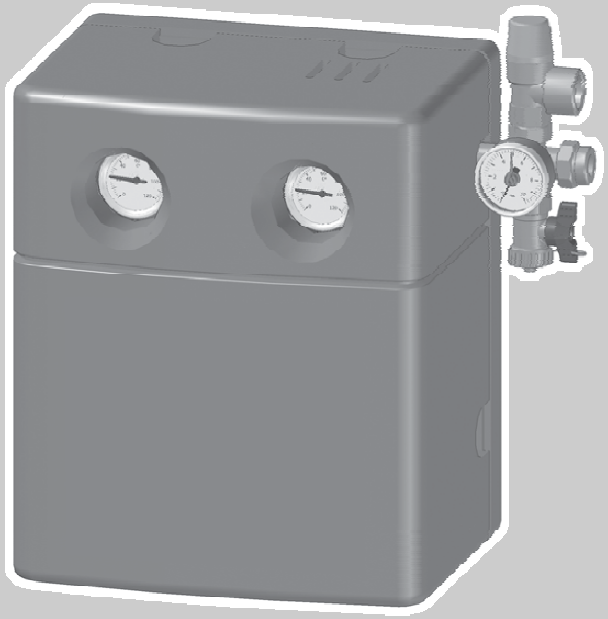
Installation and servicing instructions

Solar station



Logasol KS0105
Logasol KS0110
Logasol KS0120

For Contractors

Please read carefully prior to installation and maintenance.

6 720 614 829 US - (2008/03)

Contents

1 Safety instructions and explanation of symbols

1.1 General safety instructions

About this manual

This manual contains important information for the safe and correct installation and maintenance of the solar pumping station.

These instructions are designed for a solar installer who due to their technical training and experience, are accustomed to working with solar thermal systems and hot water installations. Only carry out these installation steps if you possess these skills.

The illustrations in this manual show the standard solar pumping station with external controller.

- Hand the manual to the customer. Explain how the device works and how to operate it.

Please observe these instructions

- Please read these instructions carefully.
- To prevent injury and property damage, always follow the safety instructions.
- Any tasks that require the solar pump station to be opened must be carried out by solar specialists.
- The electrical supply must be connected by a qualified electrician.
- Before opening the solar pump station, isolate the station from the power supply.
- To limit the domestic hot water temperature to 140 °F (60 °C) max., fit a blending valve after the domestic hot water storage cylinder.
- Do not make modifications to the solar pump station.
- Only use materials which can withstand temperatures of up to 300 °F (150 °C).
- Cover the collectors when purging and filling the solar thermal system. Purpose made covers are available from Buderus.

1.2 Symbols

Safety instructions in this document are identified by a warning-triangle symbol and are printed on a grey background.

Hazard texts indicate the seriousness of the hazard in terms of the consequences of not following the safety instructions.

- **Caution** indicates that minor damage to property could result.
- **Warning** indicates that minor personal injury or serious damage to property could result.
- **Danger** indicates that serious personal injury could result. In particularly serious cases, lives could be at risk.

Notes are identified by the symbol shown on the left. They are bordered by horizontal lines above and below the text.

Notes contain important information in cases where there is no risk of personal injury or damage to property.

2 Details of the product

2.1 EU Declaration of Conformity

The design and operation of this product conform to the applicable European directives and supplementary national requirements. Confirmity has been demonstrated.

2.2 Intended use

KS solar pump stations may only be used for the operation of solar thermal systems in conjunction with suitable controllers from Buderus.

KS solar pump stations are intended solely for systems filled with propylene glycol/water mixtures (Tyfocor L or Tyfocor LS). The use of any other solar fluid is not permitted.

2.3 Contents

- Before commencing any installation work, check the contents of each package.

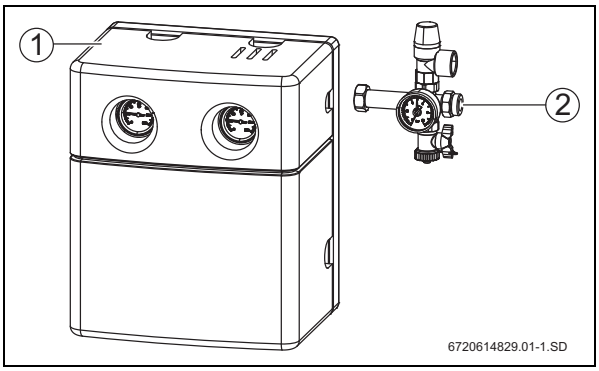


Fig. 1 Package Contents - Solar pump station with controller

1 Solar pump station (2-line solar pump station without controller)
2 Safety assembly (pressure relief valve, pressure gauge, fill & drain valve)
And Fixing consumables (not shown)

2.4 Other equipment

In addition to the usual tools, a 1/2" (13 mm) socket with a 6 inch (150 mm) extension is required for the installation work.

Make sure that the connected leads are not placed under tension.

2.5 Product description

If either the Logasol KS0120 is used, one automatic air vent per collector array is required in addition to the air separator in the solar pumping station.

The illustration on the right shows solar pumping stations with their front insulation panels removed.

- To open the solar pump station: pull the cover (insulation) panel forwards to remove.

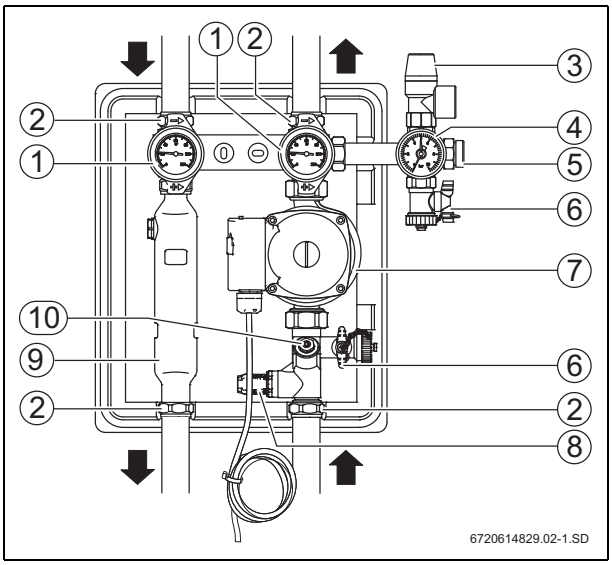


Fig. 2 Solar pump stations without front insulation casing and without built-in controller

1 Ball valve with temperature gauge (red = flow[1)], blue = return) and integrated gravity brake (position 0° = normal running, 45° = gravity brake bypassed)
2 Compression fitting
3 Pressure relief valve
4 Pressure gauge
5 Connection to solar expansion vessel
6 Fill & drain valve
7 Solar pump
8 Flow rate indicator
9 Air separator[1)]
10 Control/shut-off valve

1) Only with standard solar pump station

2.6 Specifications and variants

		KS0105
Maximum possible temperature	°F (°C)	Supply: 266 (130) / return: 230 (110) (pump)
Safety valve response pressure	psi (bar)	87 (6)
Safety valve	–	DN 15, 3/4” connection
Mains voltage	–	120V AC, 60 Hz
Maximum current consumption per pump	A	0.54
Dimensions (H x W x D)	inch (mm)	14 x 11 3/8 x 9 1/4 (355 x 290 x 235)
Flow and return connections (compression fittings)	inch (mm)	1/2 (15)
Number of flat plate collectors	–	1 - 5

Tab. 1 Specifications of KS0105

		KS0110
Maximum possible temperature	°F (°C)	Supply: 266 (130) / return: 230 (110) (pump)
Safety valve response pressure	psi (bar)	87 (6)
Safety valve	–	DN 15, 3/4” connection
Mains voltage	–	120V AC, 60 Hz
Maximum current consumption per pump	A	0.54
Dimensions (H x W x D)	inch (mm)	14 x 11 3/8 x 9 1/4 (355 x 290 x 235)
Flow and return connections (compression fittings)	inch (mm)	3/4 (22)
Number of flat plate collectors	–	6 - 10

Tab. 2 Specifications of KS0110

		KS0120
Maximum possible temperature	°F (°C)	Supply: 266 (130) / return: 230 (110) (pump)
Safety valve response pressure	psi (bar)	87 (6)
Safety valve	–	DN 15, 3/4” connection
Mains voltage	–	120V AC, 60 Hz
Maximum current consumption per pump	A	0.85
Dimensions (H x W x D)	inch (mm)	14 x 11 3/8 x 9 1/4 (355 x 290 x 235)
Flow and return connections (compression fittings)	inch (mm)	1 (28 mm)
Number of flat plate collectors	–	11 - 20

Tab. 3 Specifications of KS0120

2.7 Example applications

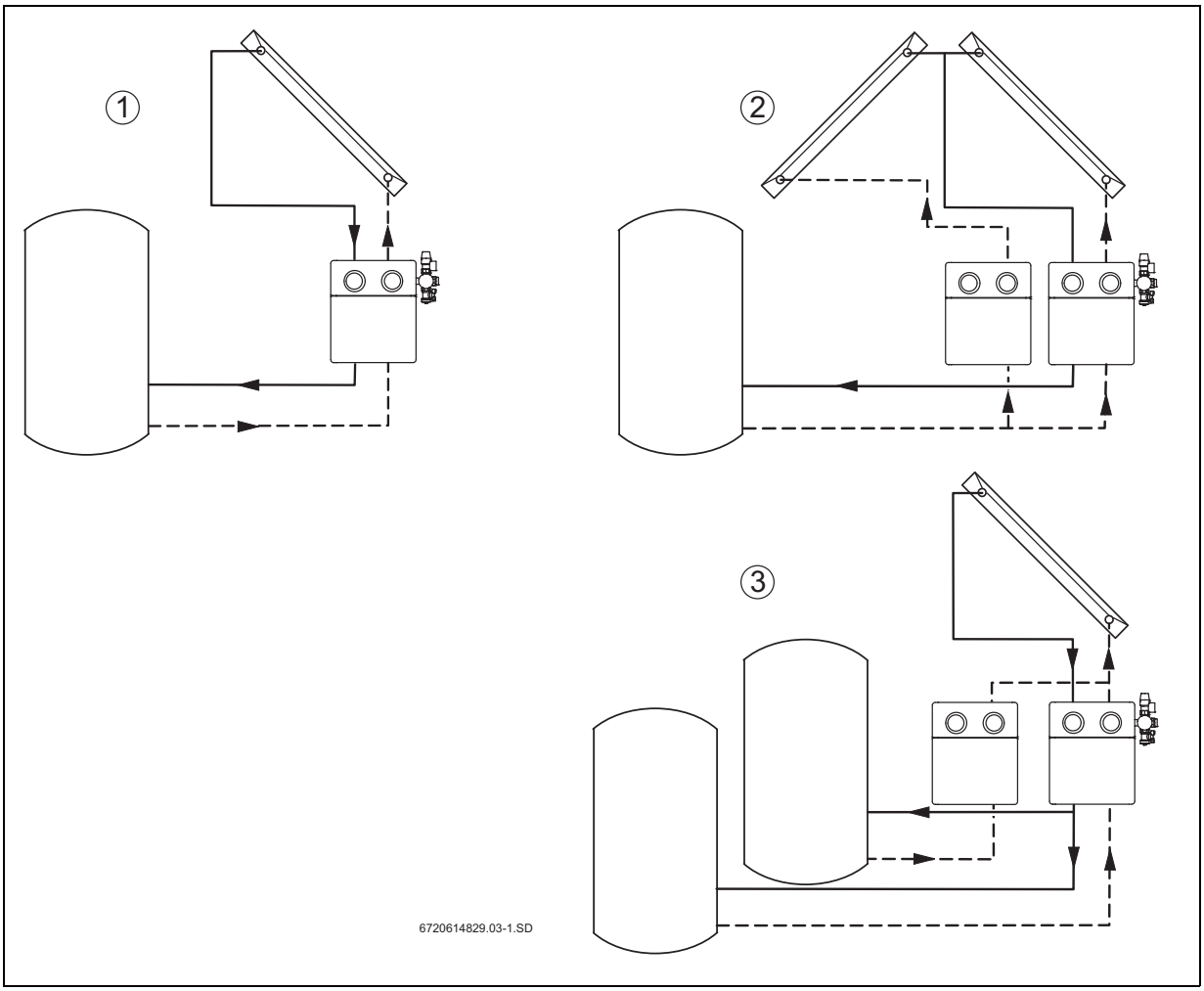


Fig. 3 Different hydraulic applications

1 standard solar pump station
2 Double 2-line solar pump stations. E.g. East / west facing roof
3 2-consumer system with two dual-circuit solar pump stations

3 Regulations

In this chapter you will learn which technical rules and regulations apply to this installation.

Observe all standards and guidelines applicable to the installation and operation of the system in your country and region.

Caution! Ensure that these installation instruction are read and understood before installation. The Installation, adjustment, service and maintenance of this equioment must be performed by a licensed professional heating contractor.

Caution! Ensure a proper lightning protection at your solar installation according local codes.
In the lower part of the building, install an electrical conductor on the piping system of the solar circuit in complaince with local regulations.

Ensure after installation work is completed, the contractor must familiarize the system operator/ owner with all part, as well as any safety requirements, shut-down procedure, and the need for professional service and maintenance annually.

Caution! For solar installations use only red bronze fittings, brass fittings and copper pipes. Do not use galvanized pipes, galvanized fittings, graphitized gaskets or any type of plastic pipes and fittings.

All Components within the piping system must be resistant to the heat transfer medium. Insulation of outdoor piping must be resistant to temperature up to 302 °F, UV radiation and to destruction by birds.

NOTICE! Ensure the use of strongly recommended heat transfer medium "Tycofor L" .

4 Installing pipework

4.1 General information regarding pipework

Caution: System damage from plastic pipes (e.g. PE pipes)

- Only use materials which can withstand the temperatures of up to 302 °F (150 °C) which occur in solar thermal systems.

The collectors, the solar pump station and the solar storage tank are interconnected with copper pipes and where appropriate, Buderus twin tube.

- To prevent air locks: route the pipes from the tank to the collector field on a rising incline.
- Install a fitting into the return pipe at the lowest point in the system for draining the solar fluid (tee with fill & drain valve (4).

Include a fill and drain valve in the flow pipe as well if necessary (→ Chapter 6.2.3).

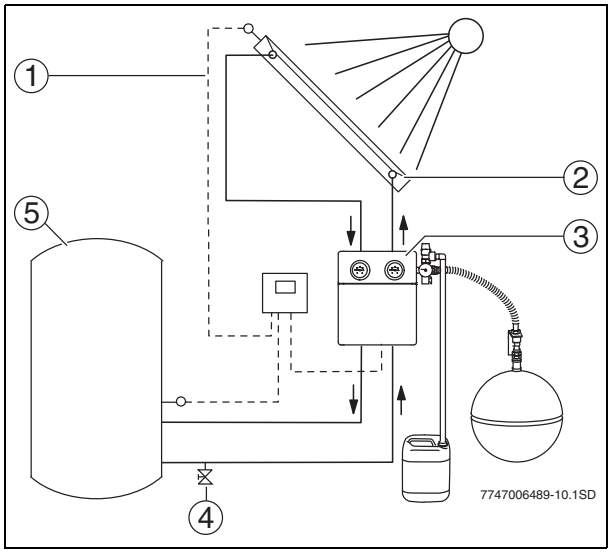


Fig. 4 The piping of the solar thermal system

1 Wire to the collector temperature sensor
2 Collectors
3 Solar pump station
4 Fill & drain valve for system draining (not supplied)
5 Solar tank1

Connecting the pipes

Caution: Risk of system damage due to heat from soldering. The connecting lines must be pressure and temperature resistant.

- Copper pipes for solar thermal systems should always be soldered with brazing or silver solder (i.e. not soft solder).

Compression fittings or push-fit fittings can be used instead of soldering if they are glycol and heat-resistant 300° F (to 150 °C).

We recommend carrying out basic pipe sizing estimates that can be made using Tab. 4.

- If there are many additional points of resistance (bends, valves etc.), you may need to select a pipe with a larger diameter.

If threaded pipe connections are caulked with hemp:

- Use a thread sealing compound resistant to temperatures up to 300 °F (150 °C) (e.g. NeoFermit universal).

Straight pipe length	Number of collectors			
	Up to 5	Up to 10[1)]	Up to 15[1)]	Up to 20[1)]
Up to 20 ft (6 m)	Buderus Twin-tube Ø 1/2 in (15 mm)	Ø 3/4 in (22 mm)	Ø 3/4 in (22 mm)	Ø 3/4 in (22 mm)
Up to 30 ft (10 m)	Buderus Twin-tube Ø 1/2 in (15 mm)	Ø 3/4 in (22 mm)	Ø 3/4 in (22 mm)	Ø 1 in (28 mm)
Up to 50 ft (15 m)	Buderus Twin-tube Ø 1/2 in (15 mm)	Ø 3/4 in (22 mm)	Ø 1 in (28 mm)	Ø 1 in (28 mm)
Up to 65 ft (20 m)	Ø 3/4 in (22 mm)	Ø 3/4 in (22 mm)	Ø 1 in (28 mm)	Ø 1 in (28 mm)
Up to 80 ft (25 m)	Ø 3/4 in (22 mm)	Ø 1 in (28 mm)	Ø 1 in (28 mm)	Ø 1 1/4 in (35 mm)

Tab. 4 Minimum pipe sizes

1) US 3/4" (22 mm) adaptor available from Buderus

4.2 Laying pipes

Pipes

Work must be carried out by a qualified electrician.

- One grounding clamp must be fitted to both the supply pipe and the return pipe (at any position).
- Connect the clamps to the building's equipotential bonding strip by means of a standard PVC-sheathed bonding cable (NYM type, at least 0.09 sq inch (6 mm²)).

Laying pipes with an automatic air vent on the roof (available as accessory SKN 3.0 / FKC-1/ FKB-1 Air vent kit / SKS 4.0 Air vent kit)

- Pipes to the air vent should follow a rising gradient. Any downward change of direction requires an additional automatic air vent (temperature-resistant to 300 °F (150 °C)).

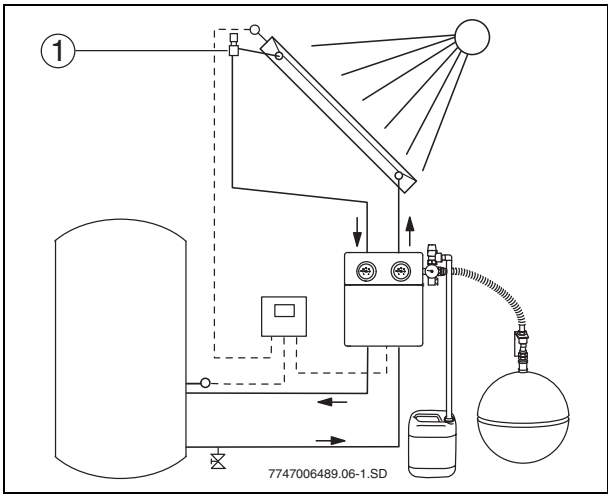


Fig. 5 Position of the automatic air vent valve

1 Automatic air vent

Insulating pipes

- Insulate outdoor piping with material which is both resistant to UV light and high temperatures (up to 300 °F (150 °C)).
- Insulate indoor piping with material which is resistant to high temperatures (up to 300 °F).

Standard grey foam pipe insulation is not normally rated for these temperatures.

5 Installing the solar pump station

5.1 Layout of the installation space

Caution: Damage to the solar pump station from heat buildup

- Make sure that the ventilation slots at the top and bottom of the thermal-protective casing are open.

- To make it easier to connect the temperature sensors: install the solar pump station (2) as close as possible to the solar storage tank (1).
- Allow enough room for a solar expansion vessel (3) and container (4).

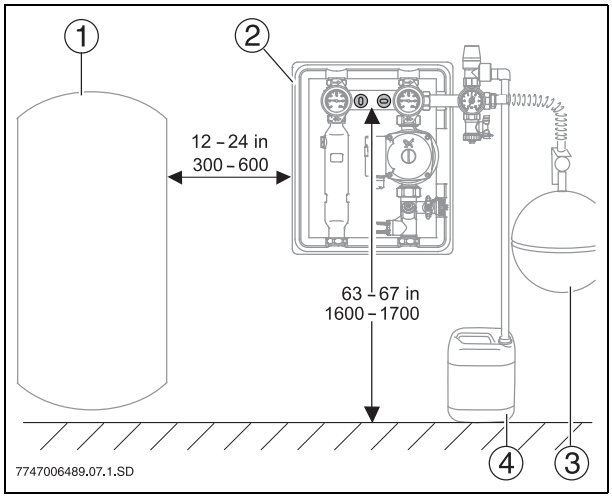


Fig. 6 Recommended positioning (measurements in in)

1 Solar storage tank
2 Solar pump station
3 Solar Expansion vessel
4 Solar fluid container

5.2 Mounting the solar pump station

A socket (13 mm) with a 6 inch (150 mm) extension is required to screw in the screws. With a shorter extension, the handles and temperature gauges can be pulled forwards and removed for easier access to the screws.

Standard solar pump station

- Drill hole (2) and fix solar pump station using screw and wall plug supplied.
- Drill holes (1) spaced 2 3/8 inch (60 mm) apart and install solar pump station using screws and wall plugs supplied.

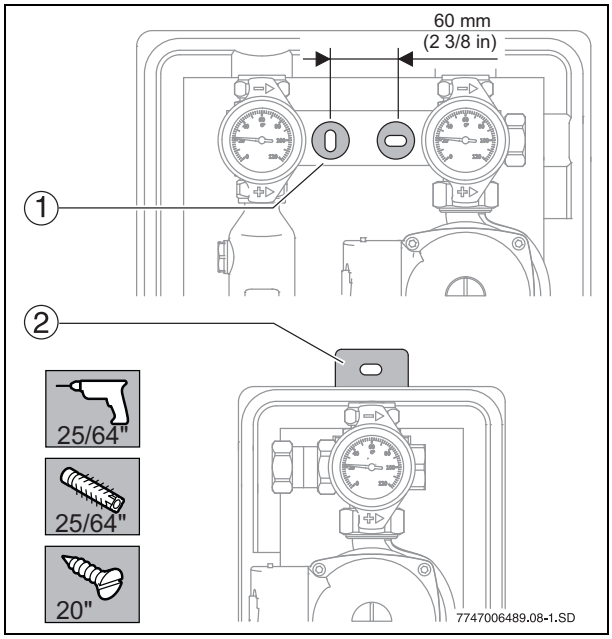


Fig. 7 Mounting the station

1 Standard solar pump station
2 Additional solar pump station

5.3 Electrical connections

Electrical connections must only be carried out by qualified electricians.

Caution: Damage to pump

- Do not run the pump until the pipework has been filled with solar fluid. Otherwise the pump can be damaged.

5.3.1 Solar pump station with an external controller

Have electrical wiring connected according to the controller instructions by a qualified electrician.

5.4 Installing the safety assembly

For additional solar pump station:

- Install the safety assembly on the left.

- Install the safety assembly on the solar pump station together with the gasket supplied (1).

Caution: The pressure relief valve must be piped to the overflow vessel or drain at all time, since excessively hot solar fluid can discharge from the system.

Caution: After de-aeration, the air vent and the shut-off valve at top of the system must be closed. During holiday and vacations do not shut-off the solar system to prevent overheating in the summer.

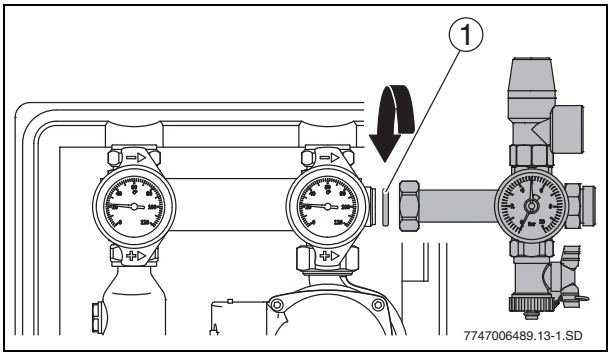


Fig. 8 Installing the safety assembly

1 Gasket (21 x 30 x 2)

5.5 Connecting the expansion vessel and pre-cooling vessel

Do not insulate the pre-cooling vessel (if installed) and the expansion vessel, nor the pipes connecting them to the safety assembly.

5.5.1 Installing the solar expansion vessel (available as an accessory)

- Install the expansion vessel with the relevant mounting materials.
- Connect the expansion vessel (3) in the return line on the solar thermal station's safety assembly.

5.5.2 Adjusting the charge pressure of the expansion vessel

The charge pressure of the expansion vessel is given by the static system head plus 5.8 psi (0.4 bar) (1 foot difference in height equals 0.45 psi).

- Set a minimum pressure of 17.4 psi (1,2 bar).

- To make use of the maximum possible volume, set the charge pressure prior to prior to pressurising the solar fluid side.
- If the calculated charge pressure is higher or lower than the factory-set inlet pressure, correct the inlet pressure accordingly.

The gaskets and membrane of the expansion tank must be suitable for the solar heat transfer fluid, and for the high temperature in a solar system.

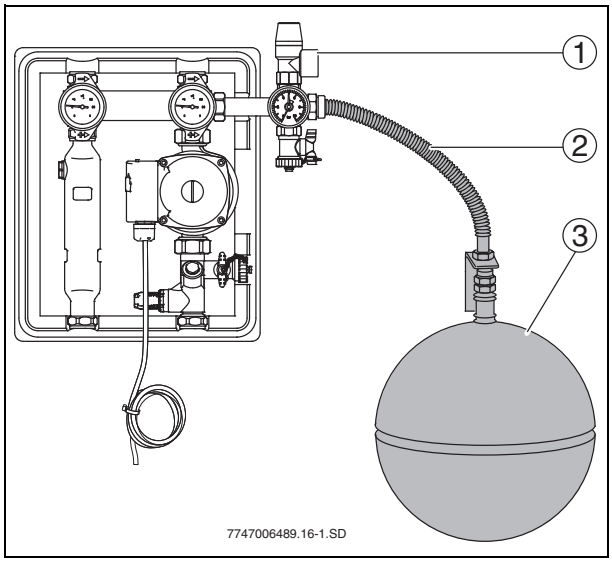


Fig. 9 Connecting the expansion vessel (in this case with flat panel collectors)

1 Safety valve
2 Flexible stainless steel hose for solar expansion vessel (available as accessory)
3 Solar expansion vessel

5.5.3 Sizing of expansion vessel

Adjust the inlet pressure of the diaphragm expansion vessel (MAG) prior to filling the solar heating system to take the system elevation into account. The required system inlet pressure has to be calculated using the following formula:

US

$$pv = 0.45 * hstat + 5.8 \text{ psi}$$

EU

$$pv = 0.1 * hstat + 0.4 \text{ bar}$$

pv MAG inlet pressure in psi or bar
*h*stat Static height in ft or m between centre of MAG and highest point of system

For detailed information about correct sizing of expansion vessel please refer to Buderus technical guide.

5.6 Connecting piping and blow-off pipe to the solar pump station

Danger: Possible injuries and system damage from incorrectly installed blow-off pipe!

- Make sure the blow-off pipe size is at least that of the safety valve (maximum length = 6 ft (2 m) and maximum of 2 bends).

- Cut the pipes to a length which will allow them to be pushed as far as possible into the compression fitting (1).
- Route the blow-off pipe (2) so that any discharge can be seen to empty out into the holding container (4) and secure it in place with a pipe clamp (3).

For tightening the lower compression joints you can brace against the points marked (5) using a size adjustable spanner or pipe grips.

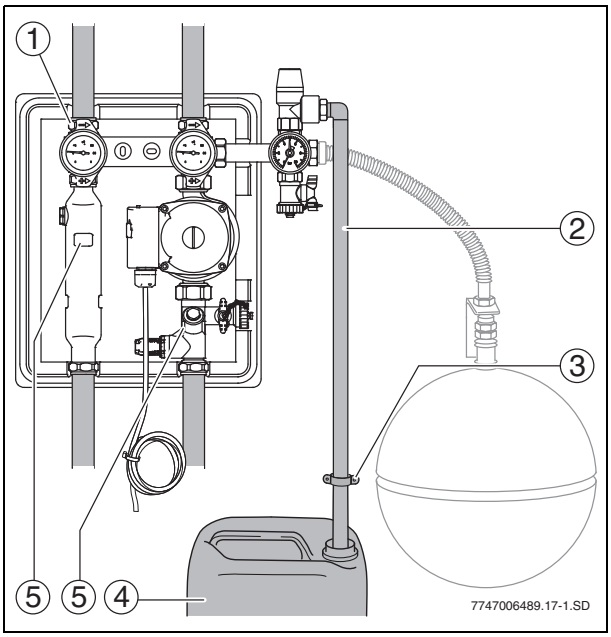


Fig. 10 Connection to solar pump station

1 Compression joints on all four outlets
2 Blow-off pipe (not supplied)
3 Hose clamp (on building)
4 Empty solar fluid container (holding container)
5 Connection bracing points

5.7 Installing the temperature sensors

Electrical connections must only be carried out by authorised electricians.

The temperature sensors are not polarity sensitive.

5.7.1 Collector temperature sensor

If the collector temperature sensor's lead is joined to the sensor lead going to the controller at a point which is exposed to moisture, a waterproof junction box must be used.

- Extend the sensor lead with a two-core lead (3), not supplied.
- If necessary, protect the connections (2) at top and bottom with junction boxes.

5.7.2 Storage tank temperature sensor

For installation instructions and data, see the installation instruction manuals for the controller.

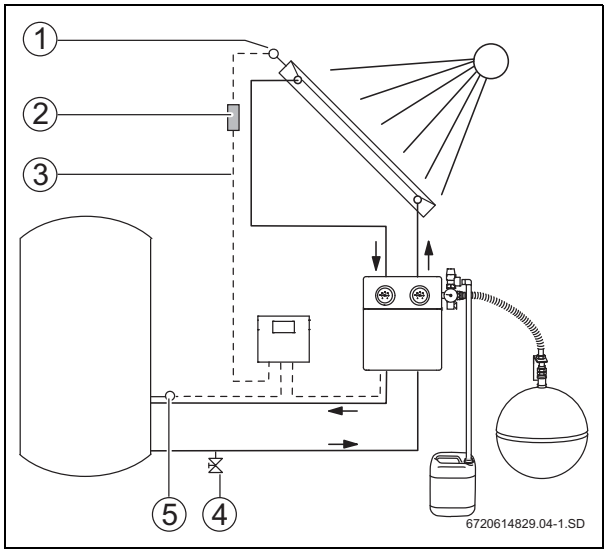


Fig. 11 Collector and storage cylinder temperature sensors to solar pump station with built-in controller

1 Collector temperature sensor
2 Connection point
3 Two-core lead (2 x 0.75 mm^2 up to a maximum length of 160 ft (50 m), not supplied)
4 Fill & drain valve for emptying (not supplied)
5 Tank temperature sensor

6 Commissioning

Caution: System damage from vaporisation in the solar thermal system

- Cover the collectors when purging and filling the solar thermal system. Purpose made covers are available from Buderus.

When filling with solar fluid, take the additional volume of the pre-cooling vessel into account (if installed). The pre-cooling vessel and the solar expansion vessel must be adequately bled.

The pump in the solar pump station is self-bleeding when in operation and therefore does not have to be bled manually.

6.1 Use of solar fluid

Caution: Risk of injury through contact with solar heat transfer fluid

- When handling solar heat transfer fluid, always wear protective gloves and goggles.
- If solar fluid comes into contact with skin: wash off the solar heat transfer fluid with water and soap.
- If solar heat transfer fluid comes into contact with eyes: holding eyelids wide open, thoroughly wash eyes with running water.

The solar fluid is pre-mixed and ready to use. It guarantees safe operation within the specified temperature range, protects the system from frost damage and minimises risk of vaporisation.

The fluid is biodegradable. A safety data sheet with further information regarding the solar heat transfer fluid can be requested from the manufacturer.

The collectors must only be operated with the following solar heat transfer fluids:

	Solar heat transfer fluid	**Temperature range**
SKN, FKC, FKB and SKS collectors	Solar fluid L	-26 ... + 340 °F (-32 ... + 170 °C)

Tab. 5 Solar heat transfer fluid according to type of collector

6.2 Flushing and filling using automatic filling pump (pressure filling)

The filler unit generates such a high rate of flow when filling the system with solar fluid that the air in the system is forced out into the container (for systems of 20 panels or more an auto air vent should be installed at the highest point of each collector row. After filling the solar system and purging all air the auto air vents must be isolated from the system).

Any remaining air still in the solar heat transfer fluid is eliminated by the air separator in the solar pump station.

Removing the expansion vessel

We recommend removing the expansion vessel before flushing the air out of the system. It must be disconnected at the lower joint of the expansion vessel connection set so that the expansion vessel charge pipe fills during the flushing process.

If the expansion vessel is not removed, it will fill up with too much fluid due to the pressure difference. That fluid will be forced back into the container when the filler pump is switched off. In some cases, the container may then overflow (if the container is topped up during the filling process to prevent the level dropping below minimum). The expansion vessel does not need to be removed if an isolating valve with bleeding facility is fitted directly before the expansion vessel. The vessel can then be isolated during the filling process.

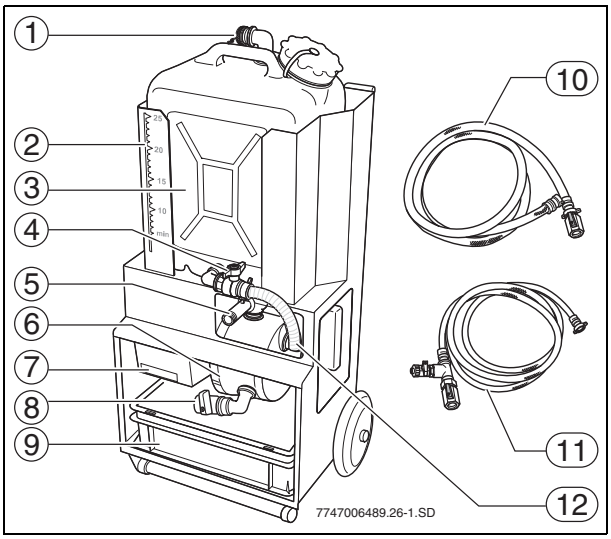


Fig. 12 Automatic filling pump package contents

1 1" connection
2 Measuring scale (6-25 litres)
3 Removable container
4 Ball valve in suction line
5 Connection (¾") for delivery hose
6 Pump
7 Pump power switch
8 Fill & drain valve for emptying the pump
9 Oil basin
10 Return hose ¾"
11 Supply hose ½"
12 Suction hose

6.2.1 Specifications

Filling station		
Mains voltage	V	120
Frequency	Hz	50 - 60
Max. power consumption	W	775
Permissible fluid temperature for pump	°F (°C)	0-131 (0-55)
Permitted lubricants	Solar fluid	
Maximum delivery height for: – Solar fluid	ft (m)	120 (36)
Maximum delivery rate for solar fluid	gpm (m³/h)	13 (3)
Reservoir capacity	(g)	8 (30)
Total weight (empty)	lbs (kg)	75 (34)

Tab. 6 Filler unit specifications

6.2.2 Application - standard system with tank coil Ø ≤ 1" (28 mm)

For details of flushing, refer to Chapter 6.2.8 to 6.2.13.

The illustrations in Chapter 6.2.8 to 6.2.15 show the flushing of a standard system (→ Fig. 13).

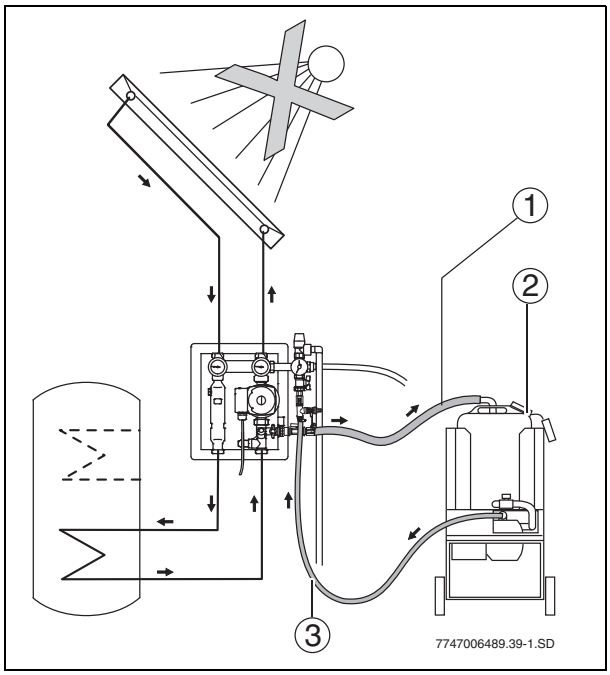


Fig. 13 Flushing a standard system

1 Return hose
2 Filling station
3 Supply hose

6.2.3 Application - standard system with tank coil Ø 1" (28 mm)

For details of filling, refer to Chapter 6.2.8 to 6.2.13.

- In order to be able to adequately bleed larger tank coils, fit a fill/drain valve (1, not supplied) close to the cylinder in the pipe feeding the coil.
- Flush the solar system in two stages:
  - Below the solar pump station

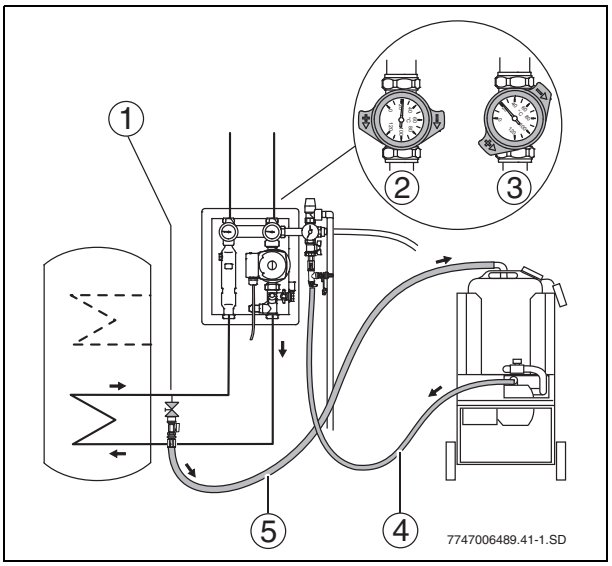


Fig. 14 Flushing a standard system with coil Ø > 28 mm - shown here: flushing below the solar pump station

1 Fill/drain valve (not supplied)
2 Left ball valve closed
3 Right ball valve and gravity brake bypassed
4 Supply hose
5 Return hose

  - Above the solar pump station

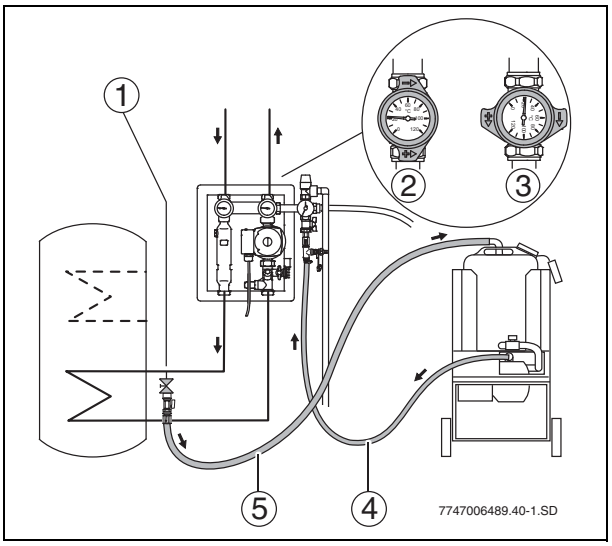


Fig. 15 Flushing a standard system with coil Ø > 28 mm - shown here: flushing above the solar pump station

1 Fill/drain valve (not supplied)
2 Left ball valve open
3 Right ball valve closed
4 Supply hose
5 Return hose

6.2.4 Application - collector arrays connected in parallel

For details of filling, refer to Chapter 6.2.8 to 6.2.13.

Warning: Risk of damage to system due to closing off return pipe

- Only fit isolating valves in the supply pipe. The safety valve will still have a direct connection to the return pipe.

If collector arrays are connected in parallel, each collector array must be purged separately.

- Only fit glycol and temperature resistant valves (1) in the supply pipes.

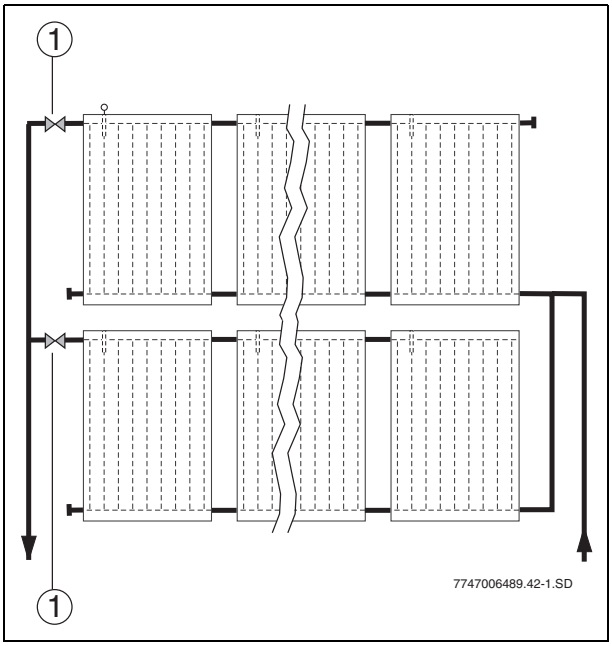


Fig. 16 Flushing collector arrays connected in parallel

1 Isolating valve

6.2.5 Application - two collector arrays tank coil Ø ≤ 1" (28 mm)

For details of filling, refer to Chapter 6.2.8 to 6.2.13.

In the case of systems with two collector arrays (e.g. east/west), each array must be purged via its own return line.

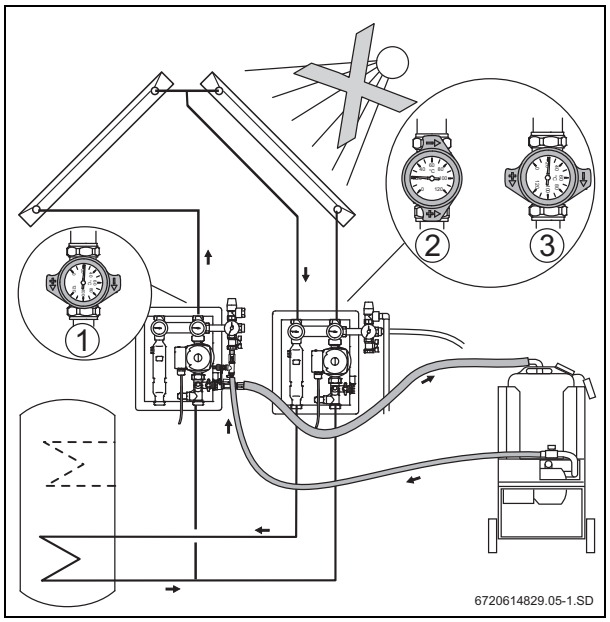


Fig. 17 Flushing two collector arrays - shown here: flushing the left collector array

1 Ball valve closed
2 Left ball valve open
3 Right ball valve closed

6.2.6 Application - two-tank systems with two pumps (cylinder coil Ø ≤ 1" (28mm))

For details of filling, refer to Chapter 6.2.8 to 6.2.13.

In the case of dual-tank systems operated by two pumps, each storage cylinder must be purged via its own return line.

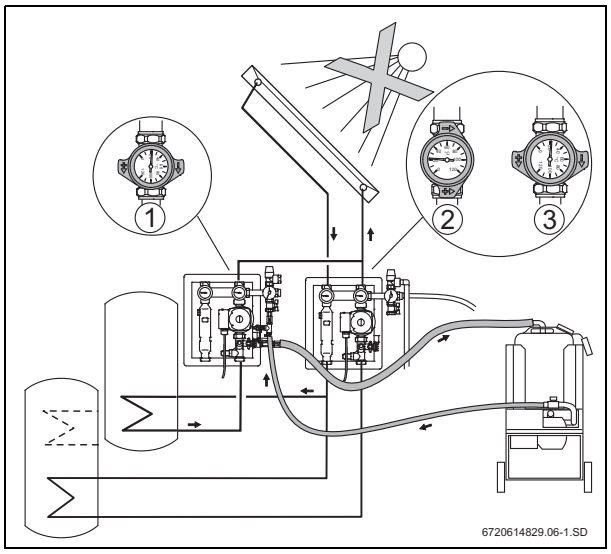


Fig. 18 Flushing systems with two heat consumers and two pumps - shown here: flushing cylinder 2

1 Ball valve closed
2 Left ball valve open
3 Right ball valve closed
4 Tank 1
5 Tank 2

6.2.7 Application - two-tank systems with one pump and one valve (cylinder coil Ø ≤ 28 mm)

For details of filling, refer to Chapter 6.2.8 to 6.2.13.

In the case of two-tank systems operated by one pump and a diverter valve (3), each tank must be flushed separately one after the other.

- Set the diverter valve to the appropriate position.

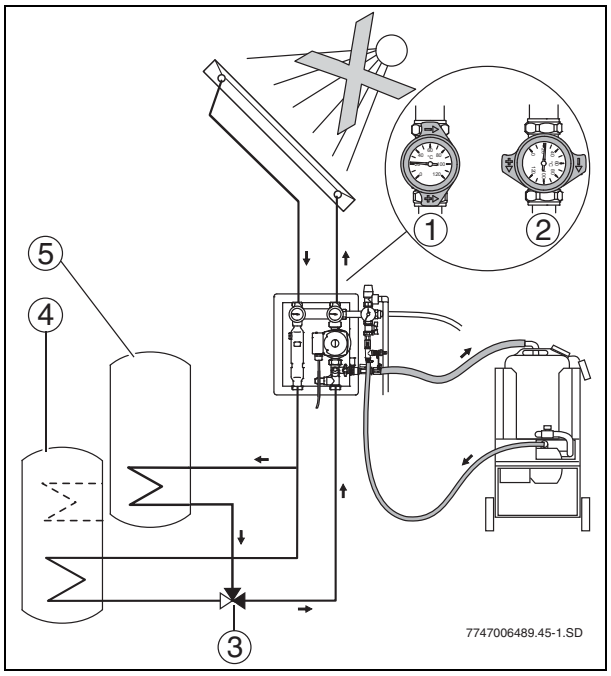


Fig. 19 Flushing systems with two heat consumers and diverter valve - shown here: flushing tank 2

1 Left ball valve open
2 Right ball valve closed
3 Diverter valve (black = open)
4 Tank 1
5 Tank 2

6.2.8 Installing a sediment bowl (available as accessory)

To make absolutely certain that no coarse dirt particles get into the pump, a sediment filter should be fitted.

- Attach jubilee clip (2) to hole on filler unit.
- Mount the sediment bowl (1) on the pipe clamp. Make sure that the ball valve can still be operated from the front.
- Connect the accompanying hose (3) between the sediment bowl and the upper connection point on the container.
- Connect the ¾" return hose (4) between the sediment bowl and the flow regulator on the solar thermal station.

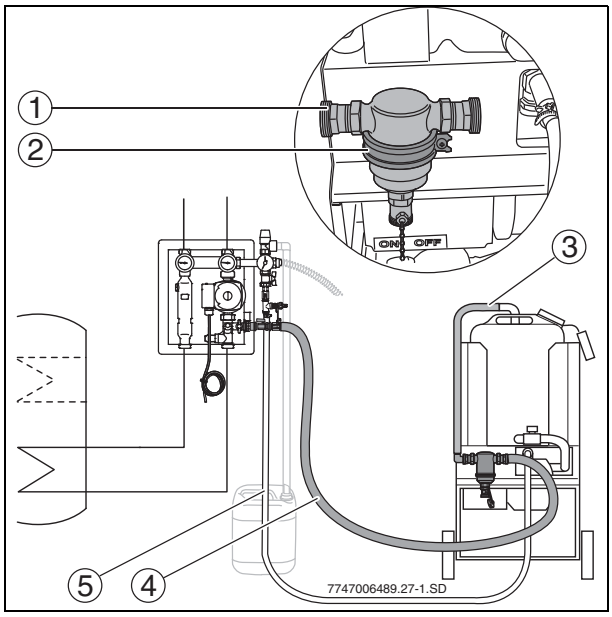


Fig. 20 Sediment filter on filler unit

1 Sediment bowl
2 Pipe clamp
3 Hose to sediment bowl
4 Return hose ¾"
5 Supply hose ½"

6.2.9 Connect filler unit to solar pump station

- Connect the ½" delivery hose to the pump (1) and to the fill & drain valve on the safety assembly using the tee (4).
- Connect the ¾" return hose between the top of the container (2) and the ball valve on the flow regulator (3).

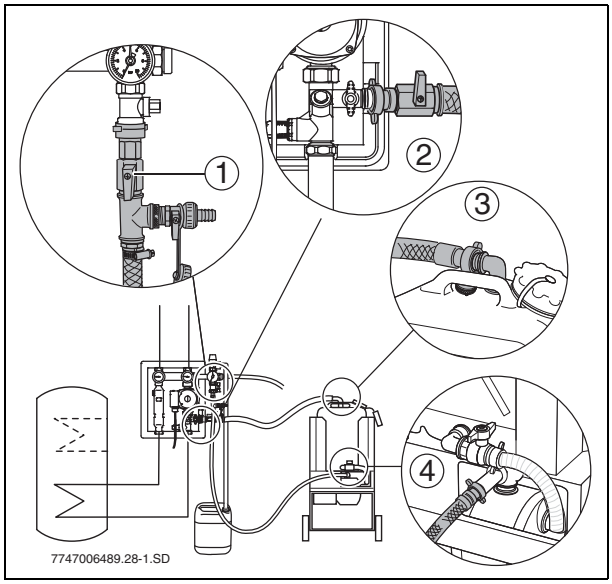


Fig. 21 Connecting supply and return hoses

1 Supply hose
2 Return hose
3 Container top
4 Connection to pump

6.2.10 Preparations

- Connect the fill & drain valve (2) to the pump.
- Fill automatic filling pump container with sufficient solar fluid.
  In addition to the system capacity, approx. 2.6 gal (10 litres) are required for the pump, hoses, etc.
- To fill the pump with solar fluid: open the ball valve on the pump's suction hose (3) and the fill & drain valve (1) in the outlet of the tee.
- Close the fill & drain valve (1) on the tee when the pump is full.

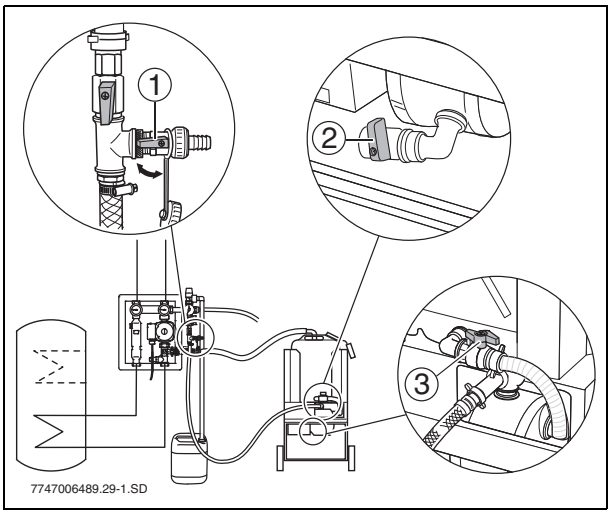


Fig. 22

1 Fill & drain valve on the outlet of the supply hose tee
2 Fill & drain valve on the pump
3 Fill & drain valve on the suction hose

- Close right ball valve (5) in the solar pump station and fully open left ball valve (6).
- Using a size 4 Allen wrench, fully open the flow regulator (3).
- Open the fill & drain valve on the safety assembly (1), on the end of the supply hose (2) and on the flow regulator (4).

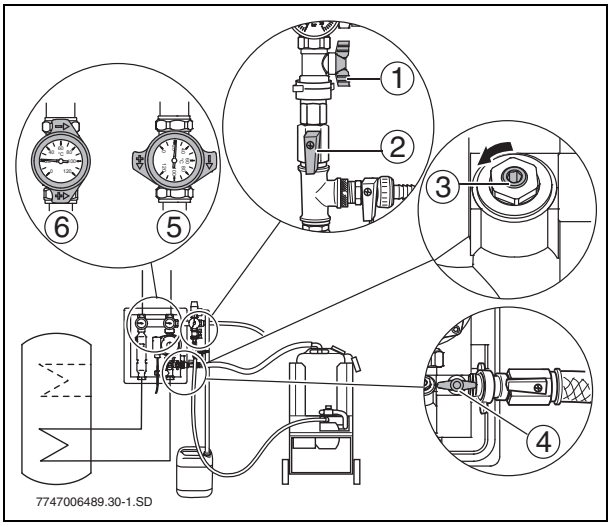


Fig. 23

1 Fill & drain valve on the safety assembly
2 Fill & drain valve on the supply hose
3 Adjusting screw on the flow regulator
4 Fill & drain valve on the flow regulator
5 Ball valve on right-hand thermometer closed (90°)
6 Ball valve on left-hand thermometer fully open (0°)

6.2.11 Venting the solar thermal system

Caution: Damage to pump
- Pump must only be allowed to run for a short period (max. 1 minute) against a closed valve.

- Switch on the pump (→ Fig. 24, item 3).

Ensure that the fluid in the filler unit container does not fall below the minimum level of 1.6 gal (6 litres) (“Min.” indicator).

- Purge the pipelines for about 10 minutes until the solar fluid (2) in the hoses and the container is free of bubbles.
- To release air bubbles that have built up in the line, while purging: quickly fully open and close the flow regulator several times.
- Purge the bypass via the flow regulator by briefly setting the right-hand ball valve at an angle (45°, gravity brake manually open) (1).
- Carry out a pressure test to check compliance with the maximum permitted pressures of all components.

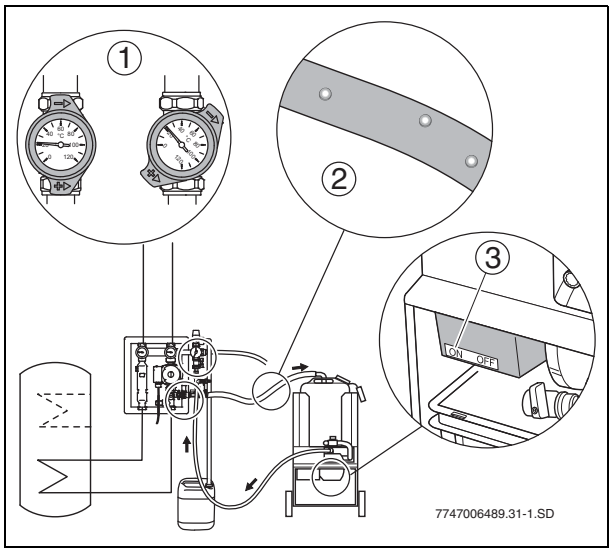


Fig. 24 Switching on the pump and checking for air bubbles

1 Ball valve and gravity brake on right-hand thermometer open (45° position)
2 Solar fluid
3 Pump switched on

6.2.12 Completing pressure filling and determining the operating pressure

When putting the system into operation, the operating pressure must be 10 psi (0.7 bar) above the static pressure (1 feet (1 metre) difference in height equals 0.44 ft (0.1 bar)).

The system pressure must be at least 22 psi (1.5 bar) (when cold, 20 °C/68 °F).

Example: 10 m static height equals 14.7 psi (1.0 bar) plus 10 psi (0.7 bar) = 24.7 psi (1.7 bar) operating pressure.

- Close the fill & drain valves on the safety assembly (2), on the flow regulator (4) and on the return hose (3).
- After switching on the pump: slowly open the fill & drain valve (2) on the safety assembly until the required operating pressure is reached.
- Switch off the pump.
- Rotate ball valves (1) on the thermometer to 0° (gravity brakes ready for operation).
- Set solar system pump to highest speed and allow to run for at least 15 minutes so that residual air can be removed by the air separator.
- Bleed the air eliminator (5) and correct the operating pressure if needed.

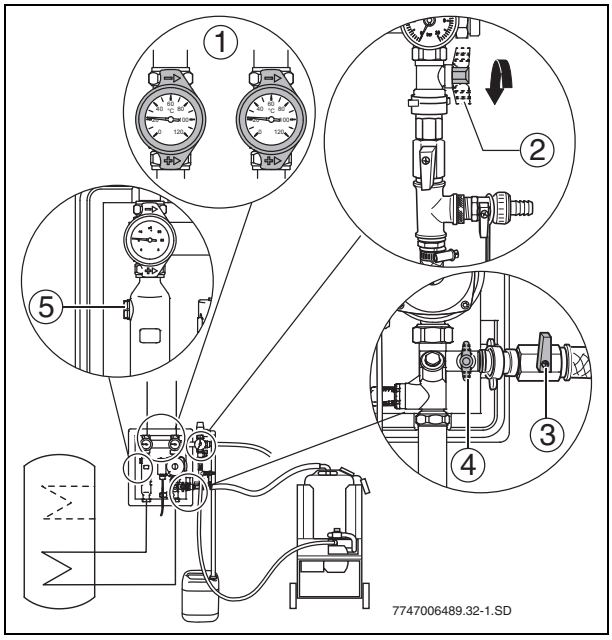


Fig. 25 Closing and opening the fill & drain valves

1 Ball valves on the thermometer in 0° position (gravity brakes ready for operation)
2 Fill & drain valve on the safety assembly
3 Fill & drain valve on the return hose
4 Fill & drain valve on the flow regulator
5 Bleed screw on the air eliminator

6.2.13 Verifying that the solar thermal system is free of air

If the black pointer on the pressure gauge (1) indicates pressure fluctuations when the solar pump is switched on and off, there is still air in the solar thermal system which must be removed.

- Switch the solar pump(s) on and off manually.
- While switching the pump on and off, observe the black pointer on the pressure gauge (1) on the safety assembly.

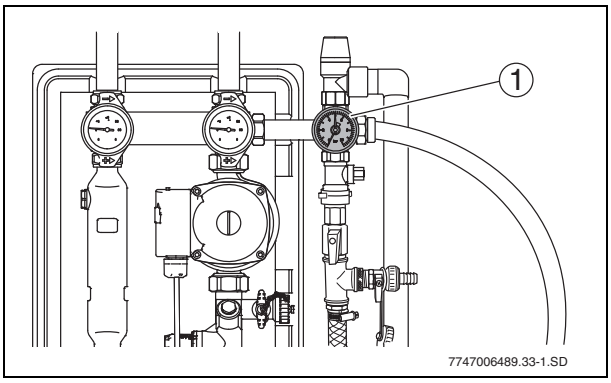


Fig. 26 Checking the pressure gauge display

1 Pressure gauge

6.2.14 Disconnect automatic filling pump

- Open the fill & drain valve (2) in the outlet of the supply hose tee.
- To drain the pump, close the ball valve (4) on the vacuum hose.
- Open the fill & drain valve (5) on the pump and allow the supply hose to empty out (into the collector pan).
- Close the fill & drain valve (5).

Drain the solar fluid into a collector pan so that it can then be poured into the filler unit or glycol container.

- Close both fill & drain valves (1, 2) on the delivery hose tee and detach the supply hose.
- Close the fill & drain valve (6) on the flow regulator and undo the return hose.
- Allow the return hose (3) to empty out and unscrew it from the container.

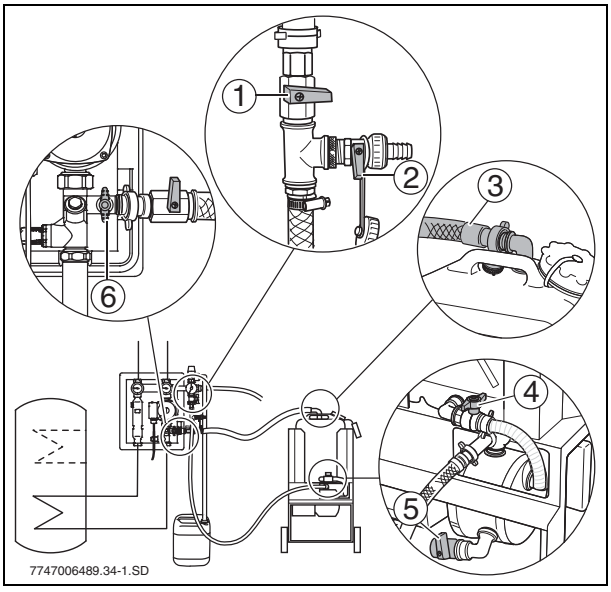


Fig. 27 Draining hoses and disconnecting filler unit

1 Fill & drain valve on the supply hose
2 Fill & drain valve on the outlet of the supply hose tee
3 Return hose
4 Ball valve on the suction hose
5 Fill & drain valve on the pump
6 Fill & drain valve on the flow regulator

- Pour the remaining solar fluid into a glycol container.
- Place the empty container back in the filler unit and attach the return and supply hoses.

6.2.15 Cleaning the automatic filling pump

The pump, hoses and container must be cleaned to protect them from wear.

Caution: Frost damage
- Ensure that no water remains in the pump.

- Attach the return hose to a water tap and fill the container with about 7 gallons (25 litres) of water.
- Place the end of the delivery hose in a drain.
- Open the ball valve on the vacuum hose (1) and wait until the pump fills up.
- Switch on the pump to clean the parts.
- Switch the pump off again as soon as the “Min.” level is reached.
- Unplug the power plug and allow the pump to empty out via the fill & drain valve (2).
- Clean the container separately.

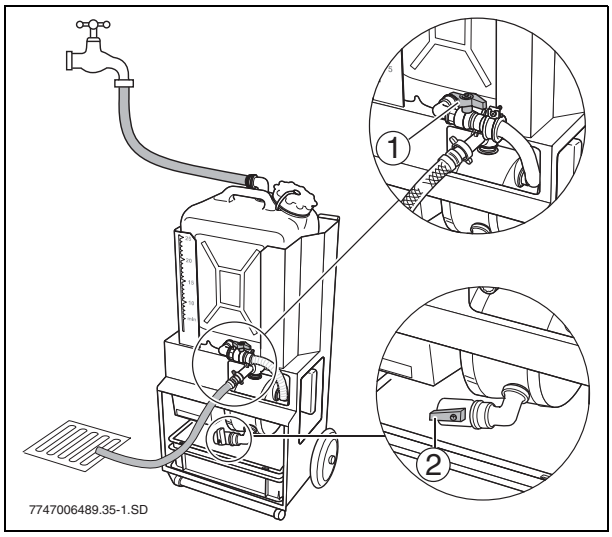


Fig. 28 Cleaning the pump and container

1 Ball valve on the suction hose
2 Fill & drain valve on the pump

6.3 Purging and filling with a hand pump (air vent on roof)

6.3.1 Purging the pipes

If a pre-cooling vessel is installed:

- Disconnect the pre-cooling vessel from the solar thermal circuit while purging so that the fluid remaining in the pre-cooling vessel does not get mixed with the solar fluid.

- Use a hose (1) to connect the fill & drain valve on the safety assembly to the municipal water supply.
- To drain the water away, connect a hose (2) to the fill & drain valve on the flow regulator.

Caution: After de-aeration, the air vent and the shut-off valve at top of the system must be closed. During holiday and vacations do not shut-off the solar system to prevent overheating in the summer.

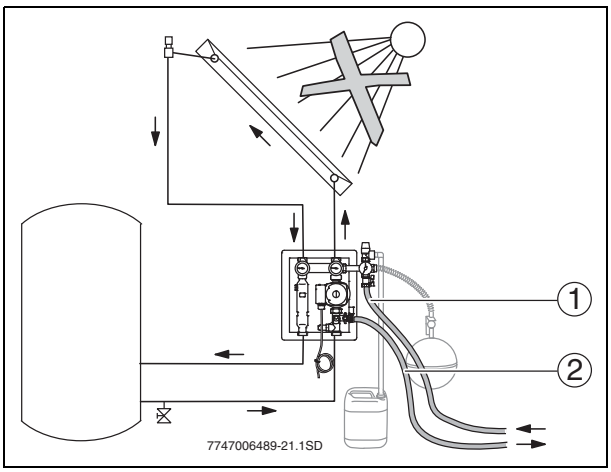


Fig. 29 Solar pump station with ball valves and gravity brakes in the thermometers

1 Hose for water supply
2 Hose for water drainage

- Open all shut-off fittings.
- Close the right-hand ball valve (2) on the solar pump station and the ball valve on the air vent (→ Fig. 31, item 3).
- Purge the pipework, making sure that the maximum operating pressure is not exceeded.
- Shut off the water supply.
- Close the fill & drain valves (3) in the solar pump station.

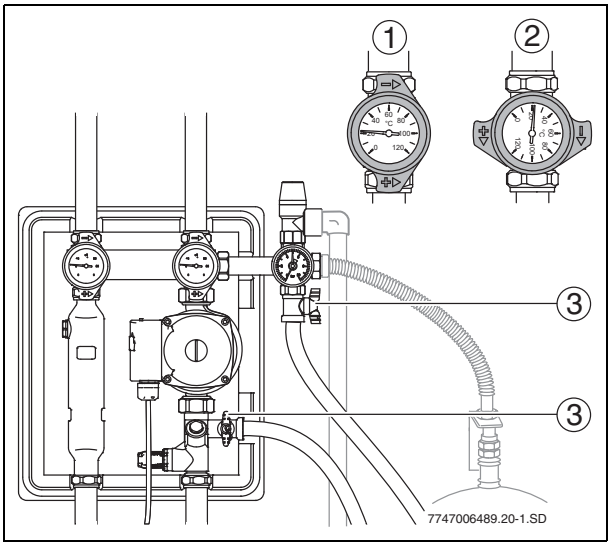


Fig. 30

1 Left-hand ball valve completely open (0°)
2 Right-hand ball valve closed (90°)
3 Fill & drain valves in the solar thermal station

6.3.2 Carrying out pressure test with water

The solar thermal system is vented by the opening of the plug screw (2) on the automatic air vent. To prevent moisture entering the air vent during operation, the weather protection cap (1) must always be over the plug screw.

- Open the ball valve (3).
- Unscrew the plug screw (2) one turn.

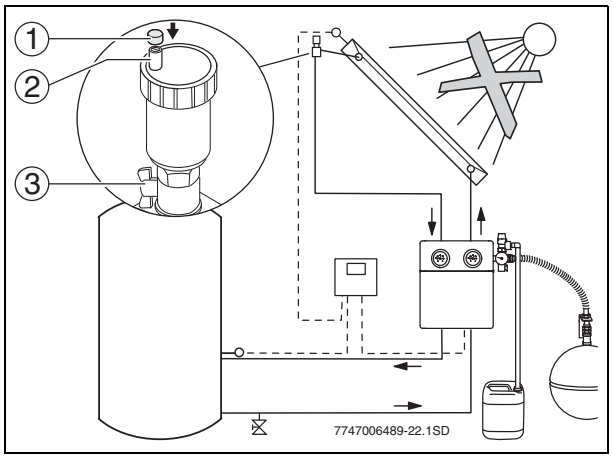


Fig. 31 Opening the air vent

1 Weather protection cap
2 Plug screw
3 Ball valve

- Set the ball valves (1) on the thermometers to 1° and open the flow regulator (1) and other shut-off fittings.
- Carry out a pressure test to check compliance with the maximum permitted pressures of all components.
- After the pressure test, drain the water and clean the automatic air vent.

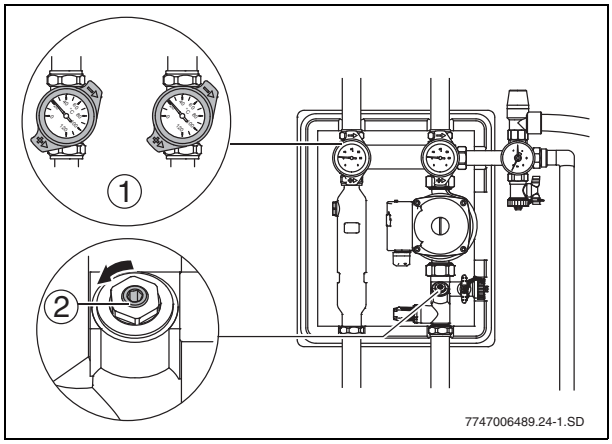


Fig. 32 Opened shut-off fittings

1 Ball valves and gravity brake open on the thermometers (45° position)
2 Flow regulator open

6.3.3 Replacing water with solar fluid

The pipes must be completely emptied of water, otherwise the solar fluid can become diluted.

To add the solar fluid, you can use electric pumps, hand pumps or power drill attachments capable of generating pressures of at least 30 psi (2 bar).

- Using a pump, fill the solar thermal system with fluid via one of the fill & drain valves (1) in the solar pump station.

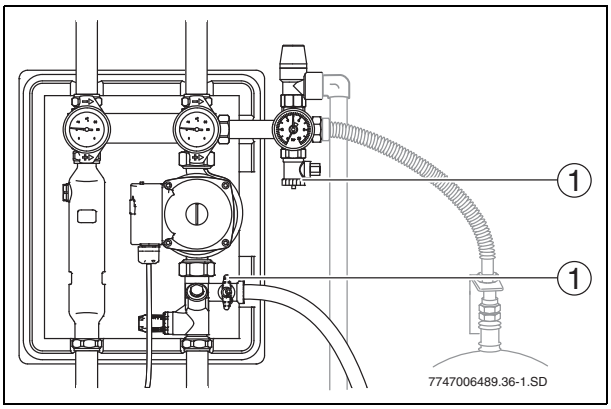


Fig. 33 Filling via fill & drain valve

1 Fill & drain valves

- Set the ball valves (→ Fig. 32, item 1) on the thermometers to 45° and open the flow regulator (→ Fig. 32, item 2) and other shut-off fittings.
- Fill the solar thermal system slowly so that air bubbles do not form.

6.3.4 Verifying that the solar thermal system is free of air

If the black pointer on the pressure gauge (1) indicates pressure fluctuations when the solar pump is switched on and off, there is still air in the solar thermal system which must be removed.

- Switch the solar pump(s) on and off manually.
- While switching the pump on and off, observe the black pointer on the pressure gauge (1) on the safety assembly.
- Lastly, set the ball valves on the thermometers so that the gravity brakes are ready for operation (0° position).

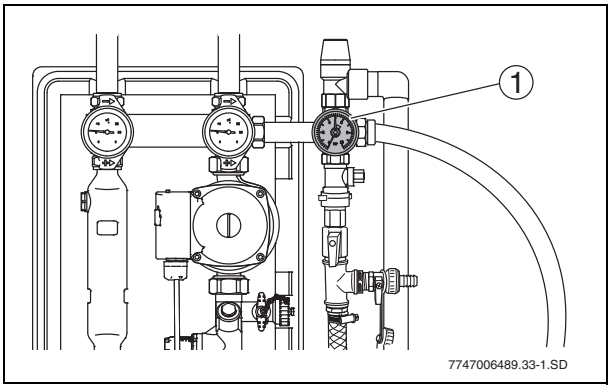


Fig. 34 Checking the pressure gauge display

1 Pressure gauge

6.3.5 Determining the operating pressure

When putting the system into operation, the operating pressure must be 10 psi (0.7 bar) above the static pressure (1 ft (1 metre) difference in height equals 0.44 psi (0.1 bar)).

The system pressure must be at least 22 psi (1.5 bar) (when cold, 68 °F (20 °C)).

Example: 33 ft (10 m) static head equals 14.7 psi (1.0 bar) plus 10 psi (0.7 bar) = 24.7 psi (1.7 bar) operating pressure (set pressure to 26 psi (1.8 bar)).

- If there is not enough pressure, pump in more solar fluid.
- Once the venting procedure is complete, close the ball valve on the air vent.

When solar fluid vaporises in the collectors, pressure compensation can only be carried out by the solar expansion vessel if the air vent is closed.

6.3.6 Determining the frost protection temperature

To determine the degree of frost protection, we recommend checking the frost protection of the solar fluid when first putting the system into operation, by means of a frost protection gauge (a refractometer). This check should be repeated at regular intervals (at least every two years).

The commonly used instruments for testing motor vehicle engine coolants are not suitable for this purpose. A suitable device can be ordered separately.

Reading for heat transfer fluid L	Concentration
– 23 °C	39 %
– 20 °C	36 %
– 18 °C	34 %
– 16 °C	31 %
– 14 °C	29 %
– 11 °C	24 %
– 10 °C	23 %
– 8 °C	19 %
– 6 °C	15 %
– 5 °C	13 %
– 3 °C	8 %

Tab. 7 Degrees of frost protection

6.3.7 Correcting frost protection

Caution: Frost damage
- Every two years, check whether the required frost protection level (to at least 13 °F (-23 °C)) is being maintained.

If the minimum frost protection level is not being maintained, more solar fluid must be added.

- Use Tab. 8 to determine the volume of the system, so that you can calculate the exact amount to be added (which is equal to the amount which first needs to be drained out).

System part	in Gallons (Litres)
1 SKN collector, vertical	0.28 (0.86)
1 SKN collector, horizontal	0.33 (1.25)
1 SKS collector, vertical	0.38 (1.43)
1 SKS collector, horizontal	0.46 (1.76)
1 2-line solar pumping station	0.05 (0.20)
1 heat exchanger in the solar storage cylinder	Refer to manufacturers specifications
1 ft (m) Copper pipe Ø 1/2" (15 mm)	0.03 (0.13)
1 ft (m) Copper pipe Ø 3/4" (22 mm)	0.08 (0.31)
1 ft (m) Copper pipe Ø 1" (28 mm)	0.14 (0.53)
1 ft (m) Copper pipe Ø 1-1/4" (35 mm)	0.28 (0.86)
1 ft (m) Copper pipe Ø 1-1/2" (42 mm)	0.33 (1.86)
1 ft (m) steel pipe R ¾	0.1 (0.37)
1 ft (m) steel pipe R 1	0.15 (0.58)
1 ft (m) steel pipe R 1¼	0.27 (1.01)
1 ft (m) steel pipe R 1½	0.36 (1.37)

Tab. 8 Volume of the separate system parts

- Use the formula on the right to determine the amount of concentrate to be added ($V_{replace}$).

$$V_{\text{replace}} = V_{\text{total}} \times \frac{45 - C_{concentration}}{100 - C_{concentration}}$$

Fig. 35 Formula for calculating the amount of fluid to be replaced

Example for solar fluid L:
- System volume (V_{total}) = 5.8 gal (22 litres)
- Frost protection level (reading taken): 6.8 °F (-14 °C)
- Equals concentration of (→ Tab. 7, page 29): 29 % (C = 29)
- Result: $V_{replace}$ = 1.5 gal (4.9 litres)

- Drain the calculated amount to be added ($V_{replace}$) and add concentrate.

6.4 Adjusting the flow rate

The flow rate is set when the system is cold 86 - 104 °F (30 - 40 °C).

– When the solar pump is speed-controlled, the controller determines the flow rate based on operating requirements.
– If the controller is not equipped with speed control or if speed control has been deactivated, the flow rate must be set to a fixed volumetric flow rate.

- Rotate ball valves (1) to 0° (gravity brakes ready for operation).
- Using a size 4 Allen wrench, fully open the flow regulator (2).
- On the controller, select mode “Manual ON” (→ controller instruction manual).

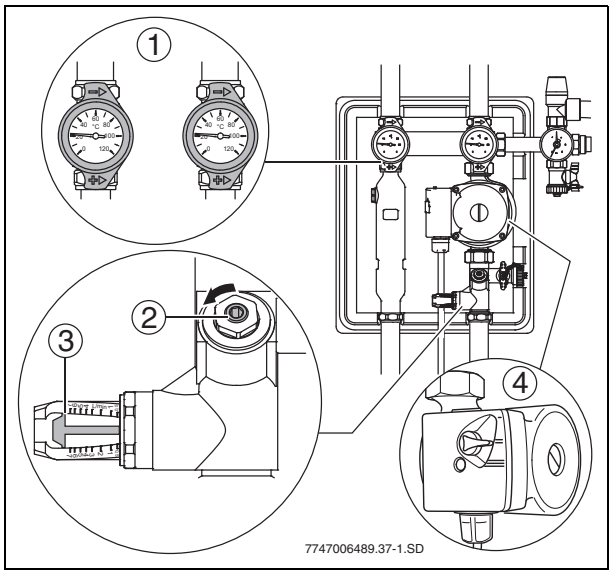


Fig. 36

1 Gravity brake ready for operation
2 Adjusting screw on the flow regulator
3 Indication point for the flow rate
4 Pump switch on the solar pump

- For the required flow rate, see Tab. 9.

The values specified in Tab. 9 apply to single-row collector arrays or multi-row arrays connected in parallel. Collector arrays connected in series must be set using the total volumetric flow rate, which must be calculated.

- Check the flow rate through the inspection window of the flow regulator (3).
- To pre-set the flow rate: adjust the speed setting of the solar pump (4) so that the required flow rate is reached with as low a speed setting as possible.

If the pre-set flow rate is not reached at the pump's highest speed level:

- Check maximum permitted pipe lengths and sizing (→ Chapter 4.1).
- If necessary, install a more powerful solar pump.

Flow rate gpm (l/min) (86 - 104 °F in return) / (30 - 40 °C)			
No. of collectors	**gpm (l/min)**	**No. of collectors**	**gpm (l/min)**
1	0.22 (1)	11	2.4 (8 - 11)
2	0.44 (1.5 - 2)	12	2.64
3	0.66 (2.5 - 3)	13	2.86 (11 - 13)
4	0.88 (3 - 4)	14	3 (12 - 14)
5	1.1 (4 - 5)	15	3.3 (13 - 14)
6	1.32 (5 - 6)	16	3.5 (13 - 16)
7	1.54 (6 - 7)	17	4 (15 - 18)
8	1.76 (7 - 8)	18	4 (15 - 18)
9	1.98 (8 - 9)	19	4.5 (16 - 19)
10	2.2 (8 - 10)	20	4.5 (17 - 20)

Tab. 9 Overview of flow rates

Speed-controlled solar pump

- On the controller, select “Auto” mode. The flow rate will be regulated by means of the solar pump speed, based on current operating requirements.

Non-speed-controlled solar pump

- Close the adjusting screw of the flow regulator (2) until the edge of the float (3) in the inspection window indicates the recommended flow rate.

After commissioning

The viscosity of the solar heat transfer fluid makes air bubbles substantially more resilient than those in pure water.

- After several hours of solar pump operation, vent the solar thermal system via the air eliminator in the solar pump station and (if installed) the air vent on the roof.

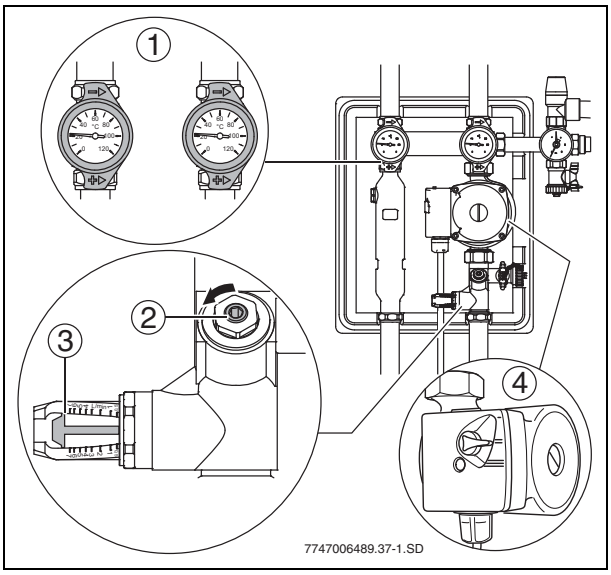


Fig. 37

1 Gravity brake ready for operation
2 Adjusting screw on the flow regulator
3 Indication point for the flow rate
4 Pump switch on the solar pump

7 Commissioning, inspection and maintenance report

We recommend conducting the first inspection and maintenance after about 500 operating hours, and then at intervals of 2 - 3 years.

- Fill out the report and tick off the tasks performed.

Owner:	Site location:

Tab. 10

Commissioning, inspection and maintenance tasks		Page	Commissioning	Inspection/maintenance		
				1.	2.	3.
Date:						
General commissioning						
1.	Flow and return pipes connected and earthed?	10	☐	–	–	–
2.	Pressure test carried out?	23, 27	☐	–	–	–
3.	Air vent closed?	29	☐	–	–	–
4.	Charge pressure of the expansion vessel checked?	13	_____ psi (bar)	–	–	–
5.	Solar system verified to be free of air?	24	☐	–	–	–
6.	pH level of solar fluid checked? Replace solar fluid if level is ≤ 7 (solar fluid coloured brown, strong odour). [1]		–	☐	☐	☐
7.	Frost protection to _____ °F (°C) checked and analysed?	29	_____ °F (°C)	_____°F (°C)	_____°F (°C)	_____°F (°C)
	Frost protection ensured until _____ (month/year) (please check frost protection every two years!)					
Solar thermal circuit						
1.	Measure operating pressure when system is cold, and enter the result here. System temperature on RL thermometer?	23, 29	_____ psi (bar) _____ °F (°C)	_____psi (bar) _____ °F (°C)	_____psi (bar) _____ °F (°C)	_____psi (bar) _____ °F (°C)
2.	Volumetric flow rate checked when the system is cold and result entered here?	31	___ gpm (l/min)	___ gpm (l/min)	___ gpm (l/min)	___ gpm (l/min)
	Solar pump setting (1/2/3)?					
3.	Gravity brakes ready to operate (closed)?	31	☐	☐	☐	☐
4.	Thermostatic DHW mixing valve functioning correctly (if installed)?		☐	☐	☐	☐
Collector array						
1.	Visual inspection of collectors carried out?	[2]	☐	☐[3]	☐[3]	☐[3]
2.	Collector temperature sensor correctly positioned and pushed into the sensor well until it bottoms out, and secured with screw fitting?		☐	☐[3]	☐[3]	☐[3]
3.	Visual inspection of the mounting structure carried out?		☐	☐[3]	☐[3]	☐[3]
4.	Visual inspection for leaks carried out at points where mounting structure meets roofing?		☐	☐[3]	☐[3]	☐[3]
5.	Visual inspection of pipe insulation carried out?		☐	☐[3]	☐[3]	☐[3]
6.	Wet cleaning of collectors carried out (when needed) without cleaning additives?		☐[3]	☐[3]	☐[3]	☐[3]
Solar cylinder						
1.	Maintenance on solar storage cylinder carried out?	[2]	–	☐	☐	☐

Tab. 11

	Commissioning, inspection and maintenance tasks	Page	Commissioning	Inspection/maintenance 1.	2.	3.
Programmer						
1.	Operating hours of solar pump P1: Period from _____ to _____ / _____ h	2)	____ -____ _____ h	____ -____ _____ h	____ -____ _____ h	____ -____ _____ h
	Operating hours of solar pump P2: Period from _____ to _____ / _____ h (a system will run for about 1200-2500 hours each year) 4)		____ -____ _____ h	____ -____ _____ h	____ -____ _____ h	____ -____ _____ h
2.	Pump functioning checked in the positions (On/Off/Auto)?		☐	☐	☐	☐
3.	Activation/deactivation temperature difference of solar pump ΔT pump 1 checked and entered here?		___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)
	Activation/deactivation temperature difference of solar pump ΔT pump 2 checked and entered here?		___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)	___ °F (K)/ ___ °F (K)
4.	Temperature indicated by all temperature sensors (resistances checked)?		☐	☐	☐	☐
5.	Temperature sensors correctly positioned, insulated and connected?		☐	☐	☐	☐
6.	Maximum cylinder temperature Tmax for solar storage cylinder 1 checked and entered here?		_____ °F (°C)	_____ °F (°C)	_____ °F (°C)	_____ °F (°C)
	Maximum cylinder temperature Tmax for solar storage cylinder 2 checked and entered here?		_____ °F (°C)	_____ °F (°C)	_____ °F (°C)	_____ °F (°C)
7.	Backup heating is functioning properly?		☐	☐	☐	☐
8.	Is the required set temperature (reheating) achieved by the controller?		☐	☐	☐	☐
Heat meter						
1.	Period from _____ to _____ / _____ kWh	2)	____ -____ _____ kWh	____ -____ _____kWh	____ -____ _____ kWh	____ -____ _____ kWh
2.	Temperature sensors correctly positioned, insulated and connected?		☐	☐	☐	☐
Comments						
	The solar thermal system has been installed and put into operation, or inspected and serviced, as instructed in this instruction manual.		☐	☐	☐	☐
	Company stamp / date / signature					

Tab. 11

1) pH indicator strips obtainable from chemists or service case.

2) See instruction manual for the component.

3) When needed.

4) Depends on specific system data.

8 Faults

Information regarding faults can also be found in the installation instructions for the controllers.

Type of fault		
Effect	**Possible causes**	**Remedy**
Pump not running although activation conditions are met.		
The solar storage tank is not being supplied by the solar thermal system.	Pump is faulty.	Check pump and replace if necessary.
	Pump stalled.	Unscrew and remove the slotted screw on the pump head and use a screwdriver to release the pump shaft. Do NOT strike the pump shaft.
	Pump is not responding to the controller.	See controller instruction manual.
Pump continually switching on and off.		
Solar yield too low.	Difference between controller cut-in and cut-out temperatures too small.	Check controller settings.
	Volumetric flow rate too high.	Check and adjust the flow rate.
	Temperature sensor position or contact is not correct.	Check temperature sensor position.
Pump does not switch off.		
Heat is being transferred out of the storage tank.	Temperature sensor faulty or in wrong position.	Check temperature sensor position, mounting and characteristics.
	Controller faulty.	Note: speed-controlled pumps do not switch off immediately, but only once the lowest speed is reached.
Domestic hot water is too hot.		
risk of scalding	Storage tank temperature limit and mixing valve are set too high.	Set the tank temperature limit and hot water mixer to a lower setting.
Domestic hot water too cold (or hot water flow rate too slow).		
	Domestic hot water thermostat on heating appliance, on heating controller or on mixing valve is set too low.	Set the temperature as instructed in the applicable operating manual (max. 140 °F (60 °C). Check that backup heating is functioning properly.
Temperature differences in solar thermal circuit are too high / flow temperature is too high / high collector temperature reached too quickly		
Solar yield too low or system damage.	Faulty temperature sensor or controller malfunction.	Check temperature sensor and settings of controller.
	Air in the system.	Bleed the system.
	Volumetric flow rate too low.	Check/adjust the flow rate.
	Blocked line.	Check/purge the pipelines.
	Collector arrays not hydraulically balanced.	Carry out hydraulic balancing.
Pressure drop in the system.		

Tab. 12

Type of fault		
Effect	**Possible causes**	**Remedy**
Solar yield too low.	Loss of solar fluid at joints.	Braze any leaks. Replace seals. Retighten screw fittings.
	Loss of solar fluid through an open safety valve.	Check charge pressure and size of expansion vessel.
	Vapour has escaped through open air vent (normal operating function).	Close air vent after venting.
	Frost damage.	Check frost protection.
No flow noticeable on flow rate indicator despite pump running.		
Solar yield too low.	Shut-off fittings are closed.	Open shut-off fittings.
	Air in the system.	Bleed the system.
	Indicator element in the flow regulator is sticking.	Clean the flow regulator.
Noises in the collector array at high levels of solar irradiation (vapour knocking).		
Leakages in solar thermal circuit.	Even flow through the collector arrays is not possible.	Check piping.
	Expansion vessel too small or faulty.	Check design and charge pressure of the expansion vessel and check operating pressure.
	Pump power is too low.	Check pump, replace if necessary.
	The collector with the collector temperature sensor is under shade.	Remove shade.
	Air in the system.	Bleed or purge the system and check slope of pipes.
Solar storage tank is cooling rapidly.		
High heat loss.	Tank insulation is faulty or not correctly fitted.	Check insulation. Insulate the tank connection points.
	Controller setting for backup heating is not correct.	Check settings of boiler controller.
	Single-pipe circulation (micro-circulation in the pipelines).	Instal a "U" bend in the pipe to prevent heat convection.
	Gravity circulation via collector array or DHW recirculation line or backup heating.	Check gravity brakes.
	Hot water recirculation running too frequently and/or at night.	Check programmed on/off times and cyclic mode.
When sun is shining on collectors, the collector glass is fogged for a long period of time.		
Condensation water in the collector.	Insufficient ventilation of the collector (in the case of ventilated collectors).	Clean ventilation openings.
System performance is falling.		

Tab. 12

Type of fault		
Effect	**Possible causes**	**Remedy**
Solar yield too low.	Collectors are under shade.	Remove shade.
	Air in the system.	Bleed the system.
	Pump is running at decreased power.	Check the pump.
	Heat exchanger dirty/calcified.	Wash/decalcify the heat exchanger.
	Collector glazing is very dirty.	Clean the collector glazing with a glass-cleaning agent (no acetone).
Backup heating is running despite good solar irradiation.		
Solar yield too low.	Storage tank temperature sensor for backup heating is faulty or incorrectly positioned.	Check storage tank temperature sensor position, mounting and characteristics.
	DHW recirculation is incorrectly connected or switched on for too long.	Check recirculation connection; if necessary, reduce switch-on time for recirculation.
	Backup heating temperature set too high.	Check settings.
	Air in the system.	Bleed the system.
	Controller faulty.	Check controller, replace if necessary.

Tab. 12

9 Application drawings

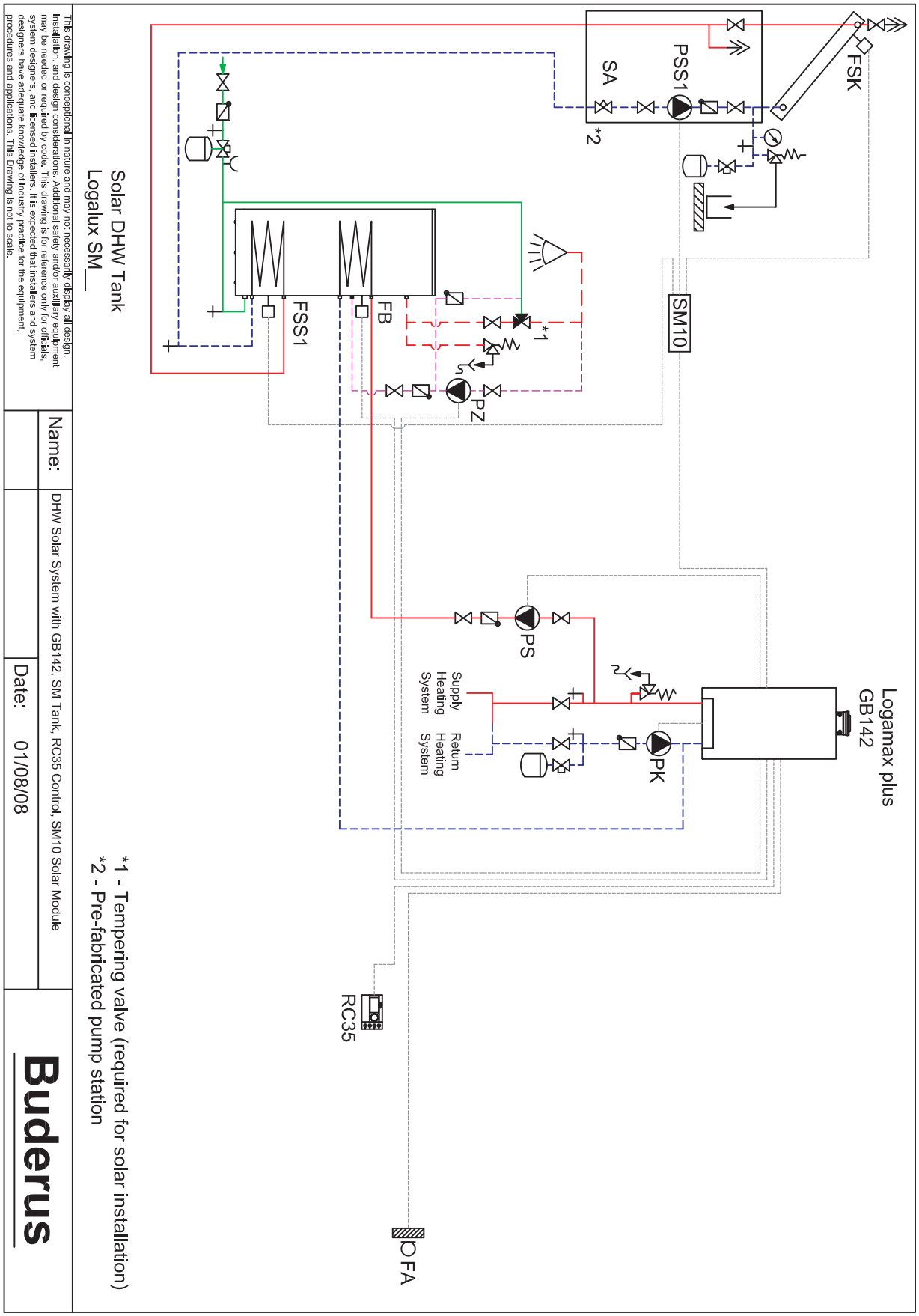
FA	Outdoor Sensor	PH	Circulator Heating Circuit
FB	DHW Sensor	PK	Boiler Pump
FK	Boiler Sensor	PS	DHW Charging Pump
FP	Upper Buffer Tank Sensor (4000 series - diverter valve control)	PSS1	Circulator Solar Station
FR	Return Sensor Heating Circuit (4000 series - diverter valve control)	PZ	Recirculation Pump
FSK	Solar Collector Sensor	P1	Circulator Solar Station
FSS1	Solar Tank Sensor (Bottom)	P1*	Diverter Valve (power on -> open, power off -> spring return close)
FV	Supply Sensor Heating Circuit	SA	Flow Setter
T1	Solar Collector Sensor (TR 0301 U is used as stand-alone solar controller)	SH	Mixing Valve Heating Circuit
T1*	Upper Buffer Tank Sensor (TR 0301 U is used as diverter valve controller)	SPB	Solar Heating Diverter Valve (4000 series, power on -> open, power off -> spring return close)
T2	Solar Tank Sensor Bottom (TR 0301 U is used as stand-alone solar controller)		
T2*	Return Sensor Heating Circuit (TR 0301 U is used as diverter valve controller)		

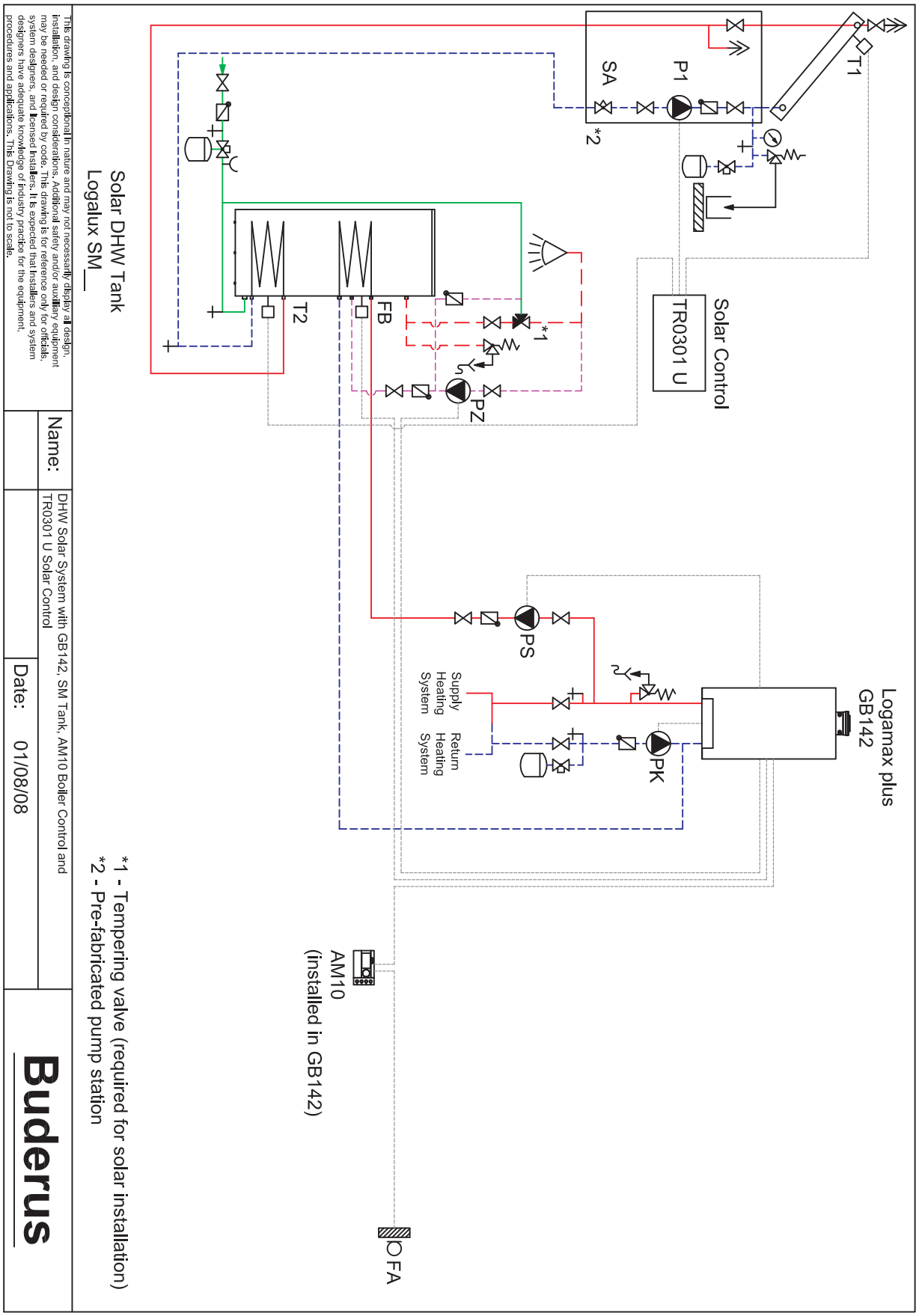
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxilliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.

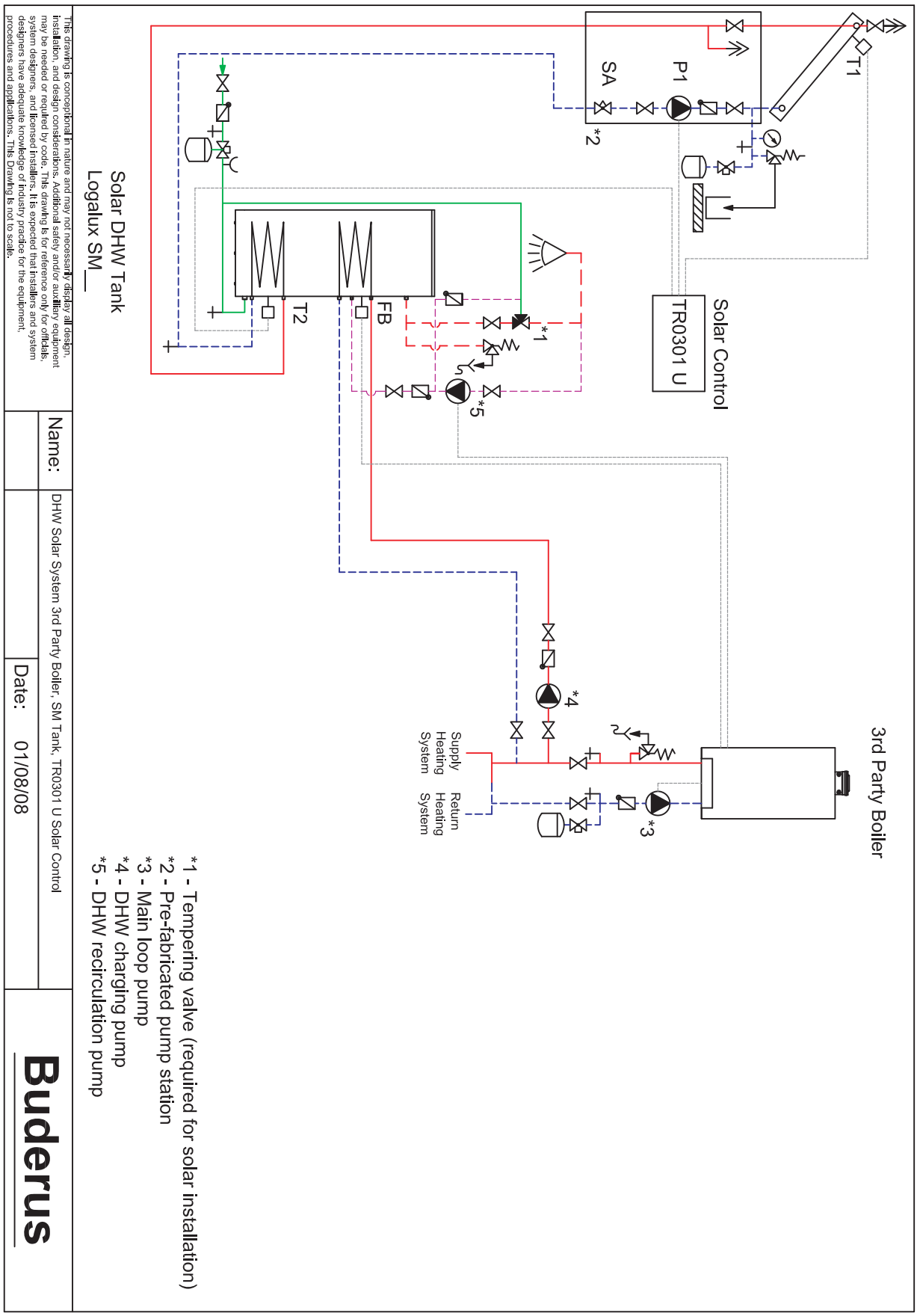
Name: Legend

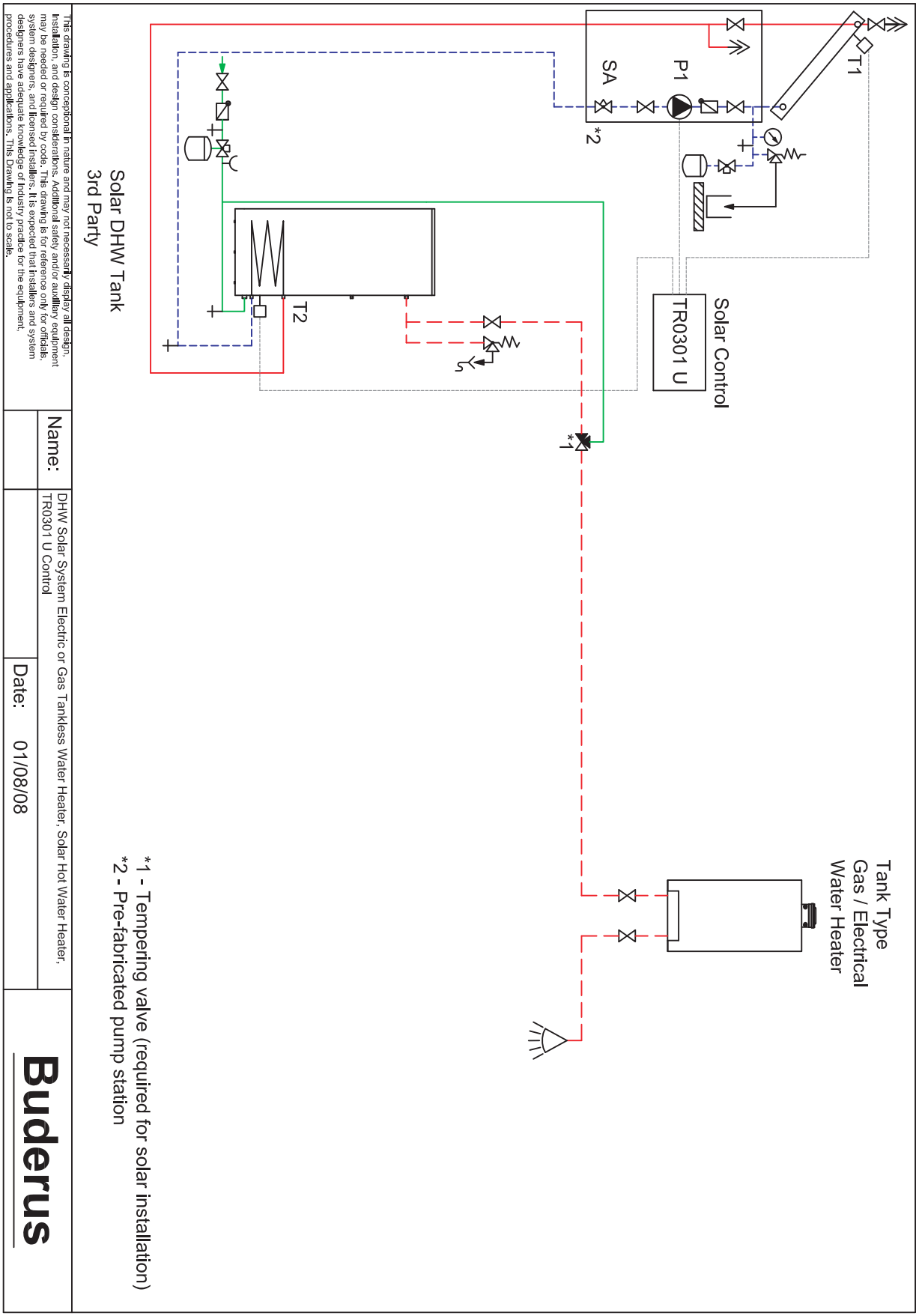
Date: 01/08/08

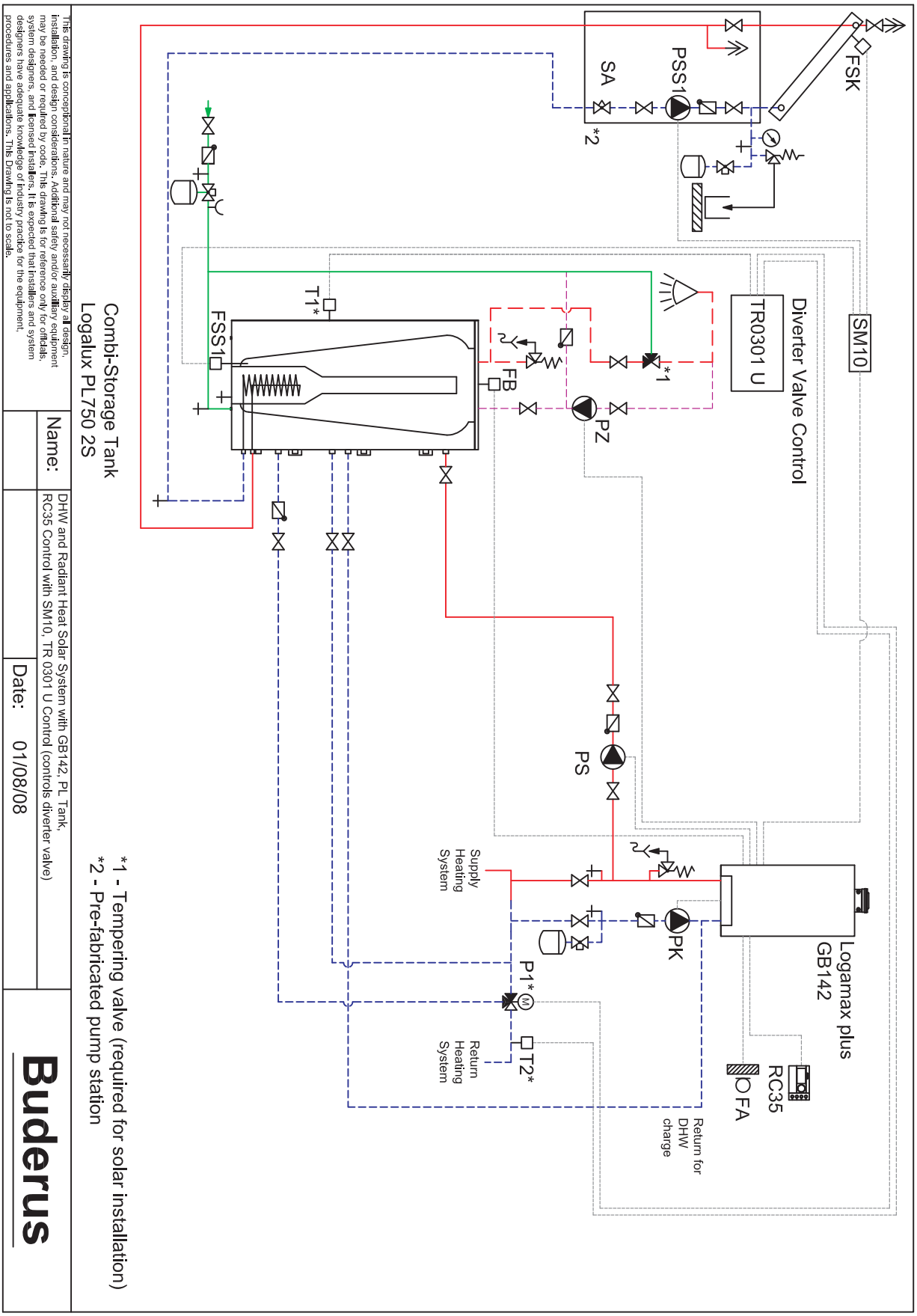
Buderus

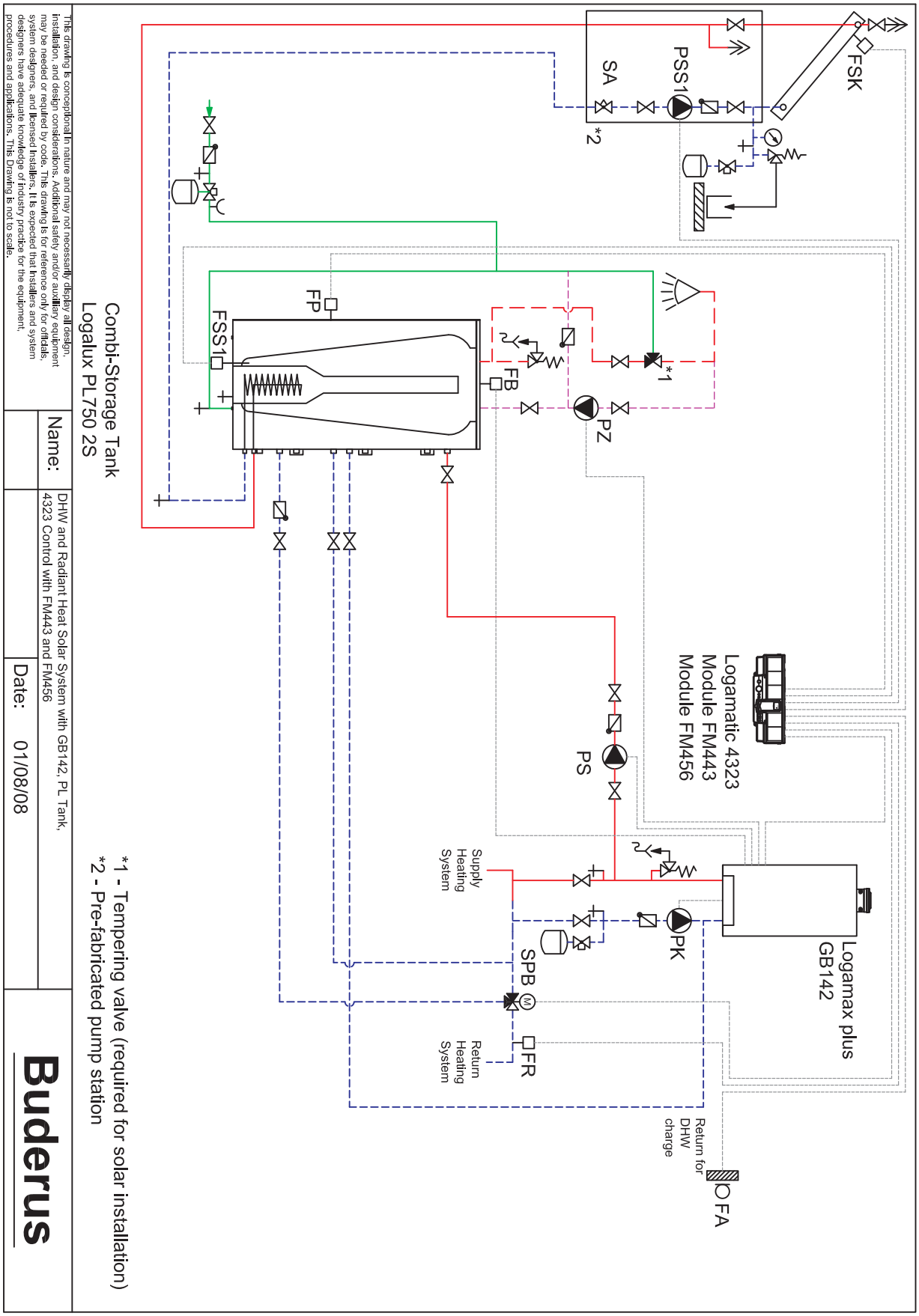

Solar DHW Tank
Logalux SM__
Logamax plus
GB142
FSK
PSS1
SA
*2
SM10
*1
PZ
FB
FSS1
PS
PK
Supply Heating System
Return Heating System
RC35
FA
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, Installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW Solar System with GB142, SM Tank, RC35 Control, SM10 Solar Module
Date: 01/08/08
Buderus

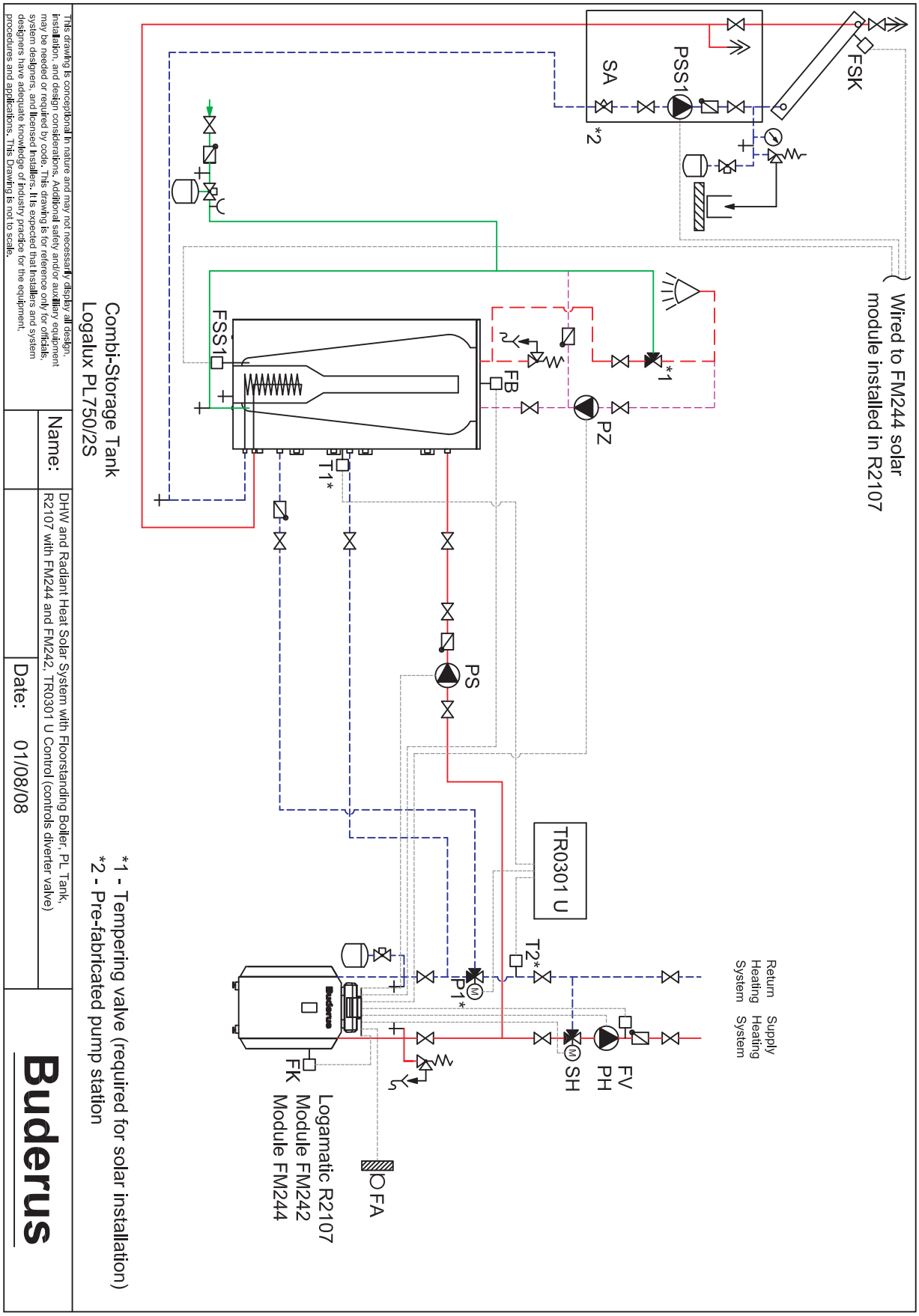

T1
P1
SA
*2
Solar Control
TR0301 U
*1
PZ
FB
T2
Solar DHW Tank
Logalux SM__
PS
PK
Supply Heating System
Return Heating System
Logamax plus GB142
AM10
(installed in GB142)
FA
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This drawing is not to scale.
Name:
DHW Solar System with GB142, SM Tank, AM10 Boiler Control and TR0301 U Solar Control
Date: 01/08/08
Buderus

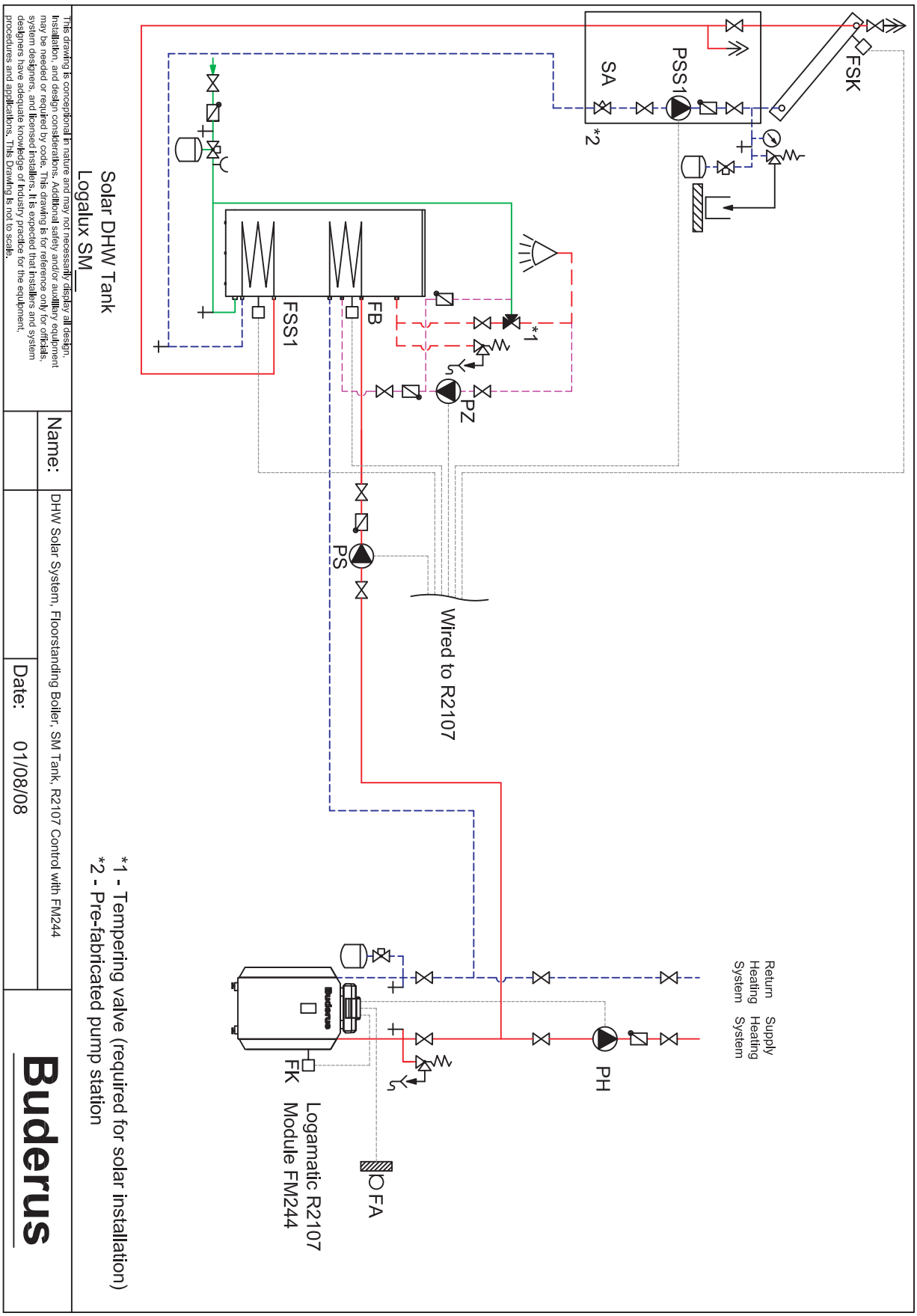

T1
SA
P1
*2
Solar Control
TR0301 U
*1
*5
FB
T2
*4
*3
3rd Party Boiler
Supply Heating System
Return Heating System
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
*3 - Main loop pump
*4 - DHW charging pump
*5 - DHW recirculation pump
Solar DHW Tank
Logalux SM_
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
Date: 01/08/08
DHW Solar System 3rd Party Boiler, SM Tank, TR0301 U Solar Control
Buderus

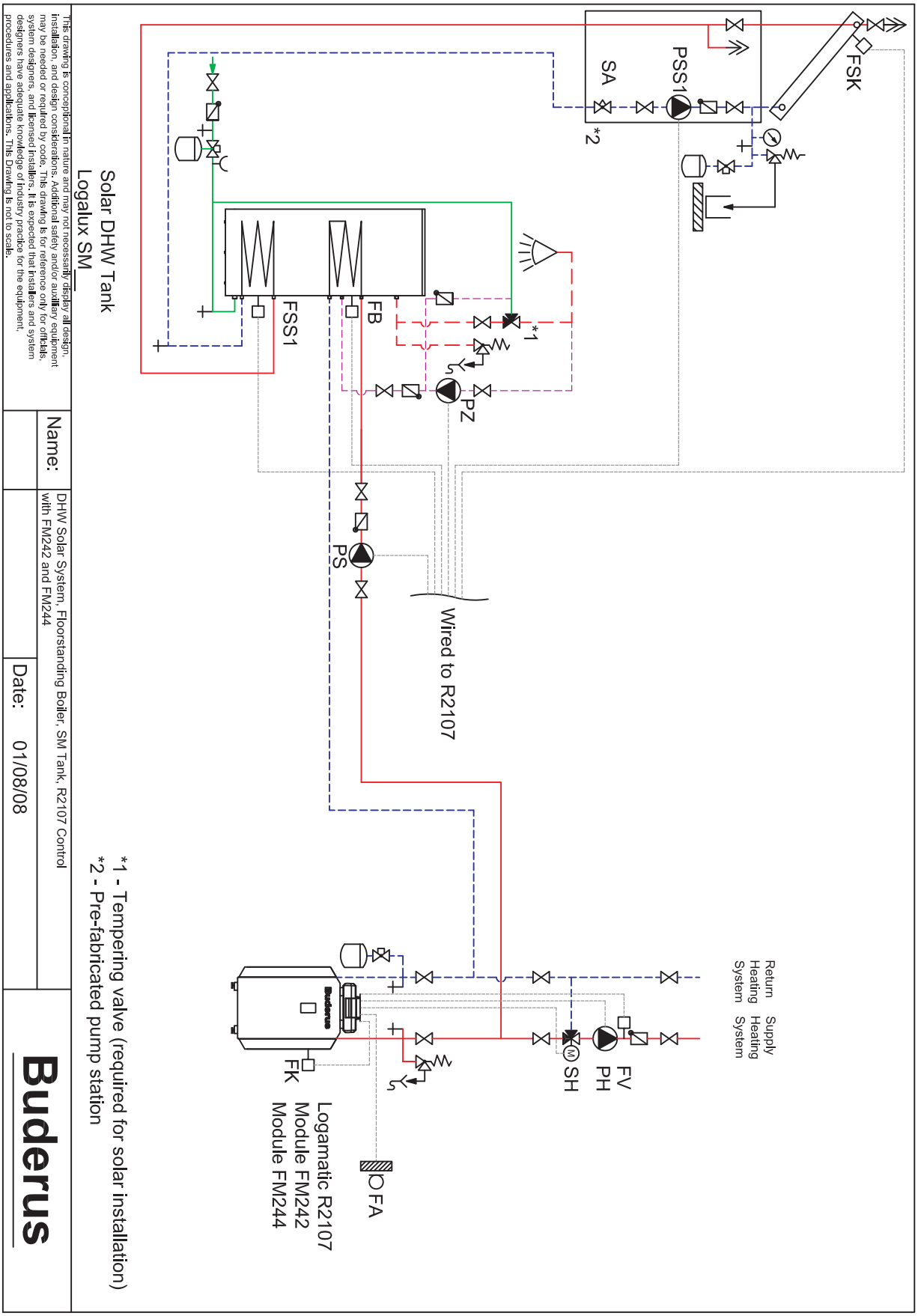

T1
P1
SA
*2
Solar Control
TR0301 U
T2
*1
Tank Type
Gas / Electrical
Water Heater
Solar DHW Tank
3rd Party
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW Solar System Electric or Gas Tankless Water Heater, Solar Hot Water Heater, TR0301 U Control
Date: 01/08/08
Buderus

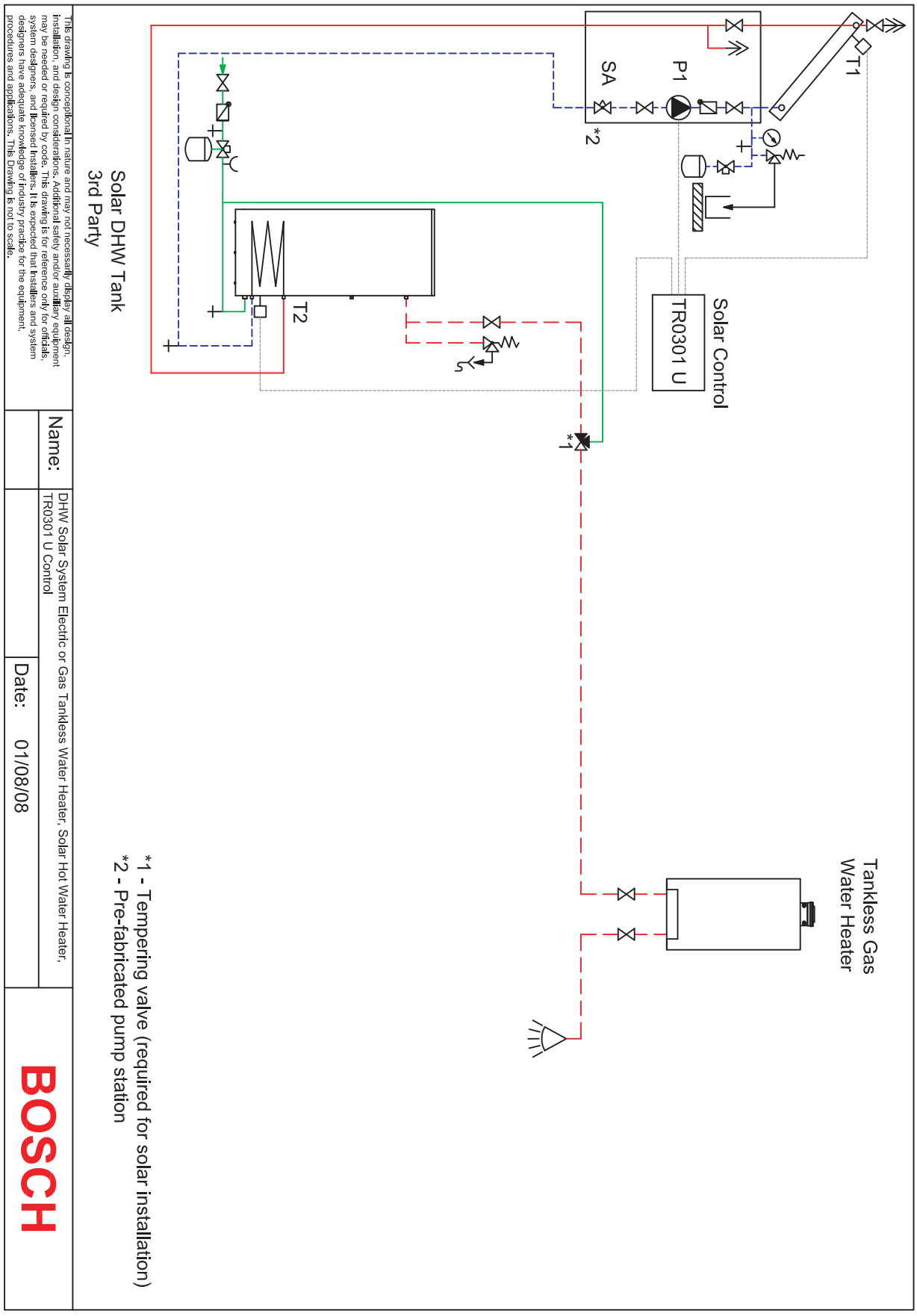

FSK
SA
PSS1
*2
SM10
Diverter Valve Control
TR0301 U
*1
PZ
FB
T1*
FSS1
PS
Supply Heating System
PK
P1*
T2*
Return Heating System
Logamax plus GB142
RC35
FA
Return for DHW charge
Combi-Storage Tank
Logalux PL750 2S
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
Name:
DHW and Radiant Heat Solar System with GB142, PL Tank, RC35 Control with SM10, TR 0301 U Control (controls diverter valve)
Date: 01/08/08
Buderus
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.

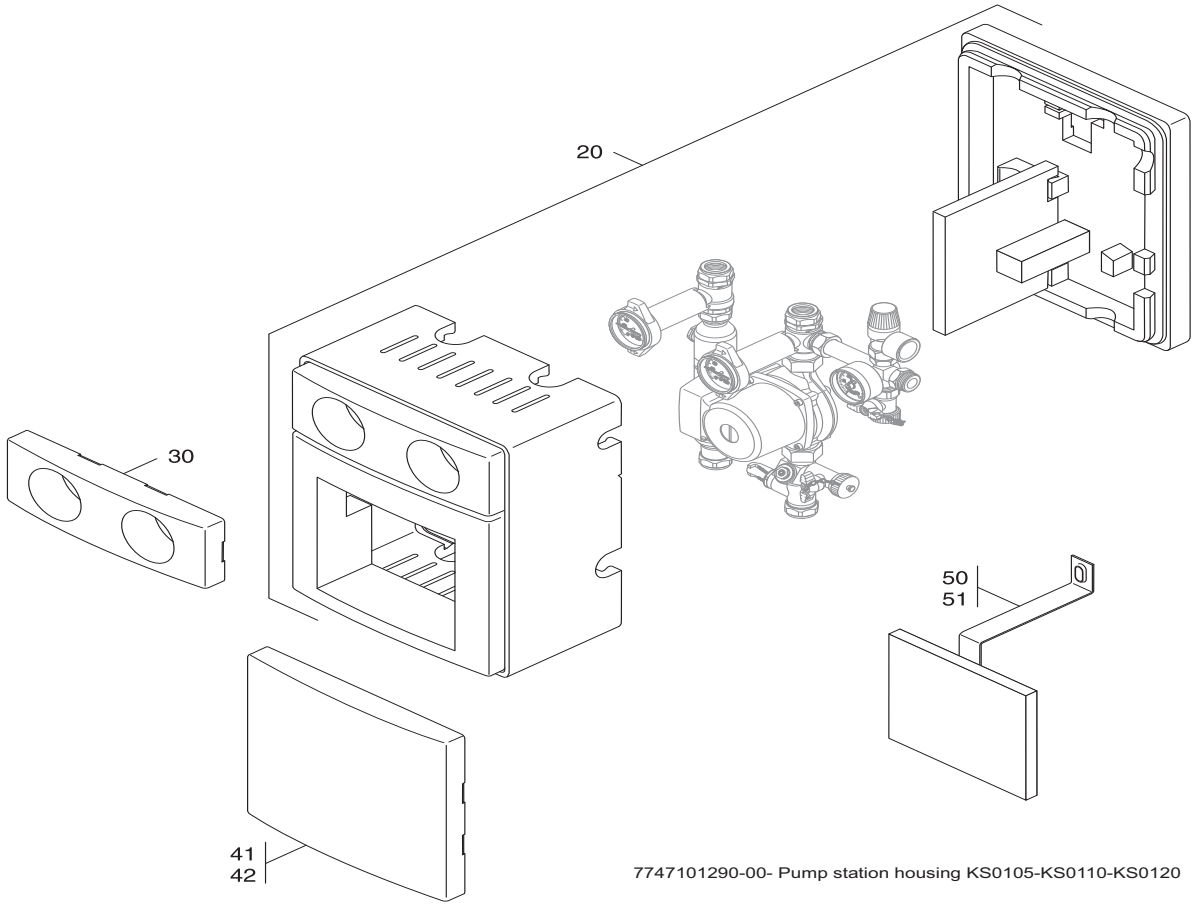

FSK
PSS1
SA
*2
FP
FSS1
FB
*1
PZ
Logamatic 4323
Module FM443
Module FM456
PS
Supply
Heating
System
PK
SPB
FR
Return
Heating
System
Logamax plus
GB142
Return for
DHW
charge
FA
Combi-Storage Tank
Logalux PL750 2S
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW and Radiant Heat Solar System with GB142, PL Tank, 4323 Control with FM443 and FM456
Date: 01/08/08
Buderus


Wired to FM244 solar module installed in R2107
FSK
PSS1
SA
*2
FSS1
FB
*1
PZ
T1*
PS
TR0301 U
T2*
P1*
SH
FV
PH
Return Heating System
Supply Heating System
FA
FK
Logamatic R2107
Module FM242
Module FM244
Combi-Storage Tank
Logalux PL750/2S
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptual in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
Date: 01/08/08
DHW and Radiant Heat Solar System with Floorstanding Boiler, PL Tank, R2107 with FM244 and FM242, TR0301 U Control (controls diverter valve)
Buderus


Solar DHW Tank
Logalux SM
FSK
PSS1
SA
*2
*1
FSS1
FB
PZ
PS
Wired to R2107
PH
Return Heating System
Supply Heating System
FK
Logamatic R2107 Module FM244
FA
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW Solar System, Floorstanding Boiler, SM Tank, R2107 Control with FM244
Date: 01/08/08
Buderus

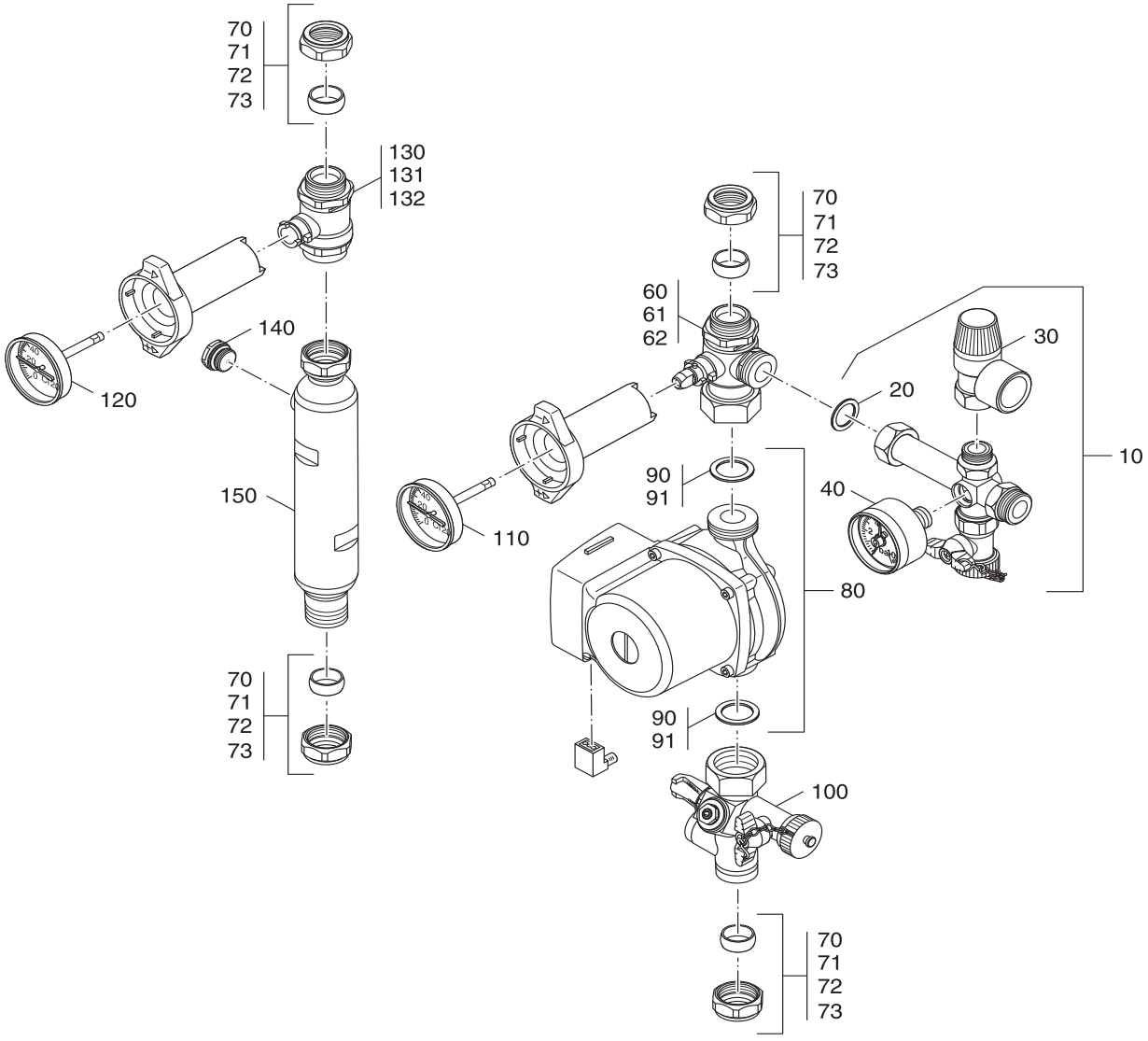

FSK
PSS1
SA
*2
*1
PZ
FSS1
FB
PS
Wired to R2107
Return Heating System
Supply Heating System
FV
PH
SH
FK
FA
Logamatic R2107
Module FM242
Module FM244
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
Solar DHW Tank
Logalux SM
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW Solar System, Floorstanding Boiler, SM Tank, R2107 Control with FM242 and FM244
Date: 01/08/08
Buderus


T1
P1
SA
*2
Solar Control
TR0301 U
T2
*1
Tankless Gas
Water Heater
Solar DHW Tank
3rd Party
*1 - Tempering valve (required for solar installation)
*2 - Pre-fabricated pump station
This drawing is conceptional in nature and may not necessarily display all design, installation, and design considerations. Additional safety and/or auxiliary equipment may be needed or required by code. This drawing is for reference only for officials, system designers, and licensed installers. It is expected that installers and system designers have adequate knowledge of industry practice for the equipment, procedures and applications. This Drawing is not to scale.
Name:
DHW Solar System Electric or Gas Tankless Water Heater, Solar Hot Water Heater, TR0301 U Control
Date: 01/08/08
BOSCH



7747101290-00- Pump station housing KS0105-KS0110-KS0120

Item	Part Number	Part Description	weight in lb
		Insulation parts for US solar pump station	
20	87182214860	Insulation complete for KS0105 and KS0110	2.07
20	87182214870	Insulation complete for KS0120	2.07
30	87182214930	Top front cover (Black) for KS0105, KS0110 and KS0120	0.3
30	87182214920	Top front cover (White) for KS0105, KS0110 and KS0120	0.3
41	87182214950	Bottom front cover (Blue) for KS0105, KS0110 and KS0120 for Buderus solar pump station incl. Brand name Buderus	0.55
42	87182237010	Bottom font cover brandless (white) for KS0105, KS0110 and KS0120 for Bosch and Buderus solar pump station	0.55
50	87182215060	Wall bracket for Comfort/Top	0.66
51	87182215080	Wall mounting bracket for solar module SM10	0.66



7747101327-00-Dual line pump station KS0105-KS0110-KS0120

Item	Part Number	Part Description	weight in lb
10	87182236880	Safety device set Solar pump station for KS0105, KS0110, KS0120	0.9
		Available individual parts:	
20	87182214730	Gasket 24 x 17 x 2 mm	0.04
30	87182214700	Relief value 87 psi (6 bar) 3/4" for KS0105, KS0110, KS0120	0.3
40	87182237000	Pressure gauge 140 psi (10 bar) 1/4"	0.18
60	87182214780	Ball value for KS0105	0.321
61	87182214790	Ball value for KS0110	0.306
62	87182214820	Ball value for KS0120	0.378
70	87182214500	Union 15mm for KS0105	0.12
71	87182214520	Union 22mm for KS0110	0.12
72	87182214510	Not for USA	-
73	87182214530	Union 28mm for KS0120	0.12
-	87182236950	Conversion adapter 15 mm to 1/2" US pipe	0.12
-	87182236960	Conversion adapter 15 mm to 5/8" US pipe	0.12
-	87182236970	Conversion adapter 22 mm to 3/4" US pipe	0.12
-	87182237020	Conversion adapter 28mm to 1" US pipe	0.12
		Solar Circulator	
80	87182236900	Grundfos Circulator UPS 15-58U for KS0105 and KS0110	2.1
80	87182236910	Grundfos Circulator UPS 25-99U for KS0120	2.15
90	87182214640	Gasket 30 x 22 x 2mm for KS0105 and KS0110	0.04
91	87182214650	Gasket 45 x 33 x 2 mm for KS0120	0.04

			Flow setter	
100		87182236920	Flow setter 0.13-1.6 gal/min for KS0105	0.61
100		87182236930	Flow setter 0.5-4.2 gal/min for KS0110	0.624
100		87182236940	Flow setter 2.1-7.4 gal/min for KS0120	0.73
110		87182236990	Thermometer for return (Blue) for KS0105, KS0110, KS0120	0.2
120		87182236980	Thermometer for supply (Red) for KS0105, KS0110, KS0120	0.2
130		87182214770	Ball value for KS0105	0.419
131		87182214800	Ball value for KS0110	0.321
132		87182214810	Ball value for KS0120	0.6
140		87182214850	Vent plug 3/8" 150 °C	0.38
150	x		Air vent vessel	

Notes

Bosch Thermotechnology Corp.
50 Wentworth Avenue
Londonderry, NH 03053
Tel. 603-552-1100
Fax 603-584-1681
www.buderussolar.com
www.boschsolar.com

Products manufactured by
Bosch Thermotechnik GmbH
D-35573 Wetzlar
www.buderus.de