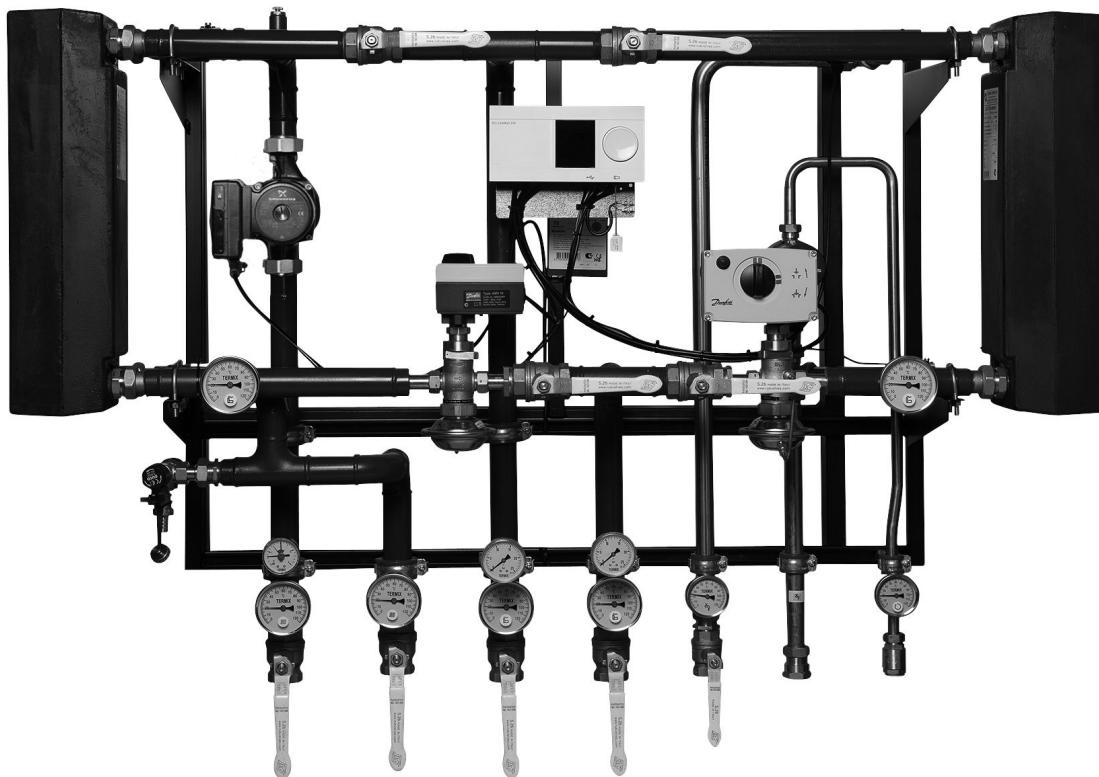


Operating Guide

Termix VVX Compact 28 - 40



1.0 Table of Contents

1.0 Table of Contents	1	8.0 Declaration.....	26
.....	2	Declaration of conformity	26
2.0 Functional description.....	3		
3.0 Safety notes.....	4		
3.1 Safety Notes – general	4		
4.0 Mounting	5		
4.1 Mounting	5		
4.2 Start-up.....	7		
4.3 Electrical connections.....	9		
5.0 Design.....	10		
5.1 Design	10		
5.2 Schematic diagram.....	11		
6.0 Controls	12		
6.1 Heating circuit.....	12		
6.2 DHW temperature control.....	15		
6.3 Other.....	17		
6.4 Maintenance.....	19		
7.0 Troubleshooting	20		
7.1 Troubleshooting in general	20		
7.2 Troubleshooting DHW	21		
7.3 Troubleshooting HE	22		
7.4 Disposal	24		



2.0 Functional description

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

Application

The Termix VVX Compact 28 - 40 is a complete solution for hot water and space heating with optimal safety, efficient energy transfer, service-friendly construction and a compact design. The substation is applicable, if a heat exchanger is required or on a conversion to district heating, where the existing equipment is unsuitable for direct connection.

District heating (DH)

The district heating circuit is prefabricated with a flow controller with integrated control valve as well as thermometers and ball valves.

Heating (HE)

The heating circuit consists of a plate heat exchanger, safety valve, manometer, thermometers, ball valves, drain valve, air valve and circulation pump and can be controlled thermostatically or by an electronic controller with an outdoor temperature sensor.

Depending on the application, different heat exchangers can be dimensioned.

Domestic hot water (DHW)

The domestic hot water is prepared in the heat exchanger and the temperature is regulated with thermostatic or electronic controls. The efficient heat exchanger offers exceptionally good heat extraction with high output. No readjustment of the DHW temperature is required after installation and initial setting of the controls. The thermostatic control valve automatically retains the comfort temperature of the hot water, even when the heating system is in reduced operation during summer or if the district heating plant changes operating parameters between summer and winter, either by lowering or increasing the flow temperature of the district heating water and/or the operating pressure in the network.

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 16 bar.

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.

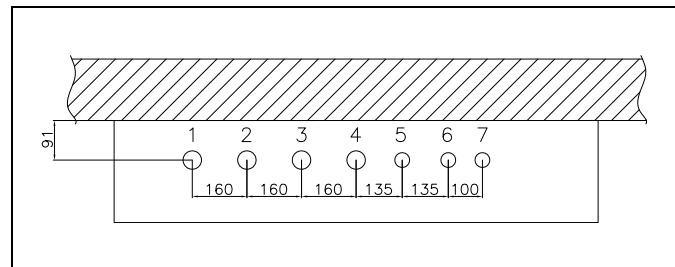


Authorized personnel only

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

Connections:

1. Heating (HE) supply
2. Heating (HE) return
3. District heating (DH) supply
4. District heating (DH) return
5. Domestic hot water (DHW)
6. Domestic cold water (DCW)
7. Hot water circulation(HCW)



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

Dimensions (mm): H 1011 x W 1856 x D 423

Weight (approx.): 80 kg

4.1.1 Installation

Mounting:

Adequate space

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

Orientation

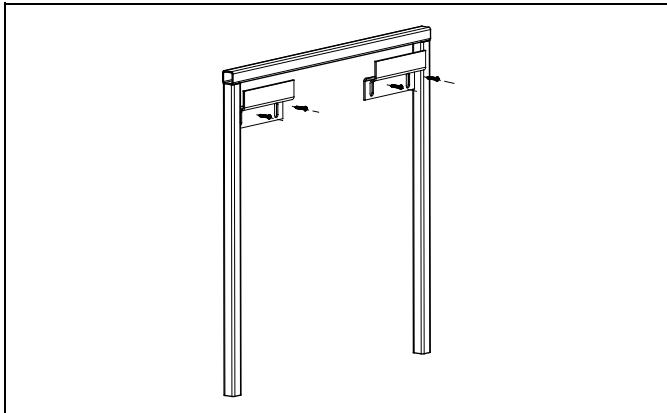
The station must be mounted so that components, keyholes and labels are placed correctly. If you wish to mount the station differently please contact your supplier.

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.



Mounting frame.

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, Indirect heating

Filling:

1: First fill

When carrying out first fill, the heat exchanger must be slowly filled with water until it reaches working pressure.



Re-tighten connections

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

2: Pressure gauge

The HE pressure gauge indicates the pressure of the HE system. This instruction must be followed strictly, to avoid dangerous situations.



Pump

The pump must be switched off during system fill.

3: Supply hose

A ball valve with plug is installed in the HE return line. To fill the system, the ball valve must first be closed, the plug removed and a supply hose connected. On re-opening the ball valve, system fill can commence.

4: Pre-pressure

When filling the system with water, the pressure gauge should be observed closely. The expansion vessel is supplied pre-pressurised to 0.5 bar. The pre-pressure required at each substation will depend on system head (the distance between the lowest and highest point in the system), for example:

Height (m)	Pressure (bar)
0 – 5	0,5
5 – 10	1,0
10 – 15	1,5
15 – 20	2,0

5: Filling stop

Filling must stop when the pressure gauge shows a pressure approximately 1-2 bar higher than the pre-pressure setting. The ball valve is then closed, the hose removed and the plug put back in.

Start-up:

1: Pump speed

Set the pump to highest speed before start-up.

2: Start pump

Start the pump and heat through the system.

3: Open shut-off valves

The shut-off valves should then 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.

4: Vent system

Switch off the pump and vent the installation after the radiators have been warmed up.

5: Adjust pump speed

Set the pump to the lowest speed consistent with comfort and electricity consumption.

Normally the change-over switch is set in the mid position (default). However for systems with under floor heating or single pipe loop systems, it may be necessary to turn the change-over switch upwards.

Higher pump speeds are only used if the heating requirement increases.

Under floor heating:

Pump stop function

If the substation is used in connection with under floor heating, the circulation pump must be connected to the pump stop function in the under floor heating controller. The pump must be stopped if all under floor heating circuits are closed.

Warranty

If this is not possible, then flow must be continued through the by-pass. Failing this, the pump will be at risk of seizure and any remaining warranty will be withdrawn.

Summer operation:

Switch off pump

In summer the circulation pump must be switched off and the shut-off valve to HE supply closed.

Running pump bi-weekly

It is recommended to start up the circulation pump (for 2 minutes) once a month during summer; the shut-off valve of the HE supply must be shut.

Electronic controller

Most electronic controllers will start up the pump automatically (please note manufacturer's instructions).

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

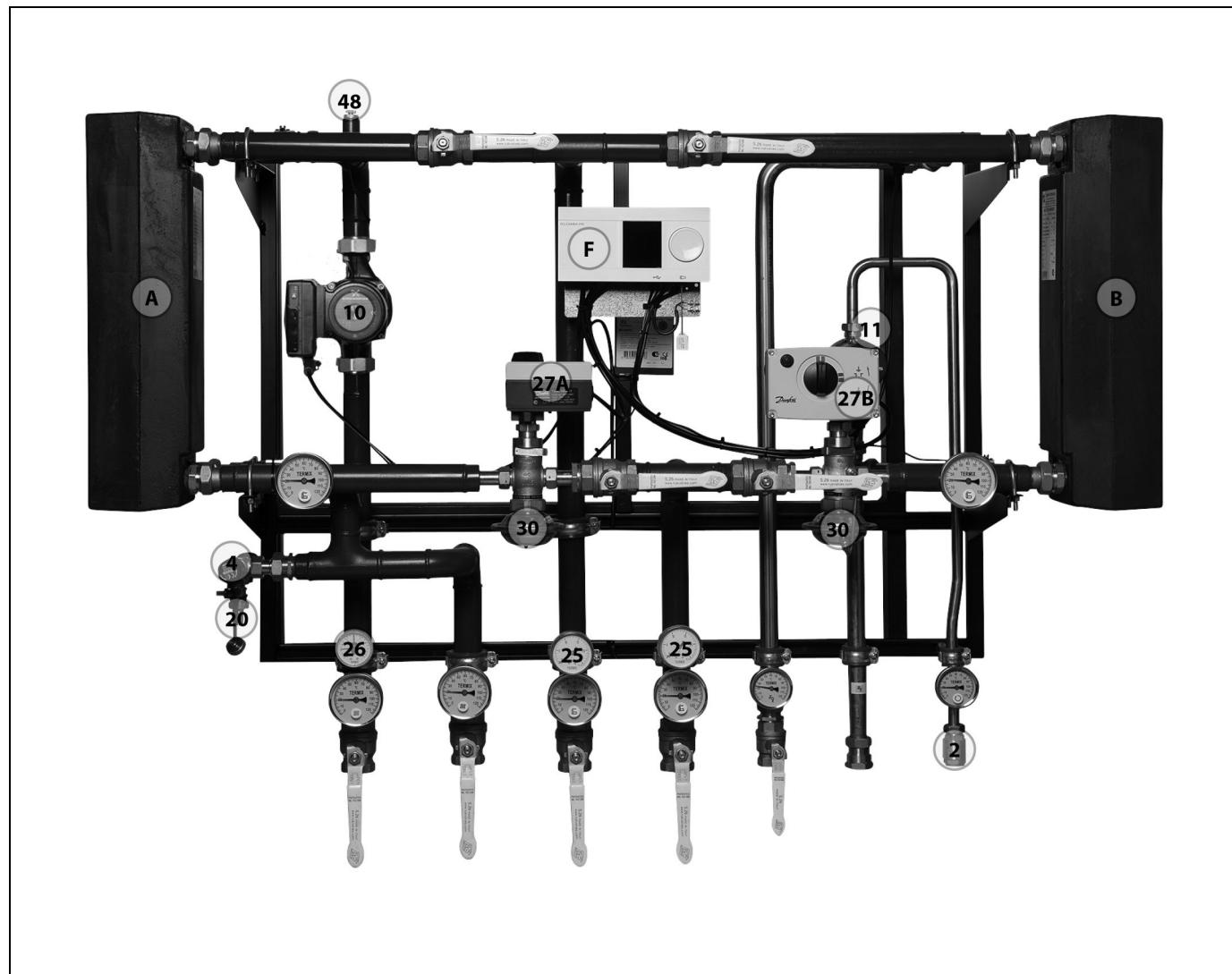
Electrical connections must be made by an authorized electrician only.

Local standards

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

5.0 Design

5.1 Design

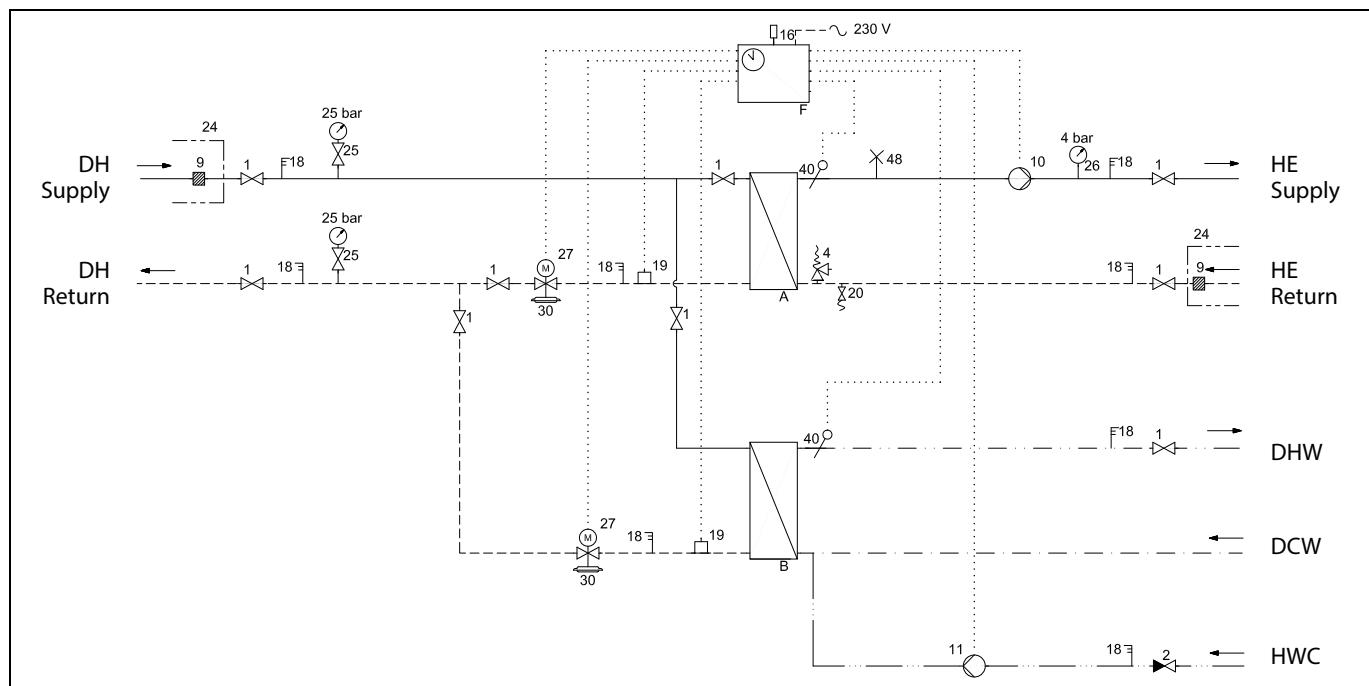


Your substation might look different than the substation shown.

Design description

A	Heat exchanger, HE	10	Circulator pump	27A	Actuator, HE
B	Heat exchanger, DHW	11	Domestic hot water pump	27B	Actuator, DHW
F	Electronic controller	20	Filling/drain valve	30	Flow controller with integrated control valve
2	Single check valve	25	Pressure gauge with ball valve	48	Air vent, manual
4	Safety valve	26	Pressure gauge		

5.2 Schematic diagram



Your substation might look different than the schematic diagram shown.

Schematic description

A	Heat exchanger, HE	10	Circulator pump	25	Pressure gauge with ball valve
B	Heat exchanger, DHW	11	Domestic hot water pump	26	Pressure gauge
F	Electronic controller	16	Outdoor sensor	27	Actuator
1	Ball valve	18	Thermometer	30	Flow controller with integrated control valve
2	Single check valve	19	Surface sensor	40	Immersion sensor
4	Safety valve	20	Filling/drain valve	48	Air vent, manual
9	Strainer	24	Delivered loose with unit		

DHW: Domestic Hot Water

DCW: Domestic Cold Water

HWC: Hot Water Circulation

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 16
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 Flow controller with integrated control valve

The controller is a self-acting flow controller with integrated control valve. The controller closes when set max. flow is exceeded and can be used in combination with Danfoss electrical actuators with or without safety function. Spring return motor can be used as safety function by power failure.



6.1.2 Electric 2-way motorized valve

Actuators with or without safety function are available for 3-point controls. Spring-return actuators can be used to provide safety shut-off in the event of power failure.



6.1.3 Electronic control

Substations with electronic control must be set in accordance with manufacturer's instructions.

Where the room temperature is controlled by radiator thermostats, it is recommended that thermostats be set for minimum temperature in each room.



Operating Guide Termix VVX Compact 28 - 40

6.1.4 Outdoor temperature sensor (ESMT)

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.



6.1.5 Circulator pump

The UPML, UPMXL circulator pumps are designed for circulating liquids in heating systems with variable flows, internally controlled with three proportional pressure curves and three constant pressure/power curves to be selected via user interface.

EuP 2015 Ready.

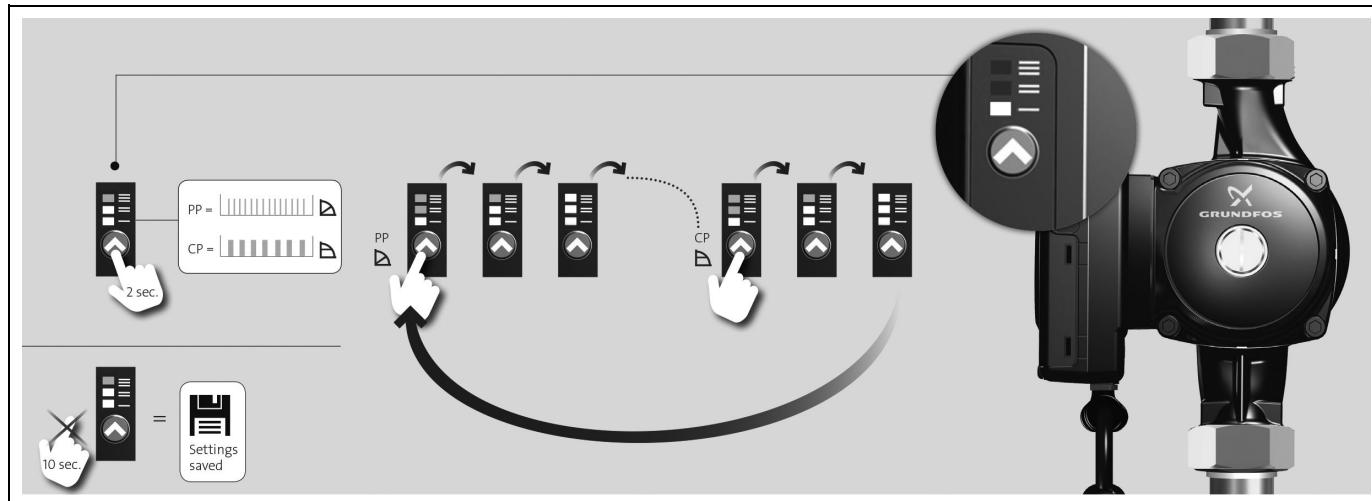
The MAGNA3 circulator pumps are designed for circulating liquids in heating systems with variable flows where you want to optimise the setting of the pump duty point, thus reducing energy costs.

EuP 2015 Ready.



Operating Guide Termix VVX Compact 28 - 40

6.1.6 Grundfos UPML / UPMXL instructions

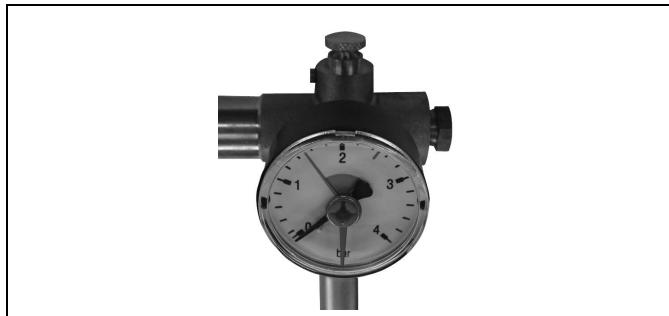


PP = Proportional pressure (fast flash)

CP = Constant pressure (slow flash)

6.1.7 HE pressure gauge

The HE pressure gauge indicates the pressure of the HE system.



6.2 DHW temperature control

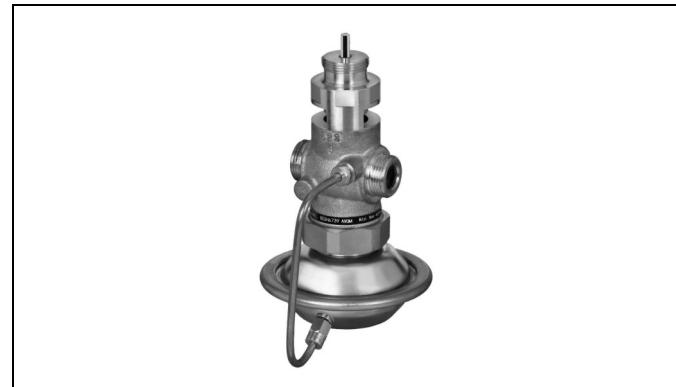
DHW temperature control

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 Flow controller with integrated control valve

The controller is a self-acting flow controller with integrated control valve. The controller closes when set max. flow is exceeded and can be used in combination with Danfoss electrical actuators with or with out safety function. Spring return motor can be used as safety function by power failure.



6.2.2 Electric 2-way motorized valve

Actuators with or without safety function are available for 3-point controls. Spring-return actuators can be used to provide safety shut-off in the event of power failure.



6.2.3 Domestic hot water pump

Important!

It is necessary to mount a domestic hot water circulation pump on the water heater to avoid regulation problems. The circulation pump can not be switched off, since this will result in regulation problems. (no flow at the sensor).



Operating Guide Termix VVX Compact 28 - 40

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 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.



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.
Hot water in some taps but not in all.	Defective or clogged non-return valve on circulation valve.	Replace – clean.
	DCW is being mixed with the DHW, e.g. in a defective thermostatic mixing valve.	Check – replace.
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.

Operating Guide Termix VVX Compact 28 - 40

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

	<p>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.</p> <ul style="list-style-type: none">• Dispose of the product through channels provided for this purpose.• Comply with all local and currently applicable laws and regulations.
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8.0 Declaration

8.1 Declaration of conformity

8.1.1 Substationlabel

Normally the below mentioned declaration of conformity applies:
"Substations - Category 0 with electrical equipment".

Unless fitted with a yellow label (PED KAT. 1) on the substationlabel
then the following declaration of conformity applies: "Substations -
Category 1 with electrical equipment".



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
		BV	VMTD F mix	KST-L	Mixing loop
C28:	CS 28 HD	CS 28 BV	CS 28 VMTD	CS 28 VX	Measuring Unit
C32:	CS 32 HD	CS 32 BV	CS 32 VMTD	CS 32 VX	BL
C40:	CS 40 HD	CS 40 BV	CS 40 VMTD	CS 40 VX	CS 40 VVX
				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: <i>Claus G. Mortensen</i> Signature: Name: Claus G. Mortensen Title: Quality Manager	Date: 2021.07.20	Approved by: <i>Karina Friis Skov</i> Signature: Name: Karina Friis Skov Title: Director, Engineering
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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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Page 1 of 1

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