Welcome to SMEDEGAARD PUMPS
Booster Set CPD Presentation
Mark Rogers
Area Sales Manager
Company history

➢ Started in 1942 in Copenhagen.

➢ In 2012 became part of the KSB Group.

➢ Production factories Denmark, Switzerland, England, Germany.

➢ 16,000 employees worldwide.

➢ Turnover in Excess of 2.5 Billion Euro.
Product Range

- Self Regulating Glandless Pumps
- In-Line Glanded Pumps fixed speed/Inverter Control
- End Suction Glanded Pumps
- HWS Bronze Pumps
- Pressurisation Equipment For Heating
- Sump pumps
- KSB Products
- Cold Water Booster sets
Main Purpose of a Booster Set

- Boosting a sufficient amount of water against minimum required pressure
- Keeping the water supply quality at the highest level.
- Water Authorities have only a statutory obligation to provide water with a flow rate of 9 litres per minute at 1 bar.
CAT 5 Booster Set
Used for back flow prevention and to eliminate contamination of the mains supply.

Incorporates a screened weir which is designed to pass a higher flow rate than the incoming mains supply.

Used on projects for bin stores and process work.

AB air gap for fluid cat.5 protection.
COLD WATER BOOSTER

Single To Multi-Pump Models.

Multistage Pumps.

Factory Mounted Inverter Drive For Each Pump.

Pressure Transducer Control.

IP55 or IP66 Control Panel With MCB’s.
COLD WATER BOOSTER

For Limited Footprint

Provide A Package With;

Frame, Booster & Tank

Horizontally Split Break Tank,(If access is an issue).
Cold Water Booster Design Types
Design Types

Flooding suction or suction lift to pressurise the C/W system to a high level break tank

Flooding suction or suction lift to pressurise the cold water draw off points

Flooding suction or suction lift to directly pressurise hot and/or cold water systems
Cold Water Booster - *Pump Types*
End Suction Pumps

- Single or twin impeller centrifugal pumps with 304 s/s AISI hydraulic components
- Maximum working pressure: 8 bar
- Maximum liquid temperature: 60°C/90°C/110°C depends on model, (typically used for cold water).
- Pump body, impeller, diffuser, shaft and casing cover in AISI 304
- Mechanical seal
- T.E.F.C. 2 pole and 4 pole motors available / Insulation class F / IP55
- 1~230V ± 10% 50Hz, 3~230/400V ± 10% 50Hz
- Permanent split capacitor and automatic thermal overload protection for 1ph version
- Thermal protection to be provided by the user for three-phase version
Multistage pumps

- Capacities up to 100m³, 400mWc
- Temperature range -15°C to +120°C, (typically used for cold water applications).
- All wetted parts in stainless steel 304.
- Can also be supplied in full stainless (316)
Pump Hydraulic Assembly

- All wetted parts made of stainless steel. 
  AISI 304 (V) or AISI 316 (VS)
- Tungsten Carbide shaft protection bush and Ceramic bearing in diffuser.
- Bearing lubrication through the pumped fluid.
- Two flat faces on shaft for a strong shaft/impeller construction
- One Bar rise in pressure per stage up to 2” and, (Two Bar above 2”).
- Price between end suction and Multistage are now comparable.
Pump Working Principle
Cold Water Booster Set Sizing
Basic Calculation of Booster Sets

- Required head
- Required capacity/ demand

*The relationship is the pump curve!*
Required Head $H$ [m]

How do we arrive at the required pressure?

**a. Static head**, difference between suction water level and highest point of discharge.

+ 

**b. System head losses**, losses through system pipework and fittings.

+ 

**c. Pressure that is required at the outlet fitting** *that is at the upper most point in the system or most distant draw off point.*

\[ a + b + c = \text{Pressure required from the booster set} \]

We now need to calculate water the flow rate required
FLOW RATE ESTIMATION
The flow rate of a booster set can be calculated using loading units.

The loading units are factors which take into account the appliance flow rate, frequency of operation and time in use. Add up the total number of loading units using Table B and read off the corresponding flow rate from Fig. C.

Table B

<table>
<thead>
<tr>
<th>Appliances</th>
<th>Loading Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC flushing cistern</td>
<td>4</td>
</tr>
<tr>
<td>Wash basin</td>
<td>4</td>
</tr>
<tr>
<td>Bath tap of nominal size $3/4''$</td>
<td>20</td>
</tr>
<tr>
<td>Bath tap of nominal size $1''$</td>
<td>20</td>
</tr>
<tr>
<td>Shower</td>
<td>6</td>
</tr>
<tr>
<td>Sink tap of nominal size $3/4''$</td>
<td>6</td>
</tr>
<tr>
<td>Sink tap of nominal size $1''$</td>
<td>10</td>
</tr>
</tbody>
</table>
# Booster Set Sizing

<table>
<thead>
<tr>
<th>Appliances</th>
<th>Loading Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC flushing cistern</td>
<td>4</td>
</tr>
<tr>
<td>Wash basin</td>
<td>4</td>
</tr>
<tr>
<td>Bath tap of nominal size $\frac{3}{4}''$</td>
<td>20</td>
</tr>
<tr>
<td>Bath tap of nominal size 1''</td>
<td>20</td>
</tr>
<tr>
<td>Shower</td>
<td>6</td>
</tr>
<tr>
<td>Sink tap of nominal size $\frac{3}{4}''$</td>
<td>6</td>
</tr>
<tr>
<td>Sink tap of nominal size 1''</td>
<td>10</td>
</tr>
</tbody>
</table>
Booster Set Sizing Example
Project - 60 Bed Residential Home

Flow Rate Calculations
Showers x 60 x 12 = 720
Basins 70 x 8 = 560
WC’s 70 x 4 = 280
Sinks x 8 x 12 = 96
Baths Assisted 2 x 40 = 80
Total loading units = 1736

Pressure Required
Height booster set location to highest outlet 7m = 0.7 bar
Frictional losses based upon max height and distance to farthest outlet = 0.5 bar
Outlet pressure required = 2 bar
Total pressure required form booster set = 3.2 bar
60 Bed Residential Home – **Flow Rate Calculations**

Showers $\times 60 \times 12 = 720$
Basins $70 \times 8 = 560$
WC’s $70 \times 4 = 280$
Sinks $x 8 \times 12 = 96$
Baths Assisted $2 \times 40 = 80$

*Total loading units = 1736*

60 Bed Residential Home – Flow Rate Calculations

Fig C – loading units nomogram

1736 load units = *6 litres per second*
Booster Set Sizing Example

60 Bed Residential Home – **Flow Rate Calculations**

Showers \( \times 60 \times 12 = 720 \)
Basins \( 70 \times 8 = 560 \)
WC’s \( 70 \times 4 = 280 \)
Sinks \( 8 \times 12 = 96 \)
Baths Assisted \( 2 \times 40 = 80 \)

**Total loading units** = 1736 = **6 litres per second**

**Pressure Required**

Height booster set location to highest outlet \( 7m = 0.7 \) bar
Frictional losses based upon max height and distance to farthest outlet \( = 0.5 \) bar
Outlet pressure required \( = 2 \) bar

**Total pressure required form booster set** = **3.2 bar**

What pumps do we select
Pump Selection

• H req. [m] = 32 (3.2bar)
• Q req. [l/s] = 6

Number of pumps to use?

2 pumps
• Duty / standby  à Q req = 100%
• Duty / assist  à Q req = 50% per pump

3 pumps
• Duty / assist / standby  à Q req = 50% per pump
• Duty / assist / assist  à Q req = 33% per pump
Manual Pump Selection

Design criteria: \( Q_{req} = 3.0 \, \text{sec} \); \( \text{Head} = 32 \, \text{m} \)
Cold Water Booster Selection Example

60 Bed Residential Home – Flow Rate Calculations

We have established total set duty of 6 litres per second and pressure per pump of 3.2 bar

and that we are using 3 pumps duty/assist/standby

How do we decide which type of booster set to use.
60 Bed Residential Home – **Flow Rate Calculations**
We have established total set duty of 6 litres per second and pressure per pump of 3.2 bar and that we are using 3 pumps duty/assist/standby for which the pump is the 10 Series Model 10B-5.
# Individual Pump Electrical Data

<table>
<thead>
<tr>
<th>2850 RPM</th>
<th>Max. Starts [h⁻¹]</th>
<th>FLC (Amps)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>230V</td>
<td>415V</td>
</tr>
<tr>
<td>kW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.37</td>
<td>58</td>
<td>10</td>
</tr>
<tr>
<td>0.55</td>
<td>58</td>
<td>10</td>
</tr>
<tr>
<td>0.75</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>1.10</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>1.50</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>2.20</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>3.00</td>
<td>66</td>
<td>20</td>
</tr>
<tr>
<td>4.00</td>
<td>69</td>
<td>20</td>
</tr>
<tr>
<td>5.50</td>
<td>69</td>
<td>15</td>
</tr>
<tr>
<td>7.50</td>
<td>69</td>
<td>12</td>
</tr>
<tr>
<td>11.00</td>
<td>76</td>
<td>11</td>
</tr>
<tr>
<td>15.00</td>
<td>76</td>
<td>10</td>
</tr>
<tr>
<td>18.50</td>
<td>76</td>
<td>10</td>
</tr>
<tr>
<td>22.00</td>
<td>76</td>
<td>10</td>
</tr>
<tr>
<td>30.00</td>
<td>84</td>
<td>6</td>
</tr>
<tr>
<td>37.00</td>
<td>84</td>
<td>6</td>
</tr>
</tbody>
</table>

*Please note the FLC figures given are per pump. It may be necessary to multiply this figure by the number of pumps on the booster sets.*
Anti Surge Protection for Cold Water Booster Sets
Anti Vacuum/Vent Air Device

Fitted To Each Riser Its Function Is To;

Remove Air

Trapped air in a boosted water system may result in large pressure variations which can cause excessive noise, create leaks and other damage in the pipework due to water hammer.
Anti Vacuum / Vent Air Device,(cont.).

Prevent A Vacuum From Forming

In the event of water loss, during power failure or maintenance, it is vital to prevent a vacuum forming within the system.

This can be a major factor to the occurrence of water hammer which can cause damage in extreme cases.
Surge Protection

Are There Any Other Measures That Can be taken?

Electronic Surge protection.
PUMP CONTROL VESSELS

• One or more pump control vessels with flow through diverter valve is fitted to each set, (size of vessel or vessels depends on booster model.

• These aid the shutdown of the pumps and alleviate water hammer.

• Lever action taps.
System Buffer Vessel

- In some applications with rapidly changing demands it is advisable to include a buffer expansion vessel to reduce the risk of momentary pressure fluctuations.

- Size will be based upon model of booster used.

- A 60litre buffer vessel for the booster in the example.
WRAS Approval

Water Regulations Advisory Scheme

This is the UK Water Industry Approval Scheme.

Approved products are shown to comply with the requirements of the water supply, (water fittings), regulations 1999 & amendments.

Directory available at wras.co.uk
Having Established Flow Rate and Pressure and Selected Booster Set
What else do we need to consider?
COLD WATER STORAGE & NPSH
net positive suction head
Why do we need to concern ourselves with the pumps NPSH, (Net Positive Suction Head). The pump may suffer from cavitation if there is not sufficient pressure at the pump inlet on the suction side of each pump with possible causes;

Higher temperatures will reduce NPSH and possibly cause cavitation and scale formation.

Tank not high enough or suction lift.

Suction manifold incorrectly sized or restriction in suction pipework.
NPSH continued

• The NPSHr, (required), is shown on the pump curves.

• The NPSHa, (available), is 9.81m plus the level of the water above the pump suction, less an allowance for water temperature, (but at low temperature’s this is not a problem), less the pipework resistance from the tank to the pump.

• ‘a’ must be greater than ‘r’
NPSH continued.

- If the water source is below the pumps then the distance from the pump suction to the lowest water level is subtracted from 9.81.

- All measurements in metres.
Why do we need to fit a Cold Water Break Tank?

Water Regulations prohibit direct connection to the water main.

Remember to calculate NPSH when fitting break tanks.

How do we calculate break tank size
Booster Set – Cold Water Break Tank Sizing

Break Tank Size – selection in accord with CIBSE data as details in Guide G and Smedegaards HV Manual information

GUIDE TO BREAK TANK SIZING
Provision of cold water storage to cover 24 hours interruption of mains supply (or check with Local Water Authority).

<table>
<thead>
<tr>
<th>Type of building</th>
<th>Storage in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwelling houses and flats</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Hostels</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Hotels</td>
<td>per resident 135</td>
</tr>
<tr>
<td>Offices without canteens</td>
<td>per head 35</td>
</tr>
<tr>
<td>Offices with canteens</td>
<td>per head 45</td>
</tr>
<tr>
<td>Restaurants</td>
<td>per head 8</td>
</tr>
<tr>
<td>Day schools</td>
<td>per resident 27</td>
</tr>
<tr>
<td>Boarding schools</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Nurses’ homes and medical quarters</td>
<td>per resident 110</td>
</tr>
</tbody>
</table>

Table A
60 Bed Residential Home – Break Tank Calculations

- 60 persons at 110 litres per person = 6,600 litres
- So we need a break tank with actual storage of 6,600 litres
- or do we?

GUIDE TO BREAK TANK SIZING

Provision of cold water storage to cover 24 hours interruption of mains supply (or check with Local Water Authority).

<table>
<thead>
<tr>
<th>Type of building</th>
<th>Storage in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwelling houses and flats</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Hostels</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Hotels</td>
<td>per resident 135</td>
</tr>
<tr>
<td>Offices without canteens</td>
<td>per head 35</td>
</tr>
<tr>
<td>Offices with canteens</td>
<td>per head 45</td>
</tr>
<tr>
<td>Restaurants</td>
<td>per head 8</td>
</tr>
<tr>
<td>Day schools</td>
<td>per resident 27</td>
</tr>
<tr>
<td>Boarding schools</td>
<td>per resident 90</td>
</tr>
<tr>
<td>Nurses’ homes and medical quarters</td>
<td>per resident 110</td>
</tr>
</tbody>
</table>

Table A
The Future

As with circulating pumps the motors of booster set pumps are required to be EEI compliant but the efficiency of the pumps as a whole is likely to become a matter of legislation in the near future.

The motor/VSD combination is also being considered for efficiency legislation.
The Future continued.

- BIM is upon us now, this will guarantee the easy access of all the required information from every manufacturer in a standardised format.
Thank you for your attention!