

Flexware®

Turbomachinery Engineers

A Veteran & Employee Owned Small Business

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Flexware® Remote Monitoring Services

We are currently using a process to send csv files with the compressor and/or turbine operating data from the client historian data base (we take the last line entered on the historian every hour) to a cloud based secure server where our software Flex Live is based. Flex Live includes Gas Flex which is a **BWR gas properties** program to do the compressor and gas properties calculations. The results including head, efficiency and power are tabulated, added to a historian file and plotted on the compressor or turbine performance curves.

The performance charts and tabulated data are posted in the cloud and the client can log into the system to view



the equipment performance information on your computer, or smart phone 24/7. While data is sent from the client to Flexware, nothing is returned back to the client for security reasons.

The system is designed to run automatically and continuously 24/7. If a performance problem occurs, the equipment engineer can call Flexware for questions and direction in determining the problem root cause for no additional charge unless a site visit is required.

A good time to have this service is if you are having performance issues with a compressor as you can have Flexware assist resolving your problems.

Normal fees are \$6,000 per year for each compressor or turbine.

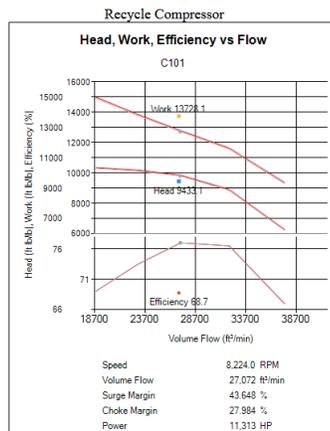


Figure #1. Head, work input and efficiency plotted vs. inlet volume flow rate for an actual compressor monitored with Flexware Remote Monitoring service. Note surge margin and choke margin are also shown along with the power and speed. The current operating point is shown relative to the performance curve.

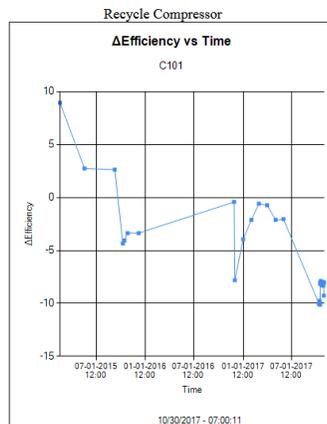


Figure 2. Trend analysis showing delta efficiency vs. time for an actual compressor using Flexware Remote Monitoring service.

Recycle Compressor			
Fluids	Units	Inlet 1	Discharge 1
Pressure	psia	215.02	287.95
Temperature	°F	54.122	105.61
GivenFlow	ft³/min	27.161	22.362
VolumeFlow	ft³/min	27.161	22.362
MassFlow	lb/hr	1,641.539	1,641.539
Enthalpy	Btu/lb	157.81	175.43
Entropy	Btu/lb °R	1.6350	1.6452
SpecificVolume	ft³/lb	0.9930	0.8176
SpecificHeat	Btu/mol °R	0.3755	0.3889
Compressibility		0.9535	0.9555
DynamicViscosity	lb/ft sec	8.0425E-006	8.8308E-006
SonicVelocity	ft/sec	1,134.1	1,195.5
KGamma		1.2734	1.2615
KTTemperature		1.3151	1.3012
KVolume		1.3003	1.2806
Sections			
Speed	RPM	8,221.9	
Power	HP	11,364	
Work	ft lbf/lb	13,707	
Head	ft lbf/lb	9,434.0	
AHead	ft lbf/lb	9,285.0	
Efficiency	%	68.826	
ΔEfficiency	%	67.739	
ΔWork	ft lbf/lb	912.75	
ΔHead	ft lbf/lb	407.02	
ΔEfficiency	%	-8.0863	
%ΔWork	%	7.1340	
%ΔHead	%	4.1355	
%ΔEfficiency	%	-10.514	
Surge	%	44.160	
Choke	%	27.728	

Figure #3. A tabulation of the performance data including the results like head, efficiency and power for an actual compressor using Flexware Remote Monitoring service. Note the values delta efficiency, delta head and delta work. The values are the deviation to the performance curve and can be tracked and plotted over time to show trends. Delta work is especially valuable to determine the accuracy of the input data. Delta efficiency is plotted over time to show the trend of the equipment condition.