Dimensioning of Equipment in the Heating Substation

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Heating substations play an important role in the development of district heating

District heating (DH) systems are widely used for heat supply in Nordic countries. In today's economic climate, where prices are constantly fluctuating and more and more attention is being paid to energy efficiency, district heating needs to be in constant evolution.

Heating substations play an important role here, and their correct dimensioning and design ensure that the heat supplied by the district heating system reaches the end users with the lowest possible losses, at the required temperatures and without creating additional problems for the supply of heat to the building.

Tabel 1. Examples of what to look for when choosing devices for heating substation.

Device	What to keep in mind when choosing an equipment	Problems it helps to reduce
Heat Exchanger	Minimum number of plates.	Less surface area for solid particles to deposit on, therefore reducing possibility of corrosion, clogging, over- heating and uneven transmittance of heat.
	0-10% over-surfacing.	
Control Valve	Pressure class PN16 or better.	Ensures that the valve does not burst during high pressures.
	The design pressure drop should be at least half of the available pressure rating of the corresponding control circuit of the heating substation.	Proper closing and opening of the chosen valve.
	Valve should have the next bigger Kv-value from manufacturers product sheet than the design Kv-value.	
Circulation Pump	For domestic hot water the pump must be made of stainless steel (Letter "N").	Suitable for domestic water, therefore no hazardous substances are discharged into the water supply.
	For domestic hot water the pump should provide 305 of the flow leaving the heat exchanger of hot water, to circulation.	Reduces the risk of *Legionella* bacteria in hot water system. Constant flow reduces heat losses in the system.
Pipes	Nominal diameter of the pipe should correspond to the connection of the circulation pump.	Ensures an uniform circulation in the building.

Introduction

Despite the rapid development of heating substations, there are still problems with their operation and, unfortunately, most of the faults are caused by the wrong choice of equipment.

In Estonia, there is a manual on the design and selection of equipment for heating substations, but in practice it may not provide enough information and answers to specific questions that may arise.

Methodology

The study focused on dimensioning of equipment that create the most problems in the operation of heating substations.

Presented devices are:

- Heat exchanger
- Control valve
- Circulation pump
- Pipes

Results

The results of the study show how pressure of the devices is distributed in the primary side of the heating substation.

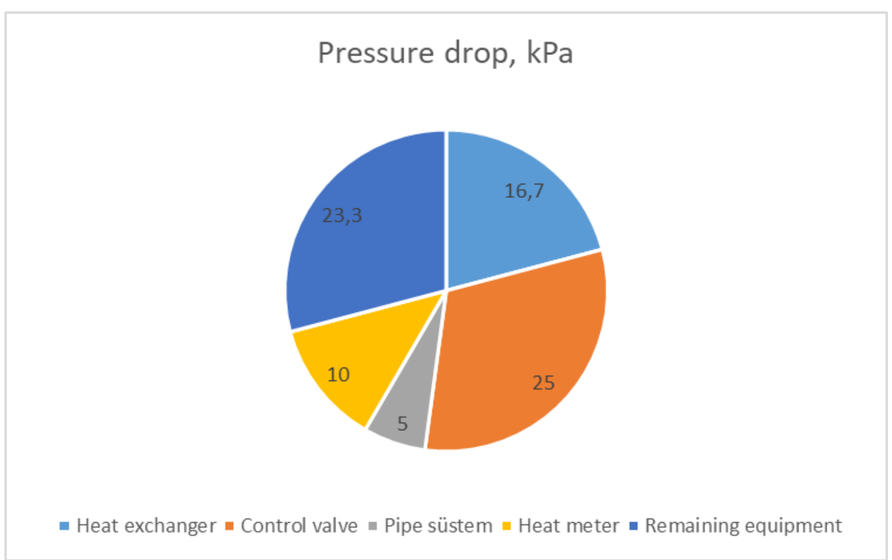

Figure 1. Selected devices are distributed on the primary side based on the pressure gradient.

Tabel 2. Examples of devices chosen in the study and why were they chosen.

Selected devices	Reasoning
SWEP Heat Exchanger B85x46	Minimum number of plates and 0% over-surfacing.
	At 16.7 kPa the device is suitable for use in a fixed pressure system.
Danfoss Control Valve VB2, DN20 6,3 m^3/h	The Kv-value corresponds to the calculated value.
	The VB2 is an automatically adjusting valve that makes it easier to regulate the flow in the system.
	At 25 kPa the device is suitable for use in a fixed pressure system.
Grundfos Circulation Pump ALPHA1 20-60 N 150	The pump is made of stainless steel.
	The pump provides 30% circulation to the hot water system.
	The ALPHA type pump is a cheaper option but reliable.
Pipes after circulation pump DN25, stainless steel	Nominal diameter of the pipe corresponds to the connection of the circulation pump.
	Stainless steel is suitable for domestic hot water management

With the equipment from Table 2 we can reduce the water flow to the building, heat loss, pumping energy consumption, temperature control speed etc., and therefore reducing energy prices for household.

Conclusion

The study provides additional information on how to select heating substation equipment, as the available guidance and training materials may remain general for engineers and designers.