Pumpen Intelligenz.

WILO AG
Nortkirchenstraße 100
44263 Dortmund
Germany
T 0231 4102-0
F 0231 4102-363
wilo@wilo.de
www.wilo.de

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Tips and tricks on selecting water supply pumps.

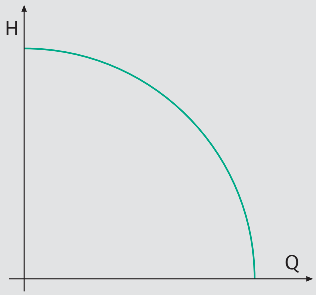
Pump characteristics.

Pump parameters are determined by two values:

• Q – flow rate in m^3/h – quantity of pumped water over a specified time

• H – pump head in [m] of a column of water

These two parameters (Q, H) describe the so-called duty point of a pump. Changing one of them influences the other (for each Q different H). All these possible duty points of a pump can be shown as a curve in a Q – H coordinates system.



Flow rate Q:

For a family house with 4 persons, we can approximate the maximum flow rate as following:

• no garden watering: Qm^3/h = 1–2 m^3/h

• with garden watering: Qm^3/h = 2–3 m^3/h

Pump head H:

A simplified formula for calculating the pump height of a water supply pump is:

$H = H_{geo} + (0.2 \times L) + 10$ [m]

H = Required pump head [m]

H_{geo} = Geometrical height from water level to highest discharge point [m]

0.2 = Approximate value for pipework resistance including pipe elbows, fittings, valves etc.

L = Length of suction and discharge pipeline [m]

10 = Minimum required pressure at the system outlet [m]

Pump selection.

Pump selection is dependent on the values determined for flow rate and pump head, which are required for installation. Based on this calculation, the most appropriate pump that can deliver the required flow and head, should be selected.

Required pump head.

It is the pressure (expressed in [m] of a water column) needed to:

• lift water to the required suction height

• overcome resistance in pipework and fittings

• deliver necessary water pressure at the outlet

In other words it consists of:

• geometrical height from water level to highest discharge point

• sum of resistances of installation: pipework, fittings, valves etc. (if the water source is located not very far from the house, it can be assumed that total losses constitute approx. 20 % of pipework length – horizontal and vertical)

To ensure the right pressure at the outlet, it is necessary to add around 10–15 m for an optimal outflow.

The data for lifting opportunities has to be taken out from technical documentation.

Required flow rate.

It is the flow rate required to cover the water demand.

As mentioned before for a family house without a garden, it can be assumed that the maximum flow rate would be 1 – 2 m^3/h, for a house with a garden, it would amount to 2 – 3 m^3/h.

If the distance between the house and tank is too great (more than 15–20 m), it is recommended that you use a submersible pump instead of a self-priming pump.

In the following examples the calculation process is based on estimated values.

Water supply pumps.
Example 1.

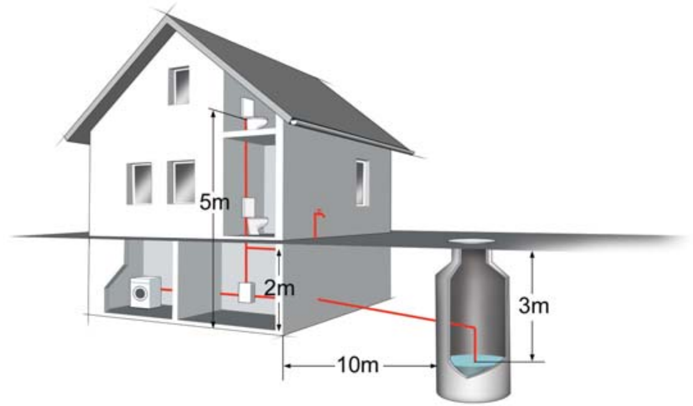
We select a pump for a family house. It pumps water from an underground tank whose water level is 3 m below ground level. The pump is installed in the basement on the floor (2 m below ground level). The highest outlet is installed 5 m above the pump. The tank is located 10 m away from the house. There are four people living in the house and the owner is planning to irrigate the garden. In order to calculate the required pump head we can assume the following from the diagram:

1. Geometrical height between pump location and the highest outlet $H_{geo} = 5$ m
2. Height difference between the pump and the lowest water level $X = 3 - 2 = 1$ [m]
3. 20 % of losses which is around 3 m (that is 20 % of total length of the pipework; total length of the pipework – L is around 16 m) $0.2 \times L = 0.2 \times 16 \text{ m} \approx 3$ m
4. 10 m to ensure a satisfactory outlet pressure

$H = H_{geo} + X + (0.2 \times L) + 10$ [m]
$H = 5 + 1 + 3 + 10 = 19$ [m]. Total pump head is 19 m.

With the option of watering the garden via outlets in the house, we can assume an output of 2 – 3 m^3/h.

Pump selection is determined by the following parameters:
- $Q = 3\ m^3/h$
- $H = 19$ m



From the characteristic fields, we select a pump to meet the desired parameters, i.e.: Wilo-SilentMaster 304.

Water supply pumps.
Example 2.

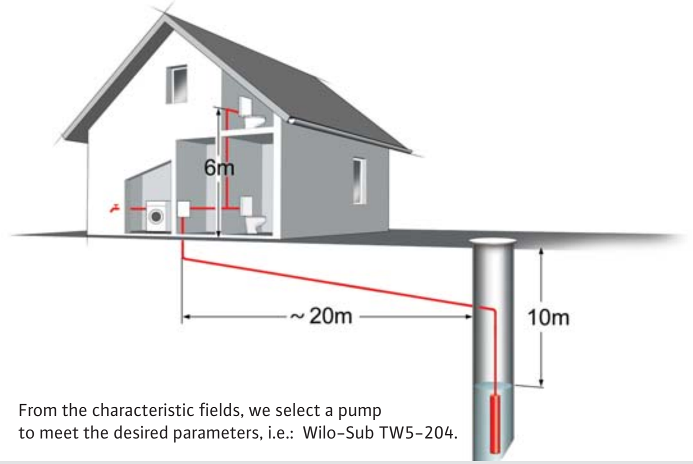
We select a water supply system for a family house from an open well, where the water level is located 10 m below ground level. The house does not have a basement and there are four people living in the house. In addition, the owner wants to irrigate the garden and wash his car. The water source is located 20 m away from the house and the highest water outlet is positioned 6 m above ground level. The water table is too deep to use a self-priming pump. A submersible pump must be used. In order to calculate the required pump head we can assume the following from the diagram:

1. Geometrical height between pump location and the highest outlet $H_{geo} = 10 + 6 = 16$ [m].
2. 20 % of losses which is around 7 m (that is 20 % of total length of the pipework; total length of the pipework – L is around 36 m) $0.2 \times L = 0.2 \times 36 \text{ m} \approx 7$ m
3. 10 m to ensure a satisfactory outlet pressure

$H = H_{geo} + (0.2 \times L) + 10$ [m]
$H = 16 + 7 + 10 = 33$ [m]. Total pump head is 33 m.

With the option of watering the garden via outlets in the house, we can assume an output of 2 – 3 m^3/h.

Pump selection is determined by the following parameters:
- $Q = 3\ m^3/h$
- $H = 33$ m



From the characteristic fields, we select a pump to meet the desired parameters, i.e.: Wilo-Sub TW5-204.

Water supply pumps.
Example 3.

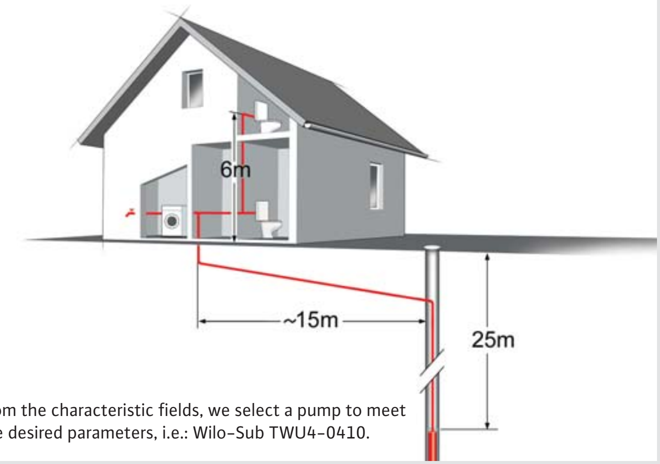
We select a water supply system for a family house from a 4“ well, where the water level is located at a depth of 25 m below ground level. The house does not have a basement and there are four people living in the house. In addition the owner wants to irrigate the garden and wash his car. The well is located 15 m from the house and the highest water outlet is positioned 6 m above ground level. The water table is too deep to use a self-priming pump. The diameter of the well also excludes the possibility of using a 5’’ pump; for this reason, a 4’’ pump should be used. In order to calculate the required pump head we can assume the following from the diagram:

1. Geometrical height between pump location and the highest outlet $H_{geo} = 25 + 6 = 31$ [m]
2. 20 % of losses which is around 9 m (that is 20 % of total length of the pipework; total length of the pipework – L is around 46 m) $0.2 \times L = 0.2 \times 46 \text{ m} \approx 9$ m
3. 10 m to ensure a satisfactory outlet pressure

$H = H_{geo} + (0.2 \times L) + 10$ [m]
$H = 31 + 9 + 10 = 50$ [m]. Total pump head is 50 m.

With the option of watering the garden via outlets in the house, we can assume an output of 2 – 3 m^3/h.

Pump selection is determined by the following parameters:
• $Q = 3$ m^3/h
• $H = 50$ m



From the characteristic fields, we select a pump to meet the desired parameters, i.e.: Wilo-Sub TWU4-0410.