Instructions

Akva Vita VX-2000
District heating substation
for indirect heating and domestic hot water systems

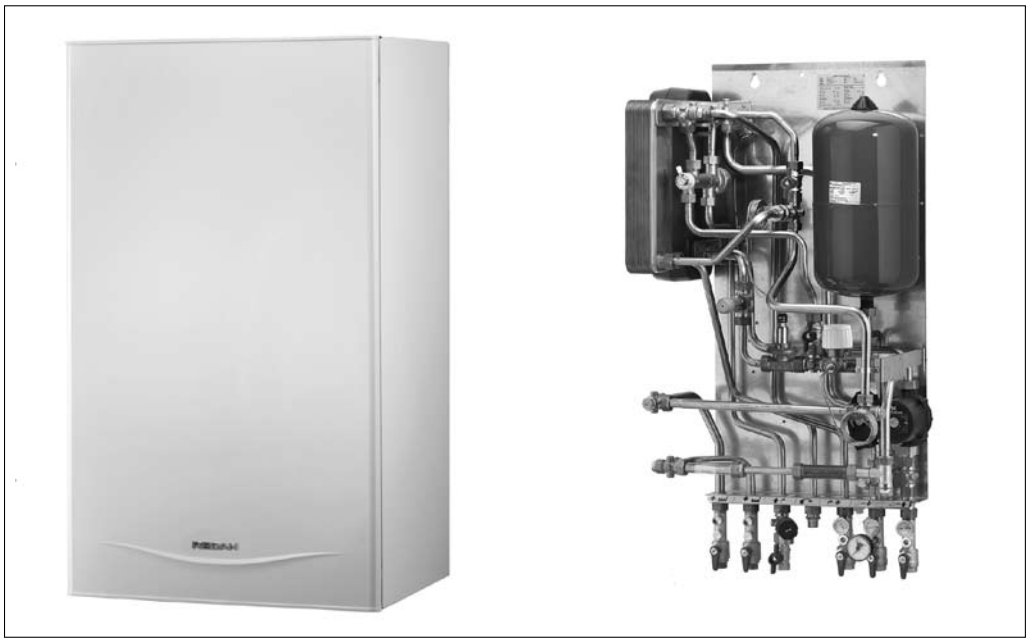

Table of Contents

Declaration of conformity

DECLARATION OF CONFORMITY

We, the manufacturer

Danfoss Redan A/S
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do hereby declare that the following products:

Danfoss Redan Substations

are in conformity with the following directives and standards:

2006/95/EC, Low Voltage Directive
2004/108/EC, EMC Directive

Applied Standards:
EN 60 335 – 1
EN 55 014
EN 61 000 – 6 – 2
EN 61 000 – 6 – 3

This declaration of conformity is provided that the given instructions are followed and that no alterations are made by third party.

Place:	Date:	Production Manager:
DK-8382 Hinnerup	01/09 2007	H. Mathiesen

Safety notes

The following instructions refer to the standard design of the substation. Special versions of substations are available on request.

To avoid injury of persons and damages to the device, it is absolutely necessary to read and observe these instructions carefully.

Necessary assembly, start-up and maintenance work must be performed by qualified and authorized personnel only.

Please comply with the instructions of the system manufacturer or system operator.

Unused connections and shut-off valves must be sealed with a plug. The plugs must be removed by an authorized service technician only.

Warning of high pressure and temperature
The maximum temperature of the flow medium in a substation is 120 °C. *

* At DH supply temp. above 90°C it is recommended to install an additional thermostatic controller.

The maximum operating pressure of the substation is 16 bar.

Be aware of the installation's permissible system pressure and temperature.

The risk of persons being injured and equipment damaged increases considerably if the recommended permissible operating parameters are exceeded.

The substation installation must be equipped with safety valves, however, always in accordance with local regulations.

Warning of hot surface
The substation has got hot surfaces, which can cause skin burns. Please be extremely cautious in close proximity to the substation.

Warning of transport damage
Before substation installation, please make sure that the substation has not been damaged during transport.

Sound level
≤ 55 dB

Corrosion protection
All pipes and components are made of stainless steel and brass.

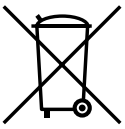
The maximum chloride compounds of the flow medium should not be higher than 300 mg/l.

The risk of equipment corrosion increases considerably if the recommended permissible chloride compounds are exceeded.

Storage

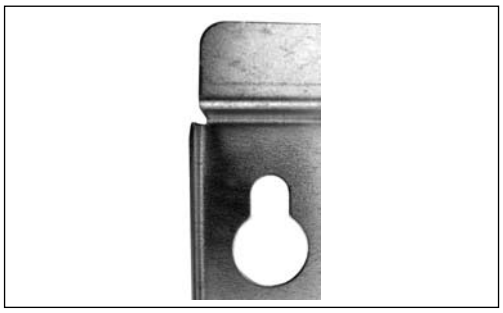
If the substation is stored before installation, make sure that the place is dry and heated.

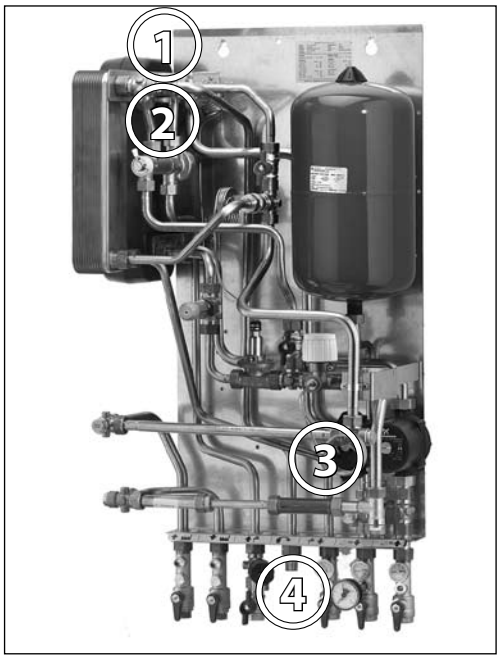
Disposal

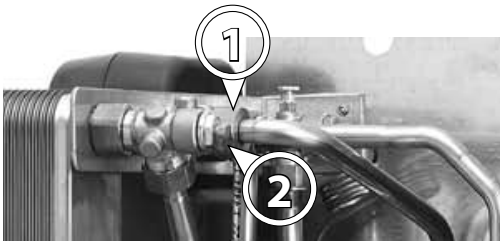


This product consists of materials which must not be disposed of together with domestic waste. Dismantle the product and sort the components in various groups before disposal. Observe the disposal rules of the local legislation.

Mounting







The substation must be installed and connected by authorized service personnel.
Installation must be in compliance with the local standards and regulations.
Allow for adequate space around the substation for mounting and maintenance purposes.

Prior to the substation installation all substation pipes and connections should be cleaned and rinsed.

Due to vibrations during transport all connections must be checked and tightened before the substation is installed.

The substation should be wall-mounted. The mounting sheet on the back of the substation has got holes for screw installation.
It does not apply to substations designed for floor-mounting.

A symbol for each of the different connections is placed on the substation.

The strainer, which sometime is delivered lose with the substation must be mounted on the HE return line right in front of the substation.

Standard delivery:
The substation is equipped with by-pass control as a standard, but it is also prepared for DHW circulation control. Switching to DHW circulation control is possible from a constructional point of view, requiring no extra components.

Remember circulation pump and non-return valve assembly (this is not part of the delivery and must be fitted remotely on site).

Control change from by-pass to circulation
- Loosen the nut (1) on back T-piece between DHW heat exchanger and PM controller and remove the blind plate.
- Remove the conical screw (2) (4 mm) on front T-piece between DHW heat exchanger and PM controller.
- Loosen and move capillary tube together with union nut from pos. 3 to 2.
- Screw the conical screw from pos. 2 (4 mm) on to the muff at pos. 3.
- Connect circulation installation system with substation pipe - pos. 4 – remember pump assembly and non-return valve mounting in the DHW circulation system (not part of the delivery).

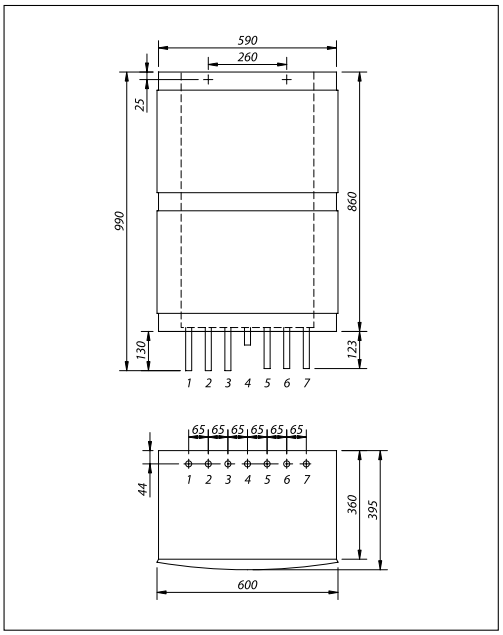
The pump must pump water in direction towards the substation.

Heat meter assembly, flexible fitting piece
The substation is equipped with a flexible fitting piece for insertion of heat meter. Possible insertion length ranges from 110 to 190 mm.

Assembly of heat meter:
Loosen nuts of fitting piece, remove fitting piece and replace with heat meter (size 110 mm). If heat meter size exceeds 110 mm loosen nut in the middle of the flexible pipe. Adjust size of flexible pipe according to actual heat meter size and insert heat meter. Tighten up the nut in the middle of the flexible pipe.

Mount the heat meter according to the medium flow direction. After each mounting of the heat meter remember to check all threaded connections.

Pipes connections



Internal installation and district heating pipes connections must be made by means of threaded, flanged or welded connections.

District heating (DH) - In the following DH is specified as the heat source for the substations. However, also other heat sources such as an oil or gas boiler or solar heating etc. could be used as the primary supply for the fitted substations, enabling the Danfoss Redan substations to be used in numerous schemes with different energy sources, depending on the local operating conditions. In order to simplify we have decided to use DH as designation for the primary supply.

Connections:
1. District heating (DH) supply
2. District heating (DH) return
3. Domestic cold water (DCW)
4. Circulation
5. Domestic hot water (DHW)
6. Heating (HE) supply
7. Heating (HE) return

Connections sizes:

DH:	G ¾" (ext. thread)
DCW + DHW + HE:	G ¾" (int. thread)
Circulation:	R ½" (ext. thread)

Dimensions (mm):

Without cover:	H 990 x W 560 x D 350 mm
With cover:	H 990 x W 595 x D 395 mm

Weight: Approx. 52 kg

Electrical connection

Electrical connections must be made by an authorised electrician only.
Electrical connections must be made in accordance with current regulations and local standards.

Before making electrical connections, please note the following:
- Please read the relevant parts of safety notes.
- The substation must be connected to 230 V AC and earth.
- The substation must be electrically connected so that it can be disconnected by repairs.

Filling, start-up

Prior to the substation installation all its pipes and connections should be cleaned and rinsed.

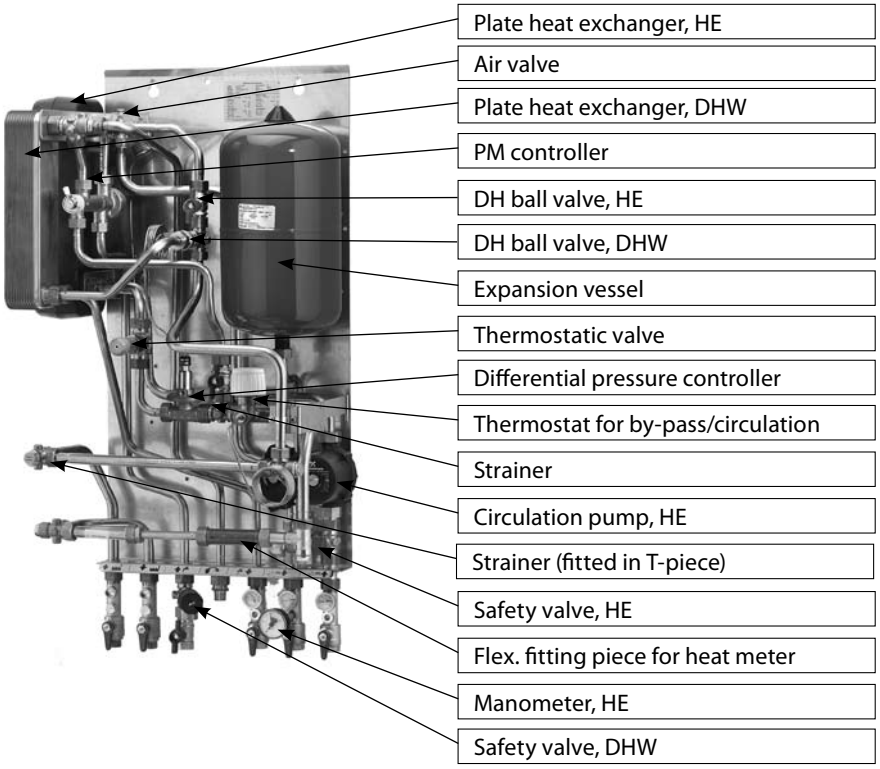
Before starting-up, check if:
- pipes are connected according to the circuit diagram,
- release valves are shut off,
- threaded and flanged connections are tightened.

The heat exchanger must be filled with water so that the pressure slowly reaches the working pressure.

After that the shut-off valves should be opened and the operation of the heat exchanger must be observed (e.g. temperatures, pressure, thermal expansion, leakages). If the heat exchanger operates in accordance with the dimensioning basis, it can be taken into continuous use.

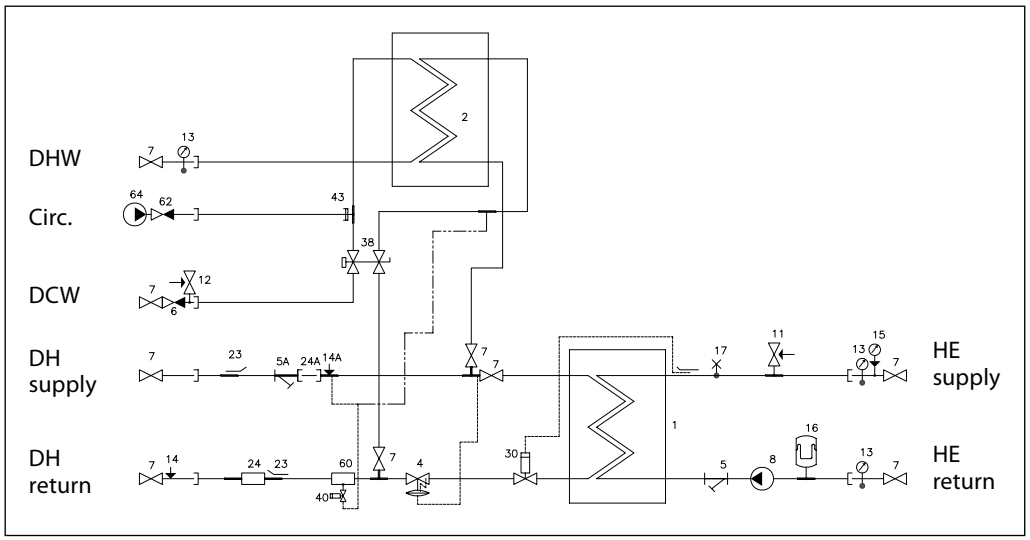
All Danfoss heat exchangers and substations have been pressure tested prior to delivery.

Design



Your substation might look different than the substation shown.

Circuit diagram (example)



Your substation might look different than the substation shown.

1 Plate heat exchanger HE
2 Plate heat exchanger DHW
4 Differential pressure controller
5 Strainer
5A Strainer (fitted in T-piece)
6 Non-return valve
7 Ball valve
8 Circulation pump, HE
11 Safety valve HE
12 Safety valve DHW
13 Thermometer
14 Pockets for pressure gauge ¼"
14A Pockets for pressure gauge ½"
15 Manometer
16 Expansion vessel
17 Air valve
23 Sensor pocket for heat meter
24 Flex. fitting piece for heat meter
24A Leak control
30 Thermostatic valve
38 PM controller
40 Thermostat Danfoss for by-pass/circulation
43 Blind plate
60 Fitting piece
Options:
62 Non-return valve (optional)
64 Circulation pump DHW (optional)

Control

Differential pressure controller
The differential pressure controller reduces the fluctuating pressure in the district heating network to a small and invariable operating pressure in the substation.

AVPL 15
The differential pressure controller can be set at any differential pressure between 5 kPa and 25 kPa (0.05 bar and 0.25 bar). The preset factory setting of the controller is 10 kPa (0.1 bar)

HE temperature control
The supply temperature for the HE circuit is controlled according to the type of temperature controller in your substation.

The room temperature is controlled by radiator thermostats. It is recommended to set the minimum thermostat setting in each room.

Thermostatic control
A higher or lower temperature in the HE supply line is adjusted as follows:
The temperature will become higher by turning the handle on the thermostatic controller towards a higher number. The temperature will become lower by turning the handle on the thermostatic controller towards a lower number.

Thermostat T°C
Approximate thermostat scale setting:

1 = 20 °C	4 = 50 °C
2 = 30 °C	5 = 60 °C
3 = 40 °C	6 = 70 °C

The values are intended as a guide.

Electronic controller
The control of substations equipped with electronic controller with outdoor temperature sensor should be done in accordance with producer instructions for the mounted controller.

Mounting of outdoor sensor
The sensor is mounted on the coldest elevation of the building/zone (normally the north elevation).

Operation in summer and winter season, circulation pump, substation start-up, maintenance

Summer season, circulation pump
In summer season the circulation pump should be switched off and simultaneously the shut-off valve of HE supply should be closed (ball-valve placed on vertical pipe beside expansion vessel).
It is recommended to start up the circulation pump (for a few minutes) once a month during the summer period; the shut-off valve of the HE supply must be shut.

Winter season, substation start-up
- open shut-off valves,
- set the pump at highest speed of rotation before start-up,
- switch off the pump and vent the installation after the radiators have been warmed,
- set the pump at lowest speed of rotation in consideration of electricity consumption and heating comfort.

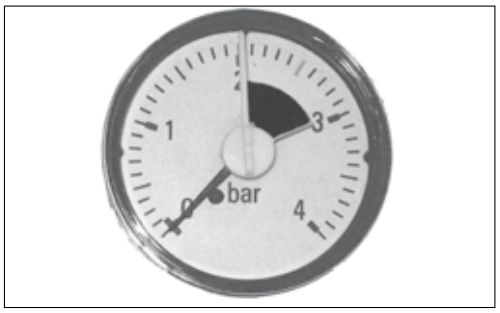
Normally the change-over switch is set in the centre position (default), however for systems with floor-heating or one-pipe systems it may be necessary to turn the change-over switch upwards (clockwise).
Higher speed of rotation is used only if the heating requirement increases.

Floor heating
If the substation is used in connection with floor heating the circulation pump must be connected to the pump stop function in the floor heating controller. If pump stop function is not possible a by-pass must be established to secure flow through the pump.

Limiting flow controller (DH return)
Additional substation equipment is mounted on district heating company request. Limiting flow controller should be set to the required maximum return temperature, in compliance with the local demands.

Approximate thermostat scale setting:
2 = 25°C
3 = 50°C
4 = 60°C

To ensure sufficient cooling and proper operation the HE return temperature (thermometer indication on secondary return) must be lower than the temperature set on the flow controller.



HE manometer. Refilling water on the HE circuit.

HE manometer
The HE manometer indicates the pressure value in HE system. The pressure during operation should be 1-1.5 bar. If the pressure drops below 1 bar, water must be added to the system.

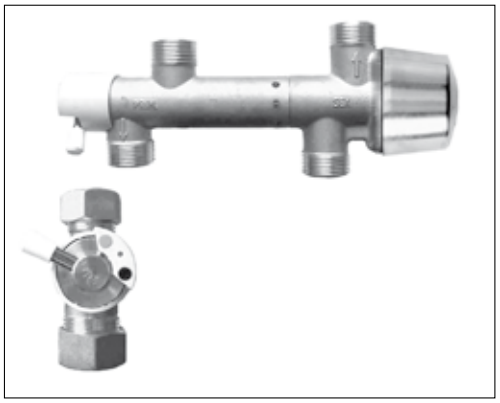
Please note that filling of water to the heating system must be done outside the substation.

The operating pressure should never exceed 1.5 bar.

The pump must be switched of when filling the system with water.

DHW temperature control
The DHW temperature is controlled according to the type of temperature controller in your substation.

The substation should be adjusted to 45-50 °C, this provides the most economical utilisation of the DH water. At DHW temperatures above 55 °C the lime scale precipitation will increase significantly.



PM controller
The DHW temperature is controlled by turning the lever towards the red (hot) or blue (cold) mark. The temperature should be set to 45-50 °C at normal use (7-8 l/min). If it is not possible to set the temperature according to the above recommendations, it is advisable to change the default controller setting.

The PM controller can operate in three basic settings:
- High
- Standard – default
- Low

Approximate setting of PM controller is dependent on district heating supply temperature and Δp:

Supply temperature:	Disposable differential pressure Δp (bar):		
	0.2 - 0.5	0.5 -1.0	> 1.0
60 - 70 °C	low	low	standard
70 - 80 °C	low	standard	standard
80 - 90 °C	low	high	high
above 90 °C*	standard	high	high

* At district heating supply temperatures above 90 °C it is recommended to install an additional thermostatic controller, which operates in series with the PM controller to ensure a constant DHW temperature.

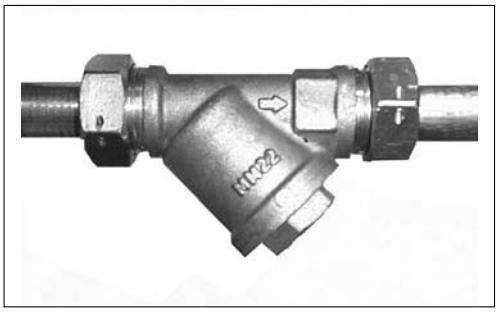
Setting changes:
- dismount lever by using the attached Allen wrench,
- remove plastic cap,
- mount lever again and turn it:
  - 1 rotation **clockwise – high**,
  - 1 rotation **counter – clockwise – low**,
- mount cap and lever again.

Thermostatic by-pass (standard)
The substation is equipped with a by-pass thermostat, Danfoss FJVR, which ensures that hot water is available immediately, when tapping starts. It is recommended to set the thermostat in pos.3. If the water temperature rises too slowly it can be necessary to set the thermostat at higher value, however, not higher than in position 4.

DHW circulation (optional)
If the substation is connected to the DHW circulation system in the building, the FJVR thermostat will control the circulation water temperature. This ensures that hot water is available at the tap point instantly and without waste of water. It is recommended to set the thermostat in pos. 2-2,5. If the circulation pump is switched off, the thermostat should be closed. In case the substation has been delivered with by-pass control, and this must be changed to DHW circulation control , this can be done by performing control change from by-pass to circulation, as described on page 4.

Approximate thermostat scale setting:
I = 10 °C
1 = 20 °C
2 = 30 °C
3 = 40 °C
4 = 45 °C
I = 50 °C (max. temp.)

Safety valve
The safety valves' task is to protect the substation from pressures exceeding the permissible pressure. The blow-off pipe of the safety valves must not be closed. The blow-off pipe outlet should be placed so that it provides safety relief and it is possible to observe water dropping from the safety valves. It is advisable to check the operation of the safety valves by turning the valve head in the indicated direction, every six months.



Strainer
Strainers should frequently be cleaned from sediments by authorized personnel, according to producer's instructions and dependent on the substation's operating conditions.

Maintenance

The substation requires little monitoring, apart from routine checks and cleaning of strainers.
Regular inspection of the substation and a check of all relevant operating parameters is recommended, for example in connection with meter reading.

Spare parts can be ordered with Danfoss, please inform us of the article number on the substation.

Troubleshooting DHW

We recommend that actual troubleshooting is carried out by authorized personnel only.

If operating disturbances occur, the following basic features should be checked before carrying out actual troubleshooting:
- the substation is connected to electricity
- the strainer on the DH supply pipe is clean,
- the supply temperature of the DH is at the normal level (summer, at least 60 °C - winter, at least 70 °C),
- the differential pressure is equal to or higher than the normal (local) differential pressure in the DH network – if in doubt, ask the DH plant,
- there is pressure on the system - check the HE manometer.

Problem	Possible cause	Solution
In general: Does the PM controller work incorrectly?	If the quantity of tap water is normal (temperature unimportant), it indicates that the PM controller works correctly.	Locate defect in another part of the installation (see below).
In general: Are the operating conditions satisfactory?	The substation requires a DH supply temperature of minimum 60 °C and a differential pressure during operation according to the information stated in the product sheet for Akva Vita VX-2000	Contact district heating supplier.
PM controller leaking; Water leaking from Allen screws at the central part of PM controller.	One of the two O-rings is defective (it does not influence the PM operation). If a non-return valve is installed in the DCW inlet (e.g. in the house service connection or in DCW meter), a safety valve should be mounted between the non-return valve and the heat exchanger.	Replace PM controller (use new sealing).
DHW tap load too low.	The diaphragm of the PM controller is defective.	Replace diaphragm or PM controller.
DHW tap load too low; Tap temperature too low; Tap temperature fluctuates.	PM controller wrongly adjusted.	Setting, see **Regulation** chapter.
	Strainer in DH supply clogged.	Clean strainer.
	Defective non-return valve in thermostatic battery (DHW tap temperature lower than DHW from unit).	Clean or replace non-return valve.
	Defective non-return valve in hot water circulation (circulation return pipe is getting cold during tapping of hot water).	Clean or replace non-return valve.
	Lime scale precipitation in plate heat exchanger for DHW (Δt primary too low during DHW tapping).	Replace the plate heat exchanger.
	Dirt in PM controller.	Clean, see **PM controller** instruction.
	DCW flow too high (big nominal diameter of pipe, high DCW pressure), in total max. 16-17 litres per minute.	DCW reduction.
DH return water temperature too high while on standby; The plate heat exchanger is cold…	The by-pass thermostat is defective or wrongly adjusted.	Replace or adjust by-pass thermostat correctly.
DH return water temperature too high while on standby; The plate heat exchanger is hot…	Dirt (sand, iron splinters or similar) in PM controller. Controller does not close. Noise from flow can often be heard.	Move handle several times between red and blue markings; at the same time do several hot-water tappings. Clean PM controller.
DH return temperature too high during hot water tapping.	Lime scale precipitation in the plate heat exchanger for DHW.	Replace the plate heat exchanger.
Connecting pieces of the PM controller do not fit the unit.	In particular when replacing PM controller in old substations.	Loosen Allen screws; turn half of the PM controller at 180°C.

Troubleshooting HE

Problem	Possible cause	Solution
Too little or no heat.	Strainer clogged in DH or HE circuit (radiator circuit).	Clean gate/strainer.
	The filter in the heat meter on DH circuit clogged.	Clean the filter (after consulting the DH plant).
	Defective or wrongly adjusted differential pressure controller.	Check the operation of the differential pressure controller – clean the valve seat if required.
	Sensor defective – or possibly dirt in the valve housing.	Check the operation of the thermostat - clean the valve seat if required.
	Automatic controls, if any, wrongly set or defective - possibly power failure.	Check if the setting of the controller is correct – see separate instructions. Check the power supply. Temporary setting of motor to "manual" control – see instructions on automatic controls.
	Pump out of operation.	Check if the pump is receiving power and that it runs. Check if there is air trapped in the pump housing - see pump manual.
	The pump is set at too low speed of rotation.	Set the pump at higher speed of rotation.
	Pressure drop - the manometer on the radiator circuit shows lower than recommended operating pressure.	Fill water on the system and check the functioning of the pressure expansion vessel if required.
	Air pockets in the system.	Vent the installation thoroughly.
	Limiting of the return temperature adjusted too low.	Adjust according to instructions.
	Defective radiator valves.	Check – replace.
	Uneven heat distribution in building because of incorrectly set balancing valves, or because there are no balancing valves.	Adjust/install balancing valves.
	Diameter of pipe to substation too small or branch pipe too long.	Check pipe dimensions.
Uneven heat distribution.	Air pockets in the system.	Vent the installation thoroughly.
DH supply temperature too high.	Wrong setting of thermostat or of automatic controls, if any.	Adjust automatic controls, - see instructions for automatic controls.
	Defective controller. The controller does not react as it should according to the instructions.	Call automatic controls manufacturer or replace the regulator.
	Defective sensor on self-acting thermostat.	Replace thermostat, - or sensor only.
DH supply temperature too low.	Wrong setting of automatic controls, if any.	Adjust automatic controls – see instructions for automatic controls.
	Defective controller. The controller does not react as it should according to the instructions.	Call in automatic controls manufacturer or replace controller.
	Defective sensor on self-acting thermostat.	Replace thermostat - or sensor only.
	Wrong placement/fitting of outdoor temperature sensor.	Place/fit the outdoor temperature sensor correctly.
	Strainer clogged.	Clean gate/strainer.

Problem	Possible cause	Solution
Poor cooling.	Too small heating surface/too small radiators compared to the total heating requirement of the building.	Increase total heating surface.
	Poor utilization of existing heating surface. Defective sensor on self-acting thermostat.	Make sure the heat is distributed evenly across the full heating surface – open all radiators and keep the radiators in the system from heating up at the bottom. It is extremely important to keep the supply temperature to the radiators as low as ever possible, while maintaining a reasonable level of comfort.
	The system is single-pipe.	The system should feature electronic controls as well as return sensors.
	Defective self-acting thermostat in the DH circuit.	Replace thermostat - or sensor only.
	Pump pressure too high.	Adjust pump to a lower level.
	Air in system.	Vent the system.
	Defective or incorrectly set radiator valve(s). One-pipe systems require special one-pipe radiator valves.	Check – set/replace.
	Dirt in the motorized valve or in the differential pressure controller.	Check – clean out.
	Defective motorized valve, sensor or automatic controller.	Check – replace.
	Electronic controller not adjusted correctly.	Adjust according to instructions.
Noise in system.	Pump pressure too high.	Adjust pump to a lower level.
Heat load too high.	Defective motorized valve, sensor or electronic controller	Check – replace.

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