated components is generated by a vacuum pump. The vacuum connection between the pump and the cold gas line consists of a flexible corrugated hose and a vacuum shut-off valve.

# 3. Unpacking and installation

Carefully unpack the items and check for damage. It is important that any transport damage should be noted when unpacking. In the event of shipping damage, contact the supplier or the manufacturer.

- Check the allowable environmental conditions and the specifications of the thermostat.
- Check for correct power supply before operating the Kaltgas system.
- Observe the safety regulations for use of liquid nitrogen.

# 4. TG-LKF-H Kaltgas system components

The following are the components of the TG-LKF-H Kaltgas System

1) LN2 siphon with small flange NW 50 for connection to the reservoir equipped with evaporator (JET-500W), length: 1500mm, Aluminum evaporator (default).

2) Vacuum insulated cold gas line with Temperature sensor Pt100, Heater with heat exchanger (HEATER-630W).

3) Safety controller SC4, safety and temperature control device for connecting the heater (HEATER), the LN2 vaporizer (JET), the temperature measurement and control sensor Pt100 and the software interface for the Kaltgas system.

4) RS232 interface converter and supplied software

5) Temperature sensor Pt100 with external temperature probes length = 450mm / diameter = 1.6 mm

6) Electrical connections;

   To connect the safety controller to the evaporator (JET) connection cable (gray)
   To connect the safety controller to the heater connection cable (white)
   Connection cable for temperature control probe (red)
   Connecting cable to the sensor chamber (black)
   USB connection cable
   Power cord 110V / 230V

7) Vacuum Pump and accessories Vacuubrand RZ 6
   - Vacuum pump corrugated hose connection

8) Apollo 150 LN2 tank capacity 150 liter

# 5. Components & assembly

**To ensure trouble free operation of the Kaltgas system, assemble the system in the following order:**

1. Attach Kaltgas gas line to the chamber or object to be cooled.

2. Attach Kaltgas corrugated vacuum hose to the vacuum pump. Run the vacuum pump before starting work for at least 20 minutes with the corrugated vacuum hose attached to both the vacuum pump and the cold gas line

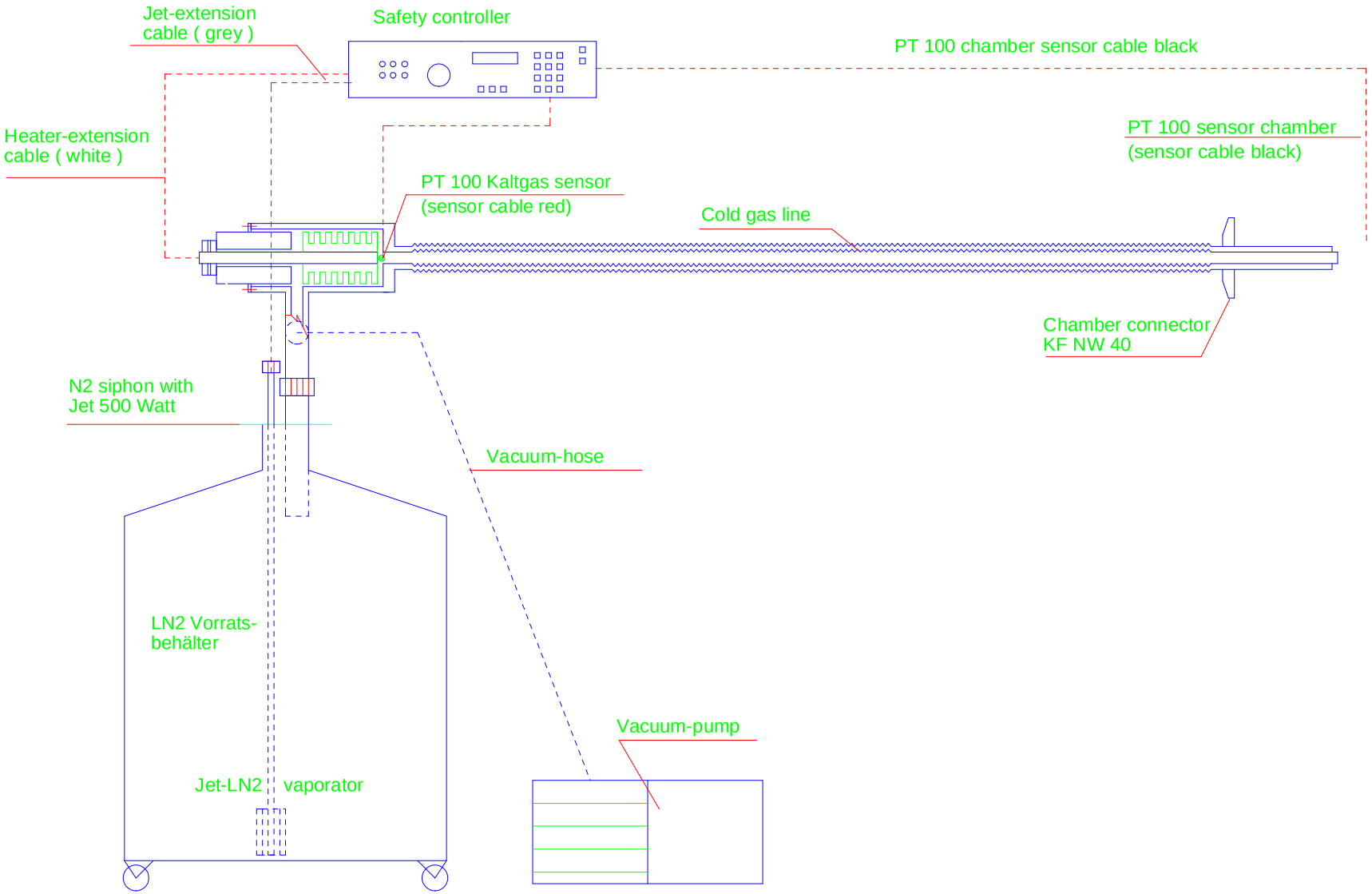
3. Install the LN2 storage tank.

4. Using the centering ring and clamp attach the siphon with the heating jet to the neck of the LN2 storage

5. Connect the cold gas line to the siphon using the compression fitting.

6. Connect all cable electrical connections:

    a. Vaporizer (JET) gray extension cable to the safety controller jet terminal
    b. Cold gas pipe (HEATER) white extension cable to the safety controller heater terminal
    c. Temperature sensor Pt100 red cable (Pt100 sensor for the cold gas hose) to the cold gas sensor jack
    d. External sensor for the chamber black cable to the temperature sensor socket on the safety controller
    d. Vacuum pump to power supply
    e. Safety controller to the power supply
    f. Safety controller connection to the converter


Jet-extension
cable ( grey )
Safety controller
PT 100 chamber sensor cable black
Heater-extension
cable ( white )
PT 100 sensor chamber
(sensor cable black)
PT 100 Kaltgas sensor
(sensor cable red)
Cold gas line
Chamber connector
KF NW 40
N2 siphon with
Jet 500 Watt
Vacuum-hose
LN2 Vorrats-
behälter
Vacuum-pump
Jet-LN2 vaporator

# 6. Operation and use of the safety controller

## 6.1 Rear of controller

a) Connect the LN2 vaporizer (JET) with the corresponding socket on the safety controller using the gray cable.

b) Connect the heat exchanger (HEATER) with the corresponding socket on the safety control unit using the white cable.

c) Connect the power cord.

## 6.2 Front of controller

a) Using the power control for the LN2 Evaporator (JET) that has a range of 0% - 100%, set the LN2 evaporator to 0% so that the jet cannot evaporate immediately after the LN2 supply is activated.

b) Using the temperature controller type JUMO dTRON 316 which displays actual value and set point, set the slider to a cooling process at a temperature below the value to be achieved. Switching on the system will ensure that the heater starts to heater immediately.

c) Safety switch (HEATER and JET)

d) When all electrical connections have been made and liquid nitrogen LN2 tank is connected and turned on, the safety controller can be switched on. This will to ensure that the first power controller (JET) is set to 0% and the temperature control is set below the actual value to be achieved.

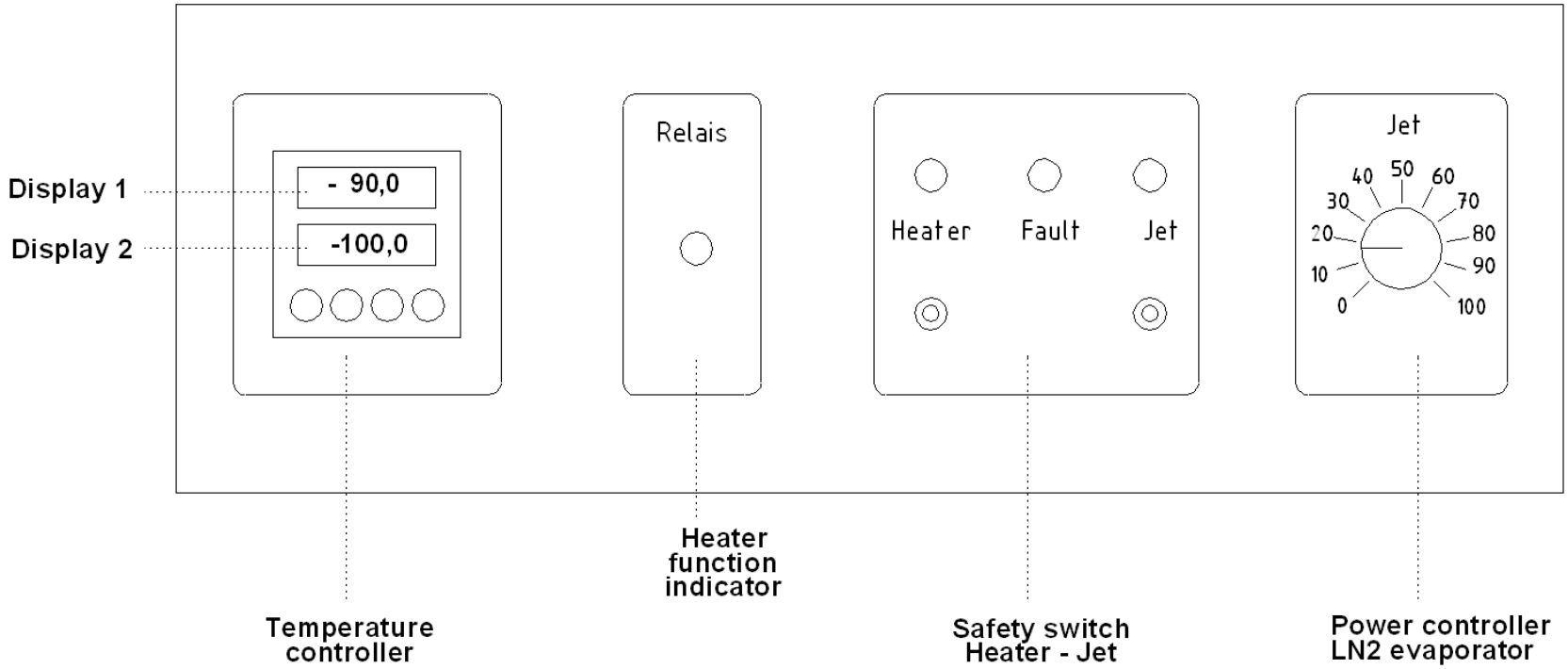
e) After turning on the security controller the heater indicators “Fault” and “Jet” are illuminated. The security line is activated manually by pressing the following keys.

1) Press button JET (JET indicator off).

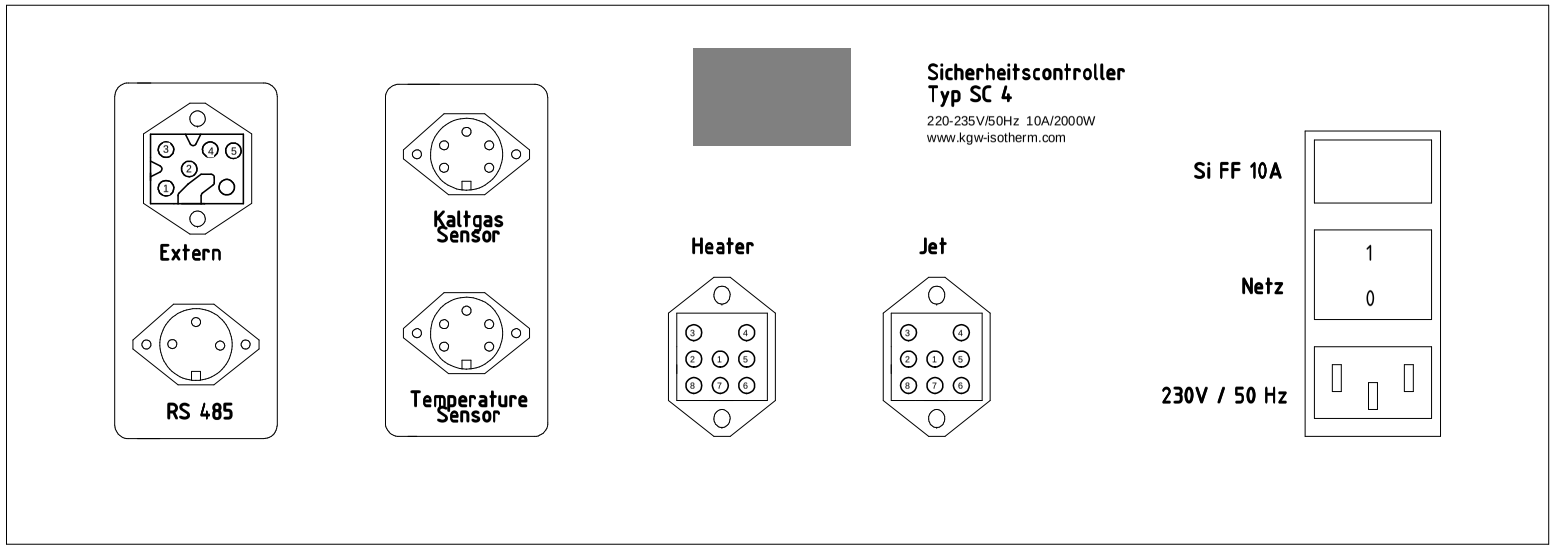
2) Press button HEATER (HEATER indicator off).

Ensure that the security indicator fault indicator is also off. The security controller is now active.

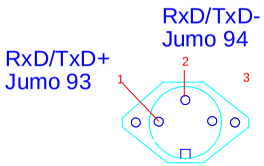
Set the power controller between 0% - 100%) to generate cooling gas flow.



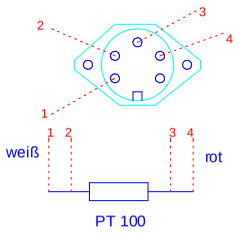

Display 1 = Actual control sensor Heater (cold gas sensor)
Display 2 = Actual temperature sensor (chamber sensor)



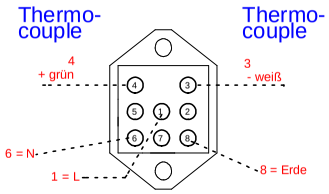

Connector pin list
of RS 485 to converter




PT 100 Kaltgas sensor
Connector pin list
4 - phase bridge

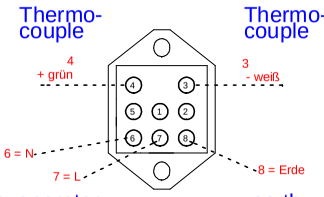



Heater
Connector pin list
Switch off temperature +550℃




Heater cable
white

Jet = LN2 evaporator
Connector pin list
Switch off temperature +170℃



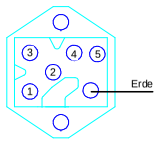

evaporator
Jet cable
grey

earth

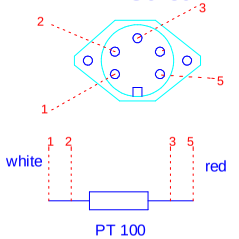
External
ALARM

Relay
230V / 5 Amp.

2 - 1 closing contact
2 - 3 opening contact




PT 100 - Temperatur
Sensor



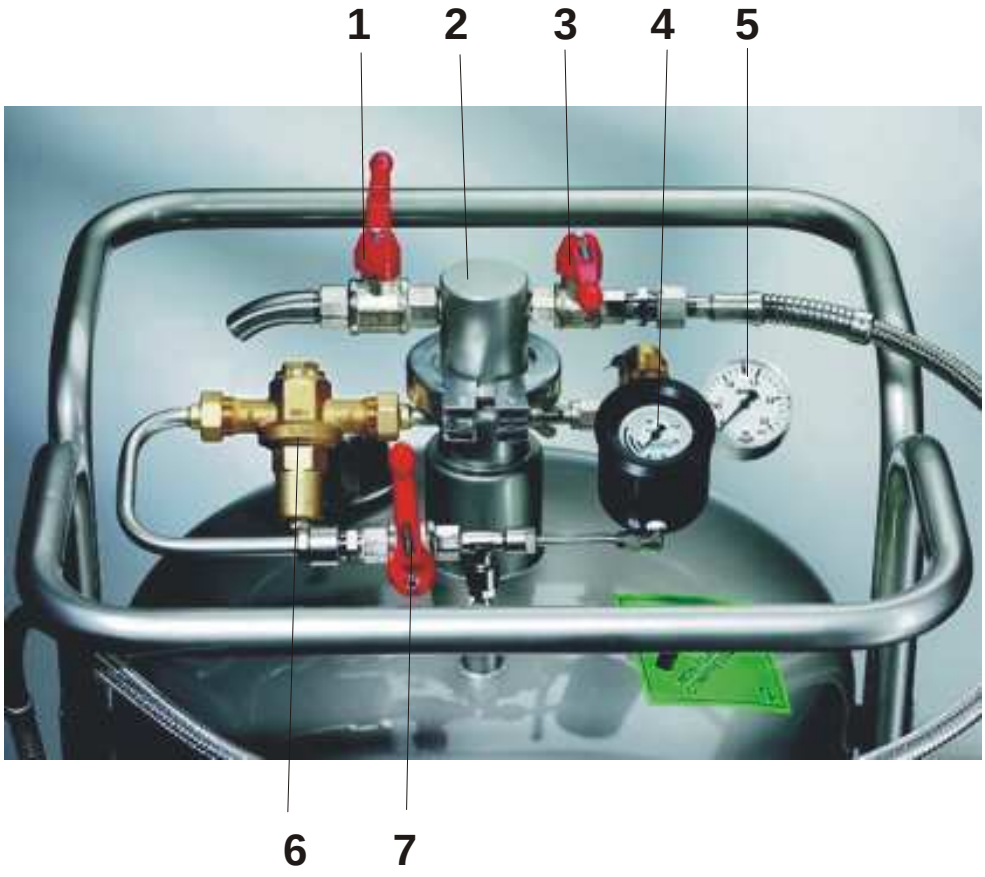
## 7. Filling the Apollo LN2 container

**Important: wear gloves and safety glasses.**

Refer to the operating manual supplied with the container. Follow the safety guidelines, GGVSE / ADR and internal guidelines in the operating manual.

**Important: For small poorly ventilated rooms, the use of an oxygen meter with alarm signal is mandatory.**

As delivered the container comprises the following, the numbers refer to the picture below



a) Open pressure relief valve (# 1) to relieve any residual internal pressure.

b) Open quick action lock on the siphon (# 2) and remove the siphon from the tank together with the attached metal tubes.

c) Do not alter the pressure regulator assembly if present. Modifications or adjustments may be only be made by the manufacturer or qualified personnel.

d) Ensure the pressurizing valve (# 7) is closed. This valve is always closed with a Kaltgas system. Opening the pressurizing valve (# 7) would produce an uncontrolled flow of gas which cannot provide a stable regulated temperature.

e) Fill the Apollo LN2 tank with the siphon removed. Prevent ingress of moisture by using the 50mm plug to cap the container when full.

f) After filling the tank with LN2 reinstall it in the Kaltgas system. Ensure the LN2 vaporizer (JET) is introduced carefully into the container.

g) Take care when inserting the LN2 evaporator (JET). This can cause a LN2 spill if the tank is overfull.

**To avoid LN2 splashing insert the evaporator and siphon slowly over a 2 minute period.**

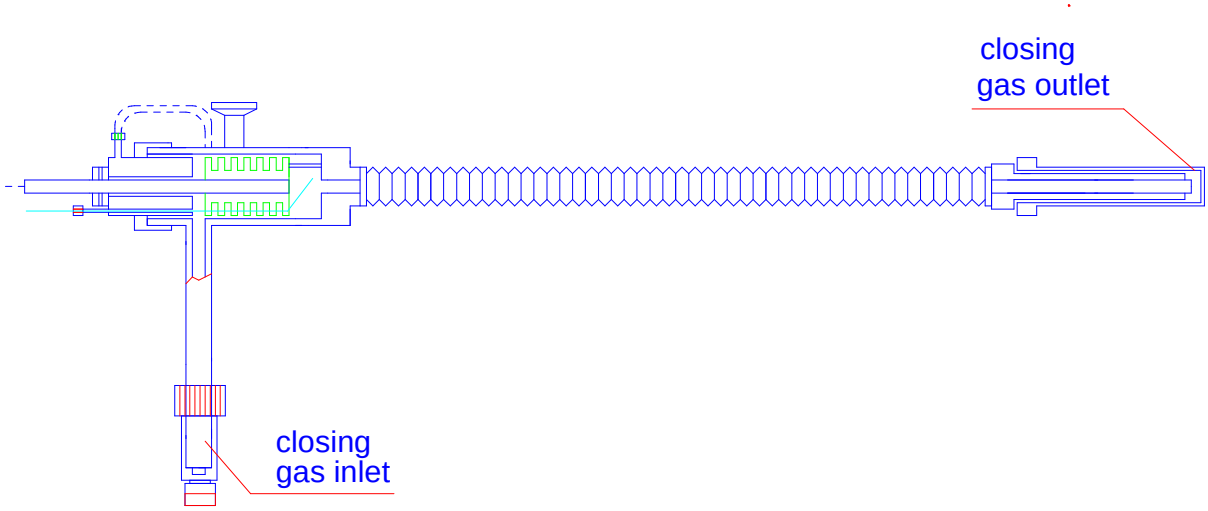
## 8. Commissioning the Kaltgas system

**Both the inlet and outlet of the cold gas line have valves to prevent moisture entry. Moisture present in the cold gas line will result in a build-up of ice in the line and subsequent system close down due to cold nitrogen gas flow being prevented. This will cause an overpressure in the storage container which has a safety pressure relief valve set to open at 0.5 bar. The safety valve will open and release nitrogen gas.**

**Care should be taken after a cooling process to avoid blockage of the cold gas line. The inner tube is cooled substantially by the tempering process and will immediately condense the moisture from the ambient air in the tube. This can cause rapid blockage of the cold gas line.**

**To avoid the above the following close down procedure should be followed.**

**After a cooling process, set the LN2 evaporator (JET) control to 0% and wait until no more gas comes out of the cold gas line. The pressure relief valve on the siphon will open. The valve mechanism in the cold gas line is closed preventing ingress of condensation or ice formation in the gas outlet area. Subsequently remove the reservoir cold gas tube from the compression fitting on the siphon. The closure sleeve will ensure protection of the cold gas tube against ingress of condensation. Heating the gas in the cold gas hose will allow gas under excess pressure to escape through the sealing plug mounted on the valve. The locking mechanisms on the tube remain cold until the next time the system is used.**



Before using the Kaltgas system, read the instruction manuals of the Jumo-controller and follow the instructions for safety control.

For startup proceed as follows:

1. Start the vacuum pump and wait 20 minutes until the required vacuum is reached.

2. Remove the cold gas line from the siphon and open drain valve.

3. Remove siphon with the LN2 vaporizer (JET) from the LN2 container and fill the container with liquid nitrogen.

4. Put the centering ring and O-ring on the container NW 50 flange and carefully insert the siphon and evaporator (JET)into the container. The evaporator should be about 1-2 cm from the bottom of the LN2 container**.**

**Attention! To avoid splashing LN2 ensure the evaporator (JET) is inserted slowly into the LN2 container**

**Important: Wear gloves and safety glasses.**

5. Place the siphon flange on the vessel flange and secure with a clamping ring.

6. Fit and lock the cold gas tube into the compression fitting on the siphon.

**Note: The cold gas pipe must not be submerged in liquid nitrogen**

7. Close exhaust valve.

Ensure that during the operation the indicated pressure of 0.3 bar indicated on the manometer is not exceeded. This will indicate a buildup of condensed frost and ice in the cold gas line

8. Set the safety switch on the thermostat controller.

9. Set evaporator performance to the desired value.

# 9. Settings

### 9.1 Standard operating conditions of the Jumo dTron 316temperature controller

The temperature controller is configured with the default mode settings that are stored in the operating software. If the user accidentally or intentionally modifies the standard settings they can be reset.

### 9.2 Temperature controller settings dTron Jumo 316

a) Temperature sensor Pt100
b) Adjustment from -199.9 °C to +120.0 °C

### 9.3 Connecting the temperature sensor on the dTron Jumo 316 controller

The safety controller has two ports for the Pt100.The top port is used for temperature control by the cold gas sensor. The Pt100 is fitted in the cold gas temperature sensor tube and controls the temperature of the gas stream (dTron Jumo 316 control panel 1).

The second connector is for the external temperature display sensor. This temperature sensor is used to display an external gas or room temperature (dTron Jumo 316 control panel 2).

### 9.3 Quick adjustment of the dTron Jumo 316 controller

Check Section 4

a) Turn on and adjust the safety control JET performance to 50%.

b) Turn temperature control device to the network position.

c) Input set point temperature to -80 °C

1) Press the up arrow keys ∆ and down ∇ arrow to adjust the set point temperature. The set point temperature is shown on the display. When the nominal setting is done the display returns to display the two temperature sensor values.

2) After 2 seconds the temperature controller automatically starts to adjust to the input set point

d) Start auto optimization of the temperature controller:

1) Press up arrow key ^ and down arrow > keys for 3 seconds
2) The screen will display 'tune' and auto optimizing will begin;
3) When ‘tune’ no longer displayed auto optimizing is complete
4) Pressing the EXIT to confirm auto optimizing is complete

To achieve optimum temperature stability, auto optimizing with a change in set point temperature and / or a change of the jet power can be carried out separately.

Using a set point temperature of -80 °C auto optim ization may be used for most temperatures.

**Self-optimization at -80℃ has already been carried out.**

**9.4 Operating settings of the Security Controller**

It is not necessary to run the Kaltgas system at maximum capacity for normal operation the following are recommended settings

| | |
|---|---|
| Maximum heating rate: | 5 ℃ / min |
| Maximum evaporator capacity (JET) during cooling without temperature control: | 100% |
| Maximum evaporator capacity (JET) during cooling with temperature control: | 90% |
| Optimal heating (HEATER) in continuous use, approximately | 30% |

**Basic settings for cooling for example to -90 °C**

**Option 1.** Fast cooling with LN2 subsequent optimization

Place the evaporator (JET) at 70% power and cool the chamber to a temperature of approximately -80 ℃. Reduce the evaporator (JET) power to 50% and cool the chamber to a controlled temperature of -90 ℃. Use this setting the evaporator (JET) power to run continuously cooling the chamber. To reduce LN2 consumption on reaching the working temperature of -90 ℃, reduce the evaporator (JET) power setting in 5% decrements until a setting of 30% heater duty is reached. This gives the lowest LN2 consumption.

**Option 2.** Temperature controlled cooling with LN2 consumption optimization

Set the evaporator (JET) power to approximately 50% and let the chamber temperature reduce automatically to -90 ℃. With this setting t he Kaltgas system will run independently. To reduce LN2 consumption on reaching the working temperature of -90 ℃, reduce the evaporator (JET) power setting in 5% decrements until a setting of 30% heater duty is reached. This gives the lowest LN2 consumption.

**Heating**

Set the evaporator (JET) power to approximately 20% and heat the chamber at a gradual heating rate of 10 ℃ per 5 min to a temper ature of approximately +20 ℃. Alternatively use the Kaltgas software.

Important when heating or cooling use the internal, built in, sensor for temperature control

**Attention! very important**

Using a temperature sensor in the chamber will not provide accurate control and can damage the Kaltgas system. The internal temperature probe of the Kaltgas system must be used for heating and for control.

**IMPORTANT**

If the Kaltgas system is run with reduced gas flow and high heating rates there are very high mechanical and thermal loads on the heat exchanger that will reduce its operating life.

IMPORTANT

All heaters have a built in thermocouple which provides monitoring of the heating element and protects it from overheating.

**Safety switching off of evaporator (JET) internal temperature max. +170 °C**

**Safety switching off heater (HEATER) internal temperature max. + 550 °C**

**Note:**

After completion of the cooling operation leave the siphon exhaust valve closed to avoid outflow of cold nitrogen gas and subsequent rick of blockage by icing. Immediately after removing the cold gas hose from LN2 tank seal the gas ports with the valves to prevent condensation from entering the tube. See Chapter 8.

### 9.5 Important setting data

The Kaltgas system is an open tempering system that covers a large temperature range. A Kaltgas system is a low temperature system. Depending on the power of the jet at higher temperatures the heating power can reach a limit and the heater cannot provide heat to reach a desired temperature. In this case the heater heats continuously (see green light on the controller) and can eventually lead to warping of the connection between the heater and heat exchanger. For this reason the following are important settings;

**Services Jet = 500 watts = 630 watts and Heater.**

a) Cooling without regulation can be done with full power.

b) Regulating at -170 ℃, 90% evaporator power.

c) Regulating at -150 ℃, 70% evaporator power

d) Regulating at -100 ℃ approximately 50% evaporat or power

e) Regulating at -50 ℃, 50% evaporator power

f) Regulating between -50 ℃ to +10 ℃ for about 35 % evaporator power

g) Regulating at 20 ℃ for about 35% evaporator pow er

h) Temperatures above +20 ℃ max. 30% evaporator po wer

**Please note:**

Cooling a chamber with a Kaltgas system is not a problem since no large thermal stresses occur. Heating from a low temperature to a higher temperature at room temperature or above requires large amounts of heat, places demands on the heat exchanger and should be done slowly. There is a procedure provided for this in the operating software

Kaltgas systems are software controlled systems.

## 10. Safety

- Only use Kaltgas systems with supervision present
- Only operate Kaltgas systems with enough LN2 in the LN2 reservoir
- Maintenance and repair of the regulator may only be performed by qualified personnel
- Protect electrical components from dust, moisture, shock and overheating
- Observe safety regulations when handling liquid nitrogen
- Material Safety Data Sheet according to TRGS 220, AIR LIQUIDE 08/29/2002
- Wear protective goggles and protective gloves
- Liquid nitrogen vessels may not be sealed gastight if there is no safety valve on then LN2 cylinder
- Observe installation instruction’s safety requirements
- Closed the exhaust valve after system use
- Switch vacuum of the vacuum pump and close the vacuum shutoff valve after system use

## 11. Cleaning and maintenance

Temperature controller and safety controllers are maintenance free. The units may only be maintained or repaired by the manufacturer

Electronic components should be cleaned with a dry cloth. Ensure no water gets inside the equipment.

# 12. Fault finding

The Kaltgas system generally works flawlessly. If a problem occurs check the following

| Problem | Possible Cause | Solution |
|---|---|---|
| Controller Specific | | Jumo manual |
| No tempering gas from the cold gas hose | Evaporator(JET) off | Start Evaporator |
| | Exhaust valve open | Close exhaust valve |
| | Defective Evaporator | Check the resistance of the evaporator. The resistance between pin 1 and pin 3 must be approximately 101.9 ohms |
| | Pressure in vessel > 0.3 bar | Shut off the system, open exhaust valve, Thaw cold gas pipe with warm nitrogen gas to remove ice. Rinse. |
| Gas temperature falls steadily | Defective heater | Check the resistance of the Heater. Resistance between pins 1 and 2 must be approximately 85.2 ohms |
| Cold gas tube warm | Defective vacuum pump | Check the pump with vacuum gauge |
| | Cold gas hose vacuum leak | Helium leak test cold gas tube |

# 13. Technical specifications

### 13.1 Safety Controller

| | |
|---|---|
| Line voltage: | 230V ~ 50Hz |
| Connections: | - JET (Harting socket)<br>- HEATER (Harting socket)<br>- Temperature controller (DIN socket-Renk) permissible |
| Environment: | 10℃ to 50 ℃. max. relative humid ity; 75% |

### 13.2 Temperature Sensor

| | |
|---|---|
| Type: | Pt 100, encapsulated |
| Resistance at 20 ℃: | 110 ohm |
| Length / diameter: | 450 mm / 1.6 mm |
| Connection: | DIN plug bayonet lock Type 71<br>Type C 5 pin |
| Cable cold gas tube probe: | red |
| Cable chamber sensor: | black |

### 13.3 Jet 500Watt / extension cable gray

| | |
|---|---|
| Power supply: | 230V ~ 50Hz; |
| Heating element dia. x length: | 12.5mm x 1500 mm / 101.9 ohms approximately |
| Connection: | plug- Harting |
| NiCr-Ni at 20 ℃: | 10.7 ohms |

### 13.4 Heater 630 Watt / extension cable white

| | |
|---|---|
| Power supply: | 230V ~ 50Hz; |
| Heating element dia. x Length: | 10mm x 450 mm / 85.2 ohms approx. |
| Connection: | plug- Harting |
| NiCr-Ni at 20 ℃: | 5.3 ohms |

### 13.5.1 nitrogen consumption at 500 watts:

Minimum Evaporator(JET) setting = 10%: 2 L / h
Maximum Evaporator(JET) setting = 100%: 10 L / h

# 14. Warranty

Warranty 12 months from date of shipment for faults in materials or manufacturing. The warranty covers the wholesale price of the device. In case of warranty contact the manufacturer.

| KGW | FORMBLATT | QUALITÄTS MANAGEMENT |
|---|---|---|

# Test sheet Kaltgas Jet LS. No.

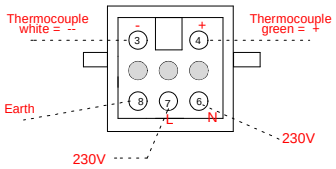
| Kapitel 10 | Formular 10/2TG-RD | Ausgabedatum: 19 Jan. 1998 |
|---|---|---|

## Heating staff for LN2-evaporator, Jet

Lenght: 1500mm
Power: 500 Watt / 230 Volt / 50Hz

## Heating staff and thermal element data

Thermocouple: -0,19 mV at ambient temperature
Thermocouple: 10,7 ohm at ambient temperature
Heating staff: 101,9 ohm at ambient temperature
Ambient temperature 22 ℃




## Electrical contact between heaters and thermocouple

Contact [redacted] no

## Continuity check of the grounding between:

| | | | |
|---|---|---|---|
| Earth | Coat | yes | [redacted] |
| Earth | heater | [redacted] | no |
| Earth | thermocouple | [redacted] | no |

Checked through:

Date:

## Number of the heating stuff:

## Jet siphon for Kaltgas hose

| | | |
|---|---|---|
| 0,5bar relief valve | yes | [redacted] |
| Manometer | yes | [redacted] |
| Exhaust cock | yes | [redacted] |

Checked through:

Date:

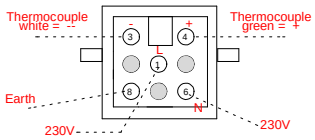
| KGW | FORMBLATT | QUALITÄTS MANAGEMENT |
|---|---|---|

# Test sheet Kaltgas Heater LS. No.

| Kapitel 10 | Formular 10/2TG-RD | Ausgabedatum: 19 Jan. 1998 |
|---|---|---|

## Heating staff for N2-evaporator, Heater

Lenght: 450mm
Power: 630 Watt / 230 Volt / 50Hz




## Heating staff and thermal element data

Thermocouple: -0,08 mV at ambient temperature
Thermocouple: 5,3 ohm at ambient temperature
Heating staff: 85,2 ohm at ambient temperature
Ambient temperature 22 ℃

## Electrical contact between heaters and thermocouple

Contact [ ] yes [ ] no

## Continuity check of the grounding between:

| | | | |
|---|---|---|---|
| Earth | Coat | yes | [ ] |
| Earth | heater | [ ] | no |
| Earth | thermocouple | [ ] | no |

Checked through:

Date:

## Heat exchanger head for Heater

| | | |
|---|---|---|
| Standard heat exchanger | yes | [ ] |
| Temperature sensor PT100 | yes | [ ] |
| Temperature sensor NiCrNi | [ ] | no |

Checked through:

Date:

# 15. Troubleshooting Kaltgas systems

This section contains troubleshooting tips to help find and fix problems with a Kaltgas system. The following additional items are required:

Blind plug for heater (HEATER) or jet (JET). The connector bridges the thermocouple monitoring the heating elements.
Multi-meter to measure resistance in ohms.
Data Sheets for evaporator (JET) and Heater (HEATER). See documents for Kaltgas systems.

1. Check all electrical data of the heating elements (jet and heater) with the multi-meter for resistance data refer to the standard evaporator (JET) test sheet. Check for short circuit between the heater, thermocouple and ground. Results should be consistent with and match the standard evaporator test sheet data.

If electrical resistance data match the values in the evaporator and heater test sheets continue to the next step. If the values are not consistent contact the manufacturer to determine repair steps.

2. Set up the Kaltgas system with all electrical connections in place.

    a) Evaporator (JET)Jet (LN2 immersion heater) to Safety Controller
    b) Heater (HEATER) to Safety Controller
    c) Temperature Sensor to Temperature Controller

Firstly switch on the safety controller. The built in alarm sounds. Wait 10 seconds and then press the reset button and then the Jet Heater reset button. The three lights on the reset buttons should go out as the alarm sounds/. If the lights do not go out and/or the alarm continues to sound there is a defective fuse which should be replaced before continuing.

For example if the jet button lamp is not extinguished after the reset, check the evaporator (JET) circuit.

Continue trouble shooting

1) Switch off the safety controller.

2) Disconnect the evaporator extension cable from the safety controller and insert a plug into the bottom of the screen which connects the thermocouple Then turn on the safety controller to activate again as described in section 2 of the safety controller.

3) If, after pressing the reset button the jet light does not illuminate, the safety controller is defective. Please send back for review at KGW.

4) With the light on the safety controller off and the evaporator (JET) is connected to the safety controller connect the blind plug to the connecting cable and switch on the  safety controller

5) If the lamp does not goes out after pressing the reset button the cable is defective and must be sent to KGW for repair/replacement. The light does go out after the reset the evaporator (JET) is faulty and should be sent to KGW for repair/replacement

Use a similar method to trouble shoot the heater (HEATER).

For further information please do not hesitate to call 0049 721 95897-77 fax or email: info@kgw-isotherm.de or your local KGW Isotherm distributor

# 16. Declarations of conformity

### 16.1 Declaration of Conformity Vacuubrand Rotary Vane Vacuum Pump

Machinery Directive as amended
89/392/EEC
91/368/WEG
93/44/EEC
93/68/EEC

Low Voltage Directive
73/23/EEC
93/68/EEC

Electromagnetic Compatibility Directive
89/336/EEC
92/31/EEC
93/68/EEC

Applied harmonized standards, in particular
EN 292-2 - EN 61010-1 -- EN 1012-2
EN 61326
EN50082-2

### 16.2 Declaration of Conformity Messner Safety Controller

Electromagnetic Compatibility Directive
(89/336/EEC)

Low Voltage Directive
73/23/EEC**16.3 Declaration of Conformity JUMO Thermostat**
See Operating Instructions B 70.3041.0 JUMO

### 16.4 Declaration of Conformity Meier Heater Bridge

Low Voltage Directive
73/23/EEC

VDE mark, tested and certified to
DIN EN 60 335 Part 1: 1995-10 (VDE 0700 Part 1)

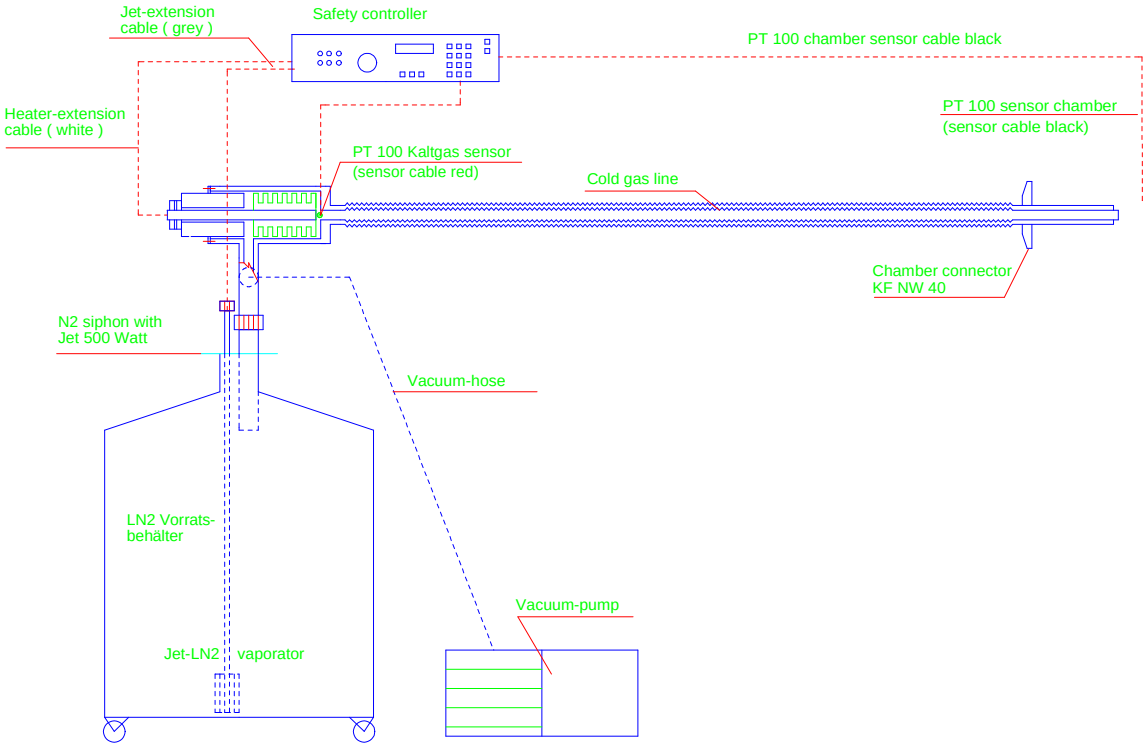
### 16.5 Declaration of Conformity Cryotherm Liquid Nitrogen Container

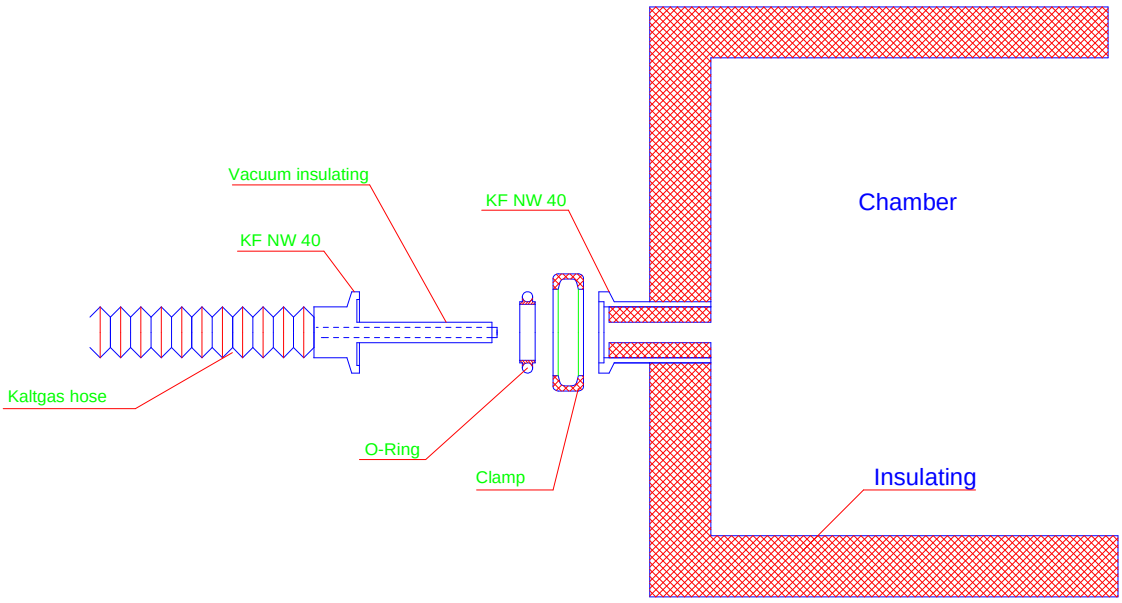
Liquid nitrogen container with a working pressure greater than 0.5 bar
Pressure Equipment Directive 97/23/EC

### 16.6 EMC testing

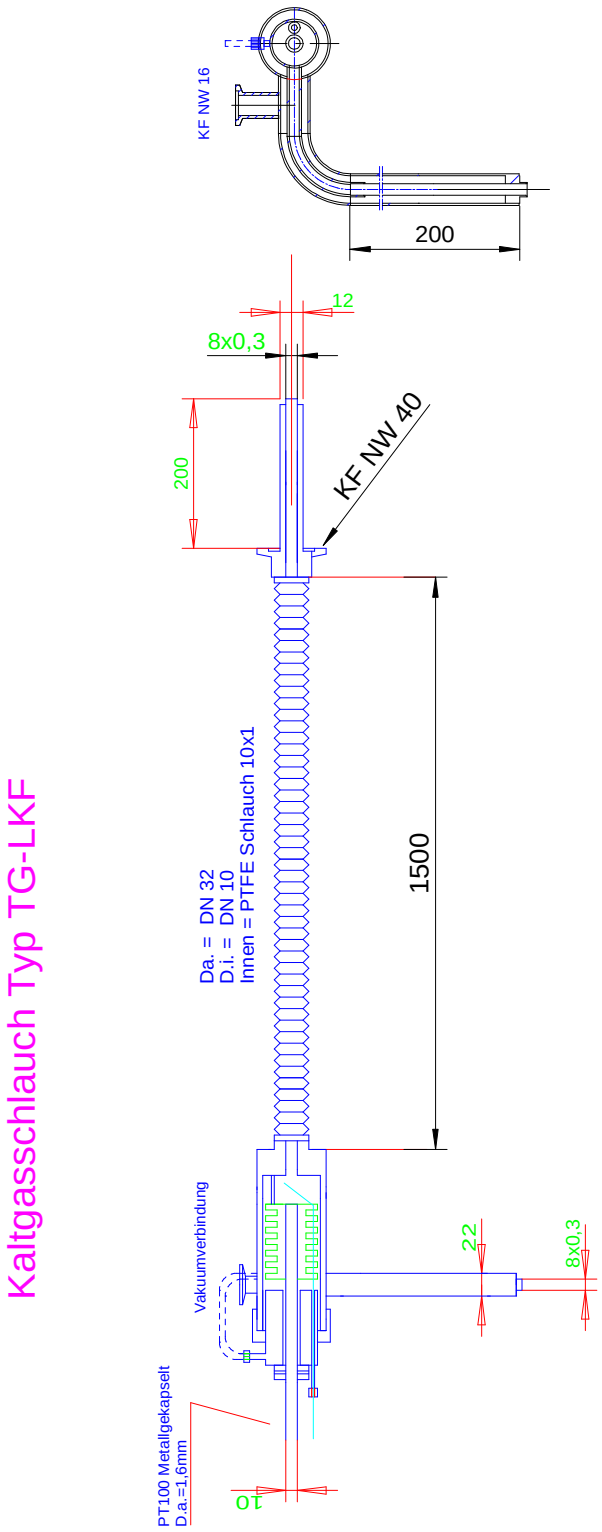
Report No.: 4514C10

# 17. Detailed diagrams

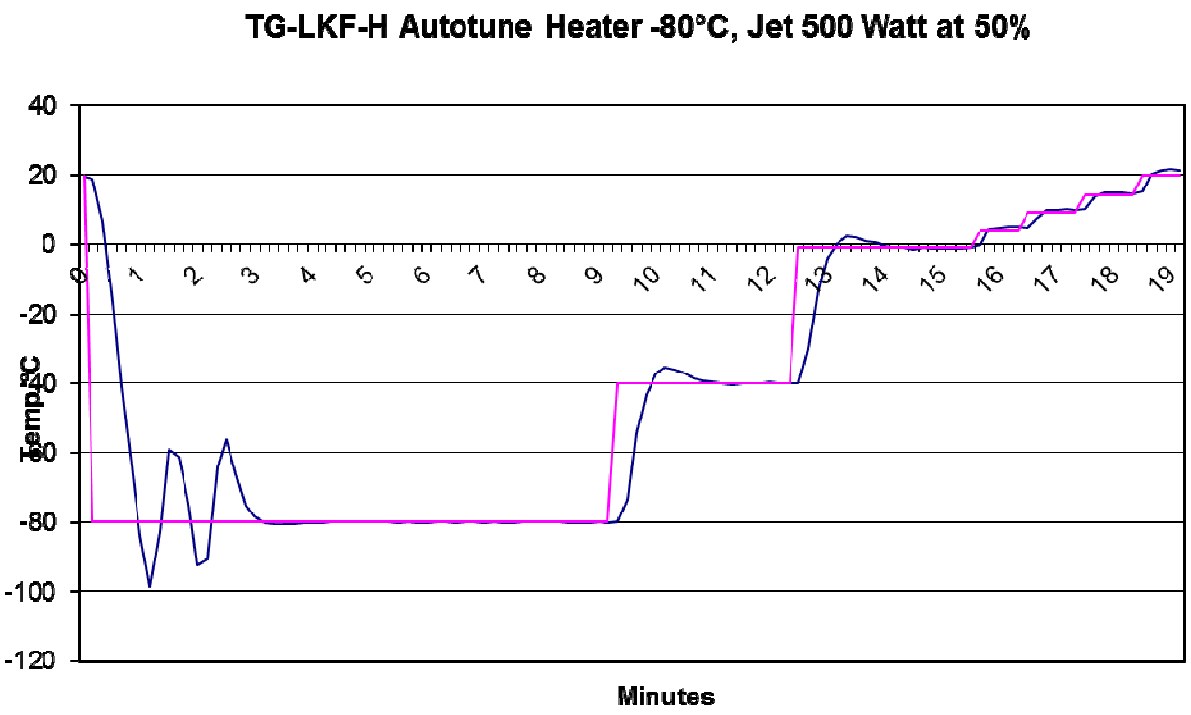


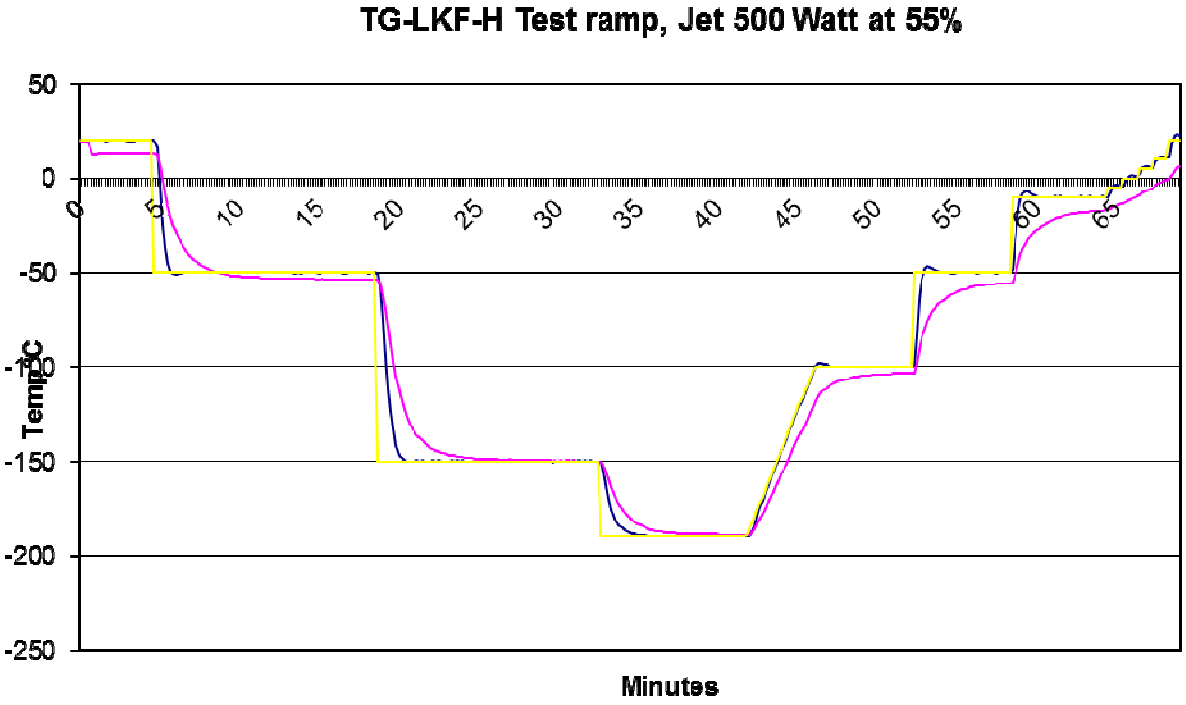



# 18. Detailed Sketch of Vacuum Insulated Hose



## 19. Test data


TG-LKF-H Autotune Heater -80°C, Jet 500 Watt at 50%
40
20
0
-20
-40
-60
-80
-100
-120
Temp °C
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Minutes


TG-LKF-H Test ramp, Jet 500 Watt at 55%
50
0
-50
-100
-150
-200
-250
Temp °C
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Minutes