Pumps Simulation

Example: Forty tons per hour of water with the temperature of 20 ◦C has to be pressured from 1 to 6 bar.

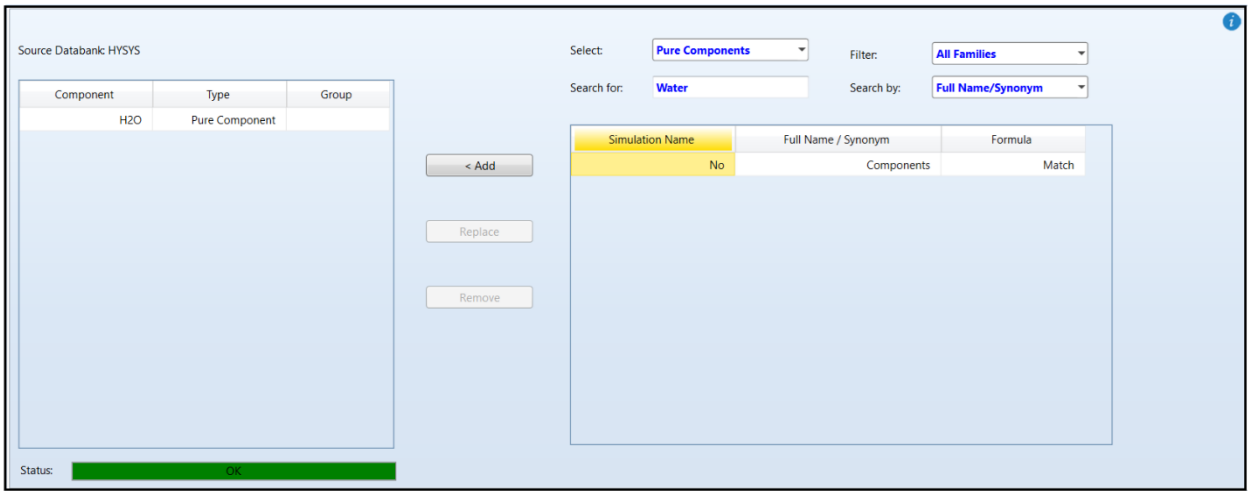
a. Calculate the electricity requirement of the pump if its efficiency is 70%.
b. The pump characteristic curve *H=f*(*Q*) provided by the producer is given in Table 4.1; considering the same efficiency as in point *a*, calculate the discharge pressure, head developed, and NPSH available.

Table 4.1 Pump performance curve data

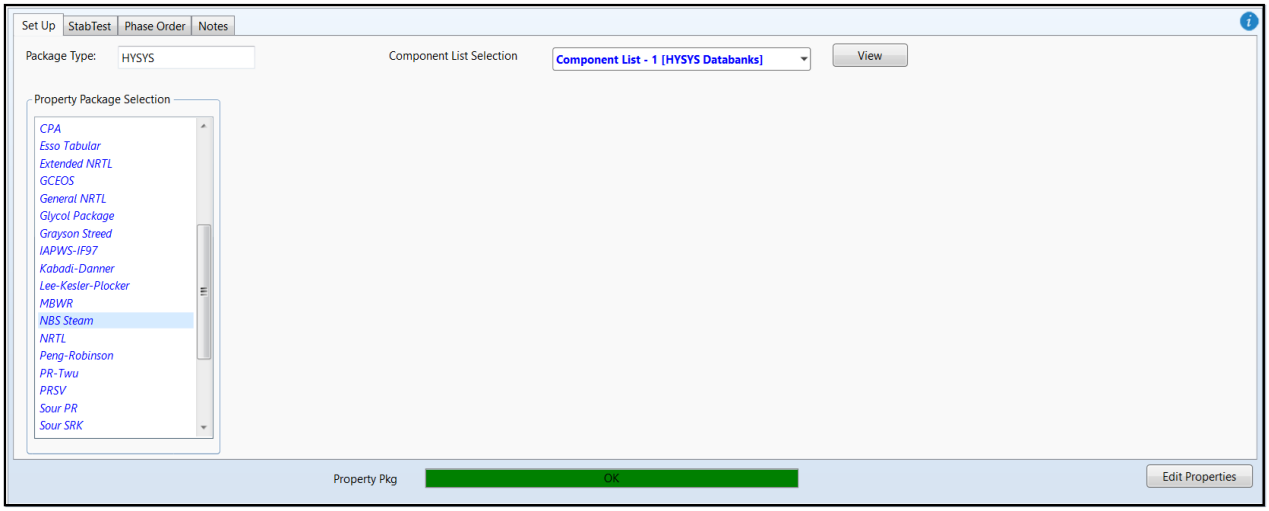
$Q\ (m^3 \cdot h^{-1})$	10	20	30	40	50	60	70	80
H (m)	60	57.5	55	53	50	47	42.5	37

Solution:

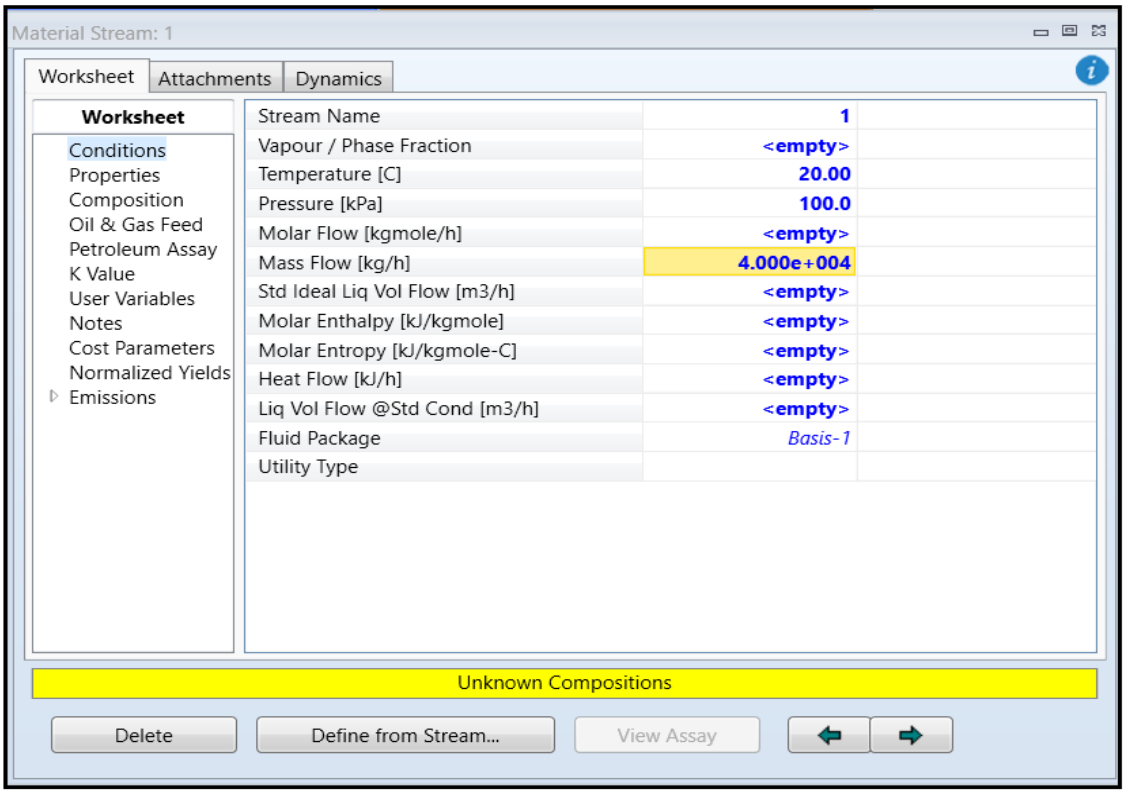
1.Define water as the component in component list under Property

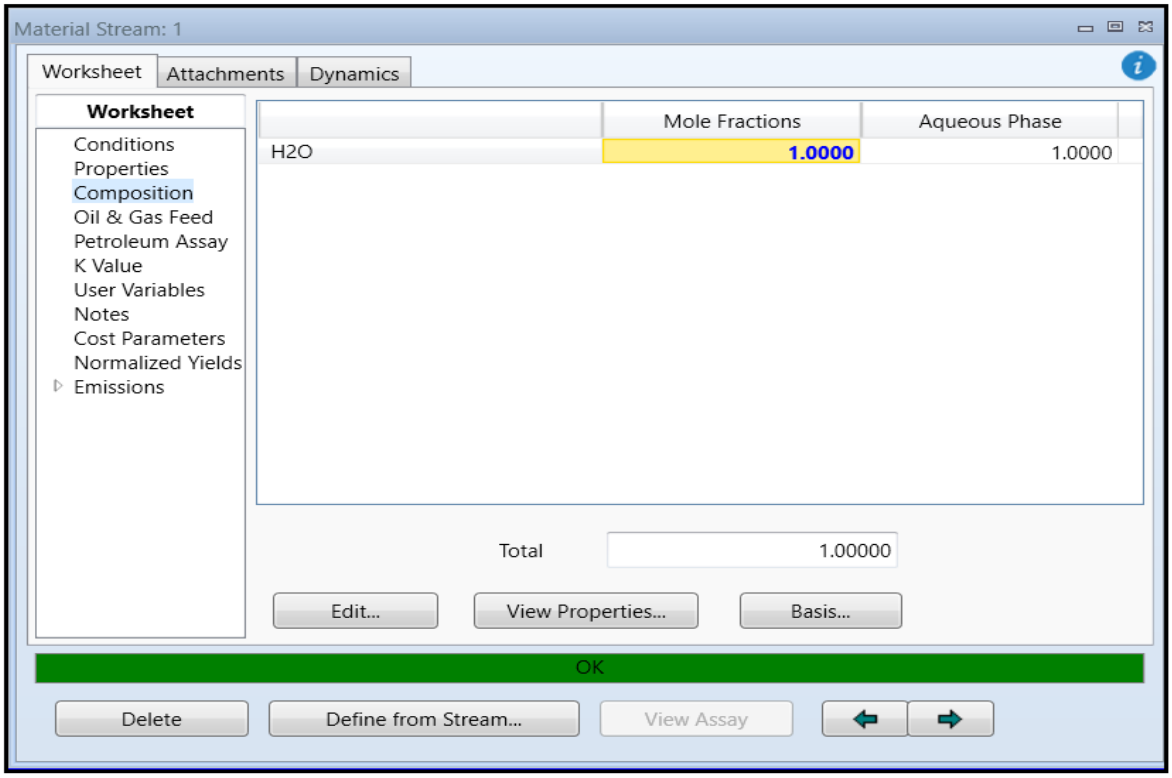


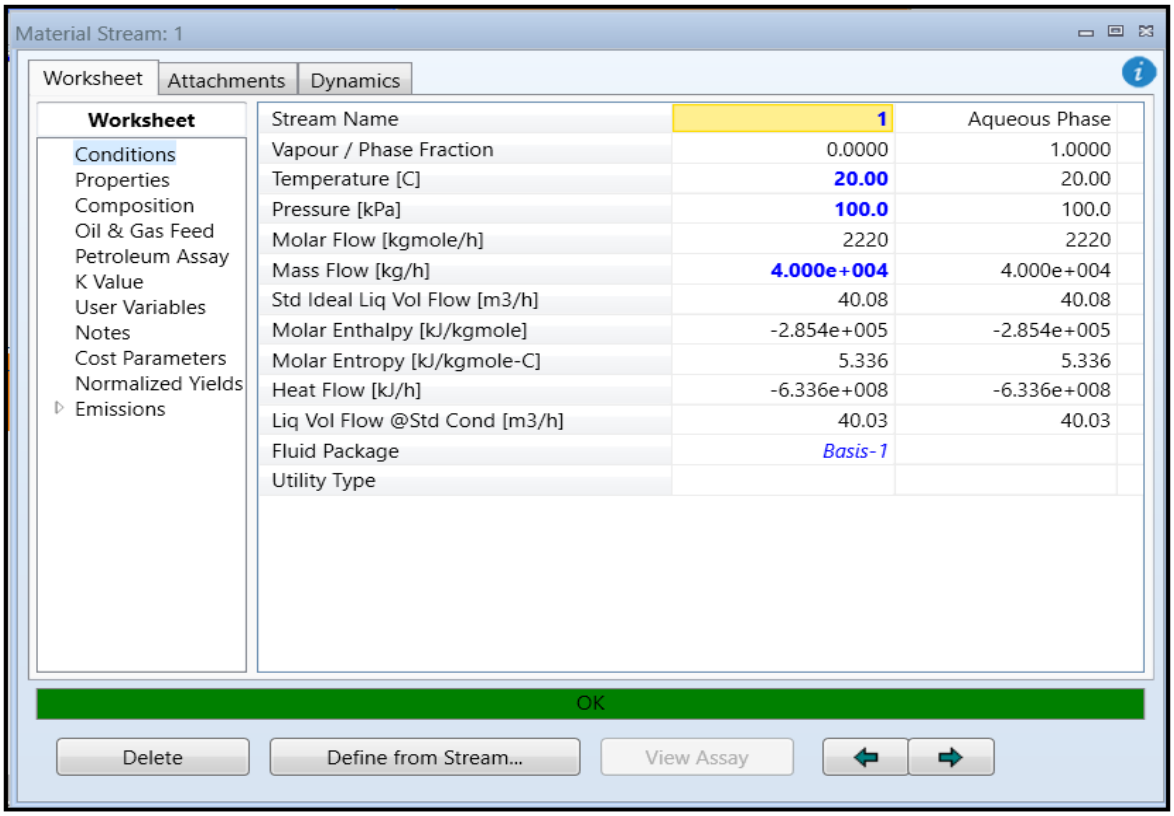
2. Select NBS Steam as the Fluid Package for water applications.



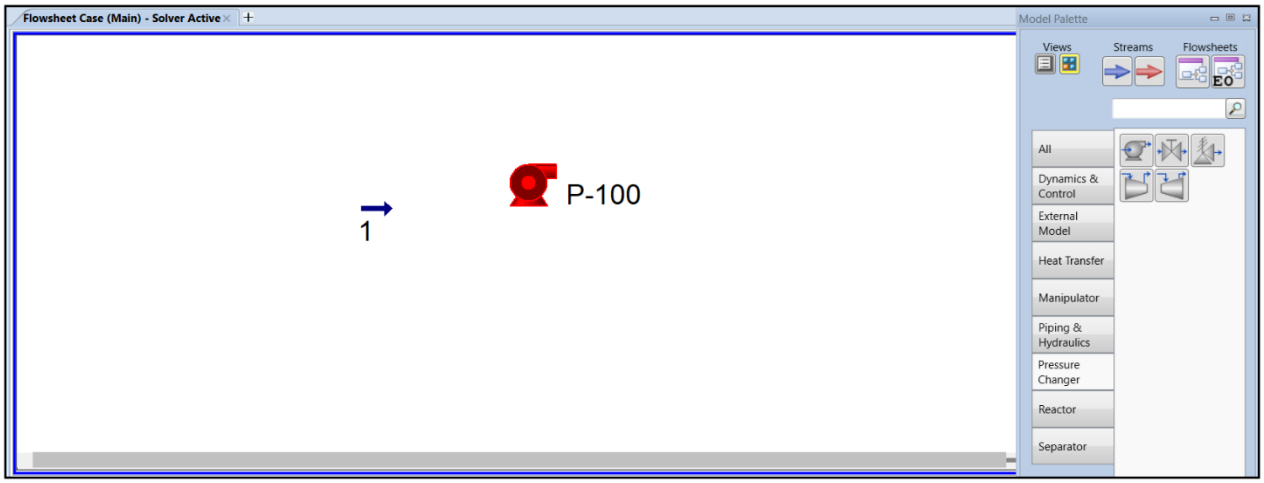
3. Enter Simulation Environment and create a material stream on the flowsheet.



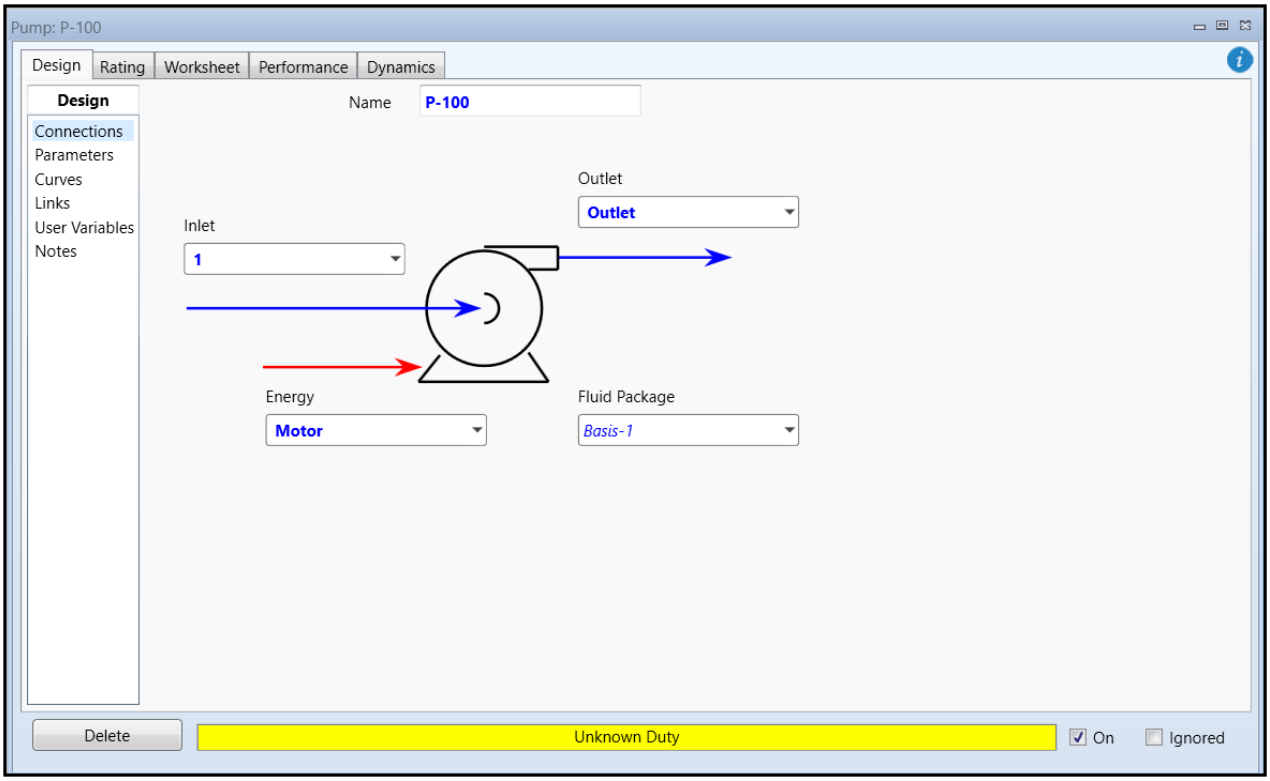

Material Stream: 1
Worksheet
Attachments
Dynamics
Worksheet
Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions
Mole Fractions
Aqueous Phase
H2O
1.0000
1.0000
Total
1.00000
Edit...
View Properties...
Basis...
OK
Delete
Define from Stream...
View Assay


Material Stream: 1
Worksheet
Attachments
Dynamics
Worksheet
Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions
Stream Name
1
Aqueous Phase
Vapour / Phase Fraction
0.0000
1.0000
Temperature [C]
20.00
20.00
Pressure [kPa]
100.0
100.0
Molar Flow [kgmole/h]
2220
2220
Mass Flow [kg/h]
4.000e+004
4.000e+004
Std Ideal Liq Vol Flow [m3/h]
40.08
40.08
Molar Enthalpy [kJ/kgmole]
-2.854e+005
-2.854e+005
Molar Entropy [kJ/kgmole-C]
5.336
5.336
Heat Flow [kJ/h]
-6.336e+008
-6.336e+008
Liq Vol Flow @Std Cond [m3/h]
40.03
40.03
Fluid Package
Basis-1
Utility Type
OK
Delete
Define from Stream...
View Assay

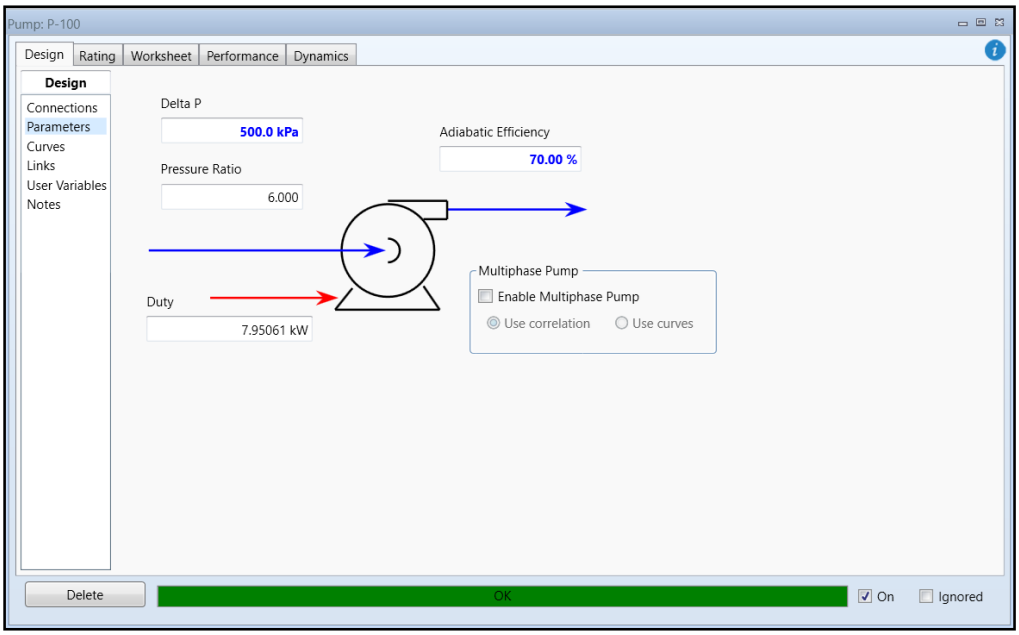
4.Select Pump under Model Pallete/Pressure Change and put it on the flowsheet.



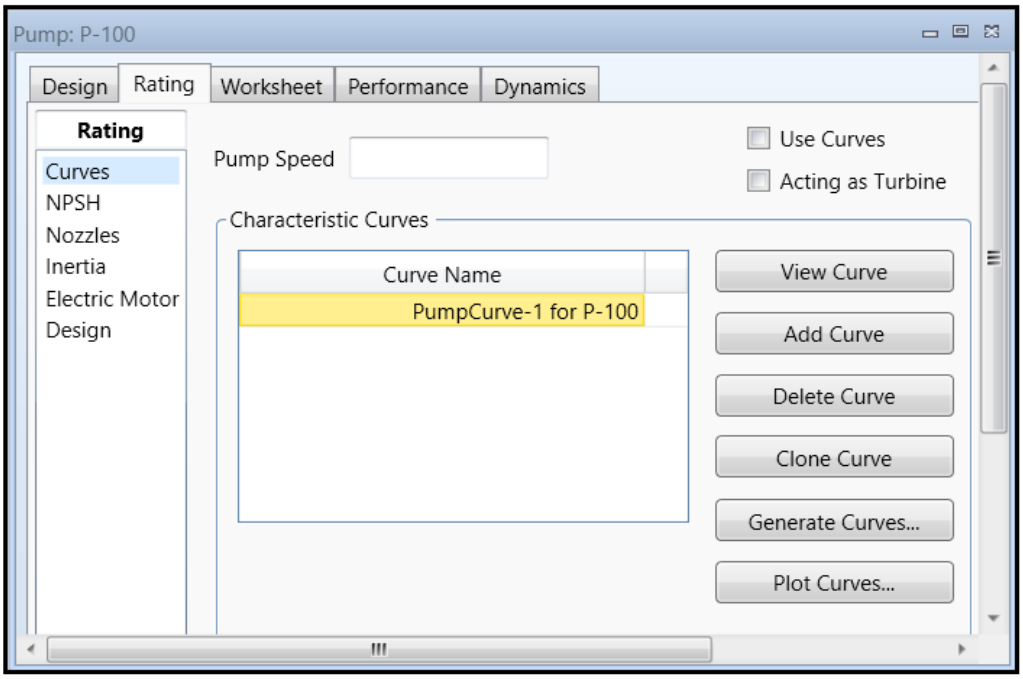
5.Double-click on the pump to see the following window, then select stream 1 as the inlet and write Outlet to create outlet stream. Finally write Motor on the energy blanket.

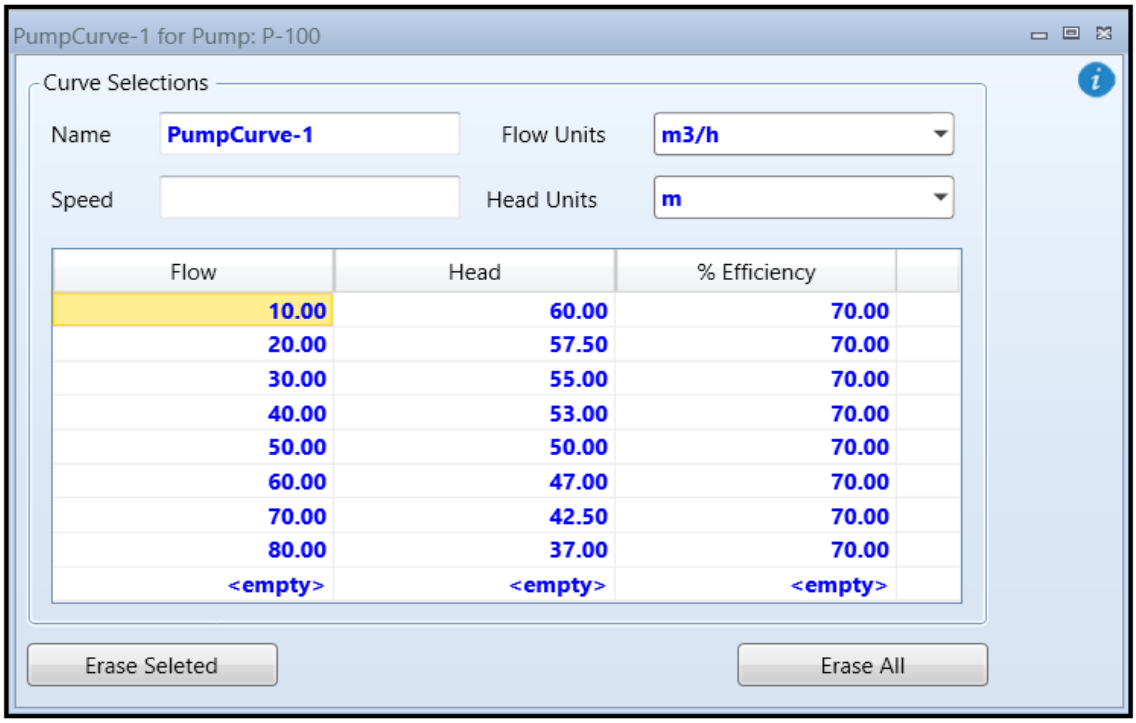


6.On the Parameter tab, enter 5 bar as the pressure difference and 70% as the pump efficiency as stated in the example.

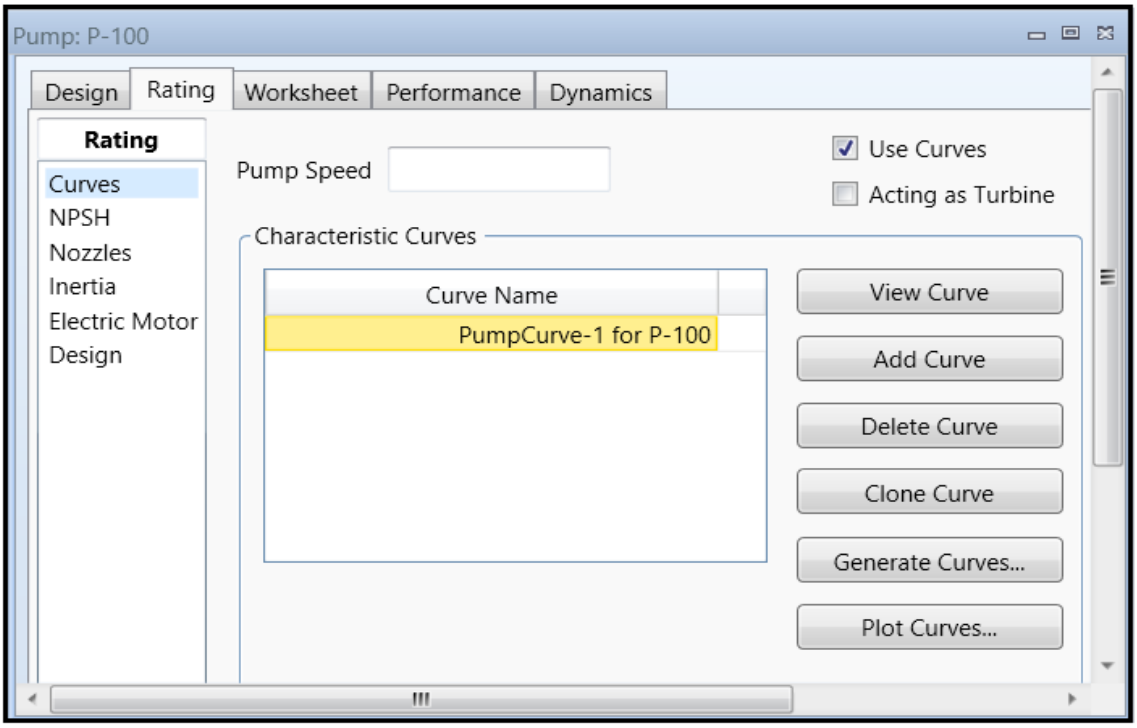


7.Based on above results, the duty required is 7.95.
8.At this stage, the characteristic curve is used. To proceed with this stage, all data in Parameters sheet is erased. Instead click Rating tab and under Curve sheet, add the curve.





9.Now activate “Use Curve”



10.Based on the result, the electricity required is 8.24 kW.