Calculations for Hydraulic Motor System

Gather Details:

A. Torque required for the component being driven in Newton metres (Nm).
   If torque has not been provided it can be calculated as follows for a wheel or winch:
   1) Radius of wheel / winch (in metres) being driven
   2) Load being lifted (kg - kilograms)
   3) Factor to overcome frictional losses (20% - 1.2)

$$torque\ (Nm)\ =\ load\ (kg) \times\ 9.8(N/kg)\ \times\ radius\ (m)\ \times\ 1.2$$

B. Estimated Working Pressure (Bar) obtained from the motor catalogue. (Note: Bar = MPA x 10).
C. Motor RPM (Revolutions Per Minute) required by the system.
D. (Delta) Δ P/ Nm of hydraulic motor selected for system (This will be listed in the motor catalog).

Motor Sytem Calculations

Step 1 - Determine the required hydraulic motor torque (Nm) per Delta P (bar) as specified in the manufacturer's catalogue.

$$Torque\ (Nm)\ =\ \frac{Torque\ required\ by\ the\ machine\ (Nm)\ \times\ \Delta\ P/Nm}{Estimated\ working\ pressure\ (bar)}$$

Step 2 - Determine System Working Pressure (bar)

$$W.P.\ (bar)\ =\ \frac{Torque\ (Nm)(required\ by\ the\ machine)\ \times\ \Delta\ P/Nm}{Motor\ Torque\ (Nm)\ nearest\ to\ Step\ 1\ from\ motor\ catalogue}$$

Step 3 - Determine flow rate required to drive motor.

$$Litres/min\ =\ \frac{cm^3/rev\ \times\ Motor\ RPM}{1000}$$

Step 4 - Determine kilowatts (kW) required to drive the pump for the given parameters.

To convert pressure in bar to MPa, divide bar by 10.
Relief valve pressure can be 10% above working pressure.
1.2 adds 20% to overcome frictional losses.

$$kW\ =\ \frac{MPa\ (of\ relief\ valve) \times\ Litres/min\ \times\ 1.2}{60}$$

Step 5 - Determine Amps (Amperage) required by an electric motor based on the required parameters (formula used for 3 phase electric motor)

$$Amps\ =\ \frac{kW\ \times\ 1000}{Volts\ \times\ 0.8\ \times\ \sqrt{3}}$$