



6.22 Site Heating and Water Heating Systems

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Applies to deliveries, installations and commissioning of site heating systems and water heating (hot water preparation) systems. Any deviations are subject to approval from ŠKODA AUTO.

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The latest updated version of this ITS is available on <http://cts.skoda-auto.com/>; the Company is not obliged to inform its business partners of ITS updates.

Therefore, all parties are strongly recommended to check this ITS regularly. These documents enter into force on the date of their latest update. The ITS wording relevant in terms of contracts and agreements already concluded is that in force at the time of issuing the purchase/service order concerned.

Note: In the event of any discrepancies among the Czech, English and German versions of this ITS, the Czech version shall prevail. The Czech version is available on <http://cts.skoda-auto.com/>.

First issue: 15/06/1999

Change - number:	Date:	Remark:
1.	2002-02-01	Arial font, ŠKODA AUTO logotype
2.	2004-06-01	fully revised
3.	2007-03-09	amended
4.	2007-04-08	art. 3.2 ammended
5.	2010-12-21	fully revised
6.	2013-12-03	fully revised
7.	2015-03-25	fully revised
8.	2017-06-29	fully revised
9.	2019-08-16	fully revised



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A. Machinery part

1. Supplier-customer relations

1.1. Bid

For the sake of drawing their Bid, the Supplier is required to check the current condition of necessary dimensions, installation openings, transport routes, etc. An exact work schedule for the assignment shall be agreed with PPB. No Bid vs. as-built changes made by the Supplier make the Supplier entitled to increase individual unit prices. As part of the Bid, the Supplier shall provide a list of technical connection data and requirements for the quality of the heating medium. Documents to be handed over shall include system implementation drawings including connection piping dimensions, descriptions of the system's functions and other necessary technical data, including an implementation schedule.

Preferably, the Supplier is obliged to offer and propose in the project documentation the systems and components listed in Annex No.2!

Components made by other manufacturers or non-standard types may only be used if approved by the ŠE-ES Department (Ško-Eneřo – ES Department, hereinafter referred to as "ŠE-ES") and PSU/3..

1.2. Project documentation

By the deadline set in the Contract, the Project Supplier shall provide technical documentation of the agreed scope. All project requirements are governed by relevant legislation – Construction Act No. 183/2006 Coll., Construction Documentation Decree No. 499/2006, Performance and Fees Rules. The supplier shall submit the agreed number of hard copies and one digital copy – as per ITS 1.01.

1.3. As-built documentation

The scope and content of the as-built documentation are governed by Decree No. 499/2006 Coll. Not later than during the takeover, the site heating and water heating system Supplier shall hand over as-built technical documents in three copies. Among others, these documents shall include:

- Implementation drawings, including an exact drawing of distribution pipes and all equipment installations
- Component drawings, including the respective cross sections
- Diagrams including descriptions of system functions and calculation input data

All drawings of the system and piping routes shall comply with applicable ČSN standards, including identifications and descriptions of individual routes.

1.4. General planning/design rules

Connection diagrams are indicative only. The actual design of connection diagrams is based on various functional requirements for the equipment, and the designer/planner does not need to strictly adhere to the connections contained in this ITS; instead, they may propose some other functional connection which they will then consult with ŠE-ES. The diagrams in ITS do not always include drains, air vents, manometers and thermometers. Depending on the actual conditions, draining points shall be placed in the lowest locations, venting points in the highest locations and visual measurement elements as necessary. The diagrams do not include BMS items (such as sensors) - such items are part of the BMS part.

Solutions not referred to in this standard are not automatically deemed to be approved. If any such solution is to be used, Š-E needs to be consulted.

For ease of disassembly/removal, any threaded connections shall be fitted with counter-threads.

Gate air curtains shall be fitted, among others, with a thermometer.

1.5. Takeover

The takeover shall be conducted in compliance with ITS 1.01.

Form of handing over the items listed below to Š-E ES: 2 data carriers, 1 printout

Below see a list of handover requirements, including a list of documentation and technical data for the permanent-use takeover:

Ser. No.	Document name
1	List of documentation handed over according to this list and this numbering
2	As-built project documentation – printout (paper, foil, etc.) + electronic copy If not otherwise stated in the Contract or Technical Brief, the Supplier is required to use SW formats under IST 1.01, Article 5. Heating equipment drawings shall be in dwg or dgn.
3	Catalogue and material lists in Czech ("passports") for the equipment, sensors, drives, valves, manostats, pumps, DDC substations, temperature sensors, etc. installed, incl. technical parameters and descriptions of system functions



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4	Instructions for use (manual) of the equipment delivered, draft operating rules, draft local emergency plan – see ON Buildings, Structures, Land
5	Equipment maintenance instructions including servicing intervals, lubrication plans, etc.
6	Operators and maintenance staff training report (attendance sheet, trainer, training syllabus – separate chapter in the manual, safety risk warnings). The Investor shall provide staff for training as requested by the Supplier.
7	Pressure, leakage and tightness test report (under ČSN 14336)
8	Operational test report- extension and heating tests (under ČSN 14336)
9	Initial pressure tanks inspection report – passport, safety valve certificate, report on tests (functionality tests) of safety valves and other safety devices and components
10	Reports on commissioning, adjustment, putting into operation, functionality tests and individual tests, contact details (under ČSN 14336)
11	Certificates and approval reports relevant to the delivered equipment
12	Table to specify valve settings, thermal parameters, time programmes, etc.
13	Equipment keys, remote controls, portable control elements if applicable
14	Declarations of conformity for the entire system plus declarations of conformity relating to subcontracted parts
15	Supplier qualification certificates, welding licences
16	Lists of spare parts and fast-wearing parts
17	Other documents under the (Project) Contract and Project Documentation
18	Initial inspection reports for electrics, BMS
19	Item test report, including certificate of quality and completeness of BMS control panels, electricity control panels

Table 1: List of documents and technical data for the permanent- use takeover

Documentation structure on the data carrier:

Project name

1. Electrics
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project documentation
2. BMS
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
3. Other
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
4. Gas
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
5. Fire safety solution
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
6. Construction
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
7. Compressed air
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
8. Heat
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation
9. Ventilation system(s)
 - a. Documentation part



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- b. Catalogue Sheets
- c. Project Documentation
- 10. Healthcare equipment
 - a. Documentation part
 - b. Catalogue Sheets
 - c. Project Documentation

General information about the documents to be delivered:

All electronic documents to be handed over shall be named in accordance with their content.

2. Standards, regulations, guidelines

All site heating systems shall comply with applicable occupational safety standards and guidelines and shall meet all relevant requirements for economical and environmentally friendly operation.

2.1. Heating part

ČSN 060310	Heating systems in buildings – design (planning) and installation
ČSN 060830	Heating systems in buildings – safety systems
ČSN 013452	Technical drawings – installations – heating and cooling
ČSN 730540	Thermal protection of buildings
ČSN 383350	Heat supply - general rules
ČSN 077401	Water and steam for thermal energy systems with steam operating pressure of up to 8 MPa.
ČSN 134309	Industrial valves. Safety valves.
ČSN 690010	Stable pressure vessels. Technical rules.
ČSN 690012	Stable pressure vessels. Operational requirements.
ČSN 736005	Layouts of technological equipment networks
ČSN 737505	Integrated routes of municipal technological equipment networks
ČSN EN 12828	Heating systems in buildings. Designing/planning hot water heating systems.
ČSN EN 12831	Heating systems in buildings - thermal performance calculations.
ČSN EN 12170	Instructions for operation, maintenance and use – Heating systems requiring qualified operators
ČSN EN 12171	Heating systems in buildings - Instructions for operation, maintenance and use – Heating systems not requiring qualified operators
ČSN EN 14336	Heating systems in buildings - installations and takeovers of hot water heating systems
Act No. 406/2000 Coll.	Energy Management
Decree No.193/2007 Coll.	
Decree No. 194/2007 Coll.	
Decree No. 78/2013 Coll.	

2.2. Hot water preparation part

ČSN 060310	Heating systems in buildings – design (planning) and installation
ČSN 060320	Heating systems in buildings - hot water preparation - designing and planning.
ČSN 060830	Heating systems in buildings – safety systems
ČSN 061010	Reservoir water heaters with water and steam heating and systems combined with electric heating.
ČSN 061201	Stand-alone solid-fuel devices.
ČSN 061401	Stand-alone gaseous-fuel devices.
ČSN EN 26	Instantaneous water heaters with atmospheric gaseous-fuel burners for heating of service (drinking) water
ČSN 134309	Industrial valves. Safety valves.
ČSN 383350	Heat supply - general rules
ČSN 690010	Stable pressure vessels. Technical rules.
ČSN 690012	Stable pressure vessels. Operational requirements.
ČSN 755409	Indoor water supply systems
ČSN 134309	Industrial valves. Safety valves.
Technical Rule TPH 13298 Service water heating – design/planning rules.	

3. General technical regulations

3.1. Heat transfer station

A system for connection of consumption points/devices to the primary heating network. The heat transfer station shall be designed to provide the required thermal output to the supply site or group of sites. If reconstructing an existing station or building a new one, the new



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station needs to be designed as pressure-independent, the pressure level of the secondary circuit being PN6. The transfer station shall be fitted with key items such as the main shut-off valves with a measurement route, exchanger stations, expansion system and, where applicable, hot water accumulation tank, R+S on the secondary heating water circuit, etc. From the construction point of view, it shall be designed as a special site separated from other areas by at least a fence or, ideally, partition (masonry) walls or as a completely separate site. The station shall be fitted with an opening to make it possible to repair and service the respective technological equipment (the size of the opening should correspond with the size of the biggest component in use). Heating machinery stations shall always be accessible for service and maintenance staff, using an independent entrance from outside, if possible. In cases where this is not possible, the proposed solution shall be consulted with and approved by the ŠE-ES Department at the project plan/design stage.

3.1.1. Design and dimensioning

Each transfer station shall be placed in a separate location to provide enough space for easy-to-survey placement of piping, technological equipment (exchangers, pumps, etc.), as well as control, regulation and measurement systems. If technically feasible, the transfer station site should also be fitted with hot water preparation equipment.

One exchange station for each building. Secondary buildings not to be connected from any other buildings' ESs.

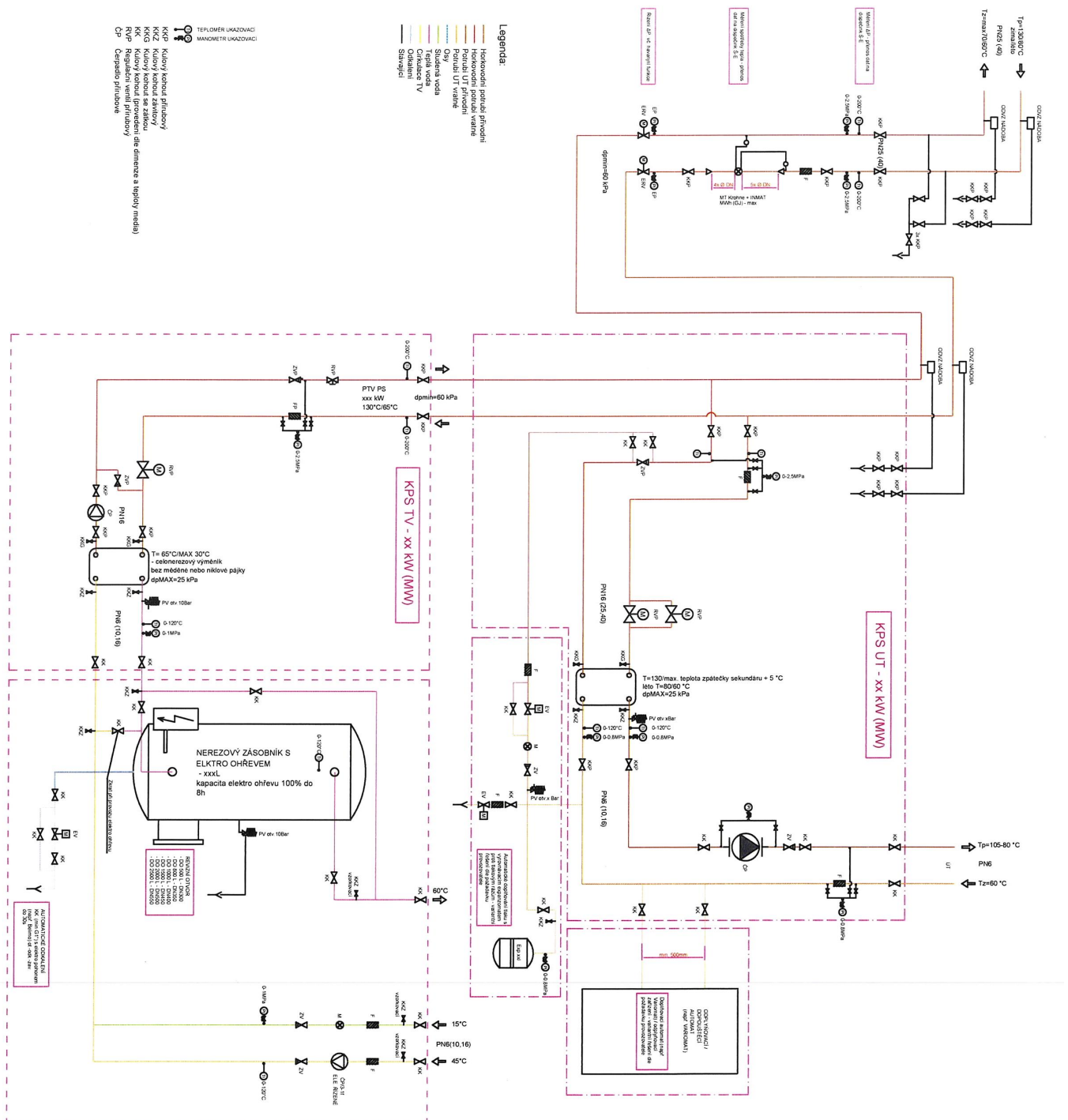
Each machinery station shall be fitted with a pit for heating system draining and a sludge pump to draw drained water or a gully (connected to the sewer system) designed to trap drained high-temperature hot water without damages to the equipment material.

	WINTER	SUMMER
Supply branch temperature	130 °C	80 °C
Return branch temperature	70 °C	60 °C
Pressure available at the heating plant	300 kPa	175 kPa

Table 2: Technical parameters of the primary heating system at the point of exit from the source

The available pressure depends on the location of the transfer station in relation to the heating plant. For the sake of drafting the transfer station dimensions, the Supplier (planner/designer) shall request ŠKODA AUTO (ŠE-ES) to provide their requirements for the connection to the existing network: the data to be provided to the Supplier include differential pressure and temperature at the nearest measurement point. The thermal parameters of the heating water are different at the various heating machinery stations, and the Supplier therefore always has to elicit such parameters from ŠE-ES.

Annex No. 1 provides a temperature diagram for the hot water heating system – dependence of the temperature of water exiting from the heating source on the outdoor temperature.

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3.1.3. Structural design components

Transfer station inlet

The hot water branch entering the transfer station (inlet) shall be fitted with a shut-off valve, inlet filter, thermometer or flow meter, electrically controlled emergency valve with double pressure control, direct thermometer and manometer.

The return branch shall be fitted with an electrically controlled emergency valve, direct thermometer and manometer and shut-off valve. Both branches shall be fitted with drainage and, if possible, venting mechanisms. The main shut-off valves (size DN250 or higher) shall be fitted with by-passes.

Main shut-off valve – DN/PN	Bypass pipes and valves – DN/PN
DN250 / PN25	DN32 / PN40
DN300 – 350 / PN25	DN40 / PN40
DN400 <	DN65 / PN25

Table 3: Bypass valves and piping DN

The dual-function emergency shut-off valve (control valve) is responsible for:

- Controlling the constant differential pressure at the station inlet
- Shutting off hot water supply to the station when the station's pre-set indoor temperature is exceeded or when the transfer station gets flooded

Transfer station diagram – general information

The control valve on the primary side upstream of the ÚT exchanger can also be of dual design, taking into account the substantial fluctuations of the heating water flow and, in this connection, the possibility to efficiently control the flow of the primary heating water to the exchanger.

A pump connected to the exchanger exit will be used in solutions without D+C downstream of the exchanger. If a D+C is in place, no pumps are fitted to the exchanger exit point; instead, they are fitted to the individual branches coming from the D+C.

The type of expansion system will be selected to correspond with the thermal output of the transfer station and the water volume. An expansion vessel and automatic refilling and draining of the system shall be used for output levels of up to ca 1 MW. An automatic pump-fitted automatic expansion system with automatic refilling, draining and air bleeding shall be used for output levels of over 1 MW. The expansion system must not be shared by various network types, such as heating and cooling.

The refilling can involve the use of water from the return branch of the primary hot water heating system via a solenoid valve and check valve. The required tests of safety systems shall be conducted under ČSN 06 0310, including issuing a test report.

Any heat exchanger shall be designed to provide an output reserve.

Heat exchangers

Plate exchangers with higher U levels (heat penetration coefficient) are the preferred solution - stainless steel, soldered. Disassemblable exchangers are preferred for process media heating - baths, chemicals, etc.). The exchanger shall be fitted with closable valves for easy fitting and removal.

Design recommendations:

- Warm water: 60/25°C – 10/55°C with a total pressure loss (in the exchanger) of 20-25kPa
- Hot heating water/warm heating water, ÚT: 130/70°C / e.g. 105/65°C with a total pressure loss (in the exchanger) of 15kPa, from 500kW: 20kPa, from 1MW: 25kPa
- If a distributor/collector and 3-way blending valves are fitted downstream of the exchanger, the max. pressure drop in the exchanger is 12kPa.
- The maximum in-cap pressure drop should be 15% of the total drop; alternatively, the maximum number of plates should be ca 100.
- Exchanger material – AISI 316L stainless steel
- Plate exchangers to be connected in line with the manufacturer's instructions.
- The preferred solution for thermal output control is a two-way control valve.

Valves and pumps

The following energy efficiency requirements apply:

- Motors of inline pumps, acceleration pumps etc. to be designed in line with EU Commission Regulation No. 640/2009
- Motors of seal-less circulation pumps to be designed in line with EU Commission Regulation No. 641/2009

Any devices that are part of the heating system shall be controlled by means of balancing valves or other control valves. Depending on the heating network characteristics, control valves shall be static or dynamic.

If balancing valves are used, the solution shall comply with the required stabilisation sections upstream and downstream of the valve.

All risers and turn-off pipes shall be fitted with shut-off and drain valves at the point of turning off the spinal network.



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Distributor and collector (hereinafter referred to as D+C)

The distributor and collector may be designed as integrated or separated, with a single reserve cap. It shall be fitted with a drain valve of min. DN50 and a shut-off valve at the point of entry to D and the exit from C. The D+C needs to be fitted with a direct differential manometer and thermometer on D.

Individual branches from R shall be fitted with shut-off and drain valves and with venting at the highest spot.

Individual return branches to C shall be fitted with balancing, shut-off and drain valves and direct thermometers. If the balancing valve also plays the shut-off role, it is not necessary to fit another shut-off valve, e.g. on the return branch of the collector.

The equipment configuration on the branches from D+C may vary. The diagram below shows the simplest branch configuration. Further, the branches may include a blending system (see below for a blending diagram) or pumps, e.g. where the D+C is connected to the secondary side of the exchanger.

Ball taps on D+C at the transfer station (except for drain valves) shall be designed for connection of partly rotating drives (ČSN EN ISO 5211).

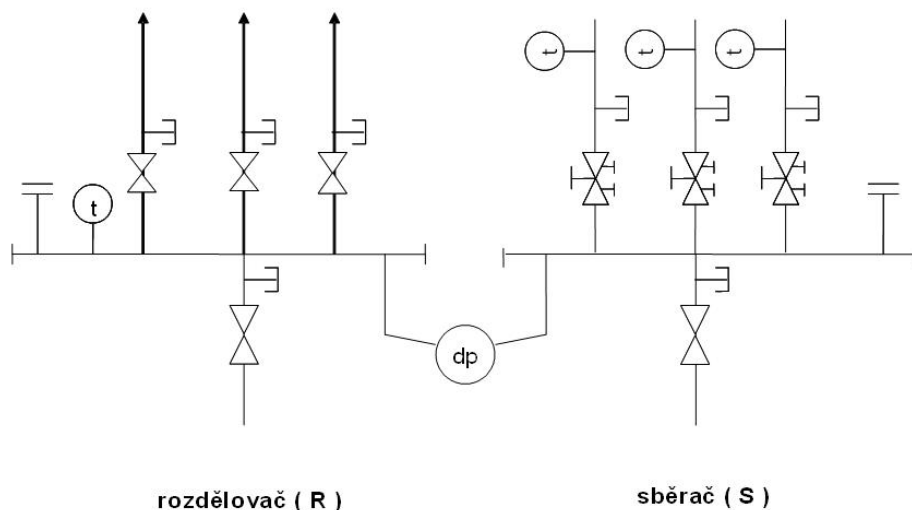


Figure 2: Distributor and collector

3.1.4. Heating output control

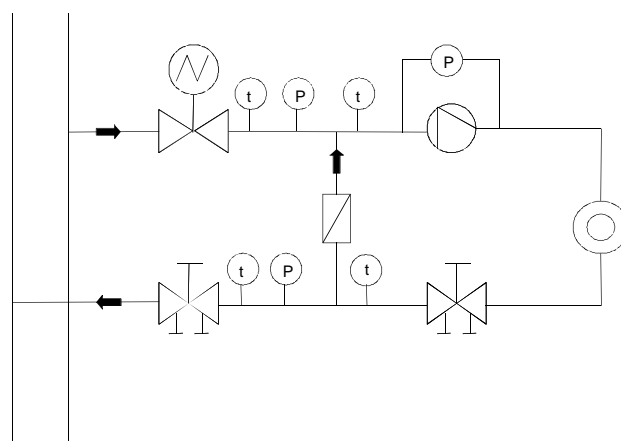
Pumps to be controlled (regulated) with a frequency converter, chokes or bypasses are not allowed.

The method of controlling the heating output of the transfer station should reflect the needs of the secondary circuit and the station connection format. It is necessary to take into account the heating station-style method of preparing hot water at the plant; the ambition of the proposed solution should therefore be to cool the return branch as much as possible (70°C).

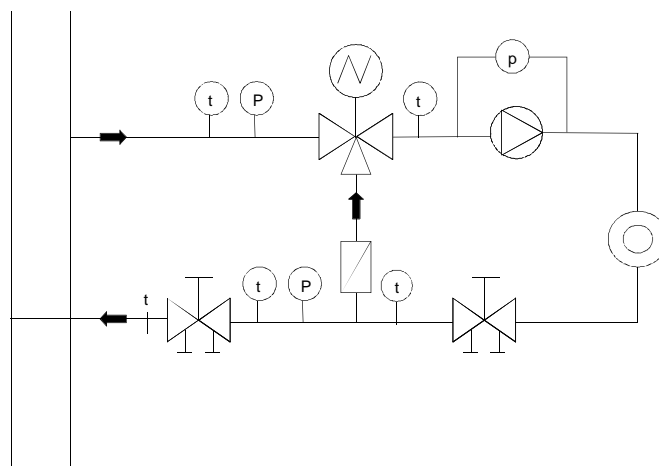


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*Blending connection**2 blending node implementation methods:*

Spinal heating water distribution network

Figure 3: Blending branch with a high input Δp - fixed shortcut-pipe injection blending

Spinal heating water distribution network

Figure 4: Blending branch with a low input Δp

Two balancing valves are fitted in blending connection solutions, one of them balancing the device circuit, the other one the device connection line in relation to the main branch. If the system involves the use of an electric pump adjustable exactly for the required flow through the device, the secondary circuit does not need to be fitted with a balancing valve.

The connection layout proposed for the transfer station shall always be consulted with ŠKODA AUTO (in reasonable cases it is possible to use also two-way control valves - quantity control).

Besides transfer stations under this ITS, the layout approval requirement also applies to e.g. process media heating.

When designing a blending connection solution with a three-way valve, the pressure on the inlet port of the three-way valve needs to be checked to prevent the flow of the heating medium from returning to the return pipe. In such cases the differential pressure should be stabilised with a suitable dynamic valve.

When designing a blending node for ventilation units, the recommended solution is fixed shortcut-pipe injection blending, on condition of having a sufficient pressure difference upstream of the node.



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To maintain the temperature of the heating water that enters the unit's exchanger, it is necessary to fit a gallery with a small control valve upstream of the unit (only in cases where the device is connected with a long connection line or it is the last device connected at the end of the branch concerned) and set the flow of the heating water from the supply pipe to the minimum to ensure that uncooled heating water is available right on the unit start.

Risk of ventilation machinery station flooding

The supply and return pipes of water heating or cooling registers should be fitted with closable electric valves linked to sensors (see ventilation system BMS).

3.1.5. Boiler rooms

- Boiler units to be designed with economisers.
- The boiler room operation shall be fully automatic and shall include data visualisation.
- Boiler rooms to be designed as attendance-free sites.

3.1.6. Heating systems

3.1.7. General rules

Heating systems shall be designed and implemented to provide all necessary functions, i.e. heating water temperatures, thermal outputs required in relation to temperatures required on work sites and outdoor temperature as well as other requirements, in particular trouble-free operation and maintenance of the whole system.

Heating systems in use

- I. Water
- II. Hot air
- III. Electric
- IV. Gas

Water system parameters

	Temperatures	Operating pressure	Nominal pressure
Hot water	130°/ 70°C	1.0 – 1.3 MPa	PN 16
Warm water	Up to 105°C/65°C		PN6, PN10

Table 4: Water system parameters

When designing heating equipment for new paint shop projects, the maximum temperature of the supply-point heating water should be 90°C.

Transfer stations shall be visualised in a superior control system. Each connection is subject to approval from the system administrator (ŠE-ES).

Dual-pipe systems are preferred (in terms of engineering design). Using a single-pipe or multi-pipe system is subject to approval from ŠE-ES. Heating output to be set under ČSN EN 12831, based on thermal losses of the heated site, with an indoor temperature of 18°C calculated for permanently attended shop floor sites (halls) (under the Collective Agreement) and min. 20°C for office space. Work site temperatures are governed by Government Decree No. 361/2007 Coll. as amended.

Any devices, transfer stations etc. in non-blended heating water distribution networks shall be designed for the required thermal drop of 130/70°C in the heating season and 80/60°C in summertime. The return-pipe temperature is required to reach the calculated 70°C (60 °C in summertime), i.e. to ensure proper cooling of the return water.

3.1.8. Structural design components

Heaters (radiators)

Depending on the type of the heated site and the pressure and temperature parameters of the heating water, all types of heaters (radiators) can be used - sectional heaters, plate heaters, tube heaters or convectors.

Hot water networks shall come with a certificate for temperatures of up to 130°C and a pressure of PN 16. Heaters shall be connected to the piping network to ensure that any heater can be replaced without having to drain the piping system.

Each heater shall be fitted with a shut-off valve (on the supply pipe) with fixed or variable, visually checkable pre-control (TRV) and an anti-theft thermostatic head, or a control valve in cases where no pre-control valve is available for the parameters of the heating medium in question (usually hot water heating systems). The heater return pipe to be fitted with a threaded control joint or a ball tap in cases where no threaded control joint is available for the parameters of the heating medium in question (usually hot water heating systems).



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Pipes, valves and pumps

Piping systems shall be fitted with venting containers and pipes (brought down to max 1 m above floor level) at the highest location and with drain valves at the lowest location. Hot water systems can be vented using automatic air bleeding valves fitted with regard to the risk of draining (e.g. must not be installed above suspended ceilings). Sludge from these valves shall be brought to spaces where venting/desludging can be performed without the risk of damaging the surrounding areas and equipment. Venting and drainage locations, particularly in offices, shall be consulted with ŠE-ES.

Safety systems

Safety systems on the secondary circuits of heating systems consisting of safety and expansion devices to be designed in line with ČSN 06 0830. Expansion devices shall be used to balance water expansion changes and to keep the pressure in the secondary circuit of the heating system within the required limits.

The documentation shall specify the site's pressure drop, minimum pressure – failure, operating pressure, refill pressure (on – off), drain pressure (on – off), maximum pressure – failure and PV settings.

Hot air systems

ŠKODA AUTO uses such systems for heating purposes as circulation-only units or units with supply of fresh (ventilation) air. These systems are the usual first-choice solution for heating of sites with relatively low air quality requirements, i.e. mainly gates, entrances and entryways. In such cases it is necessary to harmonise the operation of the system's ventilator with the gate's terminal switches; as the gate opens, the unit is activated and vice versa (gate closed, unit off).

Units located in entryways to halls to be activated by a thermal sensor.

The piping to connect the unit's exchanger to heating water shall be designed as follows: supply pipe with a manual shut-off valve, electric shut-off valve (this can be a ball tap or a valve with a very fast drive (re-adjustment time of less than 10 sec), return pipe with a balancing valve (also plays the shut-off role). The lowest point shall be fitted with a drain valve. The electric shut-off valve shall be harmonised with the unit's operation - will be open when the ventilator is in operation and closed when the ventilator is off. To maintain the temperature of the heating water entering the unit's exchanger, it is necessary to fit a gallery with a small control valve upstream of the unit (only in cases where the device is connected with a long connection line or it is the last device connected at the end of the branch concerned) and set the flow of the heating water from the supply pipe to the minimum to ensure that uncooled heating water is available right on the unit start.

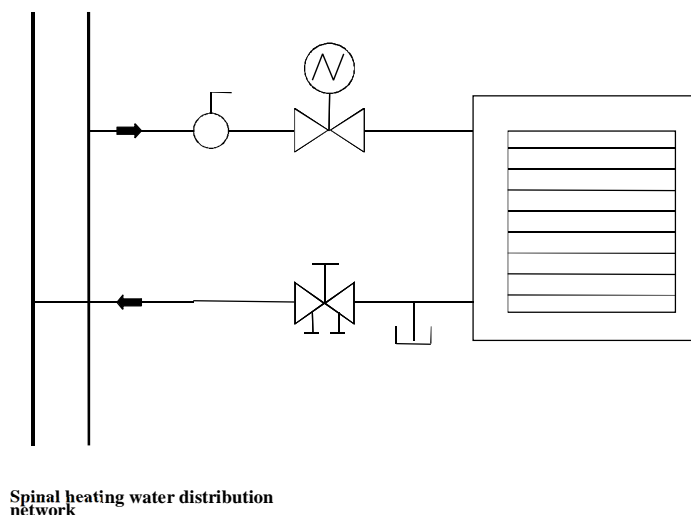


Figure 5: Unit's exchanger connected to heating water

Gas and electric systems

With the ambition to make maximum use of hot water generation in the heating cycle, the use of gas and electric systems for site heating purposes is only conditional upon technical and financial calculations to prove their efficiency as compared to hot water.

These types of networks must not be fitted without approval from ŠE-ES.



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3.1.9. Heating output control

The heating output of secondary circuits shall always be addressed in terms of both outdoor temperature and quality, i.e. by controlling the temperature of heating water exiting the exchange station with the possibility to control it additionally on the work sites concerned (TRV).

The requirements for the control system are specified in the BMS part.

3.2. Hot water (HW) preparation

3.2.1. General rules

Where possible in terms of layout and economy (network scope and structure), we make HW preparation part of the transfer station that is also used for heating systems. To make maximum use of the available space, it is possible to combine the HW preparation with the preparation of hot heating water, using plate exchangers - "block arrangement". Where the HW preparation cannot be part of a shared transfer station, it shall be placed to an independent location, separated from the ordinary work space at least with a fence.

A hot water preparation diagram is part of the transfer station diagram.

3.2.2. HW preparation parameterisation

The preferred solution for HW heating is a combination of plate exchangers and an accumulation tank. Minor facilities with constant HW consumption levels over time can do without an accumulation tank. HW preparation can therefore take the form of an accumulation-based as well as a fast-heating solution.

The primary medium for HW heating is hot water whose parameters are as follows:

		WINTER	SUMMER
Temperatures	Supply branch	130 °C	80 °C
	Return branch	70 °C	60 °C
Pressure	Pressure available at the heating plant	300 kPa	175 kPa

Table 5: Parameters of hot water used for HW heating

If HW is not prepared at the transfer station, the solution shall reflect the pressure parameters of the site concerned. HW heating shall always be indirect (HW permanently separated from the heat-carrying substance). HW consumption to be in line with ČSN 06 0320, **HW temperature 60°C**. The HW heating system shall feature automatic regulation to ensure that the HW is heated as required while preventing its overheating.

3.2.3. Structural design components

Supply branch and return branch

The supply branch of the primary circuit shall be fitted with a manual shut-off valve, inlet filter and electric control valve. The return valve is fitted with a balancing valve. If HW preparation is part of the transfer station, the aforesaid filter and, if possible, the shut-off valve do not need to be fitted (if installed).

The supply pipe to the plate exchanger may be fitted with either a two-way or a three-way valve:

- If the pressure available on the primary side is below 20kPa and fluctuates, the three-way valve solution is preferred. This configuration will make it possible to draw the supply medium in even if the available pressure drops to 0kPa.
- If the pressure is above 30kPa, the two-way valve solution is preferred.

The control valves shall feature fast drives, and the regulators (controllers) shall be type PID.

The pump on the primary side shall only operate in cases where it is necessary to heat hot water. The circulation pump on the secondary side of the exchanger shall operate permanently.

Heat exchangers

Plate exchangers with higher U levels (heat penetration coefficient) are the preferred solution; stainless steel exchangers soldered without copper and nickel. Disassemblable exchangers are not allowed. Tube exchangers combined with an accumulation tank are also an option. If galvanised pipes are used on the HW side, copper inlays must not be used in the exchangers, the reason being a risk of electrolytic corrosion.

Plate exchangers to be connected to the heating system in line with the exchanger manufacturer's instructions.

The plate exchanger shall be designed for high inter-plate turbulence and minimum overheating at the points of connection of primary hot water. We therefore recommend a thermal drop of 65/25°C – 10/60°C (with low wall temperature) and a total pressure drop (in the exchanger) of up to 20-25 kPa.

All types of exchangers shall be fitted with shut-off valves for easy removal and re-fitting.

The exchanger should be dimensioned to ensure that the entire contents of the accumulation tank are heated in less than a half-shift, i.e. within 4 hours.



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HW accumulation tank

An accumulation tank shall be used in cases where direct HW heating without accumulation is not possible due to fluctuating consumption levels. The tank can be positioned vertically or horizontally, depending on the layout of the site concerned. The accumulation tank shall be fitted with a direct thermometer and manometer and shut-off valves at the inlet and outlet points. The tanks shall be fitted with inspection openings.

Inspection opening size:

AT volume in m ³	Inspection opening DN
500	300
800	350
1,000	400
1,500	450
2,000	500
2,500	550

Table 6: Inspection opening size:

An automatic sludging mechanism shall be fitted to reservoir-based water heaters and hot water storage tanks of over 600 l (automatically opening sludging valve). This automatic sludging valve shall feature a bypass with a manual shut-off valve.

The sludging opening in tanks of 400 – 1,000 l in volume shall be fitted a sludging valve whose min. size is DN25; the size of the sludging valve in tanks of over 1,000 l shall be DN50. The sludging pipes shall be led to an in-floor covered groove led to the sewer system.

To address possible cases of hot water shutdowns in the primary system, the accumulation tanks shall be fitted with a back-up electric HW heating system. The electric heating system shall be dimensioned to ensure that at least a half of the tanks' entire capacity can reach the required thermal parameters within 8 hours. This requirement implies a necessity to spread the total required capacity of HW across several tanks.

The use of electrical instantaneous water heaters is subject to approval from ŠE-ES - in solutions without a source of drinking water and with low flows.

HW circulation

Any HW preparation system shall come with forced HW circulation, except for small stations with a low number of consumption occasions. Such cases and cases halfway between these two scenarios shall be consulted with ŠKODA AUTO (ŠE-ES).

The pump dimensions shall be designed to replace the overall volume of HW in the distribution network 4-5 times/hour.

Pipes, valves and pumps

The HW distribution network must not be made up of steel pipes without a properly treated inner surface, e.g. galvanised: the objective is to prevent corrosion and, as a consequence, water contamination.

All threaded joints shall be fitted with counter-threads for easy mechanical removal.

Sampling valves

The hot water, cold drinking water and circulation branches will be fitted with sampling valves – see the transfer station diagram.

3.2.4. Typical HW heating connection layout

The HW heating connection layout shall reflect the need to provide a particular quantity of HW over a particular span of time. Any draft transfer station connection layout shall be consulted with ŠE-ES.

3.3. Heating system requirements:

3.3.1. Piping design and installation

Design:

Unless otherwise required, use the materials listed below for heating equipment:

- Seamless steel pipes, threaded, standard, under ČSN 425710, material 11353.0, 11353.1 with guaranteed weldability
- Seamless steel pipes, threaded, reinforced, under ČSN 425711, material 11353.0, 11353.1 with guaranteed weldability
- Seamless steel pipes, smooth, under ČSN 425715, material 11353.0, 11353.1 with guaranteed weldability
- Pre-insulated steel piping
- Copper piping in reasonable cases and always subject to a consultation with ŠE-ES



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Material uniformity is an important requirement for heating systems. To prevent undesired electrochemical reactions, make sure to avoid material combinations such as copper and steel piping.

Heating system layout

The connection location/point is selected by ŠE-ES. The designer/planner is obliged to check the capacity at the connection point to avoid compromising the functionality of the existing heating system.

A heating machinery station shall be designed on new sites, housing a transfer station that may consist of the following key components – exchanger station to produce heating water and hot water, safety equipment (expansion vessels or automatic expansion vessels with air bleeders), distributor + collector, HW accumulation tank, etc. If the heating machinery station is located on a site other than where the piping enters the site, the measurement route will not be built in the machinery station but. Instead, at the point where the piping enters the building concerned.

The machinery station layout shall be designed for trouble-free maintenance and trouble-free removal and refitting of components that need to be replaced. Controls shall be located within human reach. Heavy items (such as pumps on D+C) must not be located at heights making it impossible to dismount them without pulleys and/or other aids.

Pipe and valve joints

PN6 warm water heating networks of up to 110°C

Screw joints can be used for warm water heating networks with valve and pump dimensions of up to and including DN 32. Flange joints or weld-on joints shall be used on heating distribution networks with dimensions of over DN 32. Each disassemblable (screw) joint shall come with a counter-thread joint to make it possible to dismount the valve without intervening in the piping.

PN16 hot water heating networks

Hot water networks shall be fitted with flange valves or weld-on valves. Pumps shall be of flange design. Any weld-on valve shall make it possible to replace the O-ring seal on the baluster without having to remove the valve from the piping. Hot water network valves that are not strained in their longitudinal axis (drain valves, venting valves) can be of threaded design.

Correct welding methods need to be applied when welding a flap or ball tap onto the piping: the valve core must not be exposed to high temperatures. The Supplier is obliged to demonstrate such process to the Construction Supervisor and guarantee that all temperature-sensitive valves will be welded this way.

In line with relevant guidelines, flange screws shall be tightened using a torque spanner. The thread shall be greased with a graphite-containing lubricant prior to the fitting.

Pipe laying and fastening

Pipes shall be laid and fastened by means of standard fastening elements (clamps, brackets, suspensions, etc.).

The designer/planner is obliged to design the piping fastening solution (propose distances between individual fasteners, fastener types – fixed point, sliding and axial leads) and substantiate such solution with a structural calculation. For easy dismounting, pipe suspensions, fixed points and pipe leads must not be welded to the piping.

To compensate for thermal expansion, the pipes shall be fitted with compensatory elements (use natural compensatory elements such as U, L, Z, etc. or corrugated compensators). The proposed compensator solution shall come with a relevant calculation (as part of the documentation).

Pipe sections going through ceilings or walls (construction materials) shall be wrapped in fireproof protectors (bushings).

Pipe suspensions shall be independent for each medium, as they cannot be integrated for various media (different expansion). To provide comfortable access to repaired elements of the heating or hot water network, it is not allowed to have more than two branches above each other.

Pre-insulated piping and detection system

The hot water heating supply pipe shall be in insulation class 3, the return pipe insulation class 1. The piping shall come with a detection system.

The installation shall be done in compliance with standards governing the topology of supply and return pipes. Supply piping right and return piping left to the source at the point where the pipes enter the site/building (looking in the direction from the building, the supply pipe is on the left-hand side, the return one on the right). Left and right can be swapped in technically reasonable cases, but such change needs to be mentioned in the project documentation (drawings and the Technical Report).

Pre-insulated piping shall come with a properly fitted detection system. The installation of the pre-insulated piping will be followed by a report-documented measurement of the detection system (reflectometric measurement). The next step is to fix the lengths of all wires and pipes. A permanent reflectometric measurement will be conducted on piping of over 150m in length, plus visual checks (to check its condition). All detection wires in pre-insulated pipes of all lengths shall terminate with standard detection system elements for the sake of status (condition) checks.

Venting and drainage

The piping needs to be properly sloped. Venting points in the highest locations, drainage points in the lowest ones.



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A bypass for pre-heating and HVP filling (flange valves) shall be fitted upstream of the main shut-off valve on each hot water connection pipe. **HVP and PS are always filled via the return piping, and the process is attended by the equipment administrator!** For the bypass connection see the transfer station diagram.

The bypass DN is selected according to the table below:

HVP connection piping – DN/PN	Bypass piping and valves – DN/PN
DN25 – 50 / PN40	DN15 / PN40
DN65 – 80 / PN40	DN20 / PN40
DN100 – 125 / PN25	DN25 / PN40
DN150 – 200 / PN25	DN32 / PN40
DN250 / PN25	DN40 / PN40
DN300 – 350 / PN25	DN50 / PN40
DN400 and bigger	DN65 / PN25

Table 7: Bypass DN

Considering the increased occurrence of oxides (air and sediments), seamless strong-wall pipes shall be used for the drainage and venting piping, including elbows and reduction pieces. Hot water distribution networks shall come with a 100% drain and venting valve mechanism, i.e. dual valve or valve + plug. Spinal hot water heating pipes shall be fitted with flange valves for easy replacement in case of a failure. Drainage and venting pipes are dimensioned according to the table below.

All drain valves at heating machinery stations (exchanger stations, transfer stations, etc.) shall be led to the sewer system.

Main piping	Venting pipes and valves	Drainage pipes and valves	Diameter and wall thickness - seamless drainage and venting pipes
DN15 – 50	DN15	DN15	21.3x3.6mm
DN65 – 80	DN15	DN20	26.9x3.6mm
DN100 – 125	DN20	DN25	33.7 x 4.0mm
DN150 – 200	DN25	DN40	48.3 x 4.0mm
DN250 – 350	DN32	DN65	76.1 x 4.5mm
DN400 – 600	DN40	DN80	88.9 x 5.0mm
DN700 and bigger	DN50	DN100	114.3 x 5.6mm

Table 8: Drainage and venting pipes

Records of on-site energy data, organisational units, equipment, machinery

(Under Group standard PHS 1009)

Energy consumption meters shall be fitted as follows:

	Site (hall)	Organisational unit (cost centre)	Devices (Machinery, equipment)
Stable energy data measurement	Always	From 500 kW	From 500 kW
Accessible measurement point	-	From 50 kW	From 50 kW

Table 9: Energy measurement configuration

Measurement devices (implementation):

Stable measurement points shall make it possible to deploy permanent meters without affecting standard on-site operations. Accessible measurement points shall make it possible to safely deploy temporary meters without affecting standard on-site operations and without re-builds required as a result of media measurements.

The required meters shall be fitted exclusively by a company with a valid ČMI licence, using the meters listed in the BMS part. Each fitting company shall seal the meters as required by ČMI.

Piping and valve identification



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All pipes need to be colour-coded in line with ČSN 130072 and its amendments, if any. Pipes connected to machinery and equipment shall be fitted with permanent, clearly visible marking, including the flow direction. Labels shall be placed in visible locations.

Hot heating water 130/70°C (110/70°C) will be marked PŘÍVOD H.V. (SUPPLY HW) 130/70°C and VRATNÁ H.V. (RETURN HW) 130/70°C + specific items (in the machinery station) – valve, distributor + collector body, consumption point or circuit identification on each branch, key valves (opening level (settings) to be included on control valves etc.

Warm heating water 90/70°C (or some other thermal drop) will be marked PŘÍVOD T.V. (SUPPLY WW) 90/70°C and VRATNÁ T.V. (RETURN WW) 90/70°C + specific items: see the description above.

Warm water will be marked TV + specific items: see the description above.

Warm water circulation will be marked TV cirkulace (WW circulation) + specific items: see the description above.

For ease of survey, we recommend colour-coding the supply water and return water differently (red - supply water, blue – return water).

All distribution pipes in halls shall be marked identically with the machinery stations, downstream of each wall opening (in a visible location) or, where piping is led under a suspended ceiling, a label stuck on the frame of such suspended ceiling; further, for ease of survey, the on-site identification is required to correspond with that used in the drawings. All important shut-off and division valves to be marked and described independently.

Examples of information/descriptions in machinery stations and on distribution piping:

H.V. 130/70°C M1/B
SUPPLY TO DISTRIBUTOR

H.V. 130/70°C M1/B
SUPPLY TO VZT SHIPMENT SITE

H.V. 130/70°C M1/B
RETURN FROM VZT SHIPMENT SITE

H.V. 130/70°C M1/B
RETURN – MAIN VALVE M1/B

H.V. 130/70°C M1/B
RETURN FROM COLLECTOR

H.V. 130/70°C M1/B
HUV (MAIN WATER VALVE) with dP control

H.V. 130/70°C M1/B
RETURN FROM VZT SHIPMENT SITE
FLOW CONTROL

Nast.:

T.V. 90/70°C M1/B
RETURN
Annex South, Circuit I

T.V. 90/70°C M1/B
Control valve
Annex South, Circuit I

Work on existing piping networks

The process of connecting new points of consumption to existing piping networks is governed by MP.1.906 “Connecting New Devices to Existing Energy Distribution Networks“.

Interventions to functional supply networks can only be made by properly qualified specialists. Any interventions in piping systems are subject to prior approval from ŠE-ES. The Supplier is in no way authorised to remove supply systems and piping networks, drain them, fill them or restore their operation without approval from the operator, i.e. ŠE-ES.

In the event of repairing devices connected to supply networks, the Supplier is obliged to check, before starting such repairs, that all hazardous media are fitted with warning labels and boards.

Before starting any work on underground supply networks, the Supplier shall survey and mark out all other crossing or adjacent (parallel) networks and request the underground network drawing (part of the plant master plan) from PPB.

The Supplier shall perform any operations involving piping networks in cooperation with the energy network operator, i.e. ŠE-ES.

Welding operations



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Welding operations on the piping network can only be performed by staff authorised by HZS ŠKODA AUTO a.s.

Welding operations on hot water heating piping size from and including DN200 shall be performed by a company certified under the WPQR method. Prior to starting the welding work, the company shall submit their WPQR certificate and specify the planned welding process in a WPS - a WPQR-generated document to provide data for particular weld joints to the extent of parameters determined by the WPQR qualification. This document shall be drafted under EN ISO 15609-1 and EN ISO 15609-2+Amendment A1 for all welding operations on high-pressure components and for components to be welded thereto; the above applies to both on-site and workshop welding operations.

Pressure tests, valve setting and takeover

After completing the installation, the piping and the respective parts of the equipment need to be rinsed or blown dry, and the Supplier shall conduct the required rightness test and pressure test and submit the required documents. The piping and equipment will be taken over by the technical supervisor of the project appointed by PPB.

100% weld joint tests (x-ray and, from DN100, also ultrasound) shall be conducted on outdoor hot water heating pipes (x-ray tests to include a capillary or magnetic test).

The valve setting (all control valves) will be done in compliance with ČSN 14336.

Balancing valves will be numbered in drawings, and the documentation will also include a table to specify the settings of the balancing valves, the fields including: valve No., type, dimension, kv, flow and settings (position) (Annex No. 3).

Each control valve (except for thermostatic valves and control screw joints on heaters/radiators) will be fitted with a tag to specify the set valve flow. Pumps will also be fitted with a tag to specify the transport height and circulation quantity.

The equipment test and network balancing report (leakage test and in-operation material expansion and heating tests) shall confirm that the tests have been conducted in compliance with ČSN 14336.

3.4.2. Structural design components

Pressure vessels

Technical conditions for deliveries of pressure vessels are governed by ITS 6.21 - Stable Pressure Vessels.

Pumps

Under the Directive of the European Parliament and of the Council 2009/125/EC (ErP Directive), wet-running (seal-less) pumps have to be designed under the Energy Efficiency Index (EEI), while motors of dry-running (seal-fitted) pumps under the Index of Efficiency (IE). The Directive thus requires the use of electronic pumps with rev control. The revs of these pumps can be controlled according to constant or variable pressure.

Standard pumps compliant with ČSN 110010 and amendments thereto, if any, need to be used in all applications.

In ordinary applications the pump type and parameters are selected by the planner/designer to reflect the need of the respective system/equipment. In special cases the pump type and parameters need to be consulted with the departments concerned. The type and design of the seal shall correspond with the chemical and physical characteristics of the liquid to be drawn.

The intake and delivery sides of the pump shall be fitted with shut-off valves, the delivery side also with a check valve. The pump will be fitted with a differential manometer.

Manometers

A shut-off valve with a check pipe - manometer valve - needs to be fitted upstream of each manometer. Safety valves and emergency valves shall be checked under a specific regulation.

Valves and their structural design

Valves shall meet the required quality parameters throughout the temperature and pressure ranges required for the medium concerned. Hot water networks to be fitted with division valves on outdoor spinal piping, valves at points of entry to buildings to be designed for a pressure of PN 25, indoor valves and devices for a pressure of PN 16. Valves shall be installed in locations providing comfortable access for ordinary handling, as well as for easy fitting and removal.

Hot heating water – the main shut-off valves (points of entry to buildings) shall be designed for resistance to a pressure/temperature of 130°C/PN25, metal/metal seal flaps (e.g. KSB Danais or, subject to approval from ŠE-ES, at least an equal valve) can also be fitted with ball taps. Subsidiary valves (such as KSB, MEIBES, BALLOMAX flaps) shall be designed for resistance to a pressure/temperature of 130°C/PN16, VITON seal for up to 180°C (no way EPDM). Flap disc - exclusively stainless steel. If no PN16 valve is available (from the production programme) on the PN16 heating water side, a higher PN needs to be used. The same applies to heating water on the secondary side of the exchanger: if no PN6 valve is available, a higher PN needs to be used.

Warm heating water – an EPDM seal and stainless steel disk are enough for shut-off flaps (such as KSB, MEIBES BALLOMAX).

Shut-off valves to take the form of ball taps (applies to both heating and cooling); shut-off flaps in reasonable cases only.

Type labels



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Structural elements and equipment such as tanks, pumps, heaters, coolers, etc. shall be fitted (by the manufacturer) with type labels to provide the following data:

- Manufacturer
- Production No.
- Year of production
- Power output, power input
- Volume
- Rated pressure
- Max. admissible operating pressure
- Operating temperature
- Max. admissible operating temperature
- Revs

Thermal insulations

Thermal insulations for thermal energy distribution networks, indoor thermal distribution networks for heating, cooling and technological purposes and for warm water distribution to be done in compliance with Government Resolution No.193/2007 Coll. To the Energy Management Act (No. 406/2000).

Insulation surface finish:

- Distributors, tanks - embossed 0.8 mm metal sheet or galvanised 0.8 mm metal sheet.
- Piping from DN 80 mm - embossed 0.55 mm aluminium sheet or galvanised 0.55 mm metal sheet.
- Piping of up to DN 65 - aluminium-lined foil.

3.5 Dismounting operations, waste disposal

Dismounting existing equipment

Any dismantling of existing pipes, suspensions, piping fits, steel supports, valves and all other structural elements and equipment such as tanks, pumps, heaters, coolers etc. is subject to approval from PP Škoda Auto departments.

Iron waste disposal

Based on the project documentation, technical communications will include a decision about the scope, type and quantity of the material to be removed.

The ownership of iron waste can be transferred to the contractor on condition that the revenues generated from such waste are deducted from the total price offered by the contractor.

Non-iron waste disposal – environmentally-friendly disposal

Based on the project documentation, technical communications will include a decision about the scope, type, quantity and environmental impact level of the material to be removed.

The removal and subsequent disposal of non-iron waste needs to be done in compliance with ŠkodaAuto ON.1.032 – Waste Management (organisational standard).

3.6 Rules of Operation

- Will be made for each new site or new energy system requiring RO (such as exchanger station, transfer station, compressor station, cooling station, ventilation system, piping network, HV and LV distribution system, sanitary installations such as septic tanks, pump station separators etc.) - will be handed over to ŠKO – ENERGO during the system takeover.
- Is a set of rules to govern operational processes and responsibilities, staff's obligations, maintenance, safety rules, occupational safety/hygiene rules, emergency measures, operating diary management, operational parameters of equipment, environmental measures.
- The key items of the RO contents will be as follows:
 1. Identification data of the investor, operator and contractor
 2. Important phone numbers
 3. Key technical parameters of the system
 4. Description of the installed system
 5. Instructions for the operation and maintenance
 6. Use, maintenance, operation and servicing responsibilities
 7. Occupational safety and health protection
 8. Fire prevention



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- 9. First aid in case of injuries (e.g. burns, fractures, injuries incl. bleeding, electrical injuries, gas poisonings, caustic burns, etc.)
- 10. Hygiene
- 11. Annexes
- Depending on the system complexity, the final design of the Rules of Operation may vary. The contents may include also other key items.



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Annex No. 1

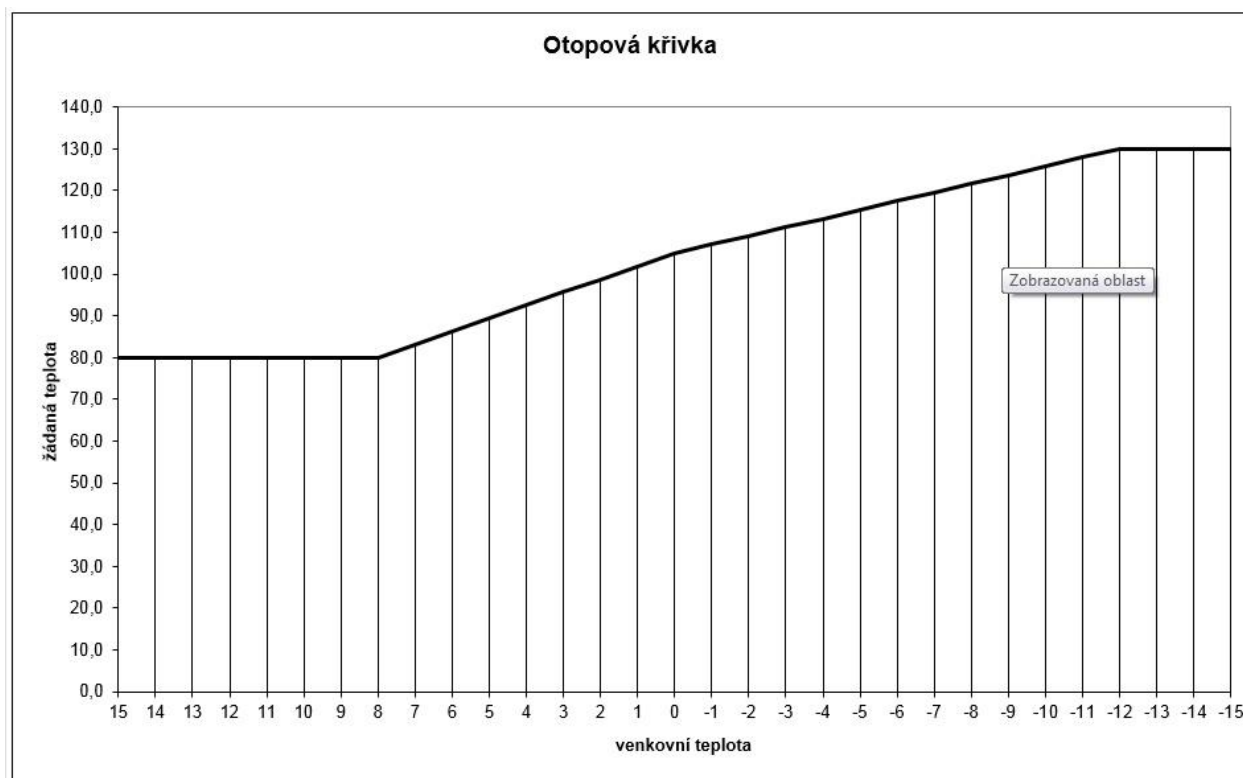


Figure 6: Hot water heating feeders - temperature diagram



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Annex 2

Preferably, the Supplier is obliged to offer and propose in the project documentation the listed systems and components!
Use of components made by other manufacturers or non-standard types is subject to approval from ŠE-ES and PSU/3!

ÚT transfer station

■ Flaps, valves, taps and slides always for pro max. temperatures and pressures	Manufacturer: KSB, Naval, Högfors, Vexve, Meibes, Ballomax, Ebro
■ Control valves Always for pro max. temperatures and pressures and control (regulation) characteristics	Manufacturer: Sauter, Honeywell, Siemens, LDM
■ Control valve drives Always according to the required adjustment speed	Manufacturer: Sauter, Honeywell, Siemens BELIMO drive recommended for up to DN50
■ Heat exchangers Preferably plate exchangers	Manufacturer: Alfa Laval, GEA, Systherm, Danfoss, Sondex

Note: for HW heating - make sure to use suitable plate structures with high thermic length!

Heating systems

■ Heaters (radiators) With regard to operating pressures and temperatures - hot water - warm water	Manufacturer: Jaga, Likon Korado, Kermi, Buderus, Purmi, Dianorm
■ Thermostatic control valves With a pre-setting capability	Manufacturer: TA, Danfoss, Heimeier, Oventrop, Honeywell
■ Balancing valves – manual and automatic - Shall include measurement nipples	Manufacturer: TA, Hydronic Systems, Danfoss, Oventrop, Crane
■ Pumps With regard to operating pressures and temperatures - Hot water PN16 - Warm water PN10	Manufacturer: Wilo, Grundfos, KSB Wilo, Grundfos, KSB
■ Hot air units	Manufacturer: GEA heating units - Sahara, Robur
■ Flaps, valves, taps and slides Always for pro max. temperatures and pressures	Manufacturer: KSB, Naval, Högfors, Vexve, Meibes, Ballomax, Ebro, Siemens
■ Control valves Always for pro max. temperatures and pressures and control (regulation) characteristics	Manufacturer: Sauter, Honeywell, Siemens, LDM
■ Control valve drives Always according to the required adjustment speed	Manufacturer: Sauter, Honeywell, Siemens BELIMO drive recommended for up to DN50



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- | | |
|--|--|
| ■ Pre-insulated piping with detection system | Manufacturer: Uponor Infra Fintherm, Isoplus |
| ■ Piping fits, suspensions | Manufacturer: Hilti, Müpro, Walraven, Sikla
Bohemia |
| ■ Automatic expansion systems | Manufacturer: Reflex |

Note: Use preferably XXXX.20 secondary blinds in Sahara heating units
Ball taps used on hot and warm water piping shall make it possible to replace the O-ring.

HW preparation

- | | |
|--|---|
| ■ Flaps, valves, taps and slides
Always for pro max. temperatures and pressures | Manufacturer:
KSB, Naval, Högfors, Vexve, Giacomini R910,
Meibes, Ballomax, Ebro, Siemens |
| ■ Control valves
Always for pro max. temperatures and pressures
and control (regulation) characteristics | Manufacturer:
Sauter, Honeywell, Siemens, LDM |
| ■ Control valve drives
Always according to the required adjustment speed | Manufacturer:
Sauter, Honeywell, Siemens |
| ■ Heat exchangers
Preferably plate exchangers | Manufacturer:
Alfa Laval, GEA, Systherm, Danfoss, Sondex |
| ■ Pumps | Manufacturer:
Wilo, Grundfos, KSB |

Note: Note: for HW heating - make sure to use suitable plate structures with high thermic length!



6.22 Site Heating and Water Heating Systems

Amended: 2019-08-16

Annex No. 3

Project name:

Balancing valve settings table

Valve No.	Valve type	Dimensio	kv	Valve flow	Valve settings



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Annex No. 4

Heating Test Report¹⁾

Heating system data

Closed system:: yes / no

Heated space:: _____ m³

Volume of water in the heating system: _____ l

Expansion tank size: _____ l

Safety valve – size: _____ MPa (bar)

Boiler type (open dive type “B“ /closed device type “C“)

Heaters warmed up evenly yes / no

Heating test performed by

Date / staff member's signature

¹⁾ Heating tests are conducted to check the system's functionality, settings and adjustment. Heating system data

Contact details

Company that has fitted the heating system

Tel. No. _____

Address _____

Date of putting the heating system into operation _____

**6.22 Site Heating and Water Heating Systems**Amended: **2019-08-16****Annex No. 5****Leakage Test Report**System rinse certificate ¹⁾_____
Date / staff member's signature

¹⁾ 1) The rinse is conducted with dismounted choke shields, water gauges, heat consumption meters and other devices which may get damaged by gathered impurities.

Contact details

Company that has fitted the heating system

Tel. No. _____

Address _____

Date of putting the heating system into operation _____

Contact details:**Company that has fitted the heating system**

Tel. No. _____

Address _____

Date of putting the heating system into operation _____

Company responsible for fitting the wiring and the heating system control

Tel. No. _____

Address _____

Date of connection _____

Source/boiler servicing organisation (maintenance)

Tel. No. _____

Address _____

Date of putting the source into operation _____



6.22 Site Heating and Water Heating Systems

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Annex No. 6

Leakage Test Report: ČSN EN 14336

Project:
Site:

System:

Section tested:

Equipment tested:

**Test type (hydraulic
or pneumatic):**

Test overpressure (bar):

Test duration (hrs):

Operating overpressure (bar):

Temperature [°C]:

Results:

**Confirmation that the system/equipment is
leak-proof and without deformations:**

Note:

Signature:
Report drafted by:
Date:



6.22 Site Heating and Water Heating Systems

Amended: 2019-08-16

Annex No. 7

Pressure Test Report: ČSN EN 14336

Project:
Site:

System:

Section tested:

Equipment tested:

**Test type (hydraulic
or pneumatic):**

Equipment/tools used:

Test overpressure (bar):

Test duration (hrs):

Operating overpressure (bar):

Temperature [°C]:

Results:

Notes:

Signature:
Report drafted by:
Date:



6.22 Site Heating and Water Heating Systems

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Annex No. 8

Operation Test Report: ČSN EN 14336

Project:
Site:

Pump system/equipment:

To be checked:

- A. Outer parts of the pumps are clean
- B. The pumps are fitted in the correct direction of the flow
- C. All components, screws, fasteners and fittings are safe and there is no deformation caused by the tightening.
- D. The blade wheel can rotate freely:
- E. Anti-vibration fastening set to correctly identify vibrations
- F. The piping network does not induce any additional expansion at the pump connection point:
- G. The bearings are clean

Signature:

Report drafted by:

Date:



6.22 Site Heating and Water Heating Systems

Amended: 2019-08-16

Annex No. 9

Control (Regulation) Settings Protocol
ČSN EN 14336Project:
Site:**General:**

To be checked:

- | | |
|---|--------------------------|
| A. All power supply lines are insulated: | <input type="checkbox"/> |
| B. All control (regulation) components are installed correctly: | <input type="checkbox"/> |
| C. Safety devices and locks are in operation: | <input type="checkbox"/> |
| D. All sensors are located/positioned correctly: | <input type="checkbox"/> |
| E. Measurement devices come with up-to-date calibration reports: | <input type="checkbox"/> |
| F. All pump flows and pressures are within the designed tolerances: | <input type="checkbox"/> |
| G. Water temperatures are within the designed tolerances: | <input type="checkbox"/> |
| H. The pressure difference is within the designed tolerances in all devices | <input type="checkbox"/> |

Power supply and cabling:

Pre-activation power supply check

- | | |
|--|--------------------------|
| A. Cabling complies with local standards: | <input type="checkbox"/> |
| B. Cabling complies with requirements laid down by the manufacturer of control (regulation) components | <input type="checkbox"/> |
| C. Earthing done correctly | <input type="checkbox"/> |
| D. Connection in compliance with the manufacturer's wiring diagrams | <input type="checkbox"/> |

Drives

To be checked:

- | | |
|--|--------------------------|
| A. Drives operate (move) correctly: | <input type="checkbox"/> |
| B. Return spring drives operate correctly: | <input type="checkbox"/> |
| C. All power-outage measures are correct: | <input type="checkbox"/> |



6.22 Site Heating and Water Heating Systems

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B. BMS part

1. Introduction

Dealing with measurement & control (regulation) requirements in the area of site heating and water heating systems, this standard is an integral part of ITS 6.22 Site Heating and Water Heating Systems.

1.1. Regulations

BMS (measurement & control) operations shall comply with ŠKODA AUTO ITSs as well as with the following items:

- EU Declaration of Conformity, including CE marking under Act No. 22/1997 Sb., as amended by Act No. 91/2016 Coll..
- Electromagnetic Compatibility (EMC) Directive EC 2014/30/EU
- Directive EC 2014/35/EU on technical requirements for low-voltage electrical equipment
- Government Resolution No. 361/2007 Coll. on occupational health protection requirements as amended by Government Resolution No. 68/2010 Sb., Government Resolution No. 93/2012 Coll. and Government Resolutions No. 9/2013 Coll. and 32/2016 Coll.
- Act No. 86/2000 Coll. on public health protection as amended
- Ministry of Health Decree No. 432/2003 Coll. on job categorisation requirements (e.g. eye strain etc.. as amended by Decrees 107/2013 and 181/2015

Technical standards and related regulations as amended:

- ČSN ISO 3511 - Measurement, management practices and equipment in technological processes
- ČSN ISO 14617 - Graphic symbols in diagrams
- ČSN EN 61297 - Industrial process management systems - Classification of adaptive control units for evaluation purposes
- ČSN EN 61298-2 ed. 2 - Equipment for measurement and management of industrial processes - General methods and processes for evaluation of properties - Part 2: Tests in reference conditions
- ČSN EN 61298-3 ed. 2 - Equipment for measurement and management of industrial processes - General methods and processes for evaluation of properties - Part 3: Tests to identify the effects of process-influencing parameters
- ČSN EN 61511 - Functional safety
- ČSN EN 62682 - Management of signalling systems for industrial processes

1.2. List of abbreviations and terms

HOT WATER HEATING SYSTEM – heating water of the following parameters: PN16, max. 130°C

ÚT – heating water of the following parameters: PN6, max. 110°C

TUV – hot service water of a temperature of +60°C

2. Parameters and scopes required for BMS

2.1. Pressure

Hot water - primary	1,600 kPa
Hot water - secondary	1,000 kPa
ÚT warm water - secondary circuit	600 kPa
Drinking water, industrial water, cooling water	1,000 kPa

Table 10: Media pressure levels

2.2. Temperature

Hot water - primary	0 -150 °C
Hot water for ÚT - secondary	0 -130 °C
TUV warm water - secondary	0 -100 °C
Spatial temperature - interior	0 - 50 °C
Outdoor temperature	-30 - +50 °C



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Table 11: Media temperature levels

3. Heating

3.1. Management system

The AMiT management system with direct Ethernet connection is required for the control of hot/warm water heating applications. The management system is based on ADiS substations (or ADiR, AMiNi, AMiRiS).

Besides this system, the following exceptions are allowed:

- TZV Česana – Honeywell
- Vrchlabí – Johnson Controls

Any other management systems are subject to written approval from the ŠKO-ENERGO ES/2 staff in charge.

To integrate a new technology unit (new substation), make sure to comply with ITS 5.15. Energy Measurement Strategy that specifies the process of integrating visualisation interfaces to the Energis add-on system.

3.2. Global peripheries

- **Tvenk** - outdoor temperature sensor
- **TprostVS** - temperature sensor on the exchanger station/heating machinery station site
- **SH** - exchanger station/heating machinery station flooding sensor with an outlet – contact relay

3.3. Hot water heating supply pipe

The hot water heating supply pipe will be fitted with the following items:

- **T1** - temperature sensor in hot water heating piping – supply pipe
- **T2** - temperature sensor in hot water heating piping – return pipe
- **P1** - pressure sensor in hot water heating piping – supply pipe
- **P2** - pressure sensor in hot water heating piping – return pipe
- **dP1** - differential pressure sensor
- **F1** - flow meter on the supply pipe of the hot water heating network
- **YP1** - two-way control valve with emergency function (spring) on the supply pipe of the hot water heating network
- **YP2** - two-way control valve with emergency function on the return pipe of the hot water heating network

3.3.1. Energy consumption measurement

The use of meters to measure energy consumptions shall reflect the importance of the measurement concerned. Where measurement is required for billing purposes, the system shall be fitted with a properly inspected calorimeter.



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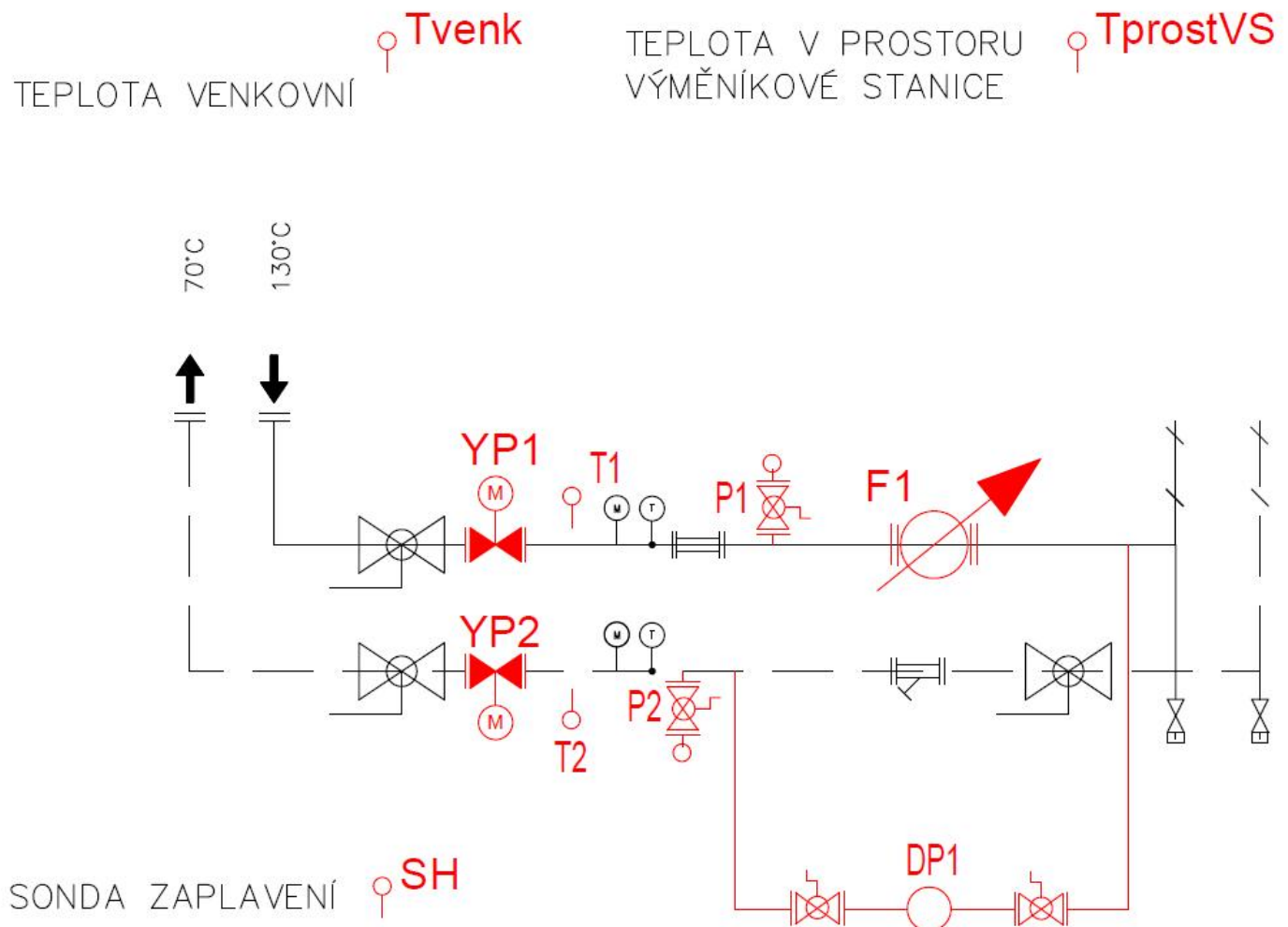


Figure 7: Hot water heating supply pipe – connection diagram

3.3.2. Description of individual elements

T1, T2 - Temperature sensors in hot water heating piping – supply pipe and return pipe

A pair of cable sensors will be used, output 4-20mA, fitted with a display, measurement element Pt100, temperature range 0-150°C, IP65, t. p. 4 with a pit whose length is to reflect the piping dimensions. The sensors will come with a calibration report.

P1, P2 - Pressure sensors in hot water heating piping – supply pipe and return pipe

Pressure sensors for non-aggressive liquids will be used. Sensor range 0-25Bar, output signal 4-20mA/2V or 0-10V, accuracy 0.25. The sensors will be fitted with a display unit for direct data readings. The installation on the piping will be done using manometric shut-off valve with a de-sludging capability. Considering the medium's temperature of over 100°C, a cooling loop shall be fitted, too.

DP1 - Differential pressure sensor in hot water heating piping

A pressure sensor for non-aggressive liquids will be used. Sensor range 0-25Bar, output signal 4-20mA. The sensor will be fitted with a display unit for direct data readings. The installation on the piping will be done using manometric shut-off valve with a de-sludging capability. Considering the medium's temperature of over 100°C, a cooling loop shall be fitted, too.

F1 - Flow meter in hot water heating piping

A flow meter from one of these manufacturers will be used: KROHNE, SIEMENS, COMACAL or other suppliers approved in writing by the ŠKO-ENERGO staff in charge



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The proposed plan needs to take into account the operating range of the flow meter to ensure correct measurement at the set checkpoints. If an induction flow meter is used, the minimum flow rate shall be 0.25m/s, (0.5 m/s for an ultrasound meter). Maximum flow rate of the medium 4m/s. The flow meter will be fitted with a display. If the flow meter is fitted in an inaccessible location, a detached (separate) display will be used. Output signal 4-20mA (instantaneous flow rate) and pulse (total flow) with a max pulse frequency of 3Hz. Temperature range 0-150°C.

YP1 - Two-way control valve with emergency function in hot water heating piping – supply pipe

Valve dimensioned for a max temperature of 130°C at PN16 (pressure parameters shall be maintained throughout the temperature range). Feed-in 24VAC, control 0-10V. Controls the flow to the required level measured by sensor DP1. Safety function activated upon exchanger station flooding indication.

YP2 - Two-way control valve with emergency function in hot water heating piping – return pipe

Valve dimensioned for a max temperature of 110°C at PN16 (pressure parameters shall be maintained throughout the temperature range). Feed-in 24VAC, control OPEN/CLOSED. Safety function activated upon exchanger station flooding indication.

Calorimeter

The solution preferred for internal measurements is calculation of thermal energy consumption in the control substation, without having to fit a calorimeter. Calorimeters are used primarily in connection of heat billing, i.e. invoices issued to third-party customers. The calorimeter fitting requirement needs to be consulted with ŠKO ENERGO as part of the proposed plan. The consumption, instantaneous flow and temperature data (sensed by flow meter) are sent to the control substation (using a communication line).

Calorimeters required: INMAT – ZPA, KROHNE or other products approved in writing by ŠKO-ENERGO staff in charge.

3.4. ÚT exchanger station

The ÚT exchanger station will be fitted with the following items:

- Y2.1 - two-way control valve with emergency function upstream of the ÚT exchanger – for low flows
- Y2.2 - two-way control valve with emergency function upstream of the ÚT exchanger – for high flows
- T10 - temperature sensor downstream of the ÚT exchanger - supply pipe
- TB2 - emergency thermostat downstream of the ÚT exchanger - supply pipe
- P6 - pressure sensor downstream of the ÚT exchanger - return pipe
- Y3 - shut off valve (ball tap/solenoid valve) for refilling the medium from the primary circuit
- Y4 - shut off valve (ball tap/solenoid valve) for draining the medium from the secondary circuit
- VP1 - water meter for replenishing the secondary circuit with the medium
- MC3.1 (MC3.2) - pump(s) downstream of the ÚT exchanger
- SX1 - automatic expansion system

3.4.1. General description of the ÚT exchanger station

The temperature of water in the ÚT distribution network is controlled by cascaded two-way control valves. When it becomes necessary to heat water in the secondary circuit, the first step is to control the temperature via valve Y2.1 (for low flows). If the required temperature is not reached after 100% opening, control valve Y2.2 opens up in the cascade (for high flows). Both control valves feature an emergency function (when the situation is identified as an emergency by the control system, the valves close automatically). The heating water from the ÚT circuits enters the exchanger station via a shut-off valve and filter to prevent mechanical impurities from getting into the exchanger station equipment. The exchanger can be closed by means of valves. The exchanger exit point is fitted with a safety valve and temperature control sensor. The system shall also be fitted with emergency thermostats to signal an emergency condition in the event of exceeding the required temperature (up to 140-150°C).

Forced circulation of heating water in the heated building is ensured by means of a single pump or a set of pumps. If multiple pumps are in place, each of them is fitted with a shut-off valve and return flap. The temperature and pressure of the heating water in the ÚT distribution network are measured with a thermometer and manometer. The ÚT circuit terminates with a shut-off valve.



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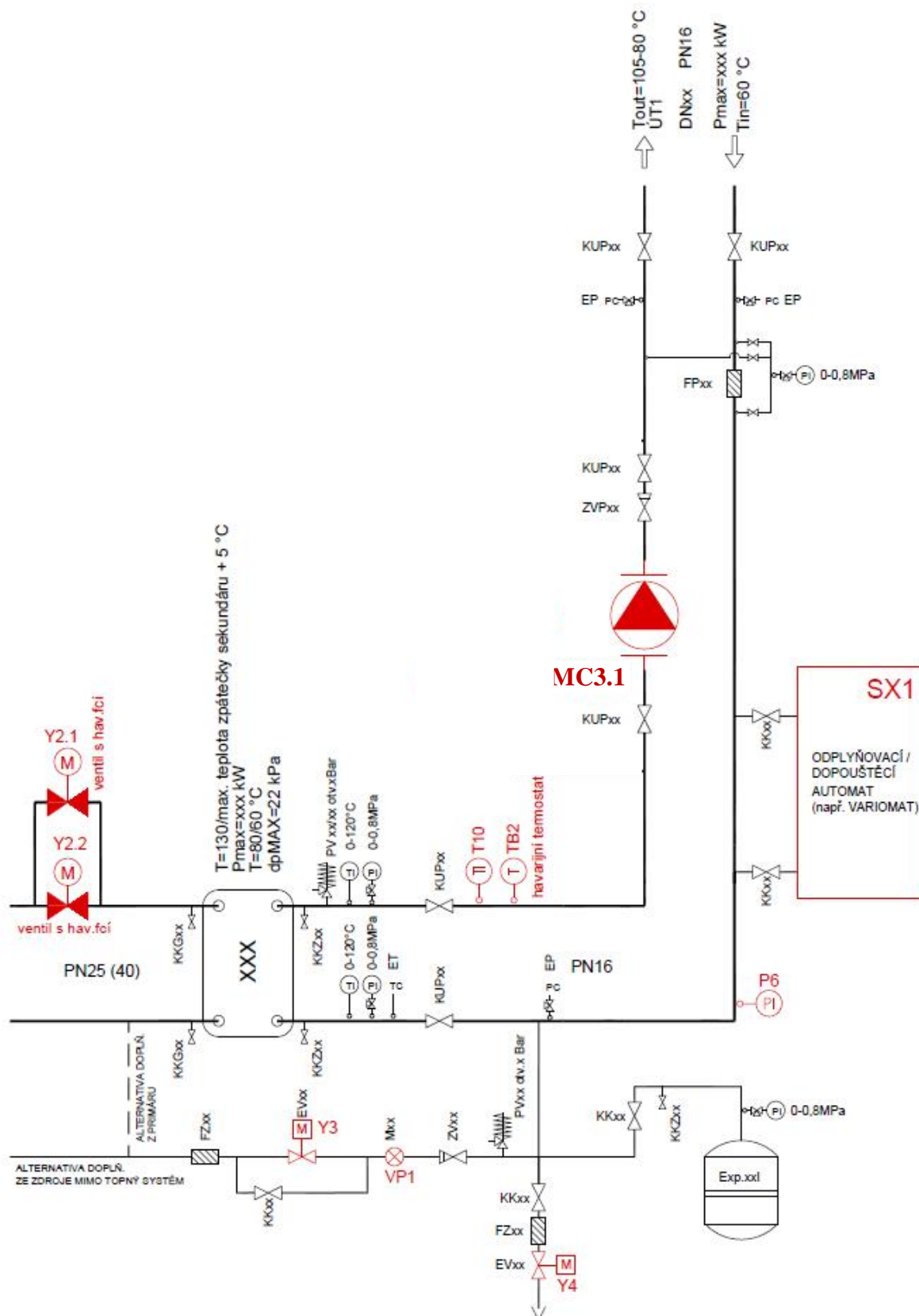


Figure 8: ÚT exchanger station – connection diagram



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3.4.2. Description of individual elements of the ÚT exchanger station and their functions/roles:

Y2.1, Y2.2 - Two-way control valves with emergency function upstream of the ÚT exchanger

The valves will be dimensioned for a max. temperature of 130°C at PN16 (pressure parameters shall be maintained throughout the temperature range). Feed-in 24VAC, control 0-10V.

The valve's control function is cascade-arranged. When it becomes necessary to heat water in the secondary circuit, the first step is to control the temperature via valve Y2.1 (for low flows). If, after 100% opening, the required temperature is not reached, control valve Y2.2 opens up in the cascade (for high flows).

The safety function is activated in response to exchanger station flooding indication and in the event of exceeding the emergency temperature (sensed by an emergency thermostat).

T10 - Temperature sensor downstream of the ÚT exchanger

Stem or cable sensor with a pit whose length is determined by the piping dimensions, output 4-20mA, fitted with a display. Temperature range 0-150°C. The sensor controls the two-way emergency valve upstream of the ÚT exchanger and thus controls the temperature in the secondary piping, either according to the equithermal curve or to a constant level.

TB2 - Emergency thermostat downstream of the ÚT exchanger

Closes the emergency control valve upstream of the ÚT exchanger in the event of exceeding the set temperature. Temperature range up to 140°C.

P6 - Pressure sensor in the secondary circuit of the ÚT exchanger

A relative pressure sensor for non-aggressive liquids will be used. Sensor range 0-10Bar (with a standard pressure of 6Bar in the secondary circuit), output signal 4-20mA/2V or 0-10V, accuracy 0.35. The sensor will be fitted with a display unit for direct data readings. The installation on the piping will be done using a shut-off valve. This sensor controls the solenoid valves for refilling and draining (of the medium) in the secondary circuit (constant pressure control).

3.4.3. Alternative solution for refilling the medium to the secondary circuit - direct

Y3 - Shut off valve (ball tap/solenoid valve) for refilling the medium from the primary circuit

The valve shall be able to close against a pressure of PN16. The drive shall feature a safety function (e.g. a spring) to ensure that the valve closes without voltage. The refilling is controlled by a pressure sensor in the secondary circuit. When the pressure drops, the valve opens up and the medium is refilled from the primary circuit.

Y4 - Shut off valve (ball tap/solenoid valve) for draining the medium from the primary circuit

The valve shall be able to close against pressure (depending on the pressure parameters downstream of the exchanger – usually PN6). The drive shall feature a safety function (e.g. a spring) to ensure that the valve closes without voltage. The draining is controlled by a pressure sensor in the secondary circuit. When the pressure is exceeded, the valve opens up and the medium is drained from the secondary circuit.

If any of the valves is open for more than 15 minutes, such condition is considered to be an emergency and both valves get closed.

3.4.4. Alternative solution for refilling the medium to the secondary circuit - VARIOMAT

If an automatic expansion system is in place, the solenoid valves for refilling and draining will be connected and controlled directly from such automatic system. The control system will feature an indicator to signal failures of the expansion system.

VPI - Water meter for replenishing the secondary circuit with the medium

The water meter will be connected to the BMS system using a pulse output to read the total quantity of the medium taken for the secondary circuit.

MC3.1, MC3.2 - Pumps in the secondary circuit downstream of the exchanger

One or two pumps may be fitted to increase the pressure and the transport distance (if two are in place, they work in a 100% back-up mode). Each of the pumps can be controlled with a controller on the distributor door, in a 0/1/AUT mode. The control system will feature an indicator to signal automatic operation. The distributor door will also be fitted with an operation/failure indicator. The operation indication (green) will be derived from the auxiliary contact of the contactor. The failure indication will be done from the safety element and, in some cases also directly from the pump (if made possible by the pump) - (yellow) indicator.

If two pumps in a 100% back-up mode are in place, if one of them fails, the system automatically activates the other one. In summertime (shutdowns) the circulation pump will be turned once a week for 2 minutes.



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3.5. TUV exchanger station – tank heating

The TUV exchanger station will be fitted with the following items:

- Y1 - Two-way control valve with emergency function upstream of the TUV exchanger
- MC4 - pump in the primary circuit for the TUV exchanger
- T5 - temperature sensor downstream of the TUV exchanger - supply pipe
- TB1 - emergency thermostat downstream of the TUV exchanger - supply pipe
- T6 - TUV tank temperature sensor
- T7 - temperature sensor at the exit point from TUV preparation
- T8 - temperature sensor on the TUV circulation piping
- EH1 - electric heating in the TUV tank
- TB3 - emergency thermostat in the TUV tank
- MC2 - TUV circulation pump
- V1 - water meter on the drinking water supply pipe to the TUV tank
- Y5 - automatic de-sludging valve from the TUV tank
- T9 - temperature sensor on the drinking water supply pipe

Note: Older applications also feature a charge pump (MC1). This pump has been abandoned in the new connection solution.

3.5.1. General description of the TUV exchanger station

Primary part

The primary medium enters the exchanger station equipment via shut-off valve KKPxx. This point is fitted with a thermometer/temperature meter. Filter FPxx prevents mechanical impurities from getting into the transfer station. The parameters of the primary medium are also measured with a manometer. A pressure measurement set makes it possible to measure pressure in various locations of the primary circuit using a single manometer. It is possible to measure pressure on the supply and return pipes as well as pressure drops (and filter clogging). The safety solution takes the form of a two-way control valve with an emergency function that is connected with an emergency thermostat on the secondary side of the exchanger piping. The primary part of the exchanger station can be drained through a drain valve.

Temperature reduction module

A mixer pump (MC4) is required in all cases (regardless of TUV hardness) to mix primary supply water with cooled return water. This way it is possible to reduce the temperature of the heating water to max. 65°C (and also reduce the risk of exchanger clogging).

Secondary part

The primary medium is brought to a plate exchanger to heat the cold water that enters the station. The required TUV temperature is controlled by a two-way control valve (Y1) with a drive – the drive features an emergency function. **To make it possible to check the clogging of the plate exchanger, its inlets and outlets shall be monitored by temperature sensors (4 – on each inlet/outlet). If the additional cooling efficiency deteriorates (ΔT grows by more than 15K), the system software is required to indicate such condition (planned maintenance).**

The cold water enters the station via a shut-off valve, filter and return flap. The cold water pressure is measured with a manometer. The water meter (V1) will be connected to the BMS system using a pulse output to read the total quantity of the medium taken for TUV. The drain valve can be used to check the functionality of the return valve.

The TUV circulation part enters the station via a shut-off valve, filter and return flap. The TUV circulation is enabled by a pump. The circulation temperature is measured with a thermometer. The TUV temperature at the exit from the exchanger is sensed by a sensor. A sensor sensing the temperature in the exchanger is used to improve the efficiency of the control (regulation) process (used in TUV heating with accumulation!). A temperature drop indicates an increased TUV consumption. The station shall be fitted with an emergency thermostat. A thermometer is used for visual TUV temperature checks, a manometer for pressure checks. The



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TUV outlet terminates with a shut-off valve. The secondary part shall make it possible to “skip”/deactivate the accumulation tank (breakdown, repair, maintenance, de-sludging, etc.).

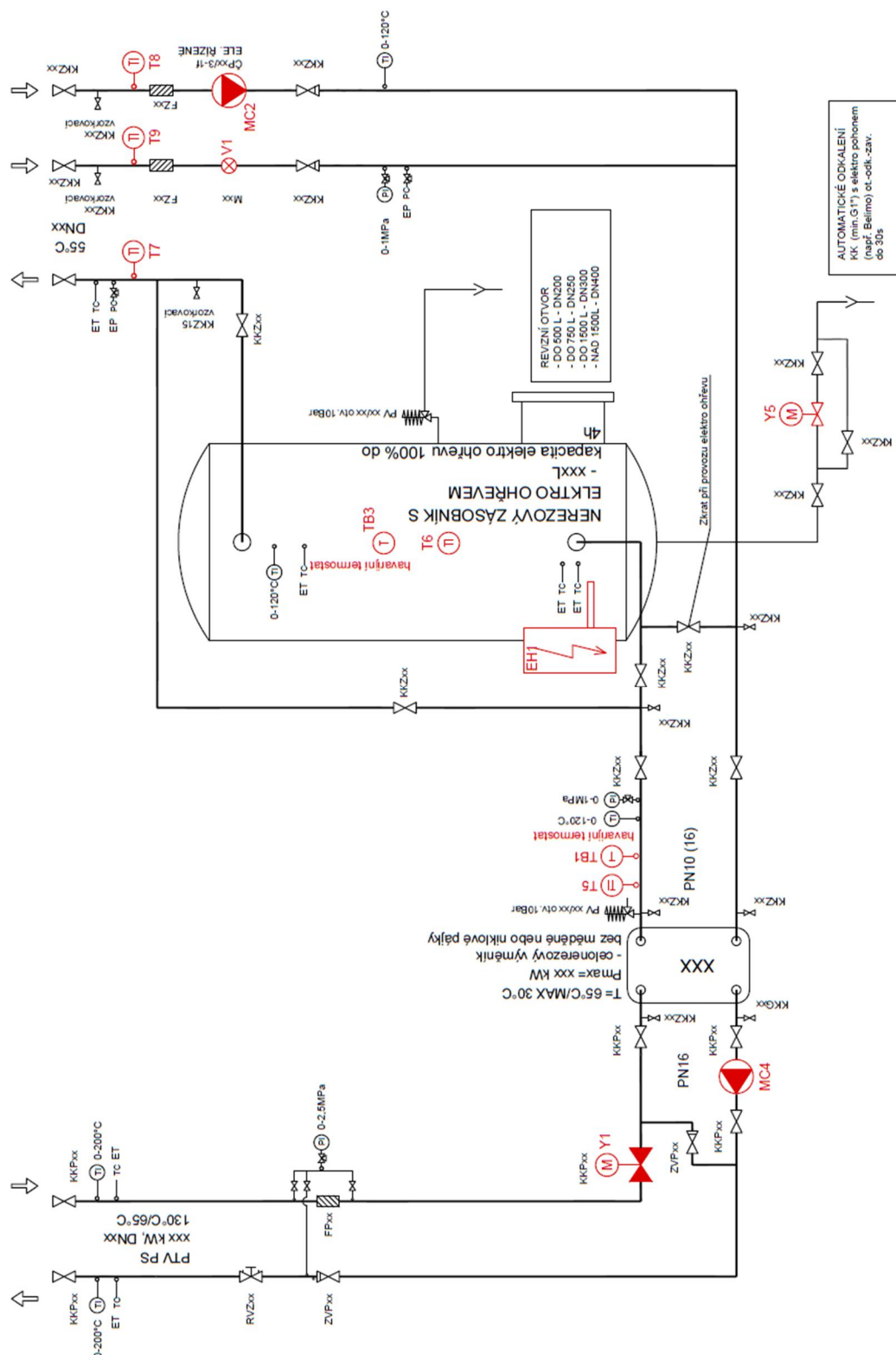


Figure 9: TUV exchanger station – connection diagram



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3.5.2. Description of individual elements of the TUV exchanger station and their functions/roles:

Y1 - Two-way control valve with emergency function upstream of the TUV exchanger

Valve dimensioned for a max temperature of 130°C at PN16 (pressure parameters shall be maintained throughout the temperature range). Feed-in 24VAC, control 0-10V. The safety function is activated in response to exchanger station flooding indication and in the event of exceeding the emergency temperature (sensed by emergency thermostat TB1 on the secondary piping downstream of the exchanger).

MC4 - Primary circuit pump upstream of the TUV exchanger

This pump operates together with the two-way control valve to control the flow of the medium through the primary circuit upstream of the TUV exchanger. The pump is activated as the two-way control valve opens up. The pump can also be controlled with the controller on the distributor door, in a 0/1/AUT mode. The control system will feature an automatic operation indicator (from the switch). The distributor door will also be fitted with an operation/failure indicator. The operation indication (green) will be derived from the auxiliary contact of the contactor. The failure indication will be done from the safety element and, in some cases also directly from the pump (if made possible by the pump) - (yellow) indicator.

T5 - Temperature sensor downstream of the TUV exchanger

Stem or cable sensor with a pit whose length is determined by the piping dimensions, output 4-20mA, fitted with a display. Temperature range 0-100°C. The sensor controls the two-way emergency valve upstream of the TUV exchanger and thus controls the temperature in the secondary piping, setting it to a constant level of +60°C.

TB1 - Emergency thermostat downstream of the TUV exchanger

Closes emergency control valve Y1 upstream of the TUV exchanger in the event of exceeding the set temperature. Temperature range up to 90°C.

T6 - TUV tank temperature sensor

Stem or cable temperature sensor designed to be put into a G ½" pit in the tank; output 4-20mA, fitted with a display. Temperature range 0-100°C. The sensor controls the charge pump in the hot water heating mode and the electric heating cell in the electric heating mode.

EH1 - Electric heating in the TUV tank

The electric heating is meant to heat the TUV tank in periods when it is not heated by the hot water heating system. Before the electric heater is activated, the valve on the primary circuit of the hot water heating system has to be closed, and the operation of the pump in the primary circuit upstream of the TUV exchanger and the charge pump shall be disabled all the time. The electric heating process is activated by the temperature sensor in the TUV tank, and its deactivation by the emergency thermostat in the same place. Temperature range - same as for hot water heating.

TB3 - Emergency thermostat in the TUV tank

Disconnects the electric heating cell upon exceeding the set temperature of +60°C (contactor-controlled safety deactivation). Temperature range up to 90°C.

MC2 - TUV circulation pump

This pump is activated for periods of expected consumption. The pump can also be controlled with the controller on the distributor door, in a 0/1/AUT mode. The control system will feature an automatic operation indicator (from the switch). The distributor door will also be fitted with an operation/failure indicator. The operation indication (green) will be derived from the auxiliary contact of the contactor. The failure indication will be done from the safety element and, in some cases also directly from the pump (if made possible by the pump) - (yellow) indicator. When the TUV heating is switched from the hot water heating network to electric heating, circulation pump MC2 remains in automatic operation. If this circulation pump (MC2) fails, the electric heating is deactivated.

VI - Water meter on the drinking water supply pipe to the TUV tank

The water meter will be connected to the BMS system using a pulse output to read the total quantity of the medium taken for TUV.

T7 - Temperature sensor at the exit point from the TUV tank

Stem or cable temperature sensor designed to be put into a G ½" pit in the piping at the exit from the TUV tank to monitor the output temperature (for consumption); output 4-20mA, fitted with a display. Temperature range 0-100°C. The sensor only has a monitoring role, the data are saved in time tables in the control room software.

T8 - Temperature sensor on the TUV circulation piping



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Stem or cable temperature sensor designed to be put into a G ½" pit in the TUV circulation piping for monitoring; output 4-20mA, fitted with a display. Temperature range 0-100°C. The sensor only has a monitoring role, the data are saved into time tables in the control room software.

T9 - Temperature sensor on drinking water piping

Stem or cable temperature sensor designed to be put into a G ½" pit in the drinking water piping for monitoring; output 4-20mA, fitted with a display. This sensor is required to be fitted on the drinking water supply pipe (entering the building), i.e. is not necessarily part of the exchanger station. The sensor only has a monitoring role, the data are saved into time tables in the control room software.

Z5 - TUV tank de-sludging valve

The servo drive of the de-sludging valve will be activated based on a predefined user-set schedule. The period over which the de-sludging valve is to be open will also be set by the user.

TUV piping temperature sensor – end of the distribution network

Stem or cable temperature sensor designed to be put into a G ½" pit in the TUV piping at the farthestmost point of the TUV circulation network for monitoring. The location and necessity of this sensor shall be consulted with the ŠKO-Energo staff in charge.

3.6. Heating machinery station and warm water branches

Depending on the actual configuration, the heating machinery station will be fitted with the following items:

Heating branch with equithermal curve-based temperature control

- Control valve for heating branch temperature control (Y10, Y11,...)
- Pump in the regulated branch (MC10, MC11,...)
- Supply water temperature sensor to control the control valve (T10.1, T10.2, ...)

Heating branch without equithermal curve-based temperature control

- Heating branch pump (identification - numerical line on the distributor)

3.6.1. Description of individual elements of the heating machinery station and their functions/roles:

Heating branch with equithermal curve-based temperature control

Control valve for the controlled (regulated) branch (Y10, Y11,)

Valve dimensioned for a temperature range according to max. temperature in the secondary circuit, pressure-dependent. Feed-in 24VAC, control 0-10V. The control valve is controlled by a supply water temperature sensor on the equithermal curve-regulated water piping. In some cases the temperature is set to a constantly reduced level.

Pump on the controlled-temperature branch (MC10, MC11,)

The pump operates along with a control valve. The pump can also be controlled with the controller on the distributor door, in a 0/1/AUT mode. The control system will feature an automatic operation indicator (from the switch). The distributor door will also be fitted with an operation/failure indicator. The operation indication (green) will be derived from the auxiliary contact of the contactor. The failure indication will be done from the safety element and, in some cases also directly from the pump (if made possible by the pump) - (yellow) indicator.

Supply water temperature sensor (T10.1, T10.2, ...)

Stem, cable or surface sensor; output 4-20mA, fitted with a display. Temperature range 0-130°C. The sensor controls the control valve in the heating branch, thus controlling the exit temperature as required by the system.



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4. General rules for programming of ES control substations

- I.Design the control system on individual sites in line with the BMS strategy and with interfaces to the control system in use on the site concerned.
- II.The control function (regulation sequence) of each controller is provided by control SW that shall be designed for the particular equipment function, in line with the project plan. Each regulator shall be completely autonomous (island operation). The above requirement does not apply to applications including data transmissions among individual controllers. In such case, however, the maintenance and operation staff need to be informed accordingly.
- III.Regulators may differ in terms of the number of connectable HW I/O (inlets/outlets), and the station shall make it possible to provide the operator with access to the application SW, i.e. the possibility to monitor up-to-the-minute data and failure statuses while setting basic control, programme-related and scheduling parameters, etc. Access is possible by connecting an external control panel with an LCD display.
- IV.The controller name shall identify the type of the applied programme relevant to the connected technological equipment. This name is important in uploading the programme to the regulator and/or in accessing the regulator from CMS (central monitoring system). The name shall be unique across the whole system.
- V.The name of the data point shall identify the station with the application programme for easy tracking when accessing the system from CMS.

4.1. Point name examples

D8_2_Tvenk	°C	Local outdoor temperature
D8_2_TprostVS	°C	Exchanger station site temperature
D8_2_P1	MPa	Pressure P1 hot water heating network 0-16bar supply
D8_2_P2	MPa	Pressure P2 hot water heating network 0-16bar return
D8_2_P3	MPa	Pressure P3 downstream of pressure control
D8_2_dP1	kPa	Pressure difference dP1
D8_2_P6	MPa	Secondary circuit pressure P6 UT
D8_2_Ti1	°C	How water heating flow
D8_2_TUV_T5	°C	Secondary circuit TUV exit temperature
D8_2_UT_T10	°C	Temperature T10 UT
D8_2_TUV_T6	°C	Temperature TUV tank
D8_2_TUV_T7	°C	Temperature TUV tank
D8_2_TUV_T8	°C	Temperature TUV exit from the building
D8_2_T102	°C	Temperature supply UT2 T10.2
D8_2_T103	°C	Temperature supply UT3 T10.3
D8_2_T106	°C	Temperature supply UT6 T10.6
D8_2_T1	°C	Temperature T1 hot water heating supply
D8_2_T2	°C	Temperature T2 hot water heating return
D8_2_HUV_YP1	%	Opening HUV (main water valve)
D8_2_HUV_YP2	%	HUV (main water valve) opening
D8_2_Y2_UTpredreg	%	Opening Y2 UT control valve
D8_2_TUV_Y1	%	Opening Y1 control valve TUV
D8_2_UT_Y22	%	Opening valve UT2 Y2.2 gate air curtain
D8_2_UT_Y23	%	Opening valve UT2 Y2.3 sahara hall
D8_2_UT_Y26	%	Opening valve UT6 Y3.6 vestavky JIH
D8_2_ENE_dt	°C	
D8_2_ENEKW	MW	

Table 12: Point name examples



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4.2. Description of control (regulation) sequences

4.2.1. Description of control (regulation) sequences for 130/70°C transfer station

Differential pressure control

The circuit responsible for controlling the pressure available in the transfer station is controlled in response to the required differential pressure at the (VA) point; this level is adjustable by the staff. The level of this differential pressure is sensed by a differential pressure sensor marked dP1 in the respective diagram. The control takes the form of PID – changing the position of control valve YP1 on the supply pipe.

Emergency function

When the machinery station flooding signal comes on, both valves (supply YP1 and return YP2) are closed for the whole duration of the breakdown condition, and are only opened by the staff after the defect has been fixed and the system unblocked.

4.2.2. ÚT station control (regulation) sequence description

Heating water temperature control

The circuit to control the temperature of the heating water at the point of exit to ÚT (sensor T10) is controlled in response to the required temperature at the (VA) point; this level is adjustable by the staff. The control is conducted by a PID controller that controls the position of the ÚT heating control valve (Y2).

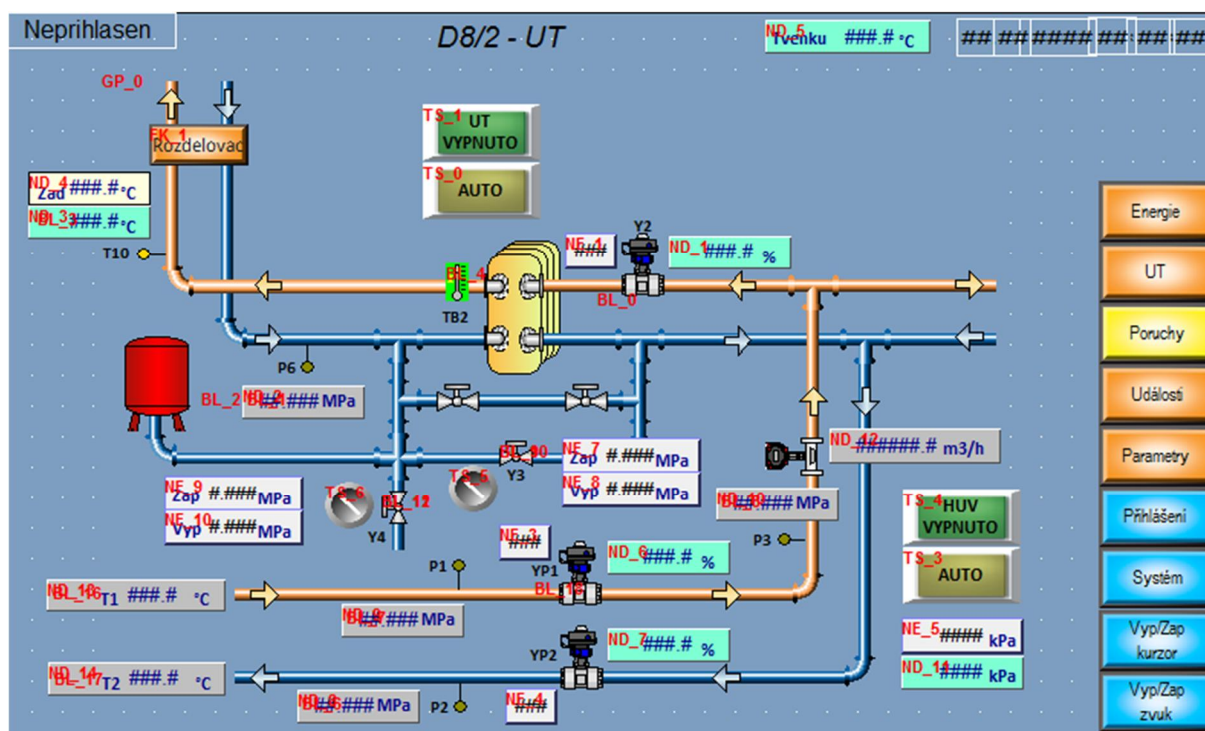


Figure 10: Screen preview - 130/70°C transfer station and ÚT station control

4.2.3. Control (regulation) sequence description - refilling the medium to the secondary circuit (constant pressure control)

The system pressure is controlled by setting the pressure for activation and deactivation of water refilling (into the system). These levels can be changed/adjusted by the staff. The secondary circuit is fitted with a pressure sensor marked P6. Based on pressure measurement and assessment, when the pressure drops below the level set for activation, the refill solenoid valve (Y3) opens up. When the pressure increases above the level set for deactivation, the refill solenoid valve (Y3) closes. The heating system is controlled also in terms of overpressure. The pressure is measured by sensor P6, and when it increases above the level set for draining activation, the solenoid valve opens on. When it drops below the level set for draining deactivation, the valve closes.

Emergency functions:



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- Long system refilling (valve Y3)
- Long system draining (valve Y4)
- Frequent system refill
- Low pressure in the secondary system (sensor P6)
- Overheating the exchanger outlet (sensor TB2)

4.2.4. TUV station control (regulation) sequence description

The temperature of hot service water is controlled in response to the required TUV level; this level can be changed by the staff or scheduled.

The output of the counter-flow heater is controlled by a PID controller - control valve position (Y1). The temperature of water is measured by a service water temperature sensor downstream of the exchanger (T5).

The temperature of hot service water in the electro mode is controlled in response to the required TUV level; this level can be changed by the staff or scheduled. The output of the electric heater is controlled by activating the control of the electric radiator. The temperature of water is measured by a service water temperature sensor in the exchanger (T6).

Emergency functions

- Pump failures (MC3.2)
- Overheating the outlet downstream of the TUV exchanger (thermostat TB1)
- Overheating the TUV tank (thermostat TB2)

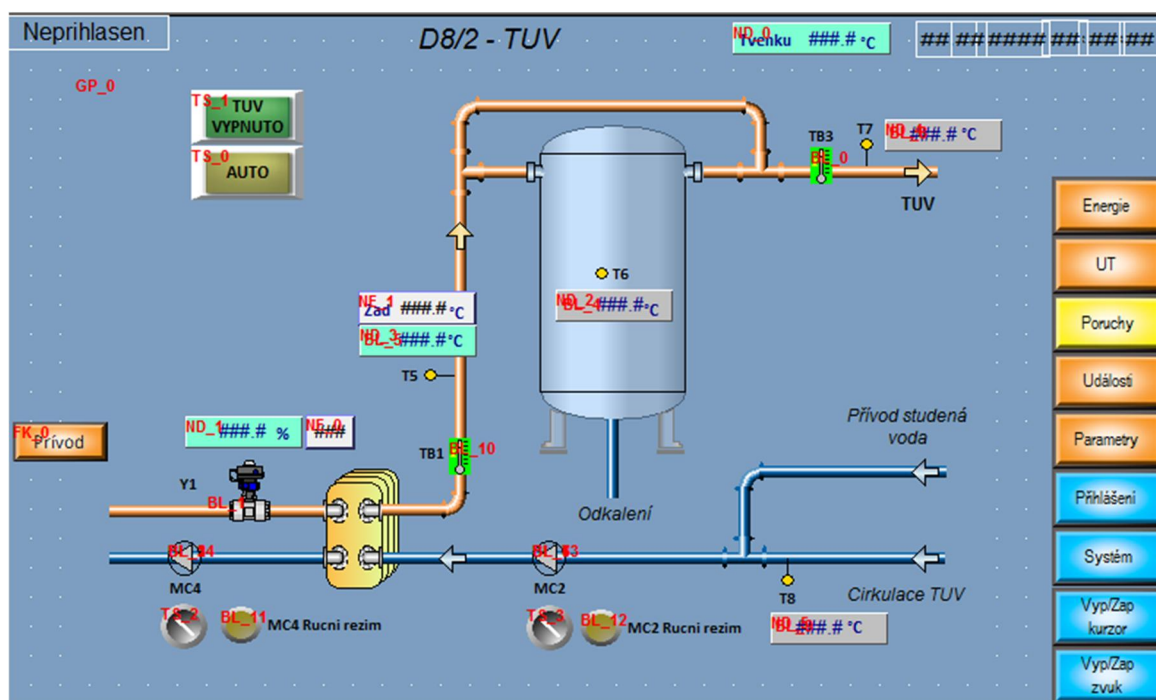


Figure 11: Screen preview - TUV control

Emergency functions

- Overheating TUV at the exit point (TB1 and TB3)
- The system closes the control valve (Y1) for the whole duration of the breakdown condition, and this valve is only opened by the staff after the defect has been fixed and the system unblocked.
- Pump failures (MC4, MC2)



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4.2.5. Description - heating machinery station and hot water branch control (regulation) sequence

Heating water temperature control (regulation)

The circuit to control the temperature of heating water at the outlet to the heating circuit (sensor T10.x) is controlled in response to the required temperature calculated based on the equithermal curve. The thermal curve can be changed by the staff (by changing the reference point) - outdoor temperature and heating water temperature. The settings (parameters) shall be accessible to the staff. The control is conducted by a PID controller that controls the position of the heating control valve on the branch concerned (Y2.x.). The circulation pumps on the heating branches are activated upon the valve-open command and come with an adjustable after-run function.

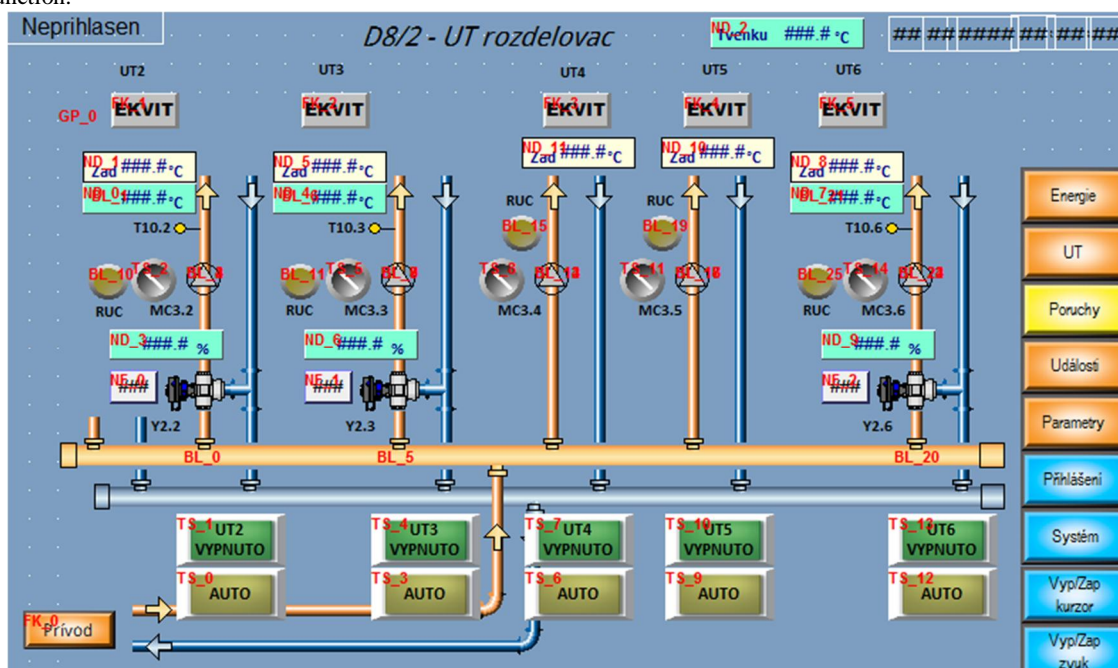


Figure 12: Screen preview - hot water heating branches

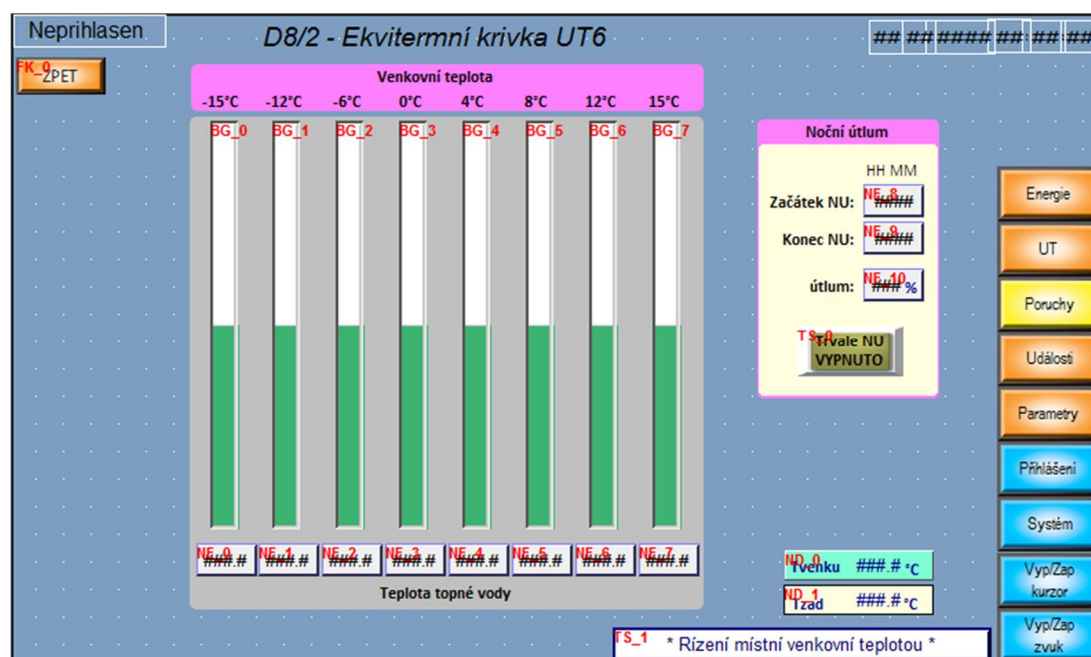


Figure 13: Screen preview - equithermal curves



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4.2.6. Control (regulation) sequence description – emergency and failure statuses

The control system comes with a series of pre-programmed emergency statuses that block the individual sequences or the whole transfer station.

4.2.7. Sample-station failures – list of examples

D8_2_HWErr_Tvenk	Failure - local outdoor temperature sensor
D8_2_HWErr_TprostVS	Failure - exchanger station site temperature sensor
D8_2_HWErr_P1	Failure - pressure sensor P1 hot water heating network 0-16bar supply
D8_2_HWErr_P2	Failure - pressure sensor P2 hot water heating network 0-16bar return
D8_2_HWErr_P3	Failure - pressure sensor P3 downstream of pressure control
D8_2_HWErr_dP1	Failure - differential pressure sensor
D8_2_HWErr_P6	Failure - pressure sensor P6 UT secondary pre-control
D8_2_HWErr_Ti1	Failure - temperature sensor Ti1 hall site
D8_2_HWErr_TUV_T5	Failure - temperature sensor secondary circuit TUV exit
D8_2_HWErr_UT_T10	Failure - pre-control temperature sensor T10 UT
D8_2_HWErr_TUV_T6	Failure - temperature sensor TUV tank
D8_2_HWErr_TUV_T7	Failure - temperature sensor TUV tank
D8_2_HWErr_TUV_T8	Failure - temperature sensor TUV exit from the building
D8_2_HWErr_T102	Temperature supply UT2 T10.2
D8_2_HWErr_T103	Temperature supply UT3 T10.3
D8_2_HWErr_T106	Temperature supply UT6 T10.6
D8_2_HWErr_T1	Temperature T1 hot water heating supply
D8_2_HWErr_T2	Temperature T2 hot water heating return
D8_2_Err_Zaplav	Machinery station flooding
D8_2_Err_HeatVS	Exchanger station site overheating 45°C
D8_2_Err_TmaxDopUT	Failure - UT pre-control refill time
D8_2_Err_TlakSekUT	Minimum pressure in secondary UT
D8_2_Err_TmaxOdpUT	Failure - long UT drain time
D8_2_Err_CasteDopousteniUT	Frequent refilling of UT pre-control
D8_2_Err_UT_Pretop	Overheating the pre-control UT exchanger outlet
D8_2_Err_UT1_CerpMC31	Failure - pump MC3.1 branch UT1
D8_2_Err_UT1_CerpMC31Jist	Failure - pump fusing MC3.1 UT1 branch
D8_2_Err_UT_Y2Regul	Failure - UT Y2 pre-control
D8_2_Err_HUV_YP1	Failure - HUV YP1 valve operation - supply
D8_2_Err_HUV_YP2	Failure - HUV YP2 valve operation - return
D8_2_Err_TUV_CerpMC2	Failure - MC2 TUV circulation pump
D8_2_Err_PrimerCerpMC4	Failure - primary circuit pump MC4
D8_2_Err_TUV_CerpMC2Jist	Failure - MC2 TUV circulation pump fusing
D8_2_Err_PretopTUV	Failure - TUV overheating
D8_2_Err_PrimerCerpMC4Jist	Failure - primary circuit pump fusing MC4
D8_2_Err_TUV_Y1Regul	Failure - TUV Y1 control
D8_2_Err_HUVRegul	Failure - HUV control
D8_2_Err_PretopTUVout	Failure - TUV outlet overheating
D8_2_Err_TUV_MC2_NoAut	Manual operation of TUV MC2 - door switch
D8_2_Err_Primer_MC4_NoAut	Manual operation of primary MC4 pump - door switch
D8_2_Err_UT1_MC31_NoAut	Manual operation of UT1 MC3.1 pump - door switch
D8_2_Err_UT2_MC32_NoAut	Manual operation of UT2 MC3.2 pump - door switch
D8_2_Err_UT3_MC33_NoAut	Manual operation of UT3 MC3.3 pump - door switch
D8_2_Err_UT4_MC34_NoAut	Manual operation of UT4 MC3.4 pump - door switch
D8_2_Err_UT5_MC35_NoAut	Manual operation of UT5 MC3.5 pump - door switch
D8_2_Err_UT6_MC36_NoAut	Manual operation of UT6 MC3.6 pump - door switch



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D8_2_Err_Modbus	MODBUS communication failure
D8_2_Err_Modbus_Inmat_Adr1	Inmat communication failure address 1
D8_2_Err_UT6_Y26regul	Failure - UT6 control annex office Y2.6
D8_2_Err_UT3_Y23regul	Failure - UT3 sahara hall control Y2.3
D8_2_Err_UT2_CerpMC32	Failure - pump MC3.2 branch UT2
D8_2_Err_UT2_CerpMC32Jist	Failure - pump fusing MC3.2 branch UT2
D8_2_Err_UT3_CerpMC33	Failure - pump MC3.3 branch UT3
D8_2_Err_UT3_CerpMC33Jist	Failure - pump fusing MC3.3 branch UT3
D8_2_Err_UT4_CerpMC34	Failure - pump MC3.4 branch UT4
D8_2_Err_UT4_CerpMC34Jist	Failure - pump fusing MC3.4 branch UT4
D8_2_Err_UT5_CerpMC35	Failure - pump MC3.5 branch UT5
D8_2_Err_UT5_CerpMC35Jist	Failure - pump fusing MC3.5 branch UT5
D8_2_Err_UT6_CerpMC36	Failure - pump MC3.6 branch UT6
D8_2_Err_UT6_CerpMC36Jist	Failure - pump fusing MC3.6 branch UT6
D8_2_Err_UT2_Y22regul	Failure - UT2 control gate air curtain Y2.2

Table 13: Sample-station failure list

4.2.8. Control (regulation) sequence description – system parameters

The control system features pre-programmed loops for individual control circuits (PID regulators). Their parameters are available to the staff that can thus intervene in the parameter settings.

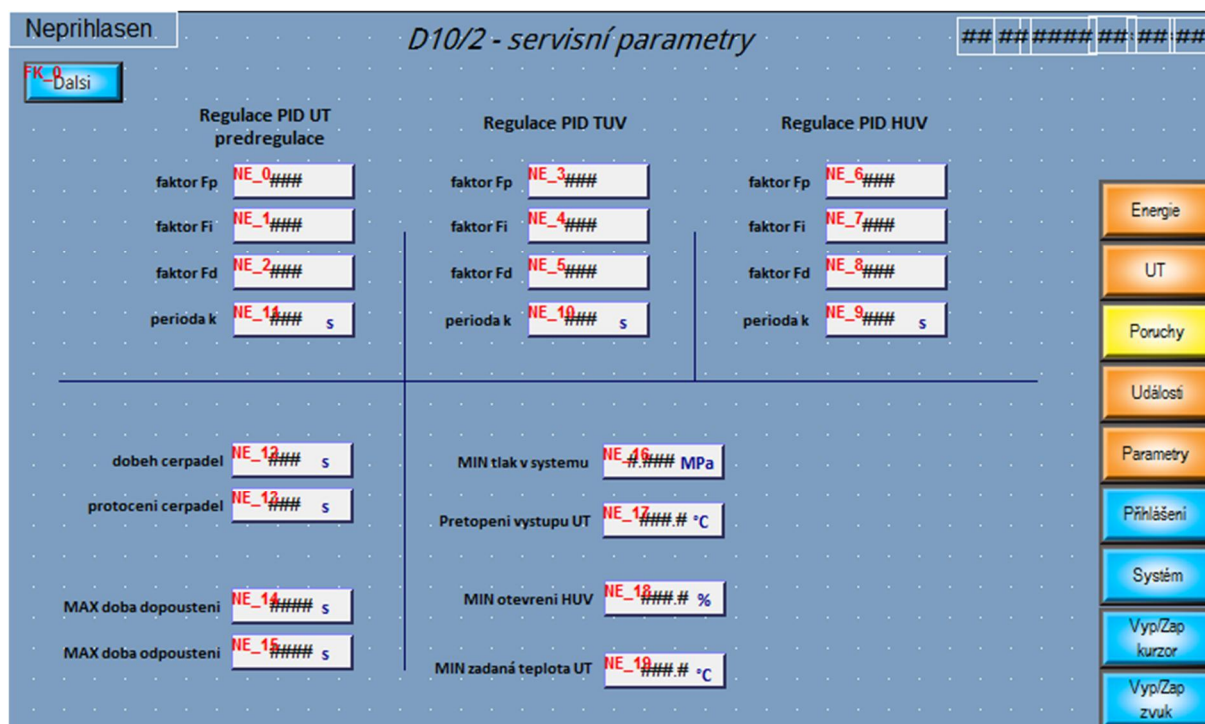


Figure 14: Screen view - service parameters

5. Scope of documentation

5.1. Construction implementation documents – minimum requirements

- Technical Report
- List of equipment – energy requirements
- List of control system inputs and outputs



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- Cabling list
- Control (regulation) diagram
- Ground plan
- Distributor - linear single-pole connection
- Functional links diagram

5.2. As-built documents – minimum requirements

- Technical Report
- List of control system inputs and outputs
- Control (regulation) diagram (logical) – functionality block diagram
- Control (regulation) diagram (physical) – ground plan drawings specifying the physical locations of cables
- Distributor(s) - linear single-pole connection
- Functional links diagram
- Drawings corrected as-built - 3 hard copies and 1 digital copy - CD (pdf drawings).
- Up-to-date SW back-up from z PLC, display and all other programmable devices, source code described in detail and readable in a text editor.
- Data points map – xls spreadsheet containing a detailed description of communicated data points of the PLC programme in connection with the controlled equipment (scopes, ports, etc.); 1 USB drive or CD.
- Instruction for use - general + for individual devices.
- Individual circuit connection drawings.
- Lists of items and their key parameters for individual circuits, lists of connections and lists of spare parts for two-year operation.
- Instructions for removal/disassembly, repairs, adjustment, calibration, fitting, staff instructions for all devices that are part of the delivered system.
- Staff training report.
- Equipment commissioning report.
- One A3-size equipment diagram: colour, in laminated foil.
- Inspection Report (initial electro inspection for BMS equipment governed by standards on protection against dangerous touch voltage and other, primarily safety-related standards).

6. Scope of the BMS delivery

6.1. Supplier requirements

- Hardware contained in the project documentation
- Software for the control substation to the extent of all data points processed
- Integrating the data points to the central control room (or multiple control sites - depending on the equipment locations).
- Creating a surveillance screen and linking the data points to the control room graphic visualisation system.

6.2. Equipment operator requirements

- Providing a data socket for connecting the substation to the LAN
- Ensuring data communication between the equipment and the control room



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