

HEATING SYSTEMS

THERMO 230/300/350

Installation instructions

with Control Unit 1572D

Rev. 01/2025
Id.No. 63425G-001

SPHEROS



Improper installation or repair of Spheros heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.

To install and repair Spheros heating and cooling systems you need to have completed a Spheros training course and have the appropriate technical documentation, special tools and special equipment.

NEVER try to install or repair Spheros heating or cooling systems if you have not completed a Spheros training course, you do not have the necessary technical skills and you do not have the technical documentation, tools and equipment available to ensure that you can complete the installation and repair work properly.

ALWAYS carefully follow Spheros installation and repair instructions and heed all **WARNINGS**.

Spheros rejects any liability for problems and damage caused by the system being installed by untrained personnel.

Highlighted words like Warning, Caution, ATTENTION and NOTE in these evacuation and charging instructions signify the following precautions:



This caption is used to indicate possible severe injuries or fatal accidents if instructions or procedures are carried out incorrectly or entirely disregarded.



This caption is used to indicate possible minor injuries if instructions or procedures are carried out incorrectly or entirely disregarded.

ATTENTION:

This caption points to actions which may cause material damage.

NOTE:

This caption is used to draw attention to an important feature.

NOTE: Subject to modification. In multilingual versions the German language is binding. The latest version of this document you will find in the download center on www.spheros.com.



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1 Statutory regulations governing installation

1.1. Statutory regulations governing installation

For the heaters exist type approvals according to the UN/ECE Regulations R10 (EMC):

No. 04 1010 and
R122 (heater) No. 00 0007 for Thermo 230
No. 00 0008 for Thermo 300
No. 00 0009 for Thermo 350

Installation is governed above all by the provisions in Annex 7 of ECE Regulation R122.

NOTE:

The provisions of these Regulations are binding within the territory governed by UN/ECE Regulations and should similarly be observed in countries without specific regulations.

(Extract from ECE Regulation R122, Annex 7)

4. The heater must have a manufacturer's label showing the manufacturer's name, the model number and type together with its rated output in kilowatts. The fuel type must also be stated and, where relevant, the operating voltage and gas pressure.

7.1. A clearly visible tell-tale in the operator's field of view shall inform when the combustion heater is switched on or off.

(Extract from ECE Regulation R122, Part I)

5.3 Vehicle Installation Requirements for Combustion Heaters

5.3.1 Scope

5.3.1.1 Subject to paragraph 5.3.1.2., combustion heaters shall be installed according to the requirements of paragraph 5.3.

5.3.1.2 Vehicles of category O having liquid fuel heaters are deemed to comply with the requirements of paragraph 5.3.

5.3.2 Positioning of combustion heater

5.3.2.1 Body sections and any other components in the vicinity of the heater must be protected from excessive heat and the possibility of fuel or oil contamination.

5.3.2.2 The combustion heater shall not constitute a risk of fire, even in the case of overheating. This requirement shall be deemed to be met if the installation ensures an adequate distance to all parts and suitable ventilation, by the use of fire resistant materials or by the use of heat shields.

5.3.2.3 In the case of M2 and M3 vehicles, the combustion heater must not be positioned in the passenger compartment. However, an installation in an effectively sealed envelope which also complies with the conditions in paragraph 5.3.2.2. may be used.

5.3.2.4 The label referred to in Annex 7, paragraph 1.4., or a duplicate, must be positioned so that it can be easily read when the heater is installed in the vehicle.

5.3.2.5 Every reasonable precaution should be taken in positioning the heater to minimize the risk of injury and damage to personal property.

5.3.3 Fuel supply

5.3.3.1 The fuel filler must not be situated in the passenger compartment and must be provided with an effective cap to prevent fuel spillage.

5.3.3.2 In the case of liquid fuel heaters, where a supply separate from that of the vehicle is provided, the type of fuel and its filler point must be clearly labelled.

5.3.3.3 A notice, indicating that the heater must be shut down before refuelling, must be affixed to the fuelling point. In addition a suitable instruction must be included in the manufacturer's operating manual.

5.3.4 Exhaust system

5.3.4.1 The exhaust outlet must be located so as to prevent emissions from entering the vehicle through ventilators, heated air inlets or opening windows.

5.3.5 Combustion air inlet

5.3.5.1 The air for the combustion chamber of the heater must not be drawn from the passenger compartment of the vehicle.

5.3.5.2 The air inlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

5.3.6 Heating air inlet *not applicable*

5.3.7 Heating air outlet *not applicable*

5.3.8 Automatic control of the heating system

5.3.8.1 The heating system must be switched off automatically and the supply of fuel must be stopped within five seconds when the vehicle's engine stops running. If a manual device is already activated, the heating system can stay in operation.

ATTENTION:

Failure to follow the installation instructions and the notes contained therein will lead to all liability being refused by Spheros. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This results to the invalidation of the general operating license / ECE Type approval of the heater.



At petrol stations and other fuel filling facilities the heater must be switched off due to the explosion hazard. To advice to this requirement the self-adhesive label with the text "Switch off heater before refueling!", delivered with each heater, is to be affixed next to the filler neck.

1.2. Provisions relating to the installation in rail vehicles

For installation in rail vehicles for heater models Thermo 230 / 300 /350 Rail an design approval exists.

NOTE:

Please consider the latest version of the Thermo Rail Installation Instructions (Ident No. 11115243_).

2 Use / version

2.1. Use of the water heaters

The water heaters, hereafter referred to as heaters, are used in conjunction with the vehicle's own heating system

- to heat the passenger cabin, and
- for pre-heating.

The heater may only be installed and operated in vehicles of the class **M2, M3, N2, N3, O1, O2, O3, O4**.

Any use beyond is not permitted.

The heaters operate independently of the engine and are connected to the cooling system, the fuel system and the electrical system of the vehicle.

 Warning!	Danger to life and health!
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The heater is not approved for use in vehicles carrying dangerous goods according to Annex 9 of the UN/ECE Regulation R122.

 Warning!	Danger to life and health!
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Because poisoning and suffocation hazard, the heater must not be operated, not even with timer, in enclosed areas such as garages or workshops without a suck off facility. This also applies to the operation during adjustment of the CO₂ content in the exhaust gas. At petrol stations and fuel depots the heater must be switched off because of explosion hazard.

 Caution!	Fire hazard!
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The heater must not be operated if in the area of its exhaust outlet are inflammable materials (e.g. dry grass and leaves, cartons, paper etc.) and/or in locations where inflammable vapors or dust may form for instance close to

- any type of fuel depots
- coal and wood storages
- storages of plastics and the like.

2.2. Versions

Thermo 230 - 24V

Water heater for "diesel"
with 23 kW heat current (20000 kcal/h)

Thermo 300 - 24V

Water heater for "diesel"
with 30 kW heat current (26000 kcal/h)

Thermo 350 - 24V

Water heater for "diesel"
with 35 kW heat current (30000 kcal/h)

On request, and depending on the configuration, the heater may be equipped with a nozzle holder preheating system.

2.3. Use / Function

See Workshop Manual!

3 Installation

ATTENTION:

- **The statutory regulations governing the installation must be adhered.**
- **If the water heater is to be operated in a separately installed heating system, prior to installation an installation planning report must always be submitted to Spheros for approval. If this approval is not obtained, all warranty and liability claims will be void. The water heater has been designed, tested and approved for specific bus requirements.**
- **To the temperature sensor cable no mechanical load must be applied (e.g. carry the heater with it).**
- **Heaters and circulating pumps shall be always installed in such a way that a negative impact by road dirt, splashing water, exhaust gases or other harmful influences is excluded.**

NOTE:

Consider the installation situation of the relevant vehicle type.

3.1. Installation location

The heater and the circulating pump are to be integrated into the cooling system (or in a separate heating system). The requirements regarding the combustion air supply (see Chapter 8) must be considered.

The heater should be installed as low as possible to allow the heater and circulating pump to be bled automatically. This is particularly important as the circulating pump is not self-priming.

If it is not possible to install the heater in the vehicle's engine bay it may be installed in a box. The installation box must have a sufficient external ventilation to ensure that the maximum temperature of 85°C is not exceeded in the box.

This installation space is not a stowage compartment and must be kept clear. This prohibition applies in particular for fuel canisters, oil cans, fire

extinguishers, cleaning rags, paper and all easily flammable materials. Water which has been ingressed or condensed must be able to run autonomously from the installation space.

Bear in mind the space required for servicing accessibility (for example for removing the combustion chamber) (see Figures 1 and 5) when installing the heater.

3.1.1. Installation Location in Rail Vehicles

For all appropriate information, refer to the corresponding Spheros rail installation instructions.

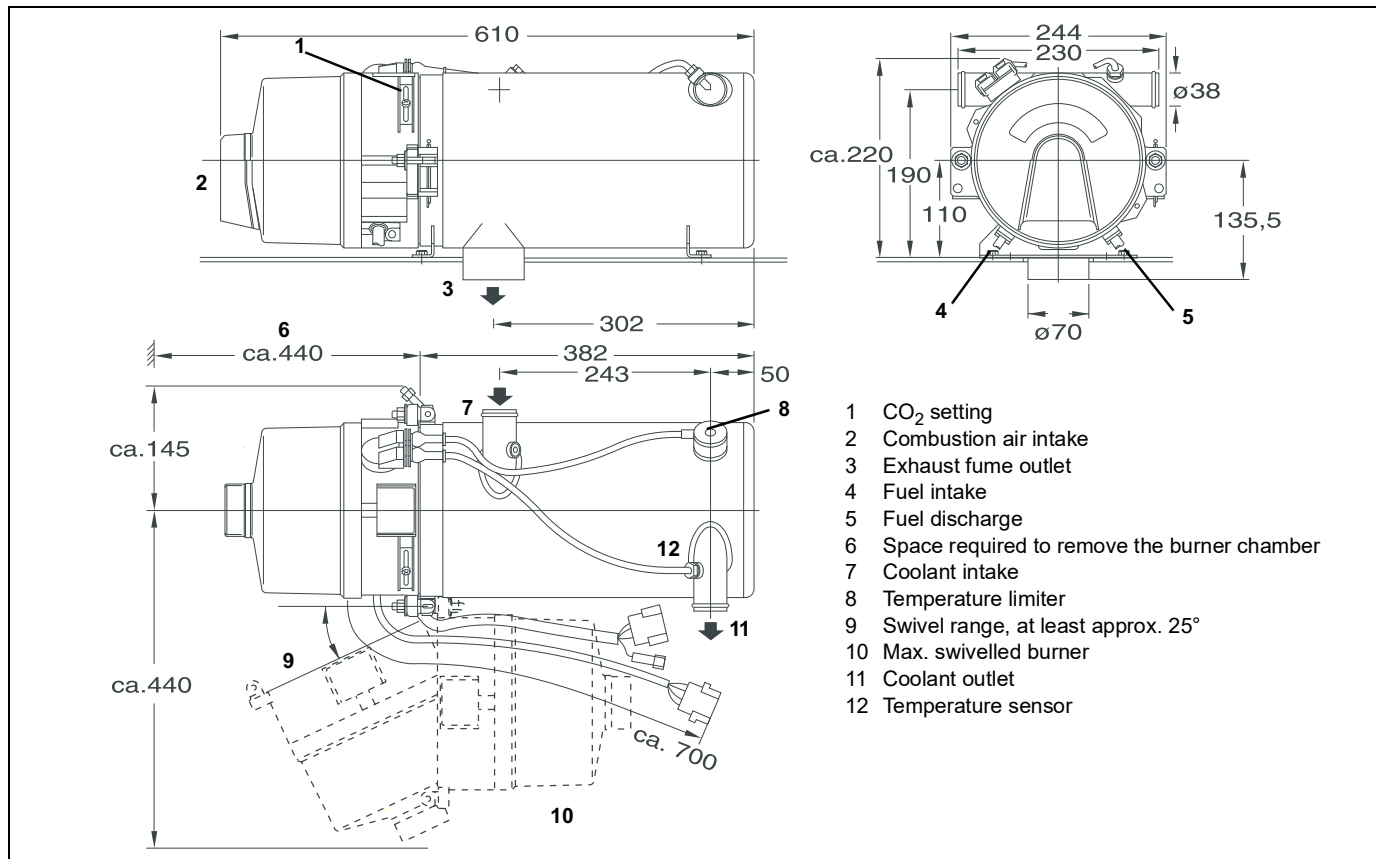


Fig. 1: Dimensions of the Thermo 230 / 300 / 350 heater (horizontal installation)

3.2. Thermo 230 / 300 / 350 heater installation

NOTE:

The heaters are only licensed for horizontal installation (see Fig. 2).

The heater may be secured either with four screws M8 or with four screws and nuts (Figure 3).

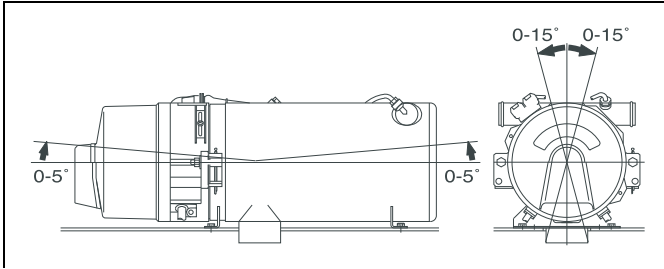


Fig. 2: Installation position

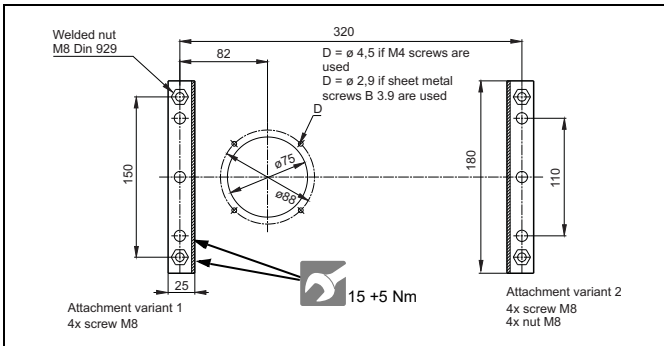


Fig. 3: Hole pattern

3.3. Model plate

The model plate must be protected from damage and must be clearly legible when the heater is installed (otherwise a duplicate model plate must be used).

NOTE:

The year of the initial operation must be durably marked by removing the year numbers that are not applicable.

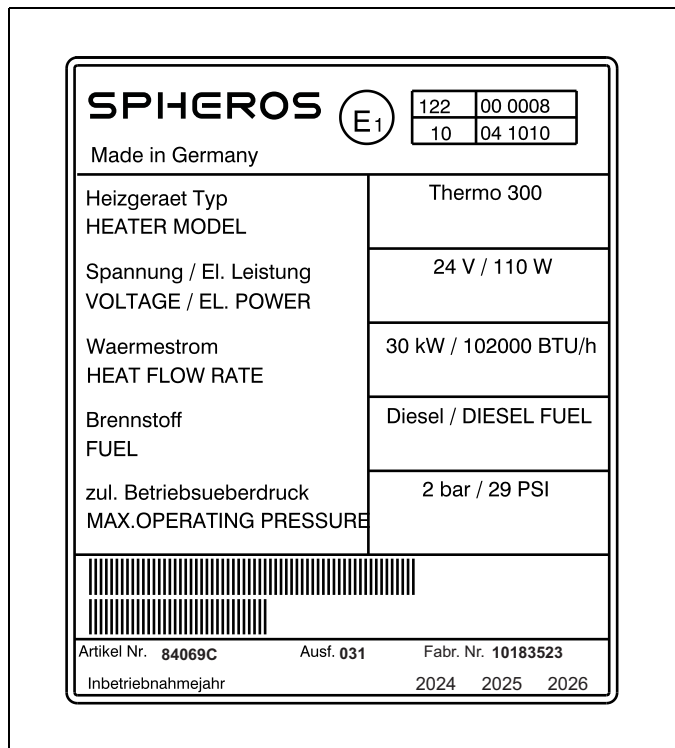


Fig. 4: Model plate (example)

4 Installation example

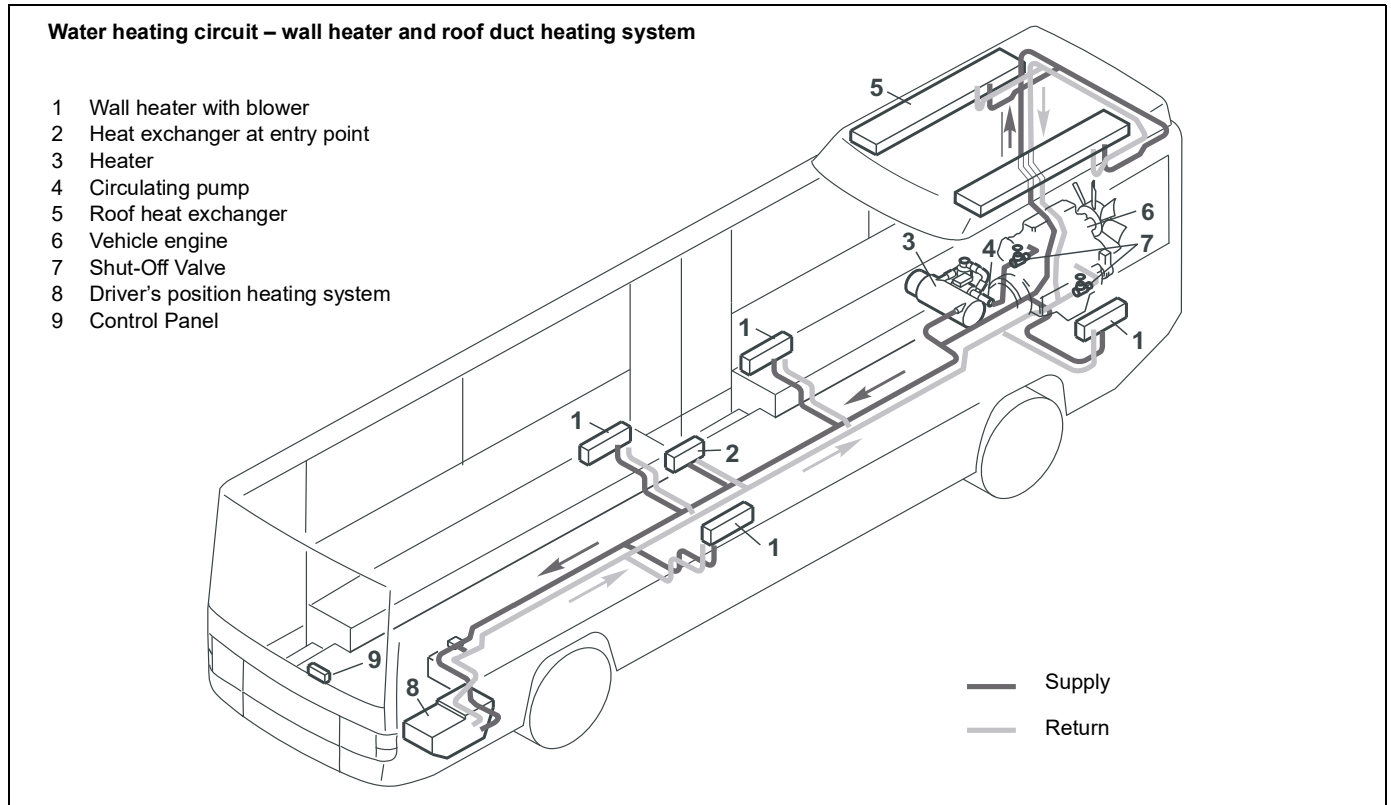


Fig. 5: Installation example for the heater

5 Installation of the circulating pump

ATTENTION:

The heater should be equipped with a Spheros circulating pump. Pumps of other manufacturers must be approved by Spheros.

The following pumps are available:

- U4814 (Aquavent 5000) 12 and 24 VDC
- U4854 (Aquavent 5000S) 24 VDC
- U4855 (Aquavent 6000C) 24 VDC
- U4856 (Aquavent 6000SC) 24 VDC
- SPump 24 VDC

NOTE:

Information about these pumps and their installation you find in the download center on www.spheros.com.



NOTE:

- The annex of this Installation instructions contains the permitted installation positions of the pumps.
- The pump ports and connection lines from the water intake and water outlet must be flush (no stress).

ATTENTION:

- **Only ONE circulating pump may be connected to the heater.**
- **When connecting the circulating pump U4856 it must be ensured that the volume flow does not drop below 2500 l/h for longer than a brief period only! Continuous operation at less than 2500 l/h will result in an undue wear of the wearing disc of the impeller!**

5.1. Circulating pumps installation positions

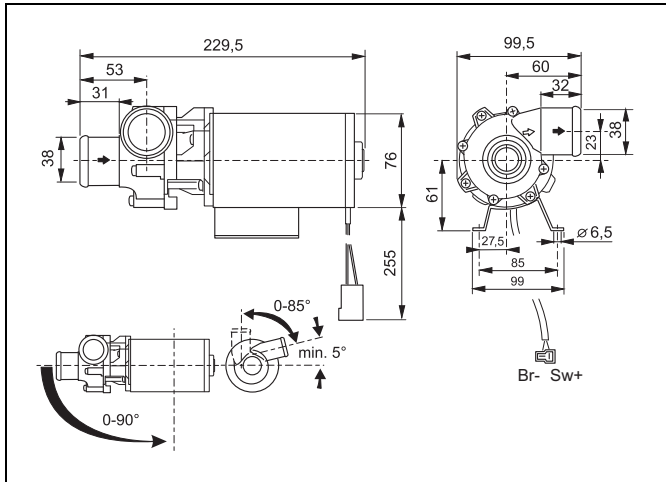


Fig. 6: U 4814 Installation position

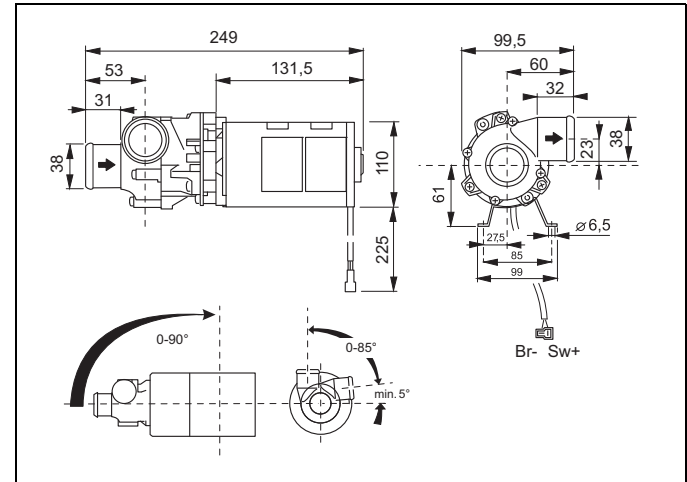


Fig. 7: U 4854 Installation position

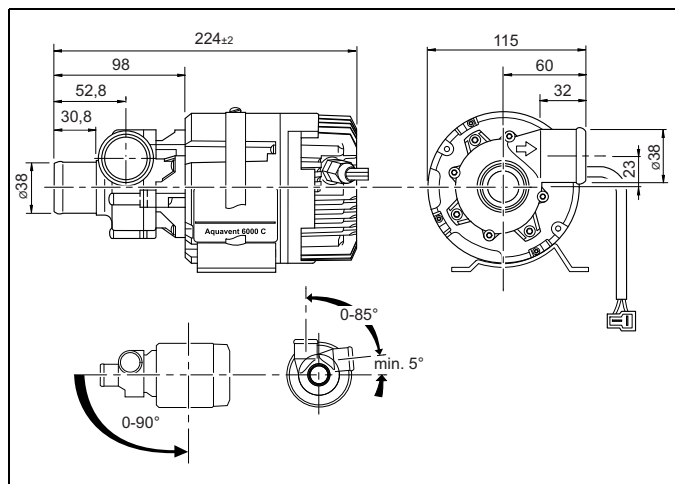


Fig. 8: U 4855 Installation position

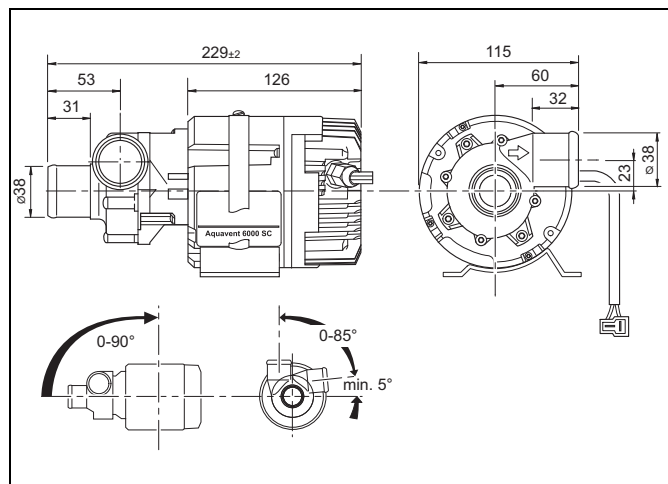


Fig. 9: U 4856 Installation position

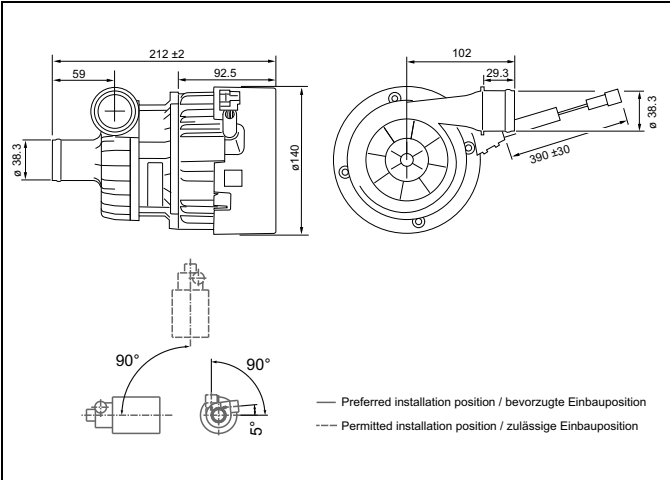


Fig. 10: SPump Installation position

6 Connection to the vehicle cooling system

The heater is to be connected to the vehicle cooling system in accordance with Figure 1. The system must contain at least 25 liters of coolant. The water in the heating circuit of the heater must contain at least 30% of a brand name anti-freeze.

A current list of approved by Spheros antifreeze agents can be found in the download center under www.spheros.com.

Basically the water hoses supplied by Spheros should be used. If this is not the case, the hoses must comply at least with DIN 73411 requirements. The hoses are to be routed without any kinks and - for proper venting of the heater - in an upward pitch, if possible. Hose connections must be secured against slipping off by means of hose clamps.

NOTE:

The tightening torques of the hose clamps used must be observed (see Workshop Manual Id.-No. DOK50088).

After 2 hrs. / 100 km heating operation, the hose clamps should be re-tightened.

In the vehicle cooling system, or in a separate heating circuit, only pressure control valves with an opening pressure of min. 0.4 bar and max. 2.0 bar may be used.

Before the heater is started up for the first time, or after the coolant has been replaced, it must be ensured that the cooling system is properly bled without use of the circulating pump. Heater and piping should be installed in such a way that static bleeding of the system is ensured.

Proper bleeding action can be recognised by the nearly silent operation of the circulating pump. Insufficient bleeding during heater operation can result to tripping of the temperature limiter.

If the circulating pump U 4855 / Aquavent 6000C is used it will be auto-

matically deactivated approx. 10 seconds after its activation if coolant is lacking or a blockage of the pump impeller has occurred, and can then be restarted after approx. 2 minutes.

If the circulating pump U 4856 / Aquavent 6000SC is used, it will be automatically deactivated approx. 45 seconds after its activation if coolant is lacking or a blockage of the pump impeller has occurred, and can then be restarted after approx. 2 minutes.

ATTENTION:

Before commissioning the heating system, the heating hoses, the pump and the heater must be completely filled.

Only by Spheros approved antifreeze agents may be used.

7 Fuel Supply

Fuel is extracted from the vehicle's fuel tank or from a separate fuel tank. Fuel lines and filters must be completely vented without using the fuel pump of the heater before commissioning. Thereby also during vehicle operation a safe fuel supply without air bubbles must be ensured continuously.

7.1. Fuel Lines

When using fuel hoses, basically the hoses supplied or offered by Spheros are to be used. If this is not the case, the fuel hoses must at least comply with the requirements of DIN 73379. Fuel hoses must not be kinked, crushed or twisted and must be secured at intervals of about 25 cm with clamps.

Materials commonly used in the construction of vehicles may be also used for fuel hoses taking into account a suitable connection system in each case. The selection should be done considering the ambient temperature range.

To prevent air inclusions from forming in the fuel, the fuel lines should be routed in an upward pitch, if possible. Connections within the fuel lines must be secured by means of hose clamps unless mechanical screwed connections are used.

ATTENTION:

If the heater is operated without coolant, the outer shell of the heater may reach a temperature equalling the ignition temperature of diesel fuel!

- The lines must be protected from stone damage
 - any dripping or evaporating fuel must neither collect nor be ignited by hot components or electrical equipment.
- To prevent this, optionally a drip pan with defined drain holes is to be installed in the area below the interface burner housing/ fuel line connectors/heat exchanger.

Note:

To prevent the fuel lines from running dry, the mouth of the return line in the tank should be below the liquid level.

The fuel pump is delivered in series for a two-pipe system (with return line).

The fuel pump can be ordered optionally for an appropriate heating system or burner head also in a single-pipe version. In a single-pipe system (without return line) according to the delivered application the return line port at the housing is closed with a screw plug and a gasket ring (see Fig. 11).

Bleeding is particularly in a single-pipe system mandatory and done using a separate bleeding device according to the prescribed for this device procedure.

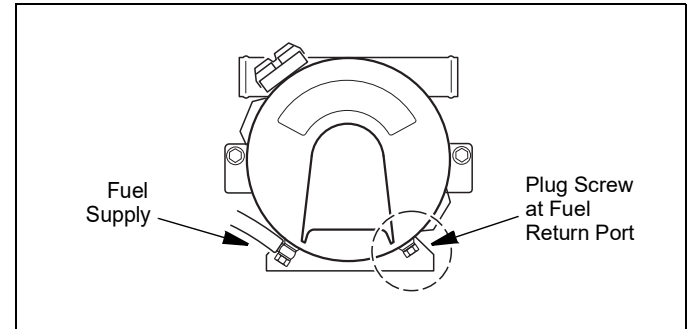


Fig. 11: Fuel Return Plug Screw at a Single-Pipe System

Then close screw plug, torque to 16 +/-1 Nm.

NOTE:

The fuel pump must not be used for bleeding purposes!

For further information on bleeding, refer to the Workshop Manual.

ATTENTION:

The operation with a closed return line will cause damage to the fuel pump, fuel can leak out - fire hazard!

Fuel lines and filters must be protected against excessive heat.

A dry-run of the fuel pump must be prevented.

Unsupported fuel lines must be secured to prevent them from sagging.

The installation of an additional fuel pump is permissible only in consultation with Spheros.

For legal provisions refer to Chapter 1.

7.1.1. Permissible dimensions of the fuel lines

- Inside diameter for suction and return lines: 6 mm (other diameters on request).
- Max. permissible length of each suction and return line: 15 m
- Max. permissible suction height: 2 m
- Max. permissible admission pressure: 0.3 bar

Deviations are to be approved by Spheros.

7.2. Fuel Filter

A fuel filter supplied or approved by Spheros must be used (consider the flow direction). To avoid malfunctions the filter or filter insert is to be replaced annually before the cold weather season starts.

7.3. Operability of the heater depending on the negative pressure in the fuel system

The preferred range designed for the fuel supply system goes up to max. 350 mbar (fuel inlet on heater).

For different fuel-side applications a separate approval by Spheros is required.

ATTENTION:

With increasing service life, the back pressure in the fuel supply may be increased due to deposits (the filter clogs) and the heater is more susceptible for malfunctions.

8 Combustion air supply

Under no circumstances may the combustion air be taken from areas occupied by people. The combustion air intake opening must not point in the direction of travel. It must be located so that it cannot become clogged with dirt or snow and cannot suck in splashing water.

Maximum dimensions of the air intake line:

- Internal diameter: 55 mm
 - Maximum line length: 5 m without the exhaust extension
 - Maximum bends: 270°
 - Total length of air intake line and exhaust pipe max. 5m
- The combustion air intake must not be routed above the exhaust outlet.

Deviations must be approved by Spheros.

NOTE:

If the combustion air intake line cannot be installed so that it slopes downwards, a water drain hole with a diameter of 4 mm is to be made at its lowest point.

If the heater is installed in a general installation space near the vehicle's fuel tank, the combustion air must be taken in from the outside and the exhaust fumes discharged into the atmosphere. The openings must be splash-proof.

An effective ventilation opening is required if the heater is installed in an enclosed box.

Thermo 230 / Thermo 300	30 cm ²
Thermo 350	35 cm ²

Verify by checking the CO₂ values whether the ventilation is effective and sufficient.

If the temperature in the installation housing exceeds the permissible ambient temperature of the heater (see Technical Data), the ventilation

opening must be enlarged subject to prior consultation with Spheros.

ATTENTION:

If permanent ambient temperatures above 65 °C are expected, the opening of the air intake line must be moved to an area with a lower temperature.

If intake air temperatures are permanently above 65 °C, a reduced service life of the heater (especially the motor and control unit) can be expected.

9 Exhaust pipe

The opening of the exhaust pipe must be aligned against the direction of travel and must not become clogged with dirt or snow.

The outflowing exhaust gas must not be re-sucked in as combustion air.

The exhaust gas must be routed to the outside / into the atmosphere.

The exhaust pipe must be fixed at least once every 50 cm.

Rigid pipes made of unalloyed or alloyed steel with a minimum wall thickness of 1.0 mm, or flexible tubes of alloyed steel are to be used.

The exhaust pipe is to be secured to the heater, e.g. by means of a clamp.

Accumulations of condensate must be drained, if necessary, a condensation water drain hole Ø 4mm must be implemented.

Combustion air intake and exhaust gas outlet must be arranged to ensure that no air pressure difference (e.g. suction) will occur in any vehicle operating condition.

For further requirements see statutory regulations.

Permissible dimensions of the exhaust pipe:

- Internal diameter: 70 mm
- Max. permissible pipe length:
 - 5 m without the combustion air intake extension
- The total length of both, the air intake pipe and the exhaust pipe must not exceed 5 m
- Max. permissible bend: 270°

Deviations only after approval by Spheros.

NOTE:

If there is a risk of contact with the exhaust pipe during normal operation, it must be secured against contact.

If the exhaust pipe is installed near temperature-sensitive parts, it must be insulated!

ATTENTION:

- **The exhaust gas temperature may be up to max. 400 °C.**
- **The exhaust pipe must end in the open air.**
- **The exhaust pipe must be sloped down, arising condensate must be able to drain away.**
- **Because of the temperatures involved, sufficient distance from heat-sensitive or flammable materials must be ensured.**
- **Outflowing exhaust gas must not be re-sucked in as combustion air.**
- **The opening of the exhaust pipe must be aligned against the direction of travel and must not become clogged with dirt or snow.**
- **If the exhaust outlet is under the vehicle floor, blowing straight down, an exhaust gas deflection is absolutely necessary.**

10 Electrical connections

10.1. Heater hook-up



Disconnect the electrical connections to the vehicle and to the temperature sensor prior to opening the heater.

The hook-up of the heaters is to be performed as shown in Figure 12 System wiring diagram.

Any plug designs that differ from the standard versions are to be requested separately from Spheros.

Before heater installation the **ripple voltage level** at the interface to the heater shall be checked. It must not be higher than 2 Vss. Otherwise a reduced service life of the electric and electronic components must be expected.

ATTENTION:

The indicated wire cross sections are to be observed.

The negative and positive poles of the heater control unit must be connected directly to the battery.

Route the electrical cables so their insulation will not be damaged (i.e. wedging, temperature exposure, kinks, chafing).

Unused connectors must be protected by dummy plugs.

10.2. Connecting the controls

The heater can be switched on and off using the following Spheros controls:

- Switch, see system wiring diagram Figure 12
- Timer, see system wiring diagram Figure 13

10.3. Control module

The control module is installed in the heater.

10.4. Economy mode

The connection of the economy mode switch is shown in the system wiring diagram, Figures 12 and 13.

The terminal „operation mode“ allows to lower the switching thresholds in the parking heat operation mode. There are three signal levels: UB, ground and without signal.

This makes possible in the parking heat operation mode to change between 3 operating modes with its own upper and lower temperature threshold each:

Normal	without signal
Economy mode	operating voltage +20.5...30 V

10.5. Water Temperature Control Thresholds:

Heater	Auxiliary heating		Parking heating		Economy setting		Comment
	On	Off (CI)	On	Off (CI)	On	Off (CI)	
Thermo 230 Thermo 300 Thermo 350	78	85	70	85	55	70	CI = control idle On/Off = lower / upper threshold Standard data record

**10.5.1. Pin Assignment of Cable Harness for Control Thresholds for Series
Thermo S 160 / Thermo S 230 / Thermo S 300 / Thermo S 350 / Thermo S 400:**

Control unit function	on/off	Volt	Connector	Pin	Comment
Auxiliary heating	on	24 V	X3	5	only in conjunction with parking heating
Parking heating	-	open	X3	4	switch connecting wire to control unit
Economy setting 1	on	24 V	X3	4	only in conjunction with parking heating
Economy setting 2	on	ground	X3	4	only in conjunction with parking heating

Terms:

Auxiliary heating: Heater is operating, engine is operating

Parking heating: Heater is operating, engine is off

Economy setting: Control temperature is on a lower level

NOTE:

Auxiliary heating has priority over the economy setting!

For further information on the operating modes economy setting, auxiliary heating and parking heating, refer to the Workshop Manual.


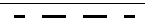


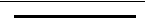
10.6. Legend for wiring diagrams

- ① Diagnostic connector
- ② Digital timer P:
with positive at connection 10 = Continuous operation with immediate heating
Connection 10 open = Variable heating duration can be programmed (10 min up to 120 min); Default setting 120 min

③ Plug assignment:

Plug assignment	4-core cable	7-core cable
D1	0,75 gr	0,75 rt
D2	0,75 or	0,75 or
D3	0,75 gn	0,75 bl
D4	0,75 br	2,0 br
F1	Not occupied	2,0 sw
F2	Not occupied	2,0 rt/ws

- ④ with connection to terminal 61 auxiliary heating mode
- ⑤ Option

Cable cross-sections		
	< 7,5 m	7,5 - 15 m
	0,75 mm ²	1,5 mm ²
	1,0 mm ²	1,5 mm ²
	1,5 mm ²	2,5 mm ²
	2,5 mm ²	4,0 mm ²
	4,0 mm ²	6,0 mm ²

Cable colours	
bl	blue
br	brown
ge	yellow
gn	green
gr	grey
or	orange
rt	red
sw	black
vi	violet
ws	white

Item	Designation	Comment
A1	Heater	
A2	Control module	SG 1572 D
B1	Flame sensor	Check polarity
B2	Temperature sensor	Any polarity
B3	Temperature limiter	
B4	Thermostat	For nozzle preheating
B5	Thermostat	Alternative to B3
B6	Thermostat	For vertical installation (MV Y1)
E	Filter heater	
E1	Heating cartridge	For nozzle preheating
F1	Fuse 25A	Blade-type fuse DIN 72581 Part 3
F2	Fuse 25A	Blade-type fuse DIN 72581 Part 3
F3	Fuse 5A	Blade-type fuse DIN 72581 Part 3
F4	Fuse 25A	Blade-type fuse DIN 72581 Part 3
F5	Fuse 5A	Blade-type fuse DIN 72581 Part 3
F6	Fuse 5A	Blade-type fuse DIN 72581 Part 3
F7	Fuse 5A	Blade-type fuse DIN 72581 Part 3
H1	Light	Indicator
H2	Light	Flame indicator
H4	Heating symbol on the display	Power-on indicator (in item P)
K4	Relay	
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
P	Digital timer, standard (1531)	For programmed operation
S1	Switch	ON/OFF

Item	Designation	Comment
S3	Switch	External activation Circulating pump
S4	Switch	Economy mode
S5	Switch	Auxiliary heating mode
S6	Switch	Filter heater on
T	Temperature switch	Filter heater
U1	Ignition spark generator	
U2	Ignition electrodes	
W1	Wiring harness (1)	
W2	Wiring harness (2)	
W3	Wiring harness (3)	
A	Plug connector, 6-pin	
C	Plug connector, 1-pin	
D	Plug connector, 4-pin	
F	Plug connector, 2-pin	
O	Plug connector, 2-pin	
Q	Plug connector, 2-pin	
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 8-pin	
X4	Plug connector, 12-pin	
X5	Plug connector, 4-pin	
X6	Plug connector, 4-pin	
X7	Plug connector, 7-pin	
Y1	Solenoid valve	

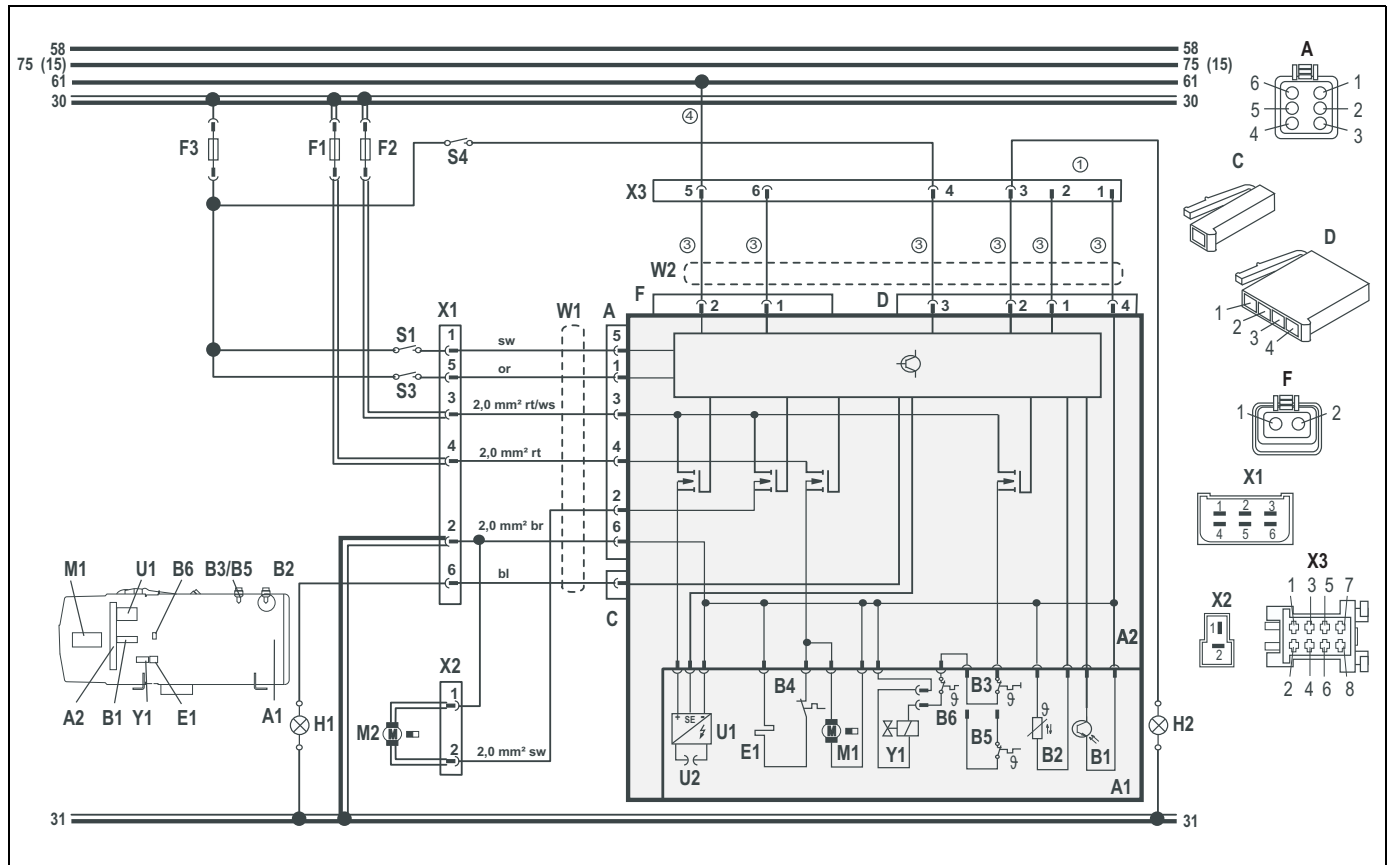


Fig. 12: System wiring for Thermo 230 / 300 / 350 24V with control module 1572 D, with switch, for legend see page 21 and 22

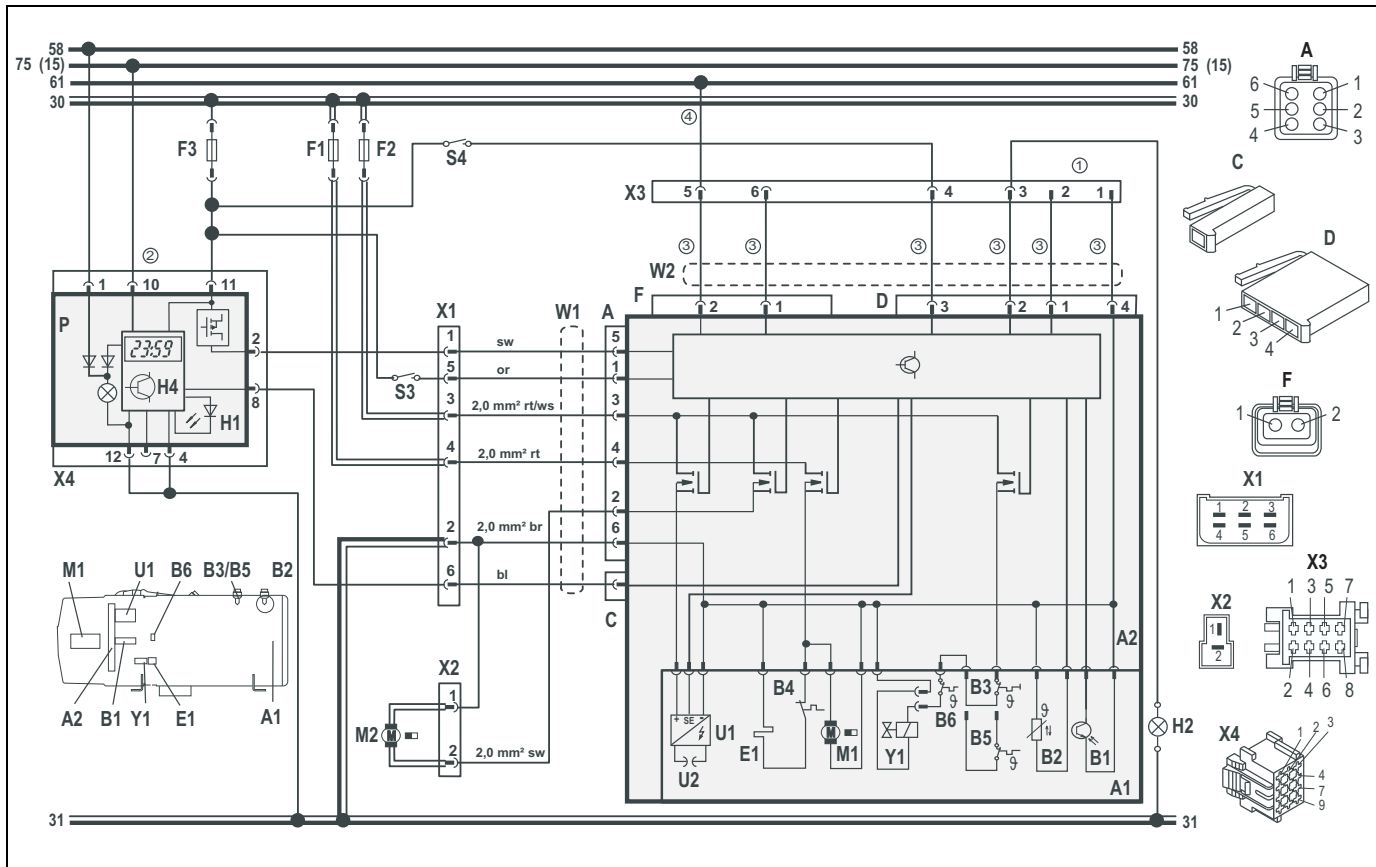


Fig. 13: System wiring for Thermo 230 / 300 / 350 24V with control module 1572 D, with standard timer, for legend see page 21 and 22

11 Initial start-up

ATTENTION:

The operating and service instructions of the heater should be read before commissioning.

It contains general operating information, operation hints and as well as maintenance and safety instructions.

It provides information how to recognise malfunctions as well as measures for their elimination.

ATTENTION:

The CO₂ value must be readjusted in accordance with the specified technical data if this is necessary for applications on the intake or exhaust side or the predominantly intended use of the heater.

With continuous use above 1,500 m, the CO₂ value must be readjusted because the lower air density leads to a negative change in the exhaust gas values.

Information and the procedure for adjusting the CO₂ value are contained in the Thermo Workshop Manual Id. No. DOK50088.

After heater installation, bleed the water system and the fuel supply system carefully. In this process it is mandatory to fill the suction line and the fuel filter of the heater completely. Spheros recommends the usage of a separate bleeding unit. Follow the appropriate instructions provided by the vehicle manufacturer. Verify the fuel supplied to the heater is bubble-free.

ATTENTION:

The fuel pump must not be used to fill the fuel system!

Generally, the hook-up of the heater to the vehicle power grid must be done only after filling the fuel system in order to prevent a premature start of the fan motor/fuel pump.

Conduct a test run of the heater to check all the water and fuel connections for leaks and to ensure that they are secure. If the heater suffers a fault during operation, the fault must be located and remedied according to given in the workshop manual instructions.

ATTENTION:

In the event no fuel comes to the fuel pump during initial start-up (dry running), there is a risk that the fuel pump will be damaged!

12 Maintenance

Periodic service activities have to be performed in accordance with the Workshop Manual.

When the heater is operated in rail vehicles, the current maintenance schedule for rail vehicles is to be used.

13 Troubleshooting

13.1. Fault lock-out

If there are any faults, proceed as follows:

Switch off the heater and then switch it on again.

If the heater doesn't start, check the following:

- Is the fuel supply ok?
- Is a sufficient amount of fuel in the tank?
- Are the fuses ok?
- Are the electrical connections and cables in order?
- Are the combustion- and exhaust air ways free of obstructions?

13.2. Error Code Output (heaters with control unit 1572D)

When equipped with a standard timer an error code readout appears on the display of the timer after a malfunction.

NOTE:

When the heater is operated by means of a switch the type of error is output during heater run-down via a flash code of the operating indicator light. After five short signals the long flash pulses are counted. The flash pulses correspond to the error number in the following table:

- F 01 no start
- F 02 flame-out *
- F 03 low voltage or excess voltage
- F 04 foreign light detected during run-up and run-down
- F 05 flame sensor defective
- F 06 temperature sensor defective
- F 07 solenoid valve defective
- F 08 fan motor defective

- F 09 circulation pump defective **
- F 10 temperature limiter defective / overheating
- F 11 igniter box defective
- F 12 error lockout due to repeated malfunction or repeated flame-out (8x no start-up or 5x flame-out)

* A response of the overheat thermostat will be stored in the control unit as a flame-out (F 02) (Thermo 231 and 301).

** The error 09 is indicated only if the heater is equipped with a circulation pump monitoring (see table below).

Table: Programmed SG1572D with circulation pump monitoring

EOL-Data record for SG 1572D			
EOL-Data record	Circulating pump monitoring		Ctr. device programmed
	Yes	No	
63317F			
63860E			
67980D	X		67981D
96774B			
97805C			
97807C	X		97810C
97809C	X		97810C
97811B	X		97812A
97813A			
97815A			

14 Technical data

Except where limit values are specified, these technical data refer to the usual heater tolerances of $\pm 10\%$ at an ambient temperature of $+20\text{ }^\circ\text{C}$ and at the rated voltage.

NOTE:

The assignment of circulating pumps to heaters must be made considering the water-side resistances.

14.1. Fuel

The following table lists the by Spheros approved fuels for this device and their specifications.

Fuel	Requirements acc.	Remarks
Summer Diesel	DIN EN 590	
Winter Diesel	DIN EN 590	
Arctic Diesel and Diesel for a strong winter climate	DIN EN 590	
Bio Diesel (FAME)*	DIN EN 14214	max. 20% see TI Fuels
Paraffinic diesel fuel from synthesis or hydro-genation (HVO)*	DIN EN 15940	only selected fuels see TI Fuels

* Further information on approved fuels contains the TI (Technical Information) Fuels. It can be found in the download center under www.spheros.com.



In case of air temperatures below $0\text{ }^\circ\text{C}$ a commercially available winter Diesel fuel, at temperatures below $-18\text{ }^\circ\text{C}$ a Diesel for arctic climate conditions must be used.

ATTENTION:

While using the fuels, their operating limits must be considered and if necessary, suitable measures (nozzle preheating, electrical heated filter) should be applied.

Heater		Thermo 230	Thermo 300	Thermo 350
Type		Thermo 230	Thermo 300	Thermo 350
ECE Type Approval Number	E1 122R 00	0007	0008	0009
Model		High pressure atomiser		
Heating flow	kW (kcal/h)	23 (20 000)	30 (26 000)	35 (30 000)
Fuel		Diesel / Heating oil EL		
Fuel consumption	kg/h	2.5	3.3	3.7
Rated voltage	V –		24	
Operating voltage range	V –		20...28	
Rated power consumption (without circulating pump) W		65	110	140
Max. ambient temperature during operation (Heater, control module, circulating pump)	°C		-40...+ 85	
Max. storage temperature (control module)	°C		+ 110 max.	
Max. operating overpressure	bar		0.4... 2.0	
Capacity of the heat exchanger	l		1.8	
Minimum capacity of the system	l		30.00	
CO ₂ in exhaust gas at rated voltage	% v/v		10.5 ± 0.5	
Heater dimensions (Tolerance ± 3 mm)	mm		Length 610	
	mm		Width 246	
	mm		Height 220	
Weight	kg		19	

Circulating pump		U 4814 Aquavent 5000	U 4854 Aquavent 5000S	U 4855 Aquavent 6000C	U4856 Aquavent 6000SC	SPump 260
Delivery rate	l/h	5000 (against 0.2 bar)	5000 (against 0.2 bar)	6000 (against 0.4 bar)	6000 (against 0.4 bar)	6000 (against 0.5 bar)
Rated voltage	V =	12 oder 24	24	24	24	24
Operating voltage range	V =	10...14 / 20...28	20...28	20...28	20...28	16,5...32
Rated power consumption	W	104	104	210	210	260

Note: For further technical data e.g. dimensions, refer to the pumps documentation.

Optional Fuel Filter Heater

Filter heater		
Rated power consumption	W	240
Rated voltage	V -	24
Switch-on point	C°	0.5 ± 2.5
Switch-off point	C°	5.5 ± 2.5

15 Environment

Recycling of heater parts

The correct disposal of the heater components determined by material groups for old appliances, damaged or defective parts and packaging material can be realized without problems. In the process the materials as steel, non-ferrous metals, plastics and electrical scrap (as motors, control devices, harnesses and sensors) are to be professionally and environmentally friendly disposed by the recycling plant.

The heater disassembly is precisely described in the workshop manual. For the package the same recycling conditions applies as for paper and paperboard. Keep the package a defined period for a possible return shipment.

memos



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