ENGINEERING
TOMORROW

Operating Guide

Termix VMTD-F-B

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2.0 Functional description

District heating substation for direct heating and instantaneous domestic hot water.

Application
The Termix VMTD-F-B is a complete solution with built-in water heater and a differential pressure controlled heatingsystem. Termix VMTD-F-B is applicable for single and multi-family houses and for decentralized systems.

District heating (DH)
The substation is prefabricated with a differential pressure controller, a fitting piece and sensor pockets for insertion of a heat meter as well as strainer and ball valves.

Heating (HE)
The heating circuit is designed for direct generation of heat. The differential pressure control sets the optimum operation conditions for radiator thermostatic valves in order to enable individual temperature control in each room. In order to enable a time-depending temperature control program, a zone valve with actuator and a room thermostat can be included as an option.

Domestic hot water (DHW)
The domestic hot water is prepared in the heat exchanger and the temperature is regulated with a thermostatic control valve. The patented sensor accelerator accelerates the closing of the Danfoss AVTB valve and protects the heat exchanger against overheating and lime scale formation. The heat exchanger cools the DH water very efficiently, thereby creating a very good operating economy. The sensor accelerator and AVTB valve also works as a bypass keeping the house supply line warm. This shortens the waiting periods during summer when the heating system is in reduced operation. The sensor accelerator helps to ensure a stable hot water temperature regardless of varying loads, flow temperatures and differential pressure without the need for readjusting the valve.

3.0 Safety notes

3.1 Safety Notes – general

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

This operating manual should be read carefully before installation and start-up of the substation. The manufacturer accepts no liability for damage or faults that result from non-compliance with the operating manual. Please read and follow all the instructions carefully to prevent accidents, injury and damage to property.
Assembly, start-up and maintenance work must be performed by qualified and authorized personnel only.
Please comply with the instructions issued by the system manufacturer or system operator.

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 150 mg/l.
The risk of equipment corrosion increases considerably if the recommended level of permissible chloride compounds is exceeded.

Energy source
The substation is designed for district heating as the primary source of energy. However, also other energy sources can be used where the operating conditions allow it and always are comparable to district heating.

Application
The substation is designed to be connected to the house installation in a frost-free room, where the temperature does not exceed 50 °C and the humidity does not exceed 60%. Do not cover or wall up the substation or in any other way block the entrance to the station.

Choice of material
Choice of materials always in compliance with local legislation.

Safety valve(s)
We recommend mounting of safety valve(s), however, always in compliance with local regulations.

Connection
The substation must be equipped with features that ensure that the substation can be separated from all energy sources (also power supply).

Emergency
In case of danger or accidents - fire, leaks or other dangerous circumstances - interrupt all energy sources to the station if possible, and seek expert help.
In case of discoloured or bad-smelling domestic hot water, close all shut-off valves on the substation, inform the operating personnel and call for expert help immediately.

REACH
All Danfoss A/S products fulfill the requirements in REACH.
One of the obligations in REACH is to inform customers about presence of Candidate list substances if any, we hereby inform you about one substance on the candidate list: The product contains brass parts which contains lead (CAS no: 7439-92-1) in a concentration above 0.1% w/w.

Storage
Any storage of the substation which may be necessary prior to installation should be in conditions which are dry and heated.

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

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

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

The maximum temperature of the flow medium in the substation is 120 °C.

The maximum operating pressure of the substation is 10 bar. PN 16 versions are available on enquiry.

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.
Power failure can result in the motor valves being stuck in open position. The surfaces of the substation can get hot, which can cause skin burns. The ball valves on district heating supply and return should be closed.

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

IMPORTANT - Tightening of connections
Due to vibrations during transport all flange connections, screw joints and electrical clamp and screw connections must be checked and tightened before water is added to the system. After water has been added to the system and the system has been put into operation, re-tighten ***ALL*** connections.

4.0 Mounting

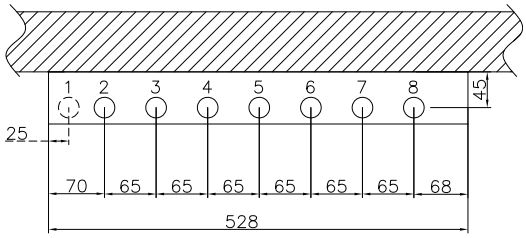
4.1 Mounting

Installation must be in compliance with local standards and regulations.
District heating (DH) - In the following sections, DH refers to the heat source which supplies the substations. A variety of energy sources, such as oil, gas or solar power, could be used as the primary supply to Danfoss substations. For the sake of simplicity, DH can be taken to mean the primary supply.

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

Connections:

1. Hot water circulation (HWC) (Optional)
2. District heating (DH) supply
3. District heating (DH) return
4. Cold water mains (CWM)
5. Domestic cold water (DCW)
6. Domestic hot water (DHW)
7. Heating (HE) supply
8. Heating (HE) return



The pipe placement can deviate from the shown drawing. Please note the markings on the station.

Connection sizes:

DH + HE:	G ¾" (int. thread)
CWM + DCW + DHW:	G ¾" (int. thread)

Dimensions (mm):
Without cover:
H 710 x W 528 x D 150
With cover (mount on wall variant):
H 800 x W 540 x D 190
With cover (built-in wall variant):
H 915–980 x W 610 x D 150

Weight (approx.): 20 kg

4.1.1 Installation

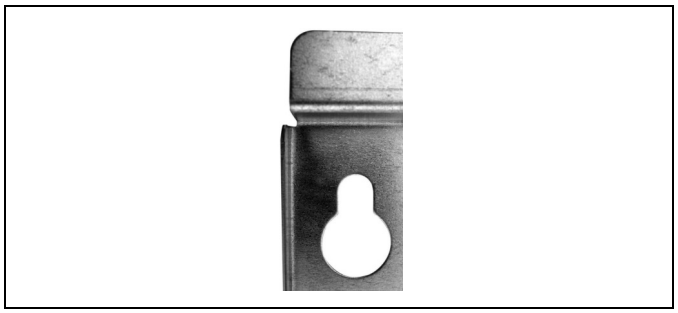
Mounting:

Adequate space
Please allow adequate space around the substation for mounting and maintenance purposes.

Orientation
The station must be mounted so that components, keyholes and labels are placed correctly. If you wish to mount the station differently please contact your supplier.

Drillings
Where substations are to be wall-mounted, drillings are provided in the back mounting plate. Floor mounted units have support.

Labelling
Each connection on the substation is labelled.



Keyhole for mounting.

Before installation:

Clean and rinse
Prior to installation, all substation pipes and connections should be cleaned and rinsed.

Tightening
Due to vibration during transport, all substation connections must be checked and tightened before installation.

Unused connections
Unused connections and shut-off valves must be sealed with a plug. Should the plugs require removal, this must only be done by an authorized service technician.

Installation:

Strainer
If a strainer is supplied with the station it must be fitted according to schematic diagram. Please note that the strainer may be supplied loose.

Connections
Internal installation and district heating pipes connections must be made using threaded, flanged or welded connections.

4.2 Start-up

Start-up, Direct heating

The shut-off valves should be opened and the unit observed as it enters service. Visual checking should confirm temperatures, pressures, acceptable thermal expansion and absence of leakage. If the heat exchanger operates in accordance with design, it can be put to regular use.

After water has been added to the system and the system has been put into operation, re-tighten ***ALL*** connections.

Re-thighten connections
After water has been added to the system and the system has been put into operation, re-tighten ***ALL*** connections.

4.3 Electrical connections

Before making electrical connections, please note the following:

Safety notes
Please read the relevant parts of the safety notes.

230 V
The substation must be connected to 230 V AC and earth.

Potential bonding
Potential bonding should be carried out according to 60364-4-41:2007 and IEC 60364-5-54:2011.
Bonding point on the mounting plate below right corner marked with earth symbol.

Disconnection
The substation must be electrically connected so that it can be disconnected for repairs.

Outdoor temperature sensor
Outdoor sensors should be mounted so as to avoid exposure to direct sunlight. They should not be placed close to doors, windows or ventilation outlets.

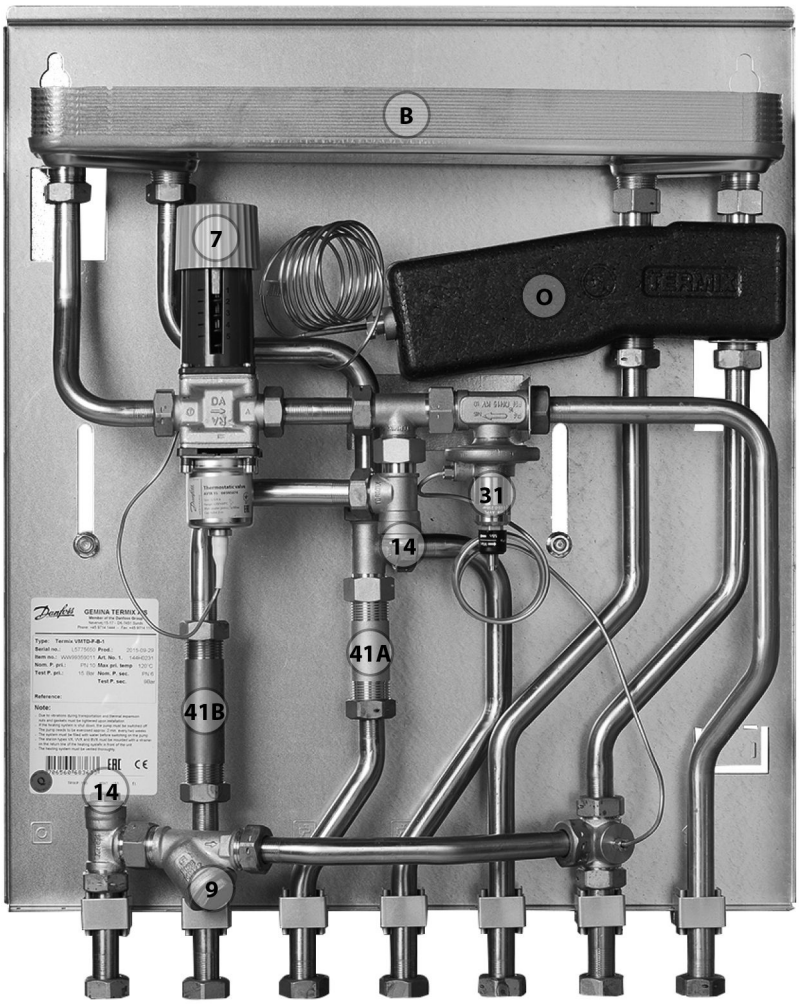
The outdoor sensor must be connected to the station on the terminal block under the electronic control.

Authorized electrician
Electrical connections must be made by an authorized electrician only.

Local standards
Electrical connections must be made in accordance with current regulations and local standards.

5.0 Design

5.1 Design

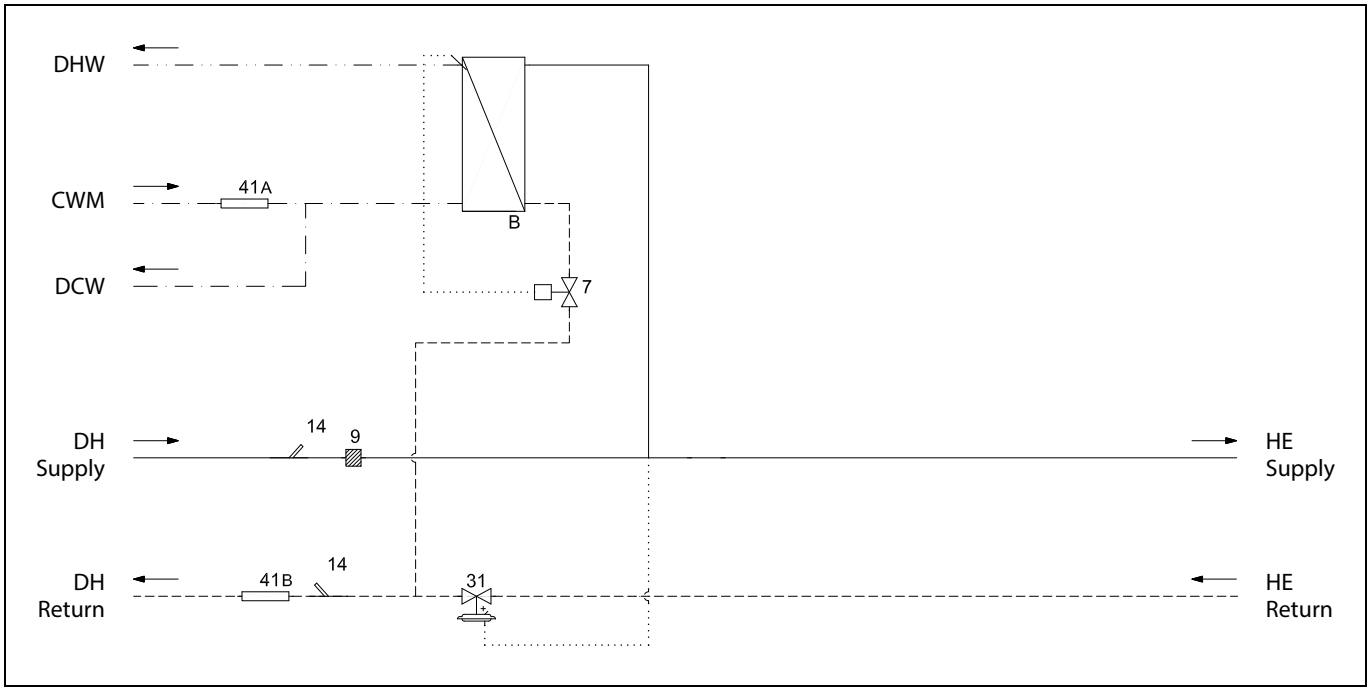


Your substation might look different than the substation shown.

Design description

B	Heat exchanger, DHW	14	Sensor pocket, energy meter
O	Termix sensor accelerator	31	Differential pressure controller
7	Thermostatic valve, DHW	41A	Fitting piece, cold water mains
9	Strainer	41B	Fitting piece, energy meter

5.2 Schematic diagram



Your substation might look different than the schematic diagram shown.

Schematic description

B Heat exchanger, DHW
7 Thermostatic valve, DHW
9 Strainer
14 Sensor pocket, energy meter
31 Differential pressure controller
41A Fitting piece, cold water mains
41B Fitting piece, energy meter

DHW: Domestic Hot Water
CWM: Cold Water Mains
DCW: Domestic Cold Water
DH Supply: District Heating Supply
DH Return: District Heating Return
HE Supply: Heating Supply
HE Return: Heating Return

5.2.1 Technical parameters

Technical parameters

Nominal pressure:	PN 10 (PN 16 versions are available on enquiry)
Max. DH supply temperature:	120 °C
Min. DCW static pressure:	0.5 bar
Brazing material (HEX):	Copper
Heat exchangers test pressure:	30 bar
Sound level:	≤ 55 dB

6.0 Controls

6.1 Heating circuit

6.1.1 Differential pressure controller

The differential pressure controller smooths out the fluctuations in pressure arriving from the district heating network. The operating pressure in the substation is thus held steady.

6.1.2 TP7000

TP7000 electronic 7 day programmable room thermostat. Signals from the room thermostat can be used to control zone valves.

6.2 DHW temperature control

DHW temperature control
There are various types of DHW temperature control used in Danfoss substations.
DHW temperature should be adjusted to 45-50 °C, as this provides optimal utilisation of DH water. At DHW temperatures above 55 °C, the possibility of lime scale deposits increases significantly.

6.2.1 AVTB controller (20–60 °)

The temperature setting is as follows:
1 = 20 °C
2 = 35 °C
3 = 50 °C
4 = 60 °C
5 = 70 °C
The values are intended as a guide.

The AVTB operates at its best at DH supply temperatures of up to 90 °C.

Thermostatic control
DHW temperature is adjusted as follows:
To increase temperature, turn the handle on the thermostatic controller to select a higher number.
To decrease temperature, turn the handle on the thermostatic controller to select a lower number.

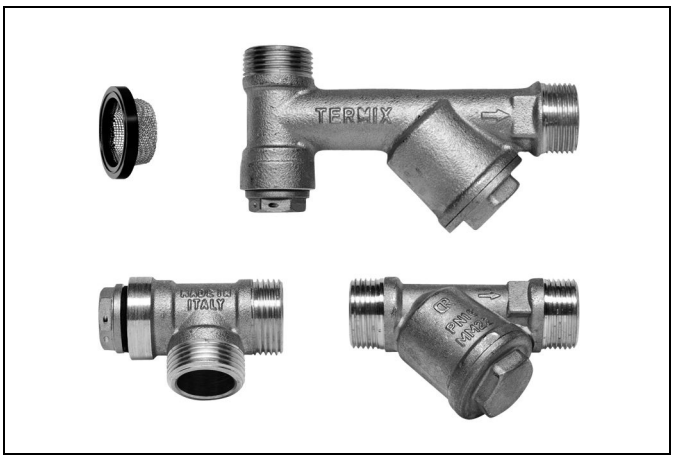
6.3 Other

6.3.1 Safety valve

The purpose of the safety valve is to protect the substation from excessive pressure.
The blow-off pipe from the safety valve must not be closed. The blow-off pipe outlet should be placed so that it discharges freely and it is possible to observe any dripping from the safety valve.
It is recommended to check the operation of safety valves at intervals of 6 months. This is done by turning the valve head in direction indicated.

6.3.2 Strainer

Strainers should be cleaned regularly by authorized personnel. The frequency of cleaning would depend on operating conditions and the manufacturer's instructions.



6.3.3 GTU Pressure Equalizer

The GTU Pressure Equalizer absorbs the expansion on the secondary side of the Termix water heaters and can be used as a substitute to the safety valve.
Furthermore the pressure equalizer absorbs a possible increase in pressure, so a discharge outlet is omitted.
The GTU Pressure Equalizer may not be applied in systems with hot water circulation.

6.3.4 Return temperature limiter FJVR (10-80 °C)

The return limiter type FJVR automatically controls the return temperature from radiators, convectors and under floor heating pipes.

6.3.5 Fitting piece

The substation is equipped with a fitting piece for energy meter.

Assembly of energy meters:

1: Close ball valves
Close the ball valves on DH Supply and DH Return, if there is water on the system.

2: Loosen nuts
Loosen the nuts on the fitting piece.

3: Remove fitting piece
Remove the fitting piece and replace it with the energy meter. Do not forget the gaskets.

4: Tighten connections
After mounting of the energy meter remember to check and tighten all threaded connections.

Sensor pocket, energy meter
The sensors of the energy meter is mounted in the sensor pockets.

6.4 Maintenance

The substation requires little monitoring, apart from routine checks. It is recommended to read the energy meter at regular intervals, and to write down the meter readings.

Regular inspections of the substation according to this Instruction are recommended, which should include:

Strainers
Cleaning of strainers.

Meters
Checking of all operating parameters such as meter readings.

Temperatures
Checking of all temperatures, such as DH supply temperature and DHW temperature.

Connections
Checking all connections for leakages.

Safety valves
The operation of the safety valves should be checked by turning the valve head in the indicated direction.

Venting
Checking that the system is thoroughly vented.

Inspections should be carried out minimum every two years.

Spare parts can be ordered from Danfoss. Please ensure that any enquiry includes the substation serial number.

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

7.0 Troubleshooting

7.1 Troubleshooting in general

In the event of operating disturbances, 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 supervisor,
- pressure on the system - check the HE pressure gauge.

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

7.2 Troubleshooting DHW

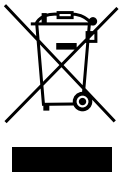
Problem	Possible cause	Solution
Too little or no DHW.	Strainer in supply or return line clogged.	Clean strainer(s).
	DHW circulation pump out of order or with too low setting.	Check circulation pump.
	Defective or clogged non-return valve.	Replace – clean.
	No electricity.	Check.
	Wrong setting of automatic controls, if any.	To adjust an electronic controller for DHW, pls. note enclosed instructions for electronic controller.
	Scaling of the plate heat exchanger.	Replace – rinse out.
	Defective motorized valve.	Check (use manual function) – replace.
	Defective temperature sensors.	Check – replace.
	Defective controller.	Check – replace.
Hot water in some taps but not in all.	DCW is being mixed with the DHW, e.g. in a defective thermostatic mixing valve.	Check – replace.
	Defective or clogged non-return valve on circulation valve.	Replace – clean.
Tap temperature too high; DHW tap load too high.	Thermostatic valve adjusted to a too high level.	Check – set.
Temperature drop during tapping.	Scaling of the plate heat exchanger.	Replace – rinse out.
	Larger DHW flow than the substation has been designed for.	Reduce DHW flow.
Thermostatic control valve does not close	Temperature difference between DH supply and DHW set point too low.	Lower the set point temperature or increase the DH supply temperature.

7.3 Troubleshooting HE

Problem	Possible cause	Solution
Too little or no heat.	Strainer clogged in DH or HE circuit (radiator circuit).	Clean gate/strainer(s).
	The filter in the energy meter on DH circuit clogged.	Clean the filter (after consulting the DH plant operator).
	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 turns. 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 pressure drop 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.	Adjust location of outdoor temperature sensor.
	Strainer clogged.	Clean gate/strainer.

Too high DH return temperature.	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 possible, while maintaining a reasonable level of comfort.
	The system is single pipe loop.	The system should feature electronic controls as well as return sensors.
	Pump pressure too high.	Adjust pump to a lower level.
	Air in system.	Vent the system.
	Defective or incorrectly set radiator valve(s). Single pipe loop 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.

7.4 Disposal



Disposal note

This symbol on the product indicates that it may not be disposed of as household waste..

It must be handed over to the applicable take-back scheme for the recycling of electrical and electronic equipment.

- Dispose of the product through channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

8.0 Declaration

8.1 Declaration of conformity

Category 0 without electrical equipment

ENGINEERING TOMORROW

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EU DECLARATION OF CONFORMITY

Danfoss A/S

Danfoss District Energy Division

Declares under our sole responsibility that the:

Product category: Small substations

Type designations:
One
Novi
VMTD Mini
VMTD
VMTD-F
Übergabestation

Covered by this declaration is in conformity with the following directives, standards or other normative documents, provided that the product is used in accordance with our instructions.

Machinery Directive 2006/42/EC
EN ISO 12100:2011
Safety of machinery – General principles for design – Risk assessment and risk reduction

Date: 2021.07.21 Place of issue: DK-7451 Sunds	Issued by: Signature: Claus G. Mortensen Name: Claus G. Mortensen Title: Quality Manager	Date: 2021.07.21 Place of issue: DK-7451 Sunds	Approved by: Signature: Karina Friis Skov Name: Karina Friis Skov Title: Director, Engineering

Danfoss only vouches for the correctness of the English version of this declaration. In the event of the declaration being translated into any other language, the translator concerned shall be liable for the correctness of the translation

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ENGINEERING TOMORROW

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EU DECLARATION OF CONFORMITY

Danfoss A/S

Danfoss District Energy Division

Declares under our sole responsibility that the:

Product category: Small substations

Type designations:

Ø18:	HD	BTD	VMTD mini mix	KST-I	One Solar A+/B+	
		BVX	VMTD mix	KST-M	One Solar	Mixing loop
		BV	VMTD F mix	KST-L	FLS	Measuring Unit
				VX	VVX	BL
C28:	CS 28 HD	CS 28 BV	CS 28 VMTD	CS 28 VX	CS 28 VVX	CS 28 BL
C32:	CS 32 HD	CS 32 BV	CS 32 VMTD	CS 32 VX	CS 32 VVX	CS 28 BL
C40:	CS 40 HD	CS 40 BV	CS 40 VMTD	CS 40 VX	CS 40 VVX	CS 40 BL

Covered by this declaration is in conformity with the following directives, standards or other normative documents, provided that the product is used in accordance with our instructions.

Machinery Directive 2006/42/EC

EN ISO 12100:2011
Safety of machinery – General principles for design – Risk assessment and risk reduction

EN 60204-1:2018
Safety of machinery – Electrical equipment of machines – Part 1: General requirements

RoHS Directive 2011/65/EU
Including amendment 2015/863

EN IEC 63000:2018
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

EMC Directive – 2014/30/EU

EN 61000-6-1:2007
Electromagnetic compatibility (EMC) – Part 6-1:
Generic standards – Immunity residential, commercial and light-industrial environments

EN 61000-6-2:2005
Electromagnetic compatibility (EMC) – Part 6-2:
Generic standards – Immunity for industrial environments

EN 61000-6-3:2007 + A1:2011
Electromagnetic compatibility (EMC) – Part 6-3:
Generic standards – Emission standard for residential, commercial and light-industrial environments

Date: 2021.07.20	Issued by: Claus G. Mortensen	Date: 2021.07.20	Approved by: Karina Friis Skov.
Place of issue: DK-7451 Sunds	**Signature:**	Place of issue: DK-7451 Sunds	**Signature:**
	Name: Claus G. Mortensen		**Name:** Karina Friis Skov
	Title: Quality Manager		**Title:** Director, Engineering

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