**Calculations**

**Given data:**

* Motor = 1800rpm
* Diameter of Bore = 75mm = 0.075m
* Diameter of Rod = 45mm = 0.045m
* Dead Load = 2.5Ton = 24516.625N
* Holding load = 8Ton = 78453.2N
* Head Loss= 10bar
* Pump efficiency = 0.9

**Solution:**

* Area of Bore = = **0.0044178**
* Area of Rod = = **0.0015904**
* Annular Area = Area of Bore – Area of Rod

Annular Area= 0.0044178 - 0.0015904

Annular Area = **0.00282737**

* **Pressure:**
* Fast up pressure:

Fast up pressure**:= 86.711bar**

With Head loss = 86.711 + 10 = **96.711bar**

* Fast Down Pressure:

Fast Down Pressure:  **55.49 bar**

With Head loss = 55.49+10 = **65.49bar**

* Working Pressure:

Working Pressure:**177.85bar**

With Head loss = 177.85 + 10 **= 187.85bar**

* Holding Pressure:

Holding Pressure:**177.85bar**

With Head loss = 177.85 + 10 **= 187.85bar**

* **Flow Rate:**
* For fast down (V = 0.2 m/s):  
  Q = Area of Bore × V= 0.0044178 × 0.2= **0.00088356 m³/s  
  Q = 53.0136 L/min**
* For working (V = 0.01 m/s):  
  Q = Area of Bore × V= 0.0044178 × 0.01= **0.000044178 m³/s**  
  **Q = 2.65068 L/min**
* Flow rate for fast up (V = 0.2 m/s)

Q= Annular Area × V = 0.002828737 × 0.2= **0.0005654 m³/s**

**Q = 33.9284 L/min**

**Maximum Flow Rate to be considered=53.0136 L/min**

* **Pump Displacement:**

D =

D = = **32.722 cc/rev**

* **Motor Size:**

**For Pump KW =**

**For Motor KW =**

* Fast up(pump) = = **5.46KW = 7.33HP**

Fast up(motor) = = **6.07KW = 8.14HP**

* Fast down(pump) = = **5.78KW = 7.75HP**

Fast down(motor) = = **6.42KW = 8.62HP**

* Working(pump) = = **0.82KW = 1.11HP**

Working(motor) = = **0.92KW = 1.23HP**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cycle phase** | **Flow rate**  **(LPM)** | **Pressure**  **Case1**  **(Bar)** | **Motor Sizing**  **(KW)** |
| **Fast Down** | 53.0136 | 65.49  (Dead load) | 6.42 |
| **Working** | 2.6506 | 187.75  (Holding load) | 0.92 |
| **Holding** | 0 | 187.75  (Holding load) | 0 |
| **Fast up** | 33.9284 | 96.711  (Dead Load) | 6.07 |

* Pump Displacement (cc/rev) = 32.722 cc/rev
* Relief Valve setting = 200bar
* Factor of Safety = 200/187.75=1.0652