RUHRPUMPEN

Specialist for Pumping Technology

Session 33 –

Handling Viscous Fluids with Centrifugal Pumps

Simon Smith May 2024

Presenter Profile – Simon Smith

Simon graduated with an honours degree in Chemical Engineering from the University of Surrey in 1978 and began a long career in the engineered pump industry spanning 43 years (so far!) with Peerless Pump, BW/IP International / Flowserve, SPP Pumps, Ruhrpumpen and Ebara Cryodynamics.

Over his long career he has filled various roles as Applications Engineer / Manager, Project Manager, Key Account Specialist, Vertical Pump Product Specialist, International Sales Engineer / Manager / Director and he has considerable experience in Training & Mentoring young engineers.

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- No 1 – API610 12th v 11th editions
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- No 3 – The Importance of System Curves (1)
- No 4 - Selecting the Right Pump for the Application
- No 5 - NPSH & Nss
- No 6 - Mechanical Seals & Systems (1)
- No 7 - Firepumps
- No 8 - BB5 Barrel Pumps
- No 9 - Pump Instrumentation
- No 10 – Non-Destructive Examination

- No 11 - Vertical Pumps (Part 1) Type VS1, VS2, VS3
- No 12 – Vertical Pumps (Part 2) Type VS4, VS5, VS6 & VS7
- No 13 – Performance Testing of Centrifugal Pumps; the What, the Why & the How
- No 14 – Testing & Inspection of API 610 Pumps
- No 15 – Start-Up, Commissioning & Troubleshooting Centrifugal Pumps
- No 16 – Introduction to Positive Displacement (Plunger) Pumps
- No 17 – Refresher Session
- No 18 – Overhung Process Pumps OH1 & OH2

Continued next slide

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- No 27 – The Importance of System Curves (2)

- No 28 – NPSH & Nss Made Simple (2)

- No 29 – Curve Shape, Head Rise & Allowable Tolerances (2)

- No 30 – Selecting the Right Pump for the Application (2)

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Full session.

⬇ Downloads. (14.73 MB)

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Full session.

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SHORT COURSE 16

Introduction to Positive Displacement (Plunger) Pumps

Session part 1.

Session Part 2.

📄 Downloads. (10.50 MB)

Session 33 – "Handling Viscous Fluids with Centrifugal Pumps"
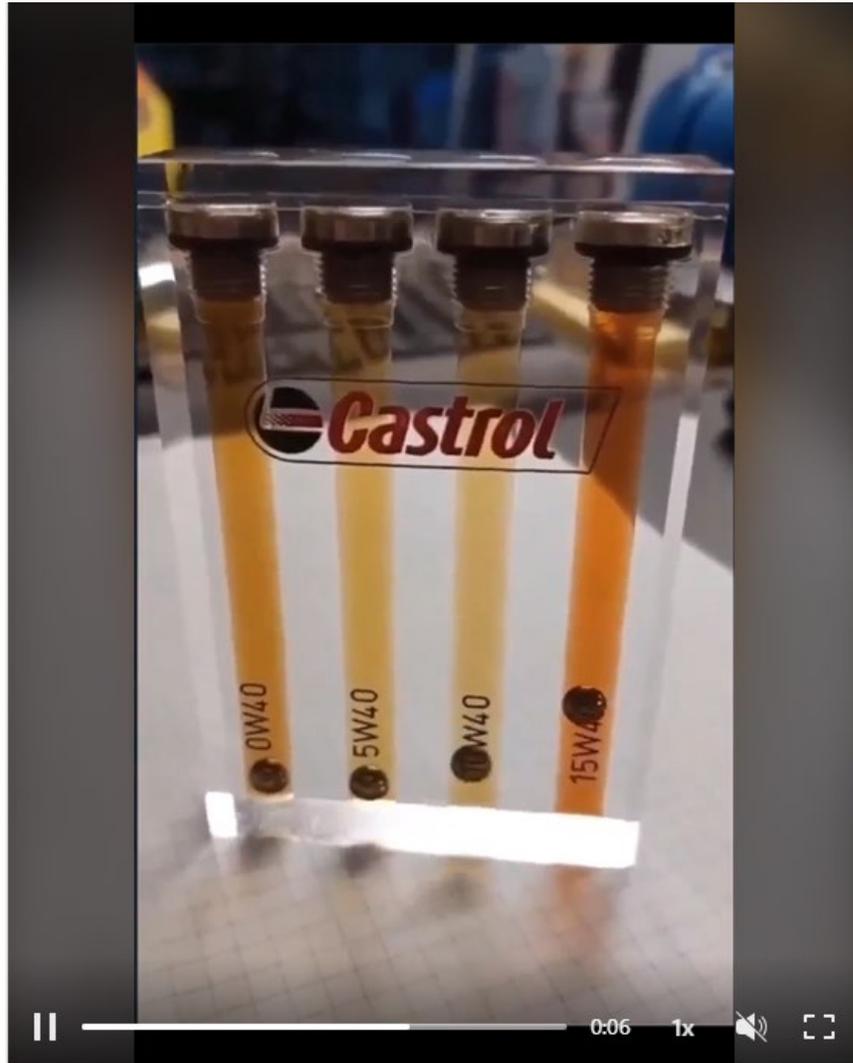
Aimed at Process and Mechanical Engineers, Consultant Engineers who specify pumping equipment as well as Applications & Sales Engineers selecting and quoting them.

This course will look at how to correct standard (water) performance curves for handling viscous fluids and the considerations to be taken into account in selecting & specifying them.

Handling Viscous Fluids

What does it look like?

LINK

https://www.linkedin.com/feed/update/urn:li:activity:7181236507876237313?updateEntityUrn=urn%3Ali%3Afs_feedUpdate%3A%28V2%2Curn%3Ali%3Aactivity%3A718123650787623713%29

15W40 viscosity = 287cSt at 20C
10W40 viscosity = 208cSt at 20 C
5W40 viscosity = 180cSt at 20 C

Handling Viscous Fluids

Referenced Source

ANSI/HI 9.6.7-2010

American National Standard (Guideline) for:

Effects of Liquid Viscosity on Rotodynamic (Centrifugal and Vertical) Pump Performance

"This is an empirical method based on the test data available from sources throughout the world. It provides a way of predicting the effects of liquid viscosity on pump performance with adequate accuracy for most practical purposes"

Handling Viscous Fluids

ANSI/HI 9.6.7-2010

"The method in this document gives correction factors similar to the previous HI method (from 2000) . The new method matches the experimental data better than the old HI method that has been widely used throughout the world for many years."

"These tests of conventional single-stage and multistage pumps cover the following range of parameters:

- closed and semi-open impellers;

- kinematic viscosity 1 to 3000 cSt;

- rate of flow at BEP with water Q_{BEP-W} = 3 to 410 m3/h (13 to 1800 gpm);

- head per stage at BEP with water H_{BEP-W} = 6 to 130 m (20 to 430 ft)."

Handling Viscous Fluids

ANSI/HI 9.6.7-2010

"There will be increased uncertainty of performance prediction outside the range of test results. This uncertainty, however, is not expected to exceed the uncertainty that existed when applying the previously published (2000) HI viscosity correction method (Maximum flow = 2271 m3/h [10,000 gpm])."

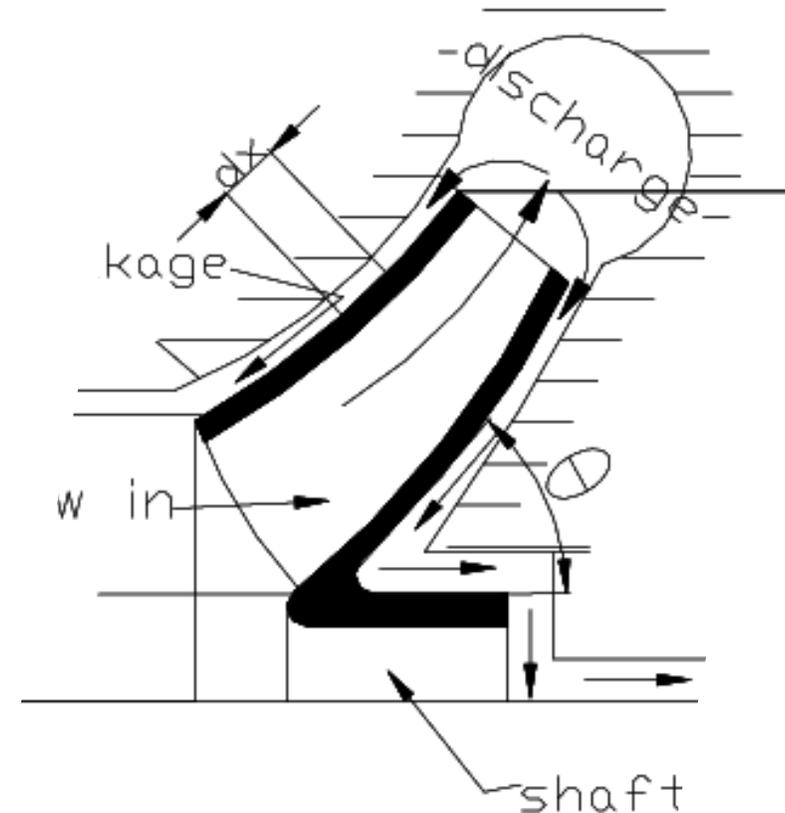# Handling Viscous Fluids

What are the Losses and Why?

- Mechanical Losses are essentially independent of the viscosity of the liquid being pumped

- Hydraulic losses similar to pipe friction losses occur at the inlet, in the impeller, in the volute or diffuser, and in the discharge of a pump.

- Volumetric losses are caused by leakage flows through the tight running clearances between pump rotor and stator parts. Such leakages **decrease** with **increasing** viscosity because the friction factors in the clearances increase with decreasing Reynolds number. The rate of flow through the pump is thus increased, resulting in a higher head. This shift of the H-Q curve caused by reduced leakage compensates to some extent the hydraulic losses mentioned above.

Handling Viscous Fluids

What are the Losses and Why?

- Disk friction losses are another type of friction loss, occurring on all wetted surfaces rotating in the pump. The associated power losses strongly influence pump efficiency with viscous liquids.

- The disk friction losses increase by a factor of about 30 when the viscosity rises from 1 to 3000 cSt.
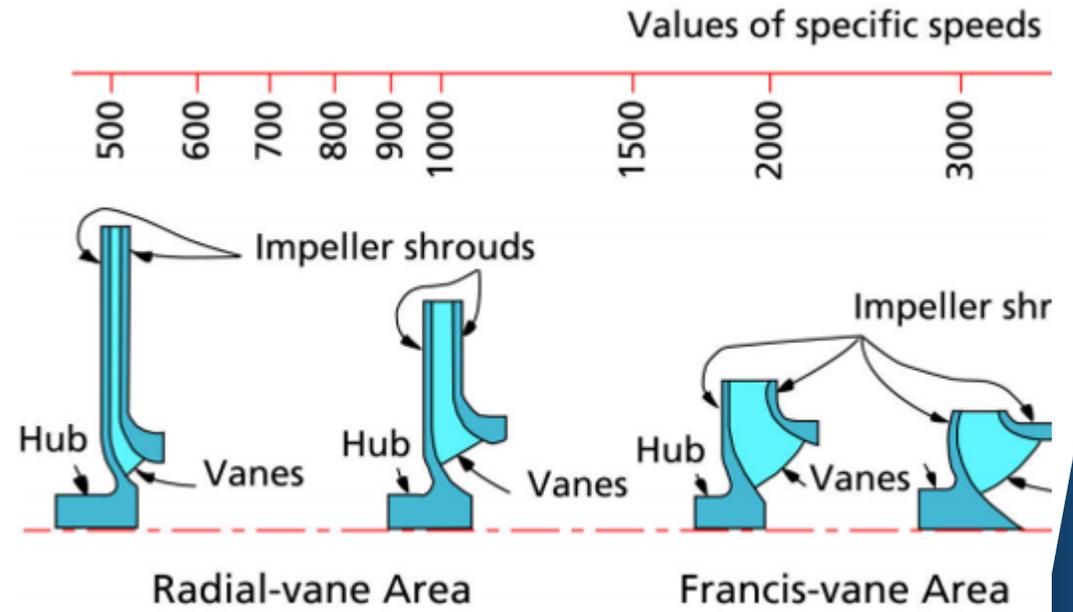
Handling Viscous Fluids

What are the Losses and Why?

- With a viscosity of 3000 cSt, the disk friction power (P_{RR}) is nearly 10 times larger than the Useful Power (P_U) for a pump specific speed of $n_s = 10$ ($N_S = 500$) and accounts for 50% of the Useful Power (P_U) for $n_s = 45$ ($N_S = 2300$).

Values of specific speeds

500 600 700 800 900 1000   1500   2000   3000

Impeller shrouds

Hub — Vanes

Hub — Vanes

Hub — Vanes

Impeller shr

Radial-vane Area

Francis-vane Area
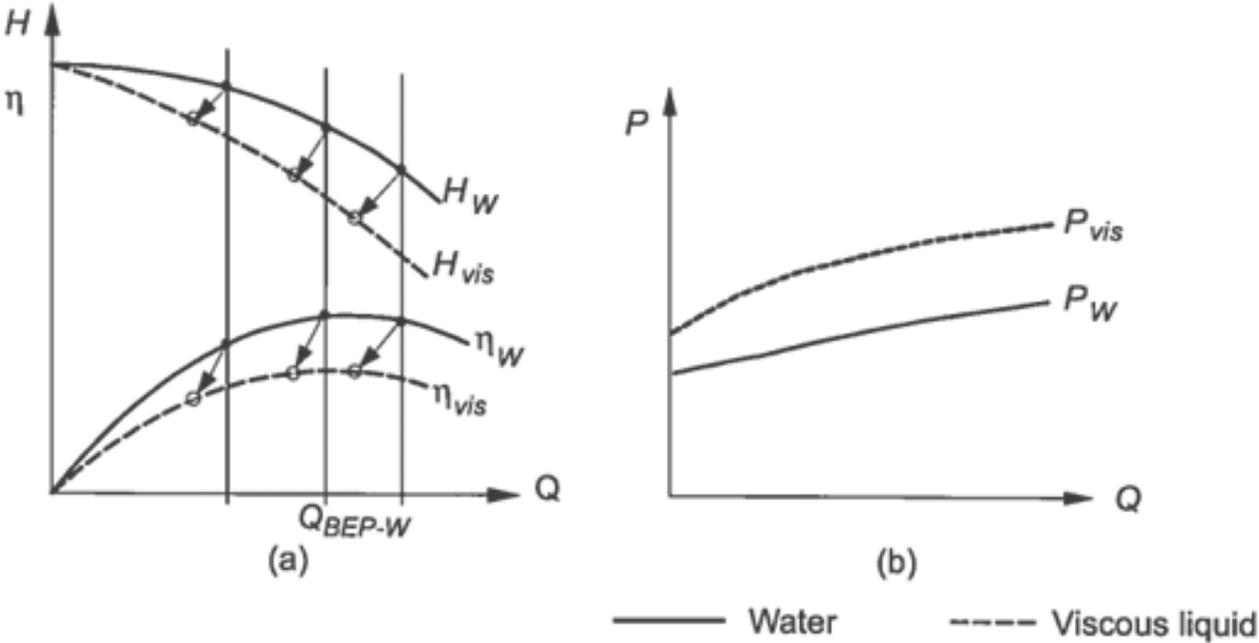
Handling Viscous Fluids

Figure 9.6.7.3.1 — Modification of pump characteristics when pumping viscous liquids

Handling Viscous Fluids

The Method

- Step 1 – Calculate "Parameter B"

Calculate parameter B given metric units of Q_{vis} in m³/h, H_{vis} in m, and V_{vis} in cSt using Equation 10:

$$B = 2.80 \times \frac{(V_{vis})^{0.50}}{(Q_{vis})^{0.25} \times (H_{vis})^{0.125}} \qquad \text{(Eq. 10)}$$

or, given US customary units of Q_{vis} in gpm, H_{vis} in ft, and V_{vis} in cSt using Equation 11:

$$B = 4.70 \times \frac{(V_{vis})^{0.50}}{(Q_{vis})^{0.25} \times (H_{vis})^{0.125}} \qquad \text{(Eq. 11)}$$

- If B > 40 then STOP! This is probably not a centrifugal pump application

Handling Viscous Fluids

The Method

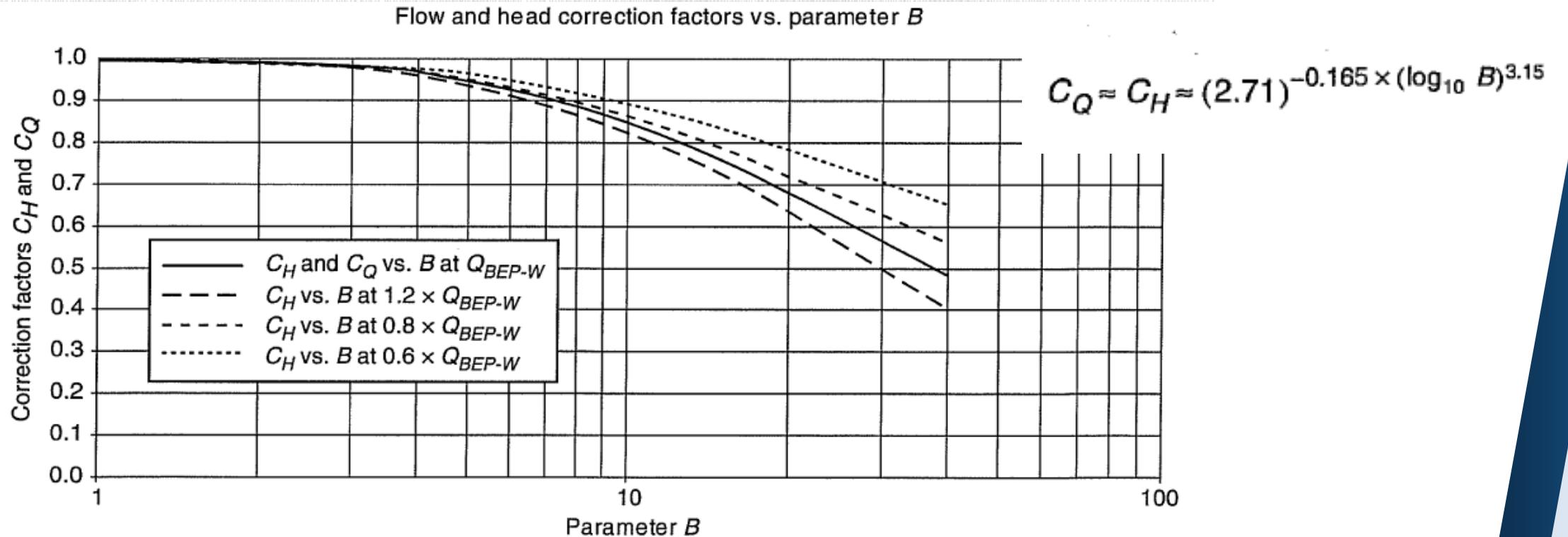- Step 2 - Read off Correction Factors for Flow (CQ) and Head (CH) from this chart.

$$C_Q \approx C_H \approx (2.71)^{-0.165 \times (\log_{10} B)^{3.15}}$$

Figure 9.6.7.4.5a — Chart of correction factors for C_Q and C_H

Handling Viscous Fluids

The Method

- Step 3 – Calculate the approximate water performance flow and head.

$$Q_W = Q_{VIS} / C_Q \qquad H_W = H_{VIS} / C_H$$

- Step 4 – Select a pump that has a performance of Q_W & H_W as close as possible to BEP

- Step 5 – Read off Correction Factors for Efficiency C_{EFF} from this chart

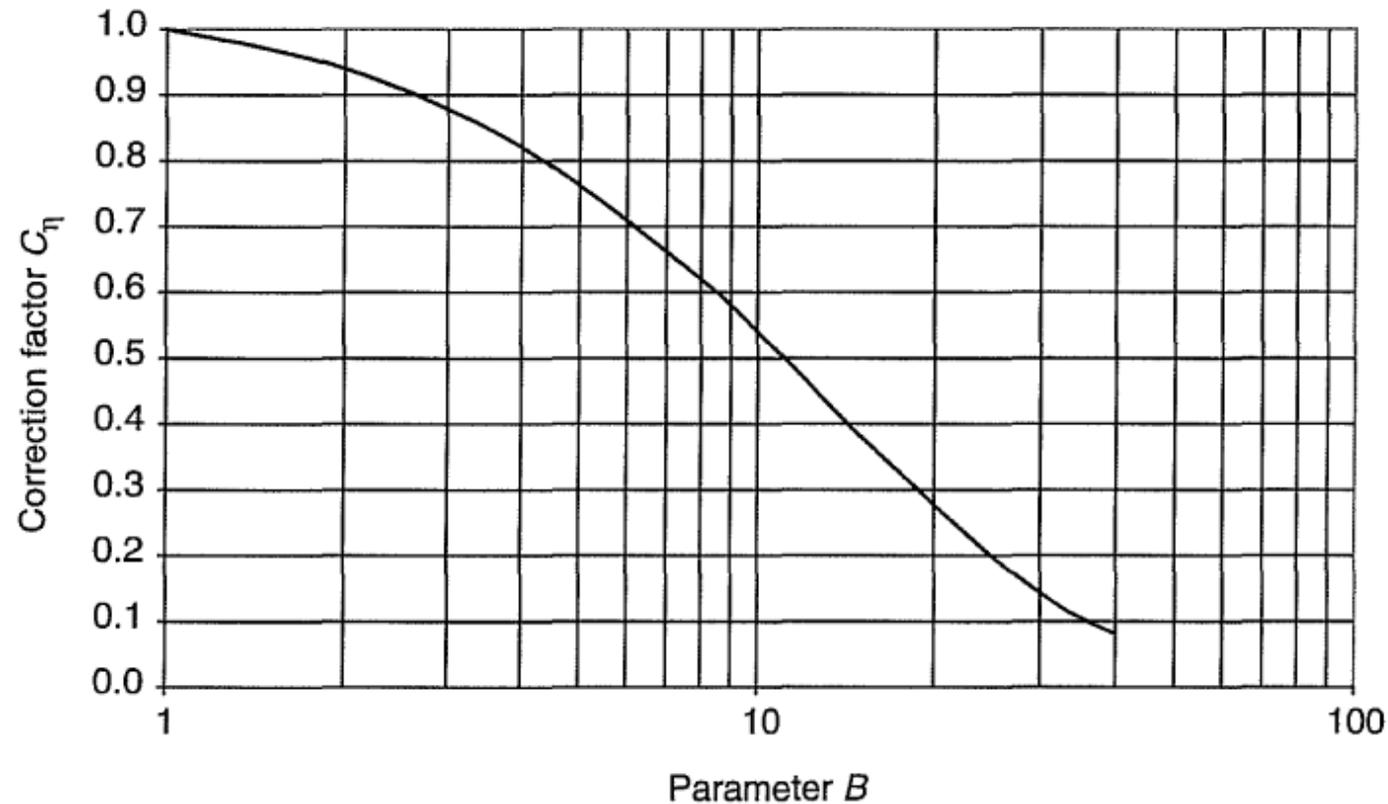 $Eff_{VIS} = C_{EFF} \times Eff_{WAT}$

Handling Viscous Fluids

The Method

For $1.0 < B < 40$: $C_\eta = B^{-(0.0547 \times B^{0.69})}$

Efficiency correction factor vs. parameter B

Figure 9.6.7.4.5b — Chart of correction factors for C_η

$$Eff_{VIS} = C_{EFF} \times Eff_{WAT}$$

Handling Viscous Fluids

The Method

- Step 6 – Calculate the Viscous Power

(using the usual power calculation formulae)

For rate of flow in m^3/h, total head in m, and shaft input power in kW, use Equation 8:

$$P_{vis} = \frac{Q_{vis} \times H_{vis-tot} \times s}{367 \times \eta_{vis}}$$

For rate of flow in gpm, total head in ft, and shaft input power in hp, use Equation 9:

$$P_{vis} = \frac{Q_{vis} \times H_{vis-tot} \times s}{3960 \times \eta_{vis}}$$

Handling Viscous Fluids

Calculating Viscosity Correction Factors

Parameter B		Metric Units					

Step 1. Calculate parameter B based on the water performance best efficiency flow ($Q_{BEP\text{-}W}$)

Given metric units of $Q_{BEP\text{-}W}$ in m³/h, $H_{BEP\text{-}W}$ in m, N in rpm, and V_{vis} in cSt, use Equation 2:

$$B = 16.5 \times \frac{(V_{vis})^{0.50} \times (H_{BEP-W})^{0.0625}}{(Q_{BEP-W})^{0.375} \times N^{0.25}} \qquad \text{(Eq. 2)}$$

Given US customary units of $Q_{BEP\text{-}W}$ in gpm, $H_{BEP\text{-}W}$ in ft, N in rpm, and V_{vis} in cSt, use Equation 3:

$$B = 26.6 \times \frac{(V_{vis})^{0.50} \times (H_{BEP-W})^{0.0625}}{(Q_{BEP-W})^{0.375} \times N^{0.25}} \qquad \text{(Eq. 3)}$$

V_{vis}	V_{vis} ^.5	H_{wat}	H_{wat} ^0.0625	Q_{wat}	Q_{wat} ^0.375	N	N ^0.25
120	10.954	77	1.312	110	5.828	2950	7.370
120		77		110		2950	

B=	5.521		Limit is 40				
	5.52						

22

$\underline{C_Q \ \& \ C_H}$ $\underline{\text{Metric Units}}$

Step 2. Calculate correction factor for flow (C_Q) (which is also equal to the correction factor for head at BEP $[C_{BEP\text{-}H}]$) corresponding to the water performance best efficiency flow $(Q_{BEP\text{-}W})$ using Equation 4. Correct the other water performance flows (Q_W) to viscous flows (Q_{vis}). These two equations are valid for all rates of flow (Q_W).

$$C_Q = (2.71)^{-0.165 \times (\log_{10} B)^{3.15}}$$ (Eq. 4)

$C_Q \ \& \ C_H =$	0.938	at BEP

Step 3. Calculate head correction factors (C_H) using Equation 6, and then corresponding values of viscous head (H_{vis}) for flows (Q_W) greater than or less than the water best efficiency flow $(Q_{BEP\text{-}W})$.

$$C_H = 1 - \left[(1 - C_{BEP-H}) \times \left(\frac{Q_W}{Q_{BEP-W}}\right)^{0.75}\right]$$ (Eq. 6)

$$H_{vis} = C_H \times H_W$$

$CH_{60\% \ QBEP\text{-}W}$	0.958	at 60% BEP
$CH_{80\% \ QBEP\text{-}W}$	0.947	at 80% BEP
$CH_{120\% \ QBEP\text{-}W}$	0.929	at 120% BEP

Handling Viscous Fluids

Example

C_{EFF}					
Step 4. Calculate the correction factor for efficiency (C_η) using Equation 7 or 8 and the corresponding values of viscous pump efficiency (η_{vis}). The following equations are valid for flows (Q_W) greater than, less than, and equal to the water best efficiency flow $Q_{BEP\text{-}W}$: $$\text{For } 1.0 < B < 40, \quad C_\eta = B^{-(0.0547 \times B^{0.69})} \qquad \text{(Eq. 7)}$$					
C_{EFF} =	0.738				

Handling Viscous Fluids

Example

- Select a pump to deliver 100m3/hr at 70m TDH of a hydrocarbon with SG 0.9 and Viscosity 120cSt

Handling Viscous Fluids

Example

- Select a pump to deliver 100m3/hr at 70m TDH of a hydrocarbon with SG 0.9 and Viscosity 120cSt
- Step 1 – B = 5.7
- Step 2 – C_Q & C_H = 0.93 (from chart)
- Step 3 – Q_W = 107m3/hr, H_W = 75 m3/hr
- Step 4 – Select Pump (water performance)
- Step 5 – C_{EFF} = 0.73 (from chart)
- Step 6 – P_{VIS} = 34.6kW
- Step 7 – Tabulate data (next slide)
- Step 8 – Draw Viscous Performance Curve on Water Curve

$$B = 2.80 \times \frac{(120)^{0.50}}{(100)^{0.25} \times (70)^{0.125}} = 5.70$$

$$Q_W = \frac{100}{0.934} = 107.1 \ m^3/h$$

$$H_W = \frac{70}{0.934} = 74.9 \ m$$

$$C_\eta = (5.70)^{-[0.0547 \times (5.70)^{0.69}]} = 0.729$$

$$\eta_{vis} = 0.729 \times 0.680 = 0.496$$

$$P_{vis} = \frac{100 \times 70 \times 0.90}{367 \times 0.496} = 34.6 \ kW$$

Handling Viscous Fluids

Manual Tabulation

	0.60	0.80	1.00	1.20
Viscosity of liquid to be pumped (V_{vis}) — cSt	120			
Specific gravity of viscous liquid (s)	0.90			
Pump shaft speed (N) — rpm	2950			
Ratio of water best efficiency flow $Q_W / Q_{BEP\text{-}W}$	0.60	0.80	1.00	1.20
Water rate of flow (Q_W or $Q_{BEP\text{-}W}$) — m³/h	66.0	88.0	110.0	132.0
Water head per stage (H_W or $H_{BEP\text{-}W}$) — m	87.3	83.0	77.0	69.7
Water pump efficiency (η_W)	0.60	0.66	0.68	0.66
Parameter B	5.52			
Correction factor for flow (C_Q)	0.938			
Correction factors for head (C_H or $C_{BEP\text{-}H}$)	0.958	0.947	0.938	0.929
Correction factor for efficiency (C_η)	0.738			
Corrected flow (Q_{vis}) — m³/h	61.9	82.5	103.2	123.8
Corrected head per stage (H_{vis} or $H_{BEP\text{-}vis}$) — m	83.6	78.6	72.2	64.8
Corrected efficiency (η_{vis})	0.44	0.49	0.50	0.48
Viscous shaft input power (P_{vis}) — kW	28.6	32.5	36.4	40.2

From published water curve

Calculated

From Charts

Calculated

Performance based on test acceptance - API

Based on curve number	: OKH 115 029.00

Liquid ⓘ

Liquid type	: Hydrocarbon
Additional liquid description	
Solids diameter, max	0.00 mm
Solids concentration, by volume	0.00 %
Temperature, max	20.00 deg C
Fluid density, rated / max	0.900 / 0.900 SG
Viscosity, rated	120.0 cSt
Vapor pressure, rated	0.02 bar.a
Cq/Ch/Ce/Cn ANSI/HI 9.6.7-2010 ⌄	: 0.93 / 0.93 / 0.73 / 1.00

Correction Factors

Material ⓘ

Material requested	S6 ⌄
Material selected	: S6

Pressure Data ⓘ

Maximum discharge pressure	: 8.25 bar.g
Maximum allowable working pressure	: 41.50 bar.g
Maximum allowable suction pressure	: 32.42 bar.g
Hydrostatic test pressure	: 62.25 bar.g

Driver & Power Data

Driver sizing specification	Rated power ⌄
Margin over specification	0.00 %
Service factor	☐ Use service factor 1.00 ⌄
Power, hydraulic	: 17.18 kW
Power, rated	: 34.16 kW
Power, maximum, rated diameter	: 36.97 kW
Power reserve (rated / max / sizing spec)	: 9.15 / 0.86 / 9.15 %
Minimum recommended motor rating	☐ set @ : 37.29 kW / 50.00 hp

Size	: SCE 4x3x11 (A) (OH2)
Stages	: 1

Operating Conditions ⓘ

Flow, rated	100.0 m3/h
Differential head / pressure, rated (requested)	70.00 m (+0.00 based on test acceptance - API)
Differential head / pressure, rated (actual)	: 70.17 m
Suction pressure, rated / max	0.00 / 0.00 bar.g
NPSH available, rated	Ample m
Site Supply Frequency	50 ⌄ Hz

Performance

Speed criteria	Synchronous ⌄
Speed, rated	☑ set @ 2960 rpm
Impeller diameter, rated	☐ set @ 253 ⌄ mm
Impeller diameter, maximum	: 278 mm
Impeller diameter, minimum	: 214 mm
Efficiency	: 50.29 %
NPSH required / margin required	: 3.55 / 0.00 m
nq (imp. eye flow) / S (imp. eye flow)	: 17 / 190 Metric units
MCSF	: 23.87 m3/h
Head, maximum, rated diameter	: 93.66 m
Head rise to shutoff	: 33.48 % ☐Using discharge orifice(☐Hide on PDF)
Discharge orifice outer diameter	: 76.20 mm
Flow, best eff. point	: 93.92 m3/h
Flow ratio, rated / BEP	: 106.47 %
Diameter ratio (rated / max)	: 91.01 %
Cutwater ratio (rated / cutwater)	: N/A
Head ratio (rated dia / max dia)	: 76.53 %
Selection status	☐ Hide on PDF : Acceptable

Handling Viscous Fluids

Example 1

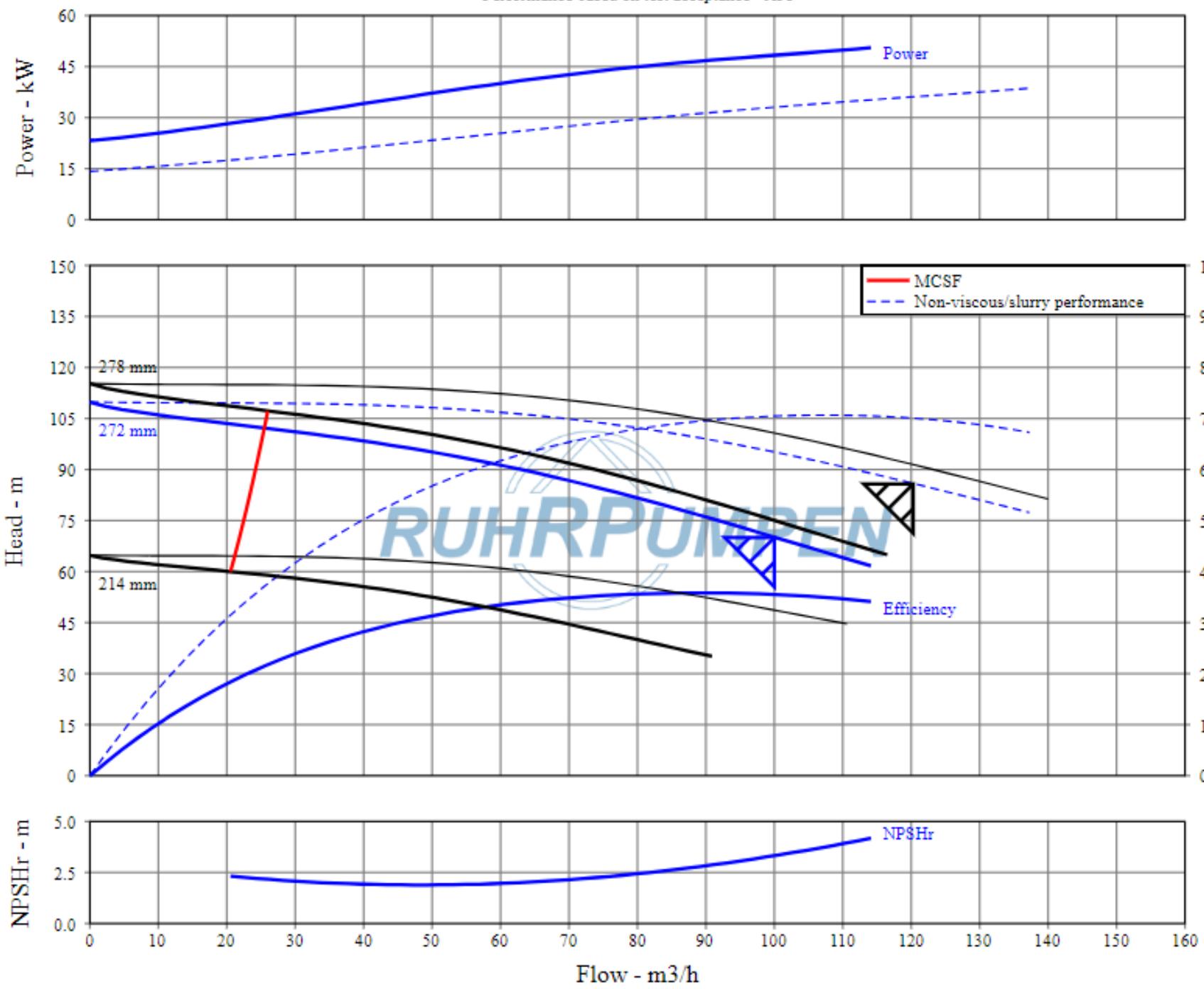- Select a pump to deliver 100m3/hr at 70m TDH of a hydrocarbon with SG 0.9 and

Viscosity	1cSt	vs	120cSt	vs	450cSt
CQ	1.0		0.93		0.83
CH	1.0		0.93		0.82
CE	1.0		0.73		0.51
Efficiency	68.1%		48.3%		35.5%
Rated Power	25.2kW		37kW		50.3kW

Pump Size 4x3x11 OH2

Handling Viscous Fluids

Example 2

- Select a pump to deliver 600m3/hr at 120m TDH of a hydrocarbon with SG 0.9 and

  Viscosity   1cSt   vs   1250cSt

	1cSt	vs	1250cSt
CQ	1.0		0.87
CH	1.0		0.88
CE	1.0		0.59
Efficiency	77.3%		47.0%
Rated Power	229kW		376kW

Pump Size 8x8x15 OH2

1250cS

Performance based on test acceptance - API

Handling Viscous Fluids

What About NPSH?

- There is no definitive answer within ANSI/HI 9.6.7-2010

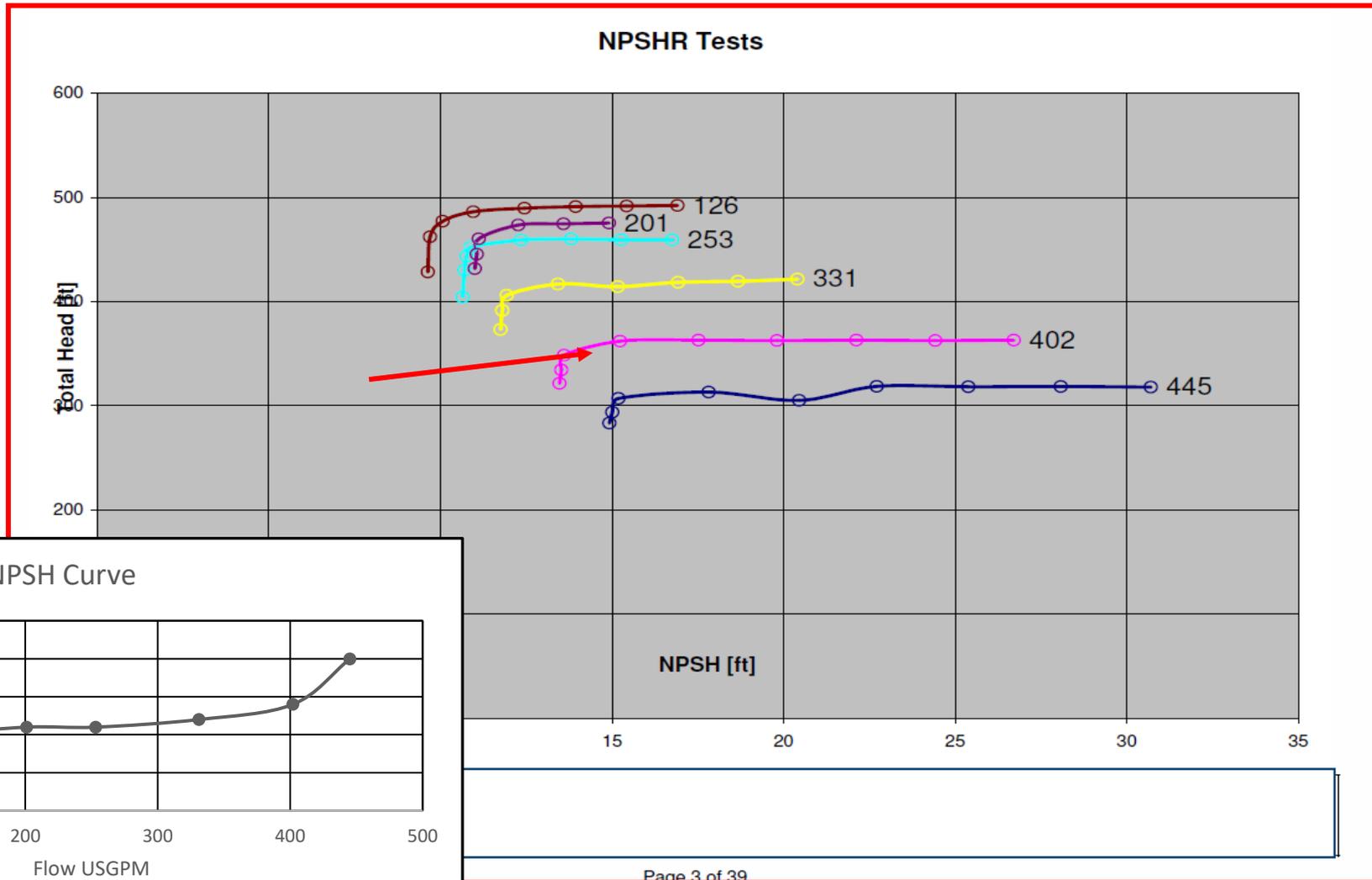"There is a dual influence of the pumped liquid viscosity on NPSH3. With increased viscosity the friction goes up, which results in an increase of NPSH3. At the same time, higher viscosity results in a decrease of air and vapor particle diffusion in the liquid. This slows down the speed of bubble growth and there is also a thermodynamic effect, which leads to some decrease of NPSH3.

The effect of viscosity on NPSH3 is substantially a function of the Reynolds number. However, this effect cannot be expressed by a single relationship for all of the different pump designs and types. As a general rule, larger size pumps and pumps with smooth and sweeping impeller inlets are less susceptible to changes in the pumped liquid viscosity."

"Gas dissolved in the liquid and gas entrained by the pumped liquid in the form of finely dispersed bubbles influence NPSH3 differently than large bubbles of gas. If the flow velocity at the pump inlet is high enough, then a small amount of entrained gas does not separate and essentially has no or very little influence on the NPSH3. The presence of larger gas accumulations greatly affects the pump suction performance. It causes the total head / NPSH3 characteristic curves to change shape from exhibiting a well defined "Knee" to having a gradual sloping decay in head. This increases the point of 3% head loss, or in other words, moves the NPSH3 to a higher value."

NPSH$_R$ NPSH Test Curve

Handling Viscous Fluids

What About NPSH

- So we see that ANSI/HI can't really make up its mind definitively what the real affect of viscosity on NPSH3 is.

- It does suggest a formula for a correction factor but does say "the user is cautioned that it is based on an analytical approach and is not based on actual NPSH test data. When pumping highly viscous liquids, ample margins of NPSHA over the NPSH3 are required and the advice of the pump manufacturer should be sought."

- RP and most other major manufacturers do not use a correction factor.

- The best advice is to be cautious with your NPSH margins.

Handling Viscous Fluids

Other Considerations

- Seal manufacturers should be consulted with all process conditions to ensure the right sealing solution

- For sealless pumps (canned motor or magnetic drive)

  - In canned motor pumps, the motor rotor and sleeve bearings are immersed in the pumped liquid. In magnetic drive pumps, the shaft magnetic coupling and bearings are immersed in the pumped liquid. The additional viscous drag due to the immersion of these components will lead to higher losses, resulting in increased power consumption and increased starting torque requirements. Heating of the viscous fluid in the rotor chamber may be a mitigating factor in sealless pump losses. Furthermore, cooling flow to the motor or magnetic coupling and bearings will be decreased. The temperature rise caused by the increased losses and decreased cooling flow must also be considered. In addition, the ability of the liquid to lubricate the sleeve bearings must be evaluated.

- Motor sizing for the maximum viscosity case.

Handling Viscous Fluids

What is the Limit of Viscosity that a Centrifugal Pump can Handle

- There is no definitive answer.

- Speak to a PD Pump vendor and he will say 200cS (☺)

- Speak to a Centrifugal Pump Vendor and he will say 2000cS

  - But you saw in Example 2 what 1250cS does to your absorbed power – 164%!

- I posted this question on LinkedIn on 3 different pumping forums.

  - My posts were read by over 700 pump guys and I got ONE Answer.

- My own opinion is that above about 500cS start looking at positive displacement pumps (largely from a cost of power viewpoint)

Handling Viscous Fluids

What is the Limit of Viscosity that a Centrifugal Pump can Handle

1. For pipeline pumps the main criteria is OPEX since the cost of power is their biggest cost by far.

2. You need to check for potential over stress on the shaft, keys, coupling etc. and overload of the motor. This is sometimes overlooked on pumps that need to start in really low ambient temperatures. I can recall some big refinery BB2 pumps for Siberia that had to start under very cold conditions and the short term fluid viscosity was so high they had to have a special startup routine that limited flow to <10% of BEP until the fluid got warm enough. Otherwise they would have damaged the pump/motor.

3. On smaller pumps and low specific speed pumps it often becomes mainly an issue of predicting the resulting performance. The thing to check here is HI 9.6.7. specifically the "B" parameter.

4. Can the mechanical seal take it ? (in terms of stress on the components from drag and shear between the seal and shaft - the traditional drive set screws may well be inadequate.

Source – Simon Bradshaw – Global Director of Engineering & Technologies – Trillium Flow Technologies

Handling Viscous Fluids

Typical Viscosities

Fluid	deg F	deg C	cSt
Crankcase Oil SAE 20	210	99	5.7-9.6
Crankcase Oil SAE 40	210	99	9.6-12.9
Castor Oil	100	38	259-325
Coconut Oil	100	38	259-325
Crude Oil 48 API	60	15.6	3.8
Crude Oil 32.6 API	60	15.6	23.2
Fuel Oils 1-3	70	21	2-16
Fuel Oil 6	122	50	100-660
Tar, Coke Oven	70	21	600-1760
Quench Oil (Typical)			100-120

Source :- EngineeringToolBox.com

Handling Viscous Fluids

Typical Viscosities Crude Oil

Source: Sánchez-Minero F., et al., 2014, *Comparison of correlations based on API gravity for predicting viscosity of crude oils*

Handling Viscous Fluids

Pumping Crude Oil Through Pipelines

https://pixabay.com/photos/person-walking-pipeline-tube-steel-731319/

Viscosity, Pipelines and how to save the world

Simon Bradshaw
Global Director of Engineering and Technology at Trillium Flow Technologies

62 articles ✓ Following

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https://www.linkedin.com/pulse/viscosity-pipelines-how-save-world-simon-bradshaw/?trackingId=A1YOekwPSsG1K3nfyk8Vsw%3D%3D

43

Coming Attractions ☺

"Firepumps for the Oil & Gas Industries"

Thur 6th June – 08.00 (UK GMT+1) (Eastern Hemisphere) & 17.00 (UK GMT+1) (Western Hemisphere)

Aimed at Process and Mechanical Engineers and Consultant Engineers specifying firepumping equipment for refineries and oilfield installations as well as Applications & Sales Engineers selecting and quoting them.

As well as covering firepumps in general the course will cover engineered firepump packages for hazardous areas such as offshore oil platforms and refineries.

Future subjects in preparation include:

- Double Case Pumps (Barrel Pumps – BB5)
- Sump Pumps
- Wastewater Pumps

RUHRPUMPEN

Specialist for Pumping Technology

Q & A

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RUHRPUMPEN AT A GLANCE

VERTICAL INTEGRATION

SALES OFFICES IN +35 COUNTRIES

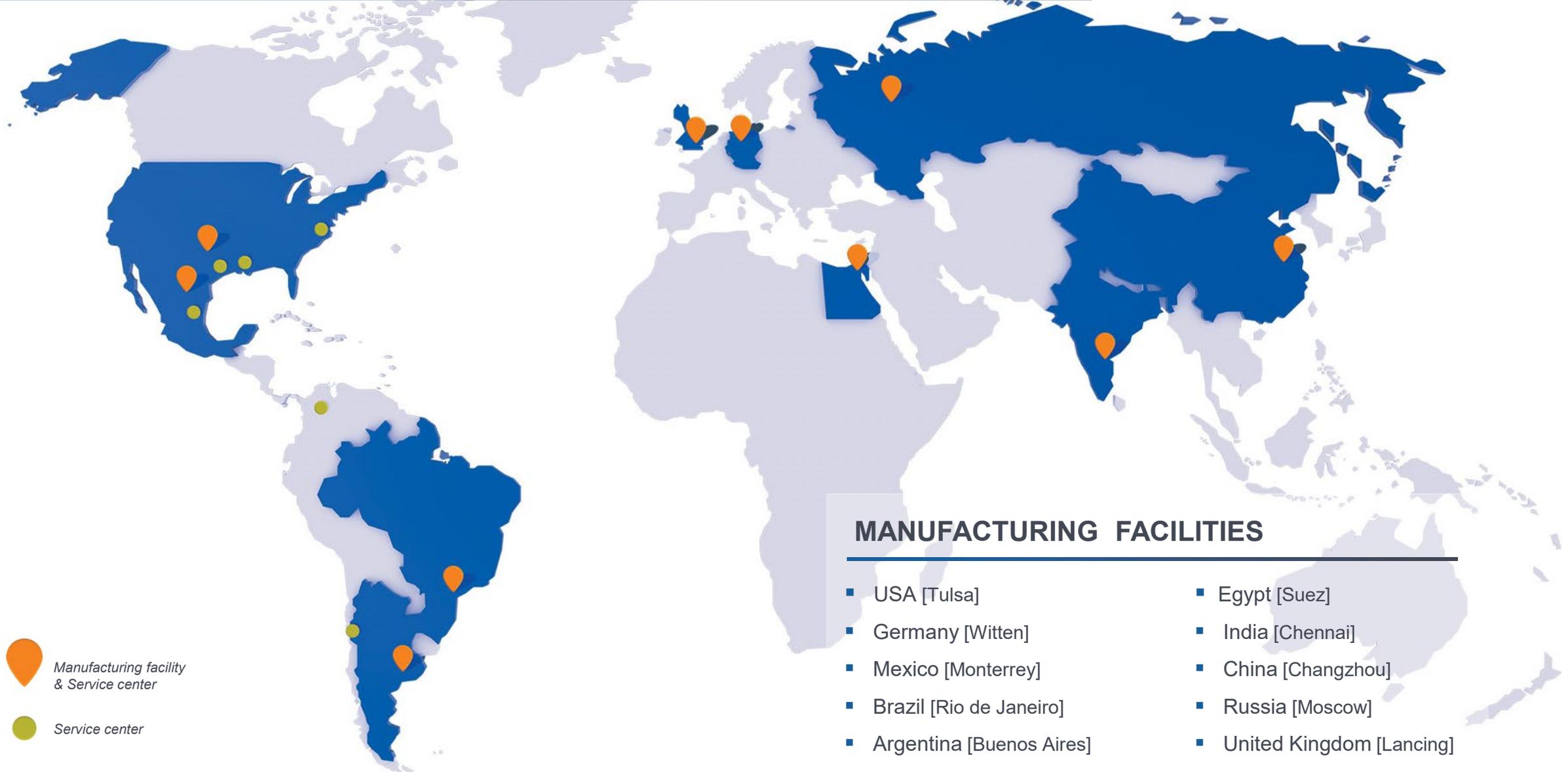MANUFACTURING **FACILITIES** IN 10 COUNTRIES

+**70** YEARS OF EXPERIENCE

+**2,000** EMPLOYEES

15 **SERVICE CENTERS**

+70,000 PUMPING SOLUTIONS INSTALLED WORLDWIDE

A GLOBAL COMPANY

RUHRPUMPEN

Manufacturing facility & Service center

Service center

MANUFACTURING FACILITIES

- USA [Tulsa]
- Germany [Witten]
- Mexico [Monterrey]
- Brazil [Rio de Janeiro]
- Argentina [Buenos Aires]

- Egypt [Suez]
- India [Chennai]
- China [Changzhou]
- Russia [Moscow]
- United Kingdom [Lancing]

MARKETS WE SERVE

Our commitment to create innovations that offer reliable solutions to our customers allow us to provide a complete range of pump systems to support **core markets** as:

OIL & GAS

CHEMICAL

INDUSTRIAL

POWER

WATER

RUHRPUMPEN

OUR PUMP LINES

Ruhrpumpen offers a broad range of highly engineered and standard pumping products that meet and exceed the requirements of the most demanding quality specifications and industry standards.

Our pumps can handle head requirements as high as 13,000 ft (4,000 m) and capacities up to 300,000 gpm (68,000 m³/hr). Moreover, our pump designs cover temperatures from cryogenic temperatures of -310 °F (-196 °C) up to 752 °F (400 °C).
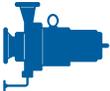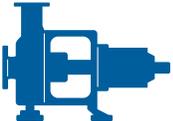

Products include:

- Single Stage Overhung Pumps
- Between Bearings Pumps
- Horizontal Multi-Stage Pumps
- Vertical Multi-Stage Pumps
- Vertical Mixed Flow & Axial Flow Pumps
- Positive Displacement Pumps
- Full Range of Industrial Pumps
- Submersible Pumps
- Magnetic Drive Pumps
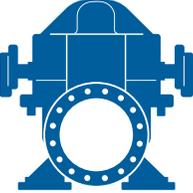- Decoking Systems
- Packaged Systems
- Fire Systems

OVERHUNG PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Sealless Magnetic Drive Pumps	CRP-M / CRP-M-CC	ISO 2858 & 15783 HI design (OH11)	
	SCE-M	API 685	
Foot Mounted OH1 and General End Suction Pumps	IPP	HI design (OH1)	
	CPP / CPP-L	HI design (OH1) ANSI B73.1	
	CPO / CPO-L	HI design (OH1) ANSI B73.1	
	CRP	HI design (OH1) ISO 2858 & 5199	
	GSD	HI design (OH0)	
	SHD / ESK / SK / SKO SKV / ST / STV	HI design (OH1)	
	SWP	HI design (OH3A)	
Centerline Mounted	SCE	API 610 (OH2)	
Vertical In-Line Pumps	SPI	API 610 (OH3)	
	IVP / IVP-CC	HI design (OH4 / OH5)	
	IIL	HI design (OH5) Dimensionally compliant with ANSI B73.2	
	SPN	API 610 (OH5)	

BETWEEN BEARING PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
1 and 2 stage	Axially split	HSC / HSD / HSL HSR / ZW	HI design (BB1)	
		HSM	HI design (BB3)	
		ZM / ZMS ZLM / ZME	API design (BB1)	
	Radially split	HVN / J	API design (BB2)	
		RON / RON-D	API design (BB2)	
Multi-stage	Axially split	SM / SM-I	API design (BB3)	
		JTN	API design (BB3)	
	Radially split single casing	GP	API design (BB4)	
	Radially split double casing	A LINE	API design (BB5)	

VERTICAL PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
Single casing	Diffuser	VTP	HI & API 610 (VS1)	
		VCT	HI & API 610 (VS1)	
		HQ	HI & API 610 (VS1)	
		VLT	HI & API 610 (VS1)	
	Volute	DSV / DX	HI & API 610 (VS2)	
	Discharge through column – Axial flow	VAF	HI & API 610 (VS3)	
	Separate discharge line	VSP / VSP-Chem	HI & API 610 (VS4)	
Double casing	Diffuser	VLT / VMT	HI & API 610 (VS6)	
	Volute	DSV / DX	HI & API 610 (VS7)	
Submersible pumps		SMF	HI design (OH8A)	
		VLT-Sub / VTP-Sub	HI design (VS0)	

SPECIAL SERVICE PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Pitot tube pumps	**COMBITUBE**	HI design	
Reciprocating pumps	**RDP**	API 674 ISO 13710	
Vertical turbine generator	**VTG**	HI design (VS6)	
Barge	**LS BARGE**	HI design	
Floating dock pumps	**ZVZ**	HI design	
	LVZ	HI design	
Cryogenic pumps	**SVNV**	-	
	VTG Cryogenic	-	
	VLT Cryogenic VLTV	-	
Pre-packaged fire pump systems	Fire systems incorporate pumps, drivers, control systems and pipework in a single container. They can be skid mounted, with or without enclosure and supplied with electric motor or diesel engine.	**NFPA-20-850** UL and FM approved components	