

## ABSTRACT

The pump designed here is a one-level centrifugal pump with vertical axle. This pump has a capacity (Q) of 50 m<sup>3</sup>/hour, total pressure height (H) of 30 meter, motor rotation (n) is taken for 3000 rpm (2 poles, frequency 50 Hz), and pumping power of 5.5 kW. This pump uses closed impeller because the fluids transmitted is clean water.

### A. Objective

The objective of designing this pump is to save the available space/place, because it is impossible to install a horizontal pump.

### B. Usage

The application of this pump are:

1. to be used in places or spaces where it is impossible to install a horizontal pump, due to the limitations of the available space;
2. to channel fluids from water reservoir to a building for the employees' uses in working-hours.

### C. The Main Dimensions of the Pump

The main dimensions of the pump comprise the axle and axle-neck diameters, the suction-mouth and blade diameters, impeller width and blade angle.

#### 1. Pump Housing

The pump housing takes the shape of snail shell/volute; the material for the pump housing is cast iron.

#### 2. Impeller

The impeller used is closed impeller of backward curve vanes type. A balancing hole is made in the impeller for reducing the axial forces caused by the fluid's pressure. The impeller dimensions are as follow:

- The number of the blade (z) : 6
- Input side diameter (D<sub>1</sub>) : 85.34 mm
- Output side diameter (D<sub>2</sub>) : 162.25 mm
- Input side width (b<sub>1</sub>) : 19.3 mm
- Output side width (b<sub>2</sub>) : 10.9 ≈ 11 mm
- Blade 1 thickness (t<sub>s1</sub>) : 1.4 mm
- Blade 2 thickness (t<sub>s2</sub>) : 3.2 mm
- Blade angle of the input side (β<sub>1</sub>) : 14°
- Blade angle of the output side (β<sub>2</sub>) : 22°
- Material : cast iron

Cast iron is selected for the impeller material because the water's acidity/pH = 7 (neutral fluids) and rotation speed U<sub>2</sub> is less than 35 m/second.

#### 3. Axle

The axle used is one with S 40 C material, with the stretching force σ<sub>B</sub> of 55 kg/mm<sup>2</sup>. The axle dimensions are as follow:

- axle length (L) : 450 mm
- impeller axle diameter (d<sub>s</sub>) : 25 mm

## **D. The Pump Supporting Elements**

### **1. Bearing**

The bearing used is ball-bearings, i.e:

- Axial bearing (Thrust ball bearing, single direction), with bearing number 51306.
- Radial bearing (Deep groove ball bearing, single row), with bearing number 6306.

The criterion in calculating the bearings is its useful-life that is taken as 40.000 to 60.000 hours of usage. The bearings' lubrication material is Vaseline (grease).

### **2. Coupling**

The coupling used is fixed flinch coupling. It is selected because:

- simple and quick to install
- concise and light
- safe on high speeds, small vibration and impact
- able to prevent overloading
- there is minimum axial shift on the axle whenever thermal expansion occurs.

### **3. Packing Case**

Packing case or stuffing box must be provided to prevent leaking. These boxes are filled with soft packing compressed against the axle by gland. This packing case is fitted together with the pump housing and asbestos material is selected for the packing.

### **4. Wedge**

The wedge used is prismatical wedge, with the dimensions:

- Size : (8 x 7) mm
- Impeller wedge length : 20 mm
- Coupling wedge length : 36 mm
- Wedge material : S 30 C

The reason for selecting wedge from that material is for the wedge to damage first, because the shear stress of the wedge is smaller than the shear stress of the axle as well as its lower cost.

### **5. Wear Resisting Ring**

The function of wear resisting ring is to reduce the friction between the pump housing and the impeller. The ring is separated from the pump so that it is easy to change. The material for the ring is from asbestos.