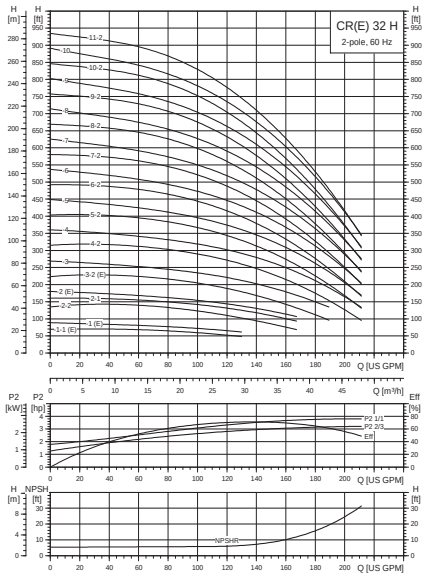
Selection of pumps

Selection of pumps should be based on:

- duty point of the pump
- sizing data such as pressure loss as a result of height differences, friction loss in the pipework, pump efficiency etc.
- pump materials
- piping dimensions
- shaft seal
- inlet pressure and operating pressure.

Duty point of the pump

From a duty point it is possible to select a pump on the basis of the curve charts in the section *Curve charts/ technical data* starting on page 24.



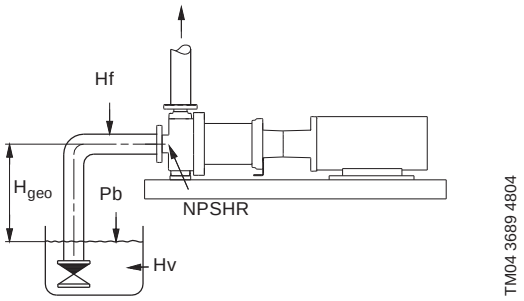
TM04 4551 1609

Fig. 23 Example of a curve chart

Sizing data

When sizing a pump the following must be taken into account.

- Required flow and pressure at the point of use.
- Pressure loss as a result of height differences (H_{geo}).
- Friction loss in the pipework (H_f).
  It may be necessary to account for pressure loss in connection with long pipes, bends or valves, etc.
- Best efficiency at the estimated duty point.
- NPSH value.
  For calculation of the NPSH value, see *Minimum inlet pressure - NPSHA* on page 22.

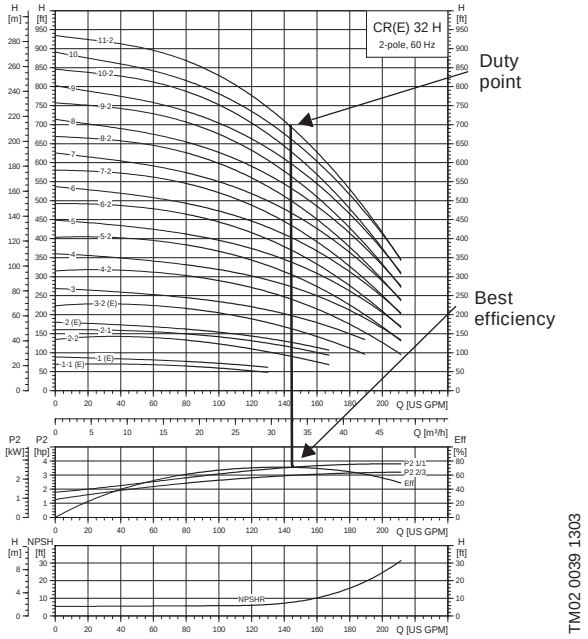


TM04 3689 4804

Fig. 24 Sizing data

Efficiency

Before determining the point of best efficiency, the operating pattern of the pump must be identified. If the pump is expected to operate in the same duty point, then select a CR(E)-H, CRN(E)-H pump which is operating in a duty point corresponding to the best efficiency of the pump.



TM02 0039 1303

Fig. 25 Example of a CR(E)-H, CRN(E)-H pump's duty point

As the pump is sized on the basis of the highest possible flow, it is important to always have the duty point to the right of the optimum efficiency point (see fig. 26, range with check mark). This must be considered in order to keep efficiency high when the flow drops.

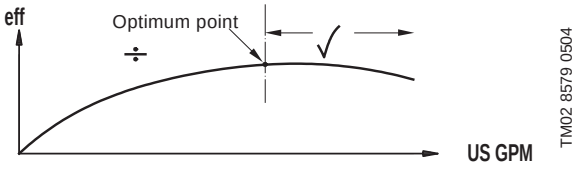


Fig. 26 Best efficiency

Normally, E-pumps are used in applications characterized by a variable flow. Consequently, it is not possible to select a pump that is constantly operating at optimum efficiency.

In order to achieve optimum operating economy, the pump should be selected on the basis of the following criteria:

- The max. required duty point should be as close as possible to the QH curve of the pump.
- The required duty point should be positioned so that P2 is close to the max. point of the 100 % curve.

Between the min. and max. performance curve E-pumps have an infinite number of performance curves each representing a specific speed. Therefore it may not be possible to select a duty point close to the 100 % curve.

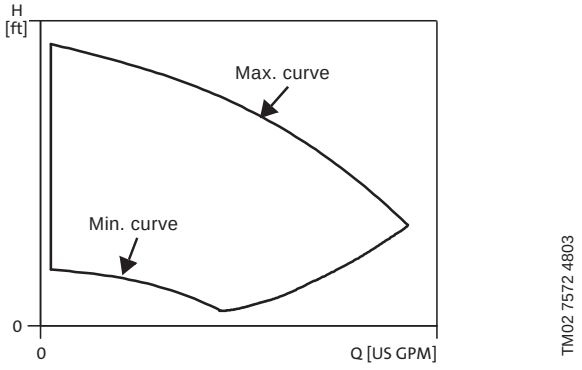


Fig. 27 Min. and max. performance curves

In situations where it is not possible to select a duty point close to the 100 % curve, the affinity equations to the right can be used. The head (H), the flow (Q) and the input power (P) are all the appropriate variables for the motor speed (n).

Note:

The approximate formulas apply on condition that the system characteristic remains unchanged for n_n and n_x, and that it is based on the formula $H = k \times Q_2$, where k is a constant.

The power equation implies that the pump efficiency is unchanged at the two speeds. In practice this is **not** correct.

Finally, it is worth noting that the efficiencies of the frequency converter and the motor **must** be taken into account if a precise calculation of the power saving resulting from a reduction of the pump speed is wanted.

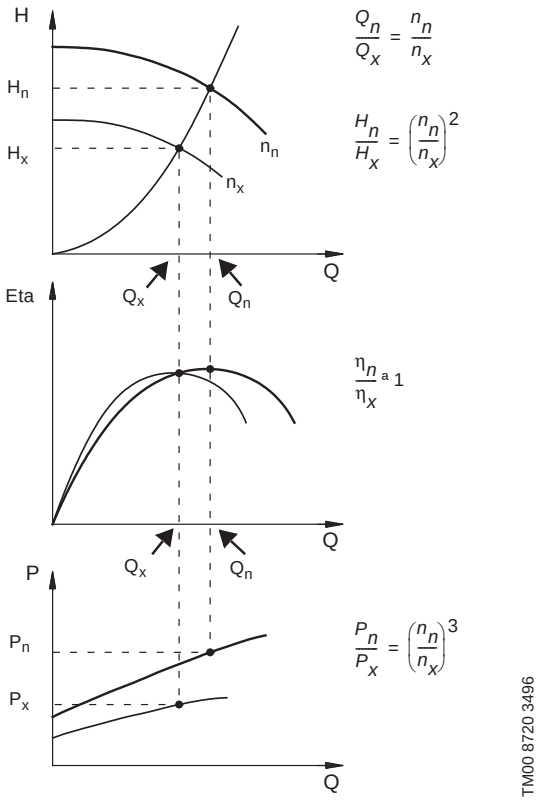


Fig. 28 Affinity equations

Legend

H_n	Rated head in feet
H_x	Current head in feet
Q_n	Rated flow in US gpm
Q_x	Current flow in US gpm
n_n	Rated motor speed in min^{-1} (n_n = 3500 min^{-1})
n_x	Current motor speed in min^{-1}
η_n	Rated efficiency in %
η_x	Current efficiency in %

WinCAPS and WebCAPS

Grundfos offers the two selection programs WinCAPS and WebCAPS.

The two programs make it possible to calculate an E-pump's specific duty point and energy consumption.

By entering the sizing data of the pump, WinCAPS and WebCAPS can calculate the exact duty point and energy consumption. For further information see page 115 and page 116.

Pump materials

The material variant should be selected based on the liquid to be pumped. The product range covers the following two basic types:

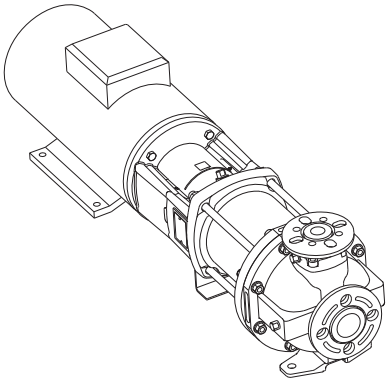
- The CR-H, CRE-H pump types are suitable for clean, non-aggressive liquids such as potable water, oils, etc.
- The CRN-H, CRNE-H pump types are suitable for industrial liquids and acids. See *List of pumped liquids* on page 100 or contact Grundfos.

Piping dimensions

CR(E)-H, CRN(E)-H pumps can be selected to comply with ANSI/ASME B73.1 piping and most baseplate dimensions based on the ANSI/ASME B73.1.

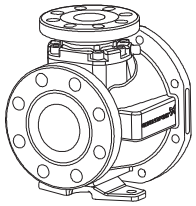
CR(E)-H, CRN(E)-H pumps can also be selected with Grundfos end-suction piping dimensions (GA is the only connector type available for CR, CRE 1s, 1, 3, 5 H pumps. See chart on page 7 for G22, G33, and G44 availability). When selecting your pump, please note:

	Pipe connection (inlet x discharge x impeller size reference)
GA	ANSI 1.5" x 1" x 6", 1.5" x 1" x 8"
G05	ANSI 2" x 1" x 10"
GB	ANSI 3" x 1.5" x 6", 3" x 1.5" x 8"
GC	ANSI 3" x 2" x 6"
G10	ANSI 3" x 2" x 6"
G50	ANSI 3" x 1.5" x 8", 3" x 1.5" x 10"
G60	ANSI 3" x 2" x 8", 3" x 2" x 10"
G20	ANSI 3" x 1.5" x 13"
G30	ANSI 3" x 2" x 13"
G70	ANSI 4" x 3" x 8", 4" x 3" x 10"
G40	ANSI 4" x 3" x 10", 4" x 3" x 13"
G22	ANSI 2" x 2"
G33	ANSI 3" x 3"
G44	ANSI 4" x 4"



TM04 4539 1609

Fig. 29 CR-H pump

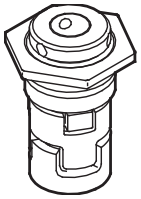


TM04 4039 0609

Fig. 30 Pump connections

Shaft seal

As standard, the CR(E)-H, CRN(E)-H range is fitted with a Grundfos shaft seal (cartridge type) suitable for the most common applications. See fig. 31.



TM02 0538 4800

Fig. 31 Shaft seal (cartridge type)

The following three key parameters **must** be taken into account, when selecting the shaft seal:

- type of pumped liquid
- liquid temperature
- maximum pressure.

Grundfos offers a wide range of shaft seal variants to meet specific demands. See *List of pumped liquids* on page 100.

Inlet pressure and operating pressure

Do **not** exceed the limit values stated on pages 16 and 18 as regards these pressures:

- maximum inlet pressure
- maximum operating pressure.

Minimum inlet pressure - NPSHA

Calculation of the inlet pressure "H" is recommended in these situations:

- The liquid temperature is high.
- The flow is significantly higher than the rated flow.
- Water is drawn from depths.
- Water is drawn through long pipes.
- Inlet conditions are poor.

To avoid cavitation, make sure that there is a minimum pressure on the suction side of the pump. The maximum suction lift "H" in feet can be calculated as follows:

$H = p_b – NPSHR – H_f – H_v – H_s$

P_b = Barometric pressure in feet absolute. (Barometric pressure can be set to 33.9 feet at sea level. In closed systems, p_b indicates system pressure in feet.)

NPSHR = Net Positive Suction Head Required in feet. (To be read from the NPSHR curve at the highest flow the pump will be delivering).

H_f = Friction loss in suction pipe in feet. (At the highest flow the pump will be delivering.)

H_v = Vapor pressure in feet. (To be read from the vapor pressure scale. "H_v" depends on the liquid temperature "T_m").

H_s = Safety margin = minimum 2.0 feet.

If the "H" calculated is positive, the pump can operate at a suction lift of maximum "H" feet.

If the "H" calculated is negative, an inlet pressure of minimum "H" feet is required.

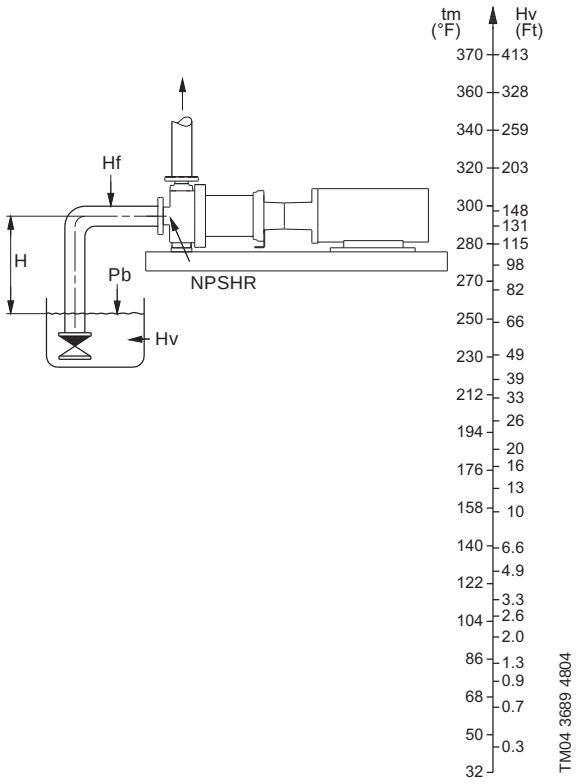


Fig. 32 Minimum inlet pressure - NPSHR

Note: In order to avoid cavitation **never** select a pump whose duty point lies too far to the right on the NPSHR curve.

Always check the NPSHR value of the pump at the highest possible flow. The NPSHR curves can be found in the curve charts on pages 24 to 94.

Maximum inlet pressure

The table on page 18 states the maximum permissible inlet pressure. However, the actual inlet pressure + maximum pump pressure (at no flow) must always be lower than the values stated in the table on page 16.

The pumps are pressure-tested at a pressure of 1.5 times the values stated on page 16.

How to read the curve charts

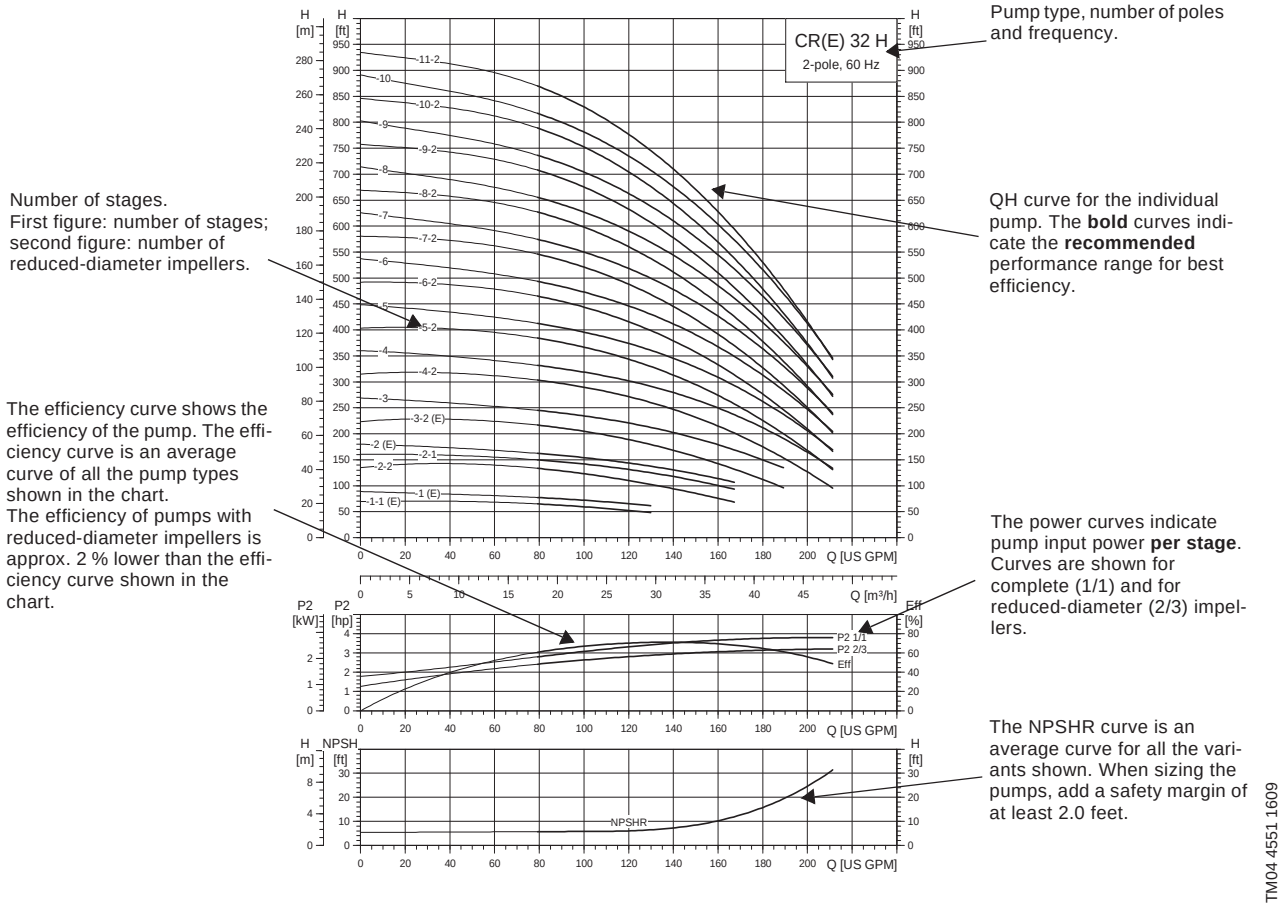


Fig. 33 How to read the curve charts

Guidelines to the curve charts

The guidelines below apply to the curves shown on the following pages:

- The motors used for the measurements are standard motors (TEFC or MLE).
- Measurements have been made with airless water at a temperature of 68 °F (20 °C).
- The curves apply to a kinematic viscosity of $\upsilon = 1\ mm^2/s$ (1 cSt).
- Due to the risk of overheating, the pumps should not be used at a flow below the minimum flow rate.
- The QH curves apply to actual speed with the motor types mentioned at 60 Hz.

The curve below shows the minimum flow rate as a percentage of the rated flow rate in relation to the liquid temperature. The dotted line shows a CR(E)-H, CRN(E)-H pump fitted with an air-cooled top assembly.

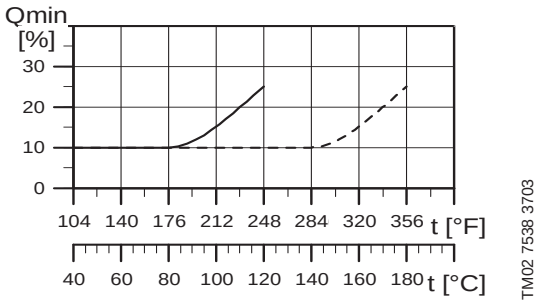


Fig. 34 Minimum flow rate