thyssenkrupp Calculator App

Operating instructions:

1. Page Specifications

Input data:
The settings are made in the Specifications sheet based on the type and performance of the pump used.

- **Operating pressure:**
  The operating pressure is entered in MPa (megapascals).
  1 MPa corresponds to 10 bar. Depending on the series, thyssenkrupp Uhde ultra-high-pressure pumps are designed for operating pressures of up to 4,000 bar or 6,000 bar. The peak performance point, at which the ratio of pressure, nozzle diameter, and service life is optimal, is as follows for the pumps:

    - Uhde 4011 - 350 MPa; nozzle 0.18 mm
    - Uhde 4015 - 380 MPa; nozzle 0.23 mm
    - Uhde 4022 - 380 MPa ; nozzle 0.25 mm
    - Uhde 4037 - 380 MPa ; nozzle 0.35 mm
    - Uhde 4045 - 380 MPa ; nozzle 0.38 mm
    - HPS 6045 - 580 MPa ; nozzle 0.25 mm
    - HPD 6090 - 580 MPa ; nozzle 0.38 mm

- **Nozzle diameter:**
  Number of nozzles: The above information always refers to one nozzle. If several cutting heads are used, the nozzle diameter is reduced accordingly. More detailed information can be found in the pump specifications.

Output data:
Here you will find information on the jet velocity, compressibility, and flow rate of the water through the respective nozzle, as well as information on the required power and the number of working strokes of the pressure intensifier.

Characteristic data:
The correct thyssenkrupp Uhde ultra-high pressure pump is selected from the output data. The characteristic data contains information on the operating pressure, power, delivery rate, and number of nozzles that can be operated under these conditions.

2. Page Cutting speed

Input data:

- **Material:**
  Several predefined materials can be selected here, but you can also create and save your own materials. Use the Add material button to create a new material by assigning a name and assigning a material index. This material index refers to the machinability determined in tests. We use the database of the world's most widely used waterjet software.

- **Material thickness:**
  A value between 0.1 mm and 300 mm can be set. Please note that reliable calculations are only possible below 100 mm. Anything above this is for guidance only and requires a test cut in practice.

- **Operating pressure - Nozzle diameter:**
  Use the values entered for pump selection.

- **Focus diameter:**
  The diameter of the focusing tube, also known as the mixing tube, is determined by the volume of water and sand that needs to be processed there. The rule of thumb is that this diameter is 3 times the diameter of the water nozzle.

- **Abrasive:**
  All calculations refer exclusively to the use of garnet sand as a cutting agent. For alternative cutting agents, the calculation can only be determined in tests.

- **Grain size:**
  Here you can choose between 80 mesh and 120 mesh. Mesh is a specification for a screen size through which the garnet sand is sieved. 80 mesh describes a sieve with 80 holes per square inch, etc. In addition to the common 80 and 120 mesh variants, many more gradations are available. Similar to sandpaper, the principle here is that you have to choose between removal rate and surface quality.

- **Particle type:**
  Alluvial, i.e., deposited garnet sand is extracted from sand mines, washed, and dried. The sand is inexpensive and widely available. Crushed sand is produced from rock by grinding and has sharper edges. Crushed sand has a 5-10% higher cutting performance but is more expensive than alluvial sand.

- **Quantity (abrasive rate):**
  Here you enter the desired amount of sand that the cutting head should process. The rule of thumb is: between 80 and 170 grams of sand per liter of water (flow rate on sheet 1)

- **Contraction constant:**
  The contraction constant accesses certain stored formulas and changes the spread between the quality levels. For the majority of calculations, the contraction constant can be assumed to be 10.

- **Cutting speed:**
  Here, a distinction is made between the five cutting speeds that have become established as standard criteria in the waterjet sector based on the formation of grooves and trailing marks. In relation to the maximum cutting speed, the cutting qualities are as follows:
  - Q1 rough cut – approx. 75% of the maximum cutting speed
  - Q2 coarse cut - approx. 65% of the maximum cutting speed
  - Q3 medium cut - approx. 40% of the maximum cutting speed
  - Q4 fine cut - approx. 30% of the maximum cutting speed
  - Q5 extra-fine cut - approx. 22% of the maximum cutting speed

3. Slider Desired cut quality

Input data:
Please specify the desired cut quality here, which will be included in the cost calculation.

- **Cutting path:**
  Enter the calculated cutting path in mm.

- **Cutting speed:**
  The cutting speed specified on page 2 is used here.

- **Cutting complexity:**
  The value for cutting complexity is a subjective assessment by the operator and has a direct influence on the cost calculation. A straight cut has a complexity of 1, while a complicated cut with many corners, connections, and micro-bridges would have a value of 10.

- **Number of cutting heads:**
  The number of cutting heads corresponds to the number of nozzles from page 1.

- **Number of connections:**
  The number of connections, i.e., the start holes, can be counted using the drawing.

- **Time per cut:**
  The cutting software determines the time individually depending on the type and thickness of the material. As a rough estimate, you can assume about 0.5 seconds per mm of material thickness.

- **Fixed costs:**
  All listed costs for machinery, personnel, etc. must be determined individually. We are happy to assist you in planning your system and provide you with all the necessary data.

- **Variable costs:**
  Variable costs are consumption costs that must be determined individually. We would be happy to provide you with guidelines for your calculation.