



Compressor Simulation





Example: A utility process plant is designed to supply Plant Air or PA to nearby petrochemicals. Process engineers want to develop the datasheet for the compressor needed to supply a 7-bar-compressed air. Here are the operating conditions of the PA at the compressor suction:

1. Operating pressure of 98 kPa.
2. Operating temperature of 45C.
3. Flowrate of 423 kmole/hr.

Use Aspen Hysys to calculate to the duty required with the assumption of 85% compressor efficiency.

How to simulate:

1. Add air as the component in component list.

Source Databank: HYSYS

Select: **Pure Components** Filter: **All Families**

Search for: Search by: **Full Name/Synonym**

Component	Type	Group
Air	Pure Component	

< Add Replace Remove

Simulation Name	Full Name / Synonym	Formula
Methane	C1	CH4
Ethane	C2	C2H6
Propane	C3	C3H8
i-Butane	i-C4	C4H10
n-Butane	n-C4	C4H10
i-Pentane	i-C5	C5H12
n-Pentane	n-C5	C5H12
n-Hexane	C6	C6H14
n-Heptane	C7	C7H16
n-Octane	C8	C8H18
n-Nonane	C9	C9H20
n-Decane	C10	C10H22

Status: **OK**

2. Select PR as Fluid Package for such system.

Set Up Binary Coeffs StabTest Phase Order Tabular Notes

Package Type: HYSYS Component List Selection: **Component List - 1 [HYSYS Databanks]** View

Property Package Selection

Options

Options	Property Package EOS
Enthalpy	Costald
Density	Modify Tc, Pc for H2, He
Modify Tc, Pc for H2, He	HYSYS Viscosity
Viscosity Method	HYSYS
Peng-Robinson Options	Cubic EOS Analytical Method
EOS Solution Methods	Default
Phase Identification	HYSYS Method
Surface Tension Method	API 12A3.2-1 Method
Thermal Conductivity	

Parameters

Property Pkg: **OK** Edit Properties



3. Enter Simulation Environment and define a stream named Air-In with aforementioned conditions.

Material Stream: Air-In

Worksheet Attachments Dynamics

Worksheet

Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions

Stream Name	Air-In
Vapour / Phase Fraction	1.0000
Temperature [C]	45.00
Pressure [kPa]	98.00
Molar Flow [kgmole/h]	423.0
Mass Flow [kg/h]	<empty>
Std Ideal Liq Vol Flow [m3/h]	<empty>
Molar Enthalpy [kJ/kgmole]	<empty>
Molar Entropy [kJ/kgmole-C]	<empty>
Heat Flow [kJ/h]	<empty>
Liq Vol Flow @Std Cond [m3/h]	<empty>
Fluid Package	Basis-1
Utility Type	

Unknown Compositions

Delete Define from Stream... View Assay ← →

Material Stream: Air-In

Worksheet Attachments Dynamics

Worksheet

Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions

	Mole Fractions	Vapour Phase
Air	1.0000	1.0000

Total 1.00000

Edit... View Properties... Basis...

OK

Delete Define from Stream... View Assay ← →



Material Stream: Air-In

Worksheet Attachments Dynamics

Worksheet

Conditions
Properties
Composition
Oil & Gas Feed
Petroleum Assay
K Value
User Variables
Notes
Cost Parameters
Normalized Yields
Emissions

Stream Name	Air-In	Vapour Phase
Vapour / Phase Fraction	1.0000	1.0000
Temperature [C]	45.00	45.00
Pressure [kPa]	98.00	98.00
Molar Flow [kgmole/h]	423.0	423.0
Mass Flow [kg/h]	1.225e+004	1.225e+004
Std Ideal Liq Vol Flow [m3/h]	13.92	13.92
Molar Enthalpy [kJ/kgmole]	567.7	567.7
Molar Entropy [kJ/kgmole-C]	120.3	120.3
Heat Flow [kJ/h]	2.402e+005	2.402e+005
Liq Vol Flow @Std Cond [m3/h]	9995	9995
Fluid Package	Basis-1	
Utility Type		

OK

Delete Define from Stream... View Assay

4. Select compressor icon from Model Palette/Pressure Change

Compressor: K-100

Design Rating Worksheet Performance Dynamics

Design

Connections
Parameters
Links
User Variables
Notes

Name K-100

Inlet

Fluid Package Basis-1

Energy

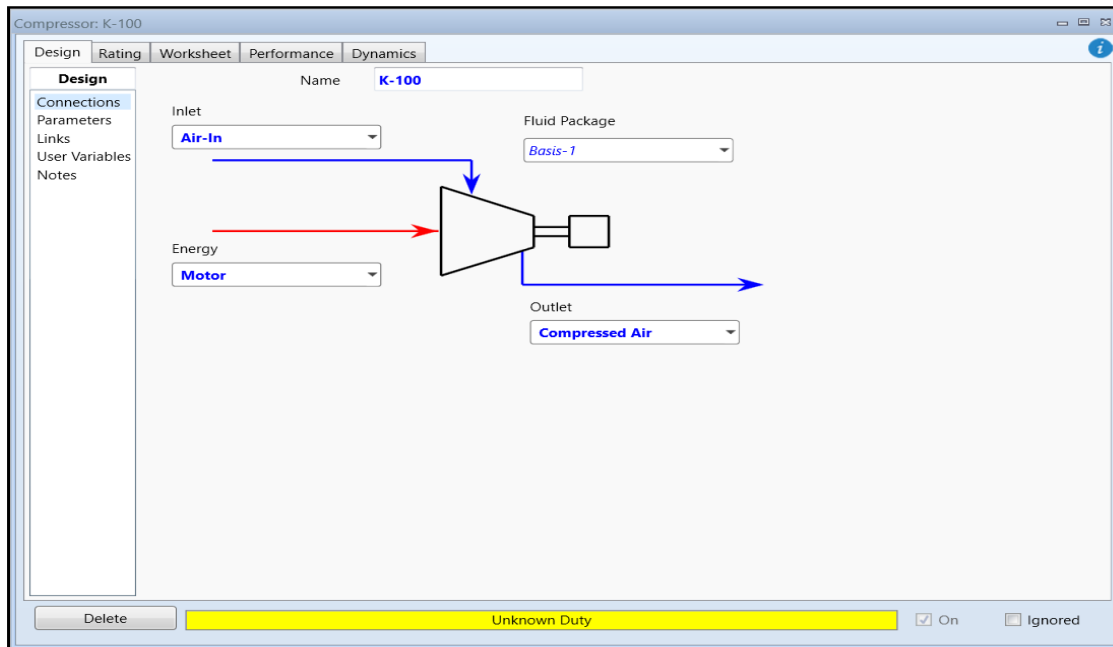
Outlet

Requires a feed stream

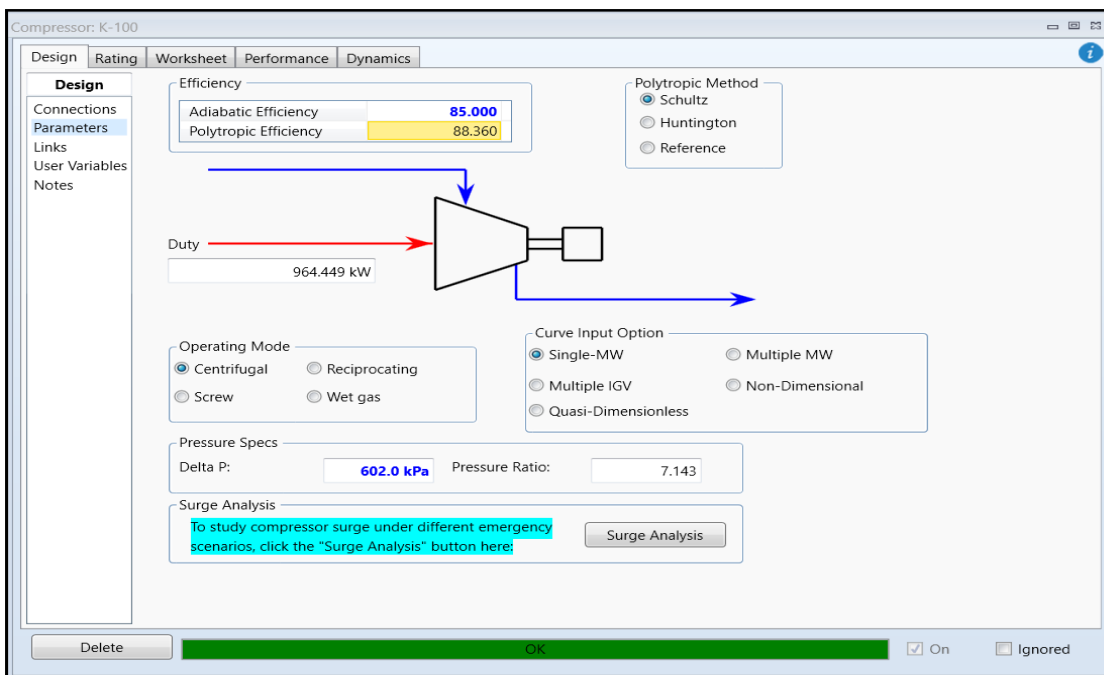
On Ignored



5. Select Air-In as the inlet stream and define Compressed Air as the outlet stream. Also, define an energy source named Motor.



6. Go to Parameter sheet, change the efficiency to 85% and set delta P to 602 kPa.





Based on the result, the calculated duty is 964.44 kW. Also, it is worthy checking the Worksheet tab and observe the dramatic increase in outlet temperature from 45°C to 322°C.

Compressor: K-100

Design Rating **Worksheet** Performance Dynamics

Worksheet

Conditions Properties Composition PF Specs

Name	Air-In	Compressed Air	Motor
Vapour	1.0000	1.0000	<empty>
Temperature [C]	45.00	322.3	<empty>
Pressure [kPa]	98.00	700.0	<empty>
Molar Flow [kgmole/h]	423.0	423.0	<empty>
Mass Flow [kg/h]	1.225e+004	1.225e+004	<empty>
LiqVol Flow [m3/h]	13.92	13.92	<empty>
Molar Enthalpy [kJ/kgmole]	567.7	8776	<empty>
Molar Entropy [kJ/kgmole-C]	120.3	122.5	<empty>
Heat Flow [kJ/h]	2.402e+005	3.712e+006	3.472e+006

Delete OK ☒ On

Compressor: K-100

Design Rating Worksheet **Performance** Dynamics

Performance

Results Power

Results	
Adiabatic Head [m]	2.457e+004
Polytropic Head [m]	2.555e+004
Adiabatic Fluid Head [kJ/kg]	241.0
Polytropic Fluid Head [kJ/kg]	250.5
Adiabatic Efficiency	85.000
Polytropic Efficiency	88.360
Power Consumed [kW]	964.4
Polytropic Head Factor	1.0018
Polytropic Exponent	1.4707
Isentropic Exponent	1.3970
Speed [rpm]	<empty>

Delete OK ☒ On ☐ Ign