

## Put the Squeeze on Energy Costs by Managing Compressed Air

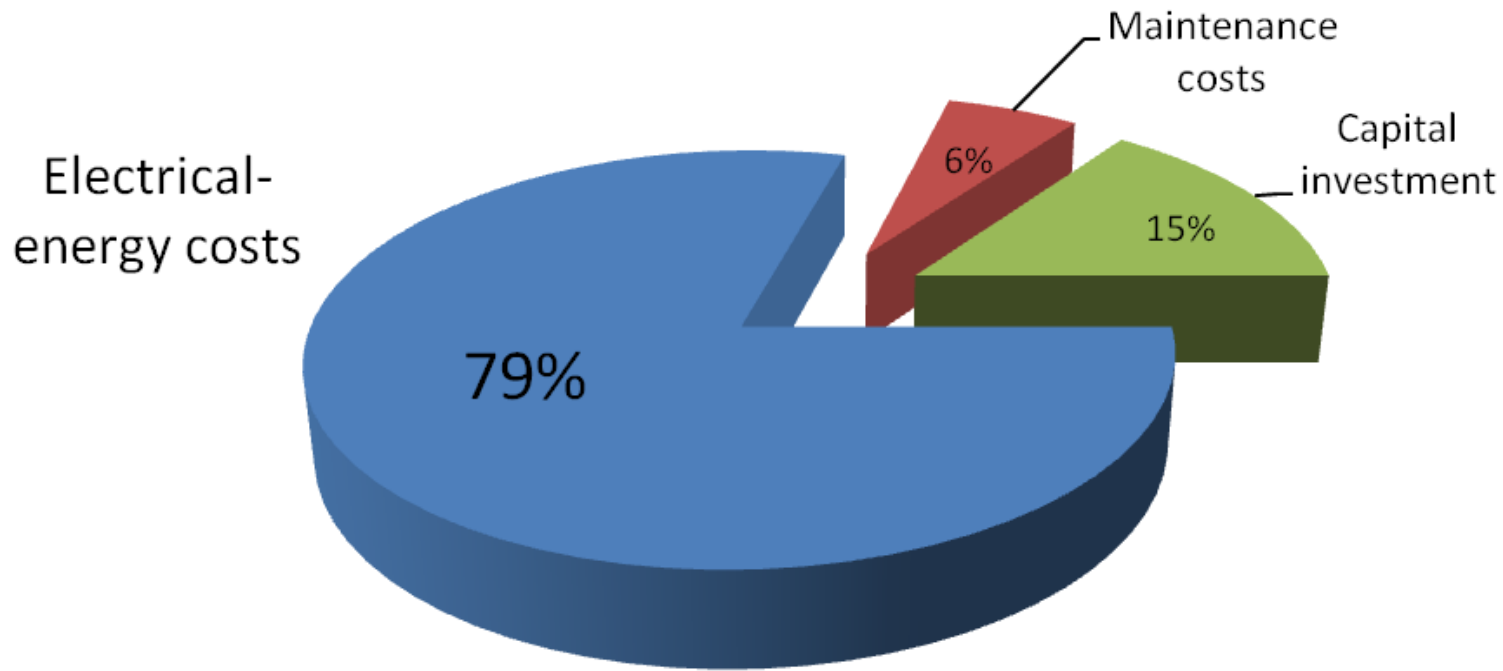


- *Paul Fisher is the President of ECT. Paul has 24 years of experience in the application and design of compressor control systems in industrial plants. He has a B.S. in Chemical Engineering and M.B.A. from Iowa State University.*

# Energy Control Technologies

Put the Squeeze on Energy Costs by  
Managing Compressed Air

## Operating costs for compressed-air systems

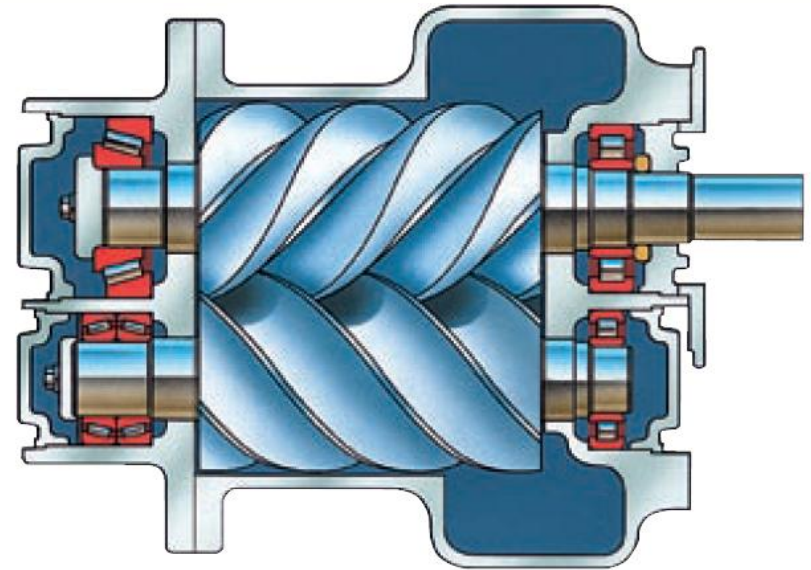


Studies show 79% of compressed air system costs are for energy. Therefore, it makes sense to pay special attention to the proper use of compressed air.

Machine Design April 2007

- Screw Compressors
- Reciprocating Compressors
- Centrifugal Compressors
- Axial Compressors

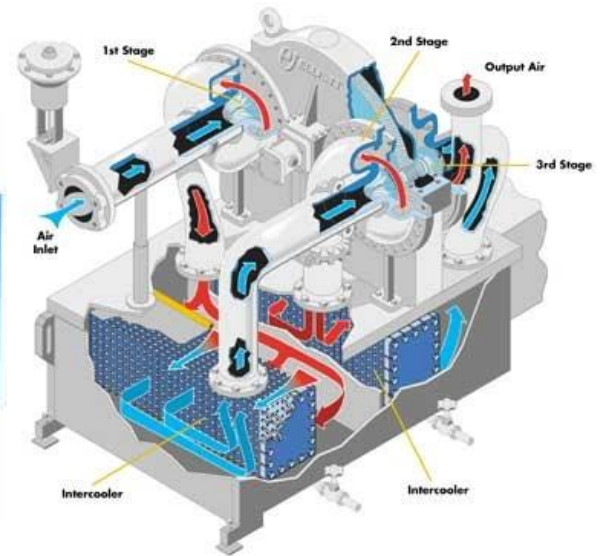
# Screw Compressors



# Reciprocating Compressors



# Centrifugal Compressors

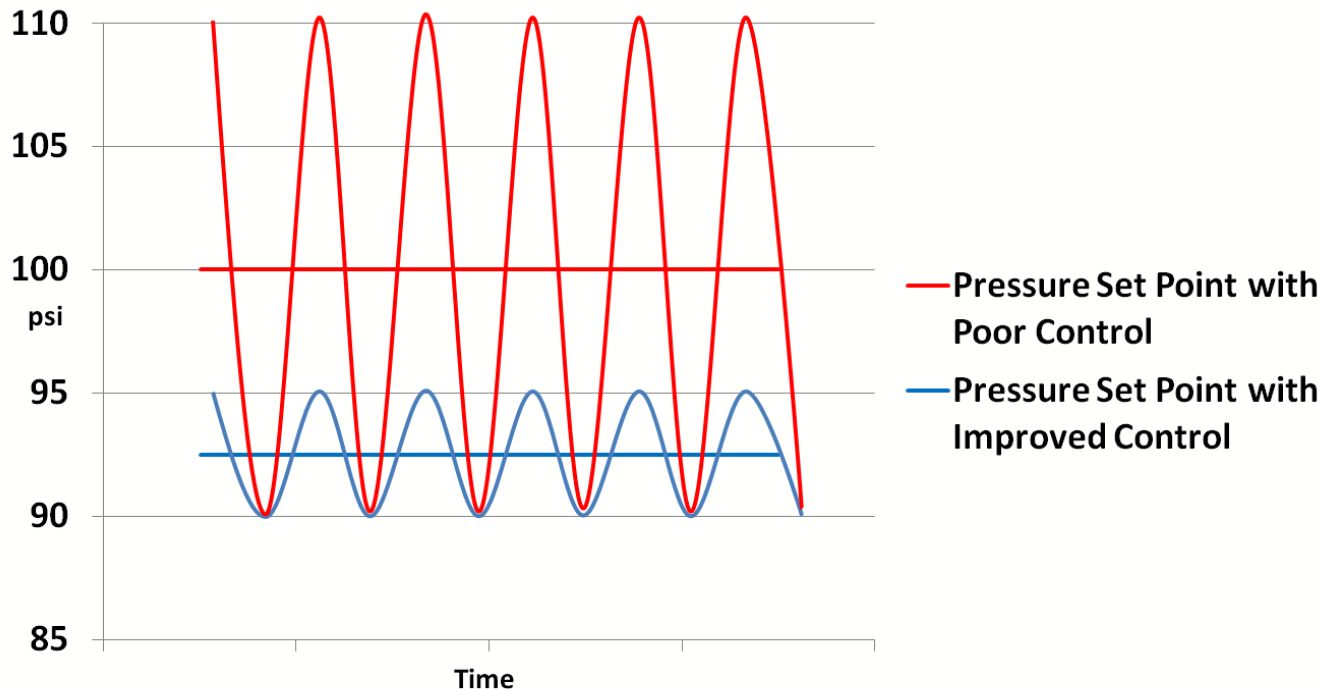


- Ingersoll-Rand
- Gardner Denver
- Quincy
- SullAir
- Atlas Copco
- Joy

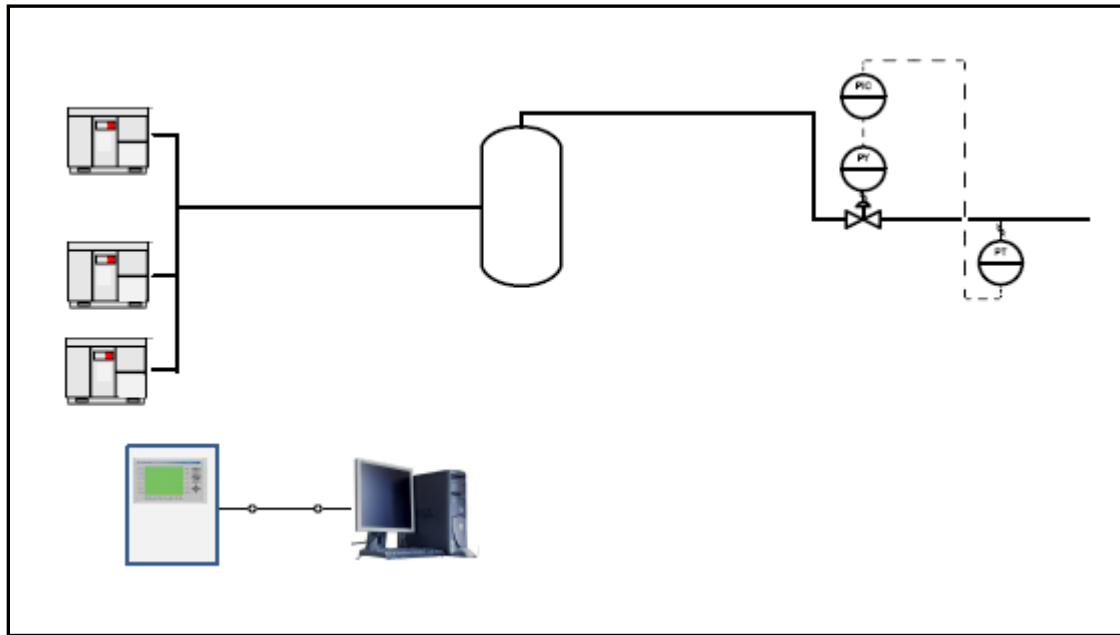
# Why Controls Approach?

- Standard approach from plant to plant
- OEM independent
- Built-in redundancy – leave existing machine-level control
- Rockwell Automation Hardware & Software
- Easy to operate and maintain by plant technicians
- Expandable
- Maximum Energy Savings
- Highest Quality of Pressure Control

# Lower Pressure Saves Energy



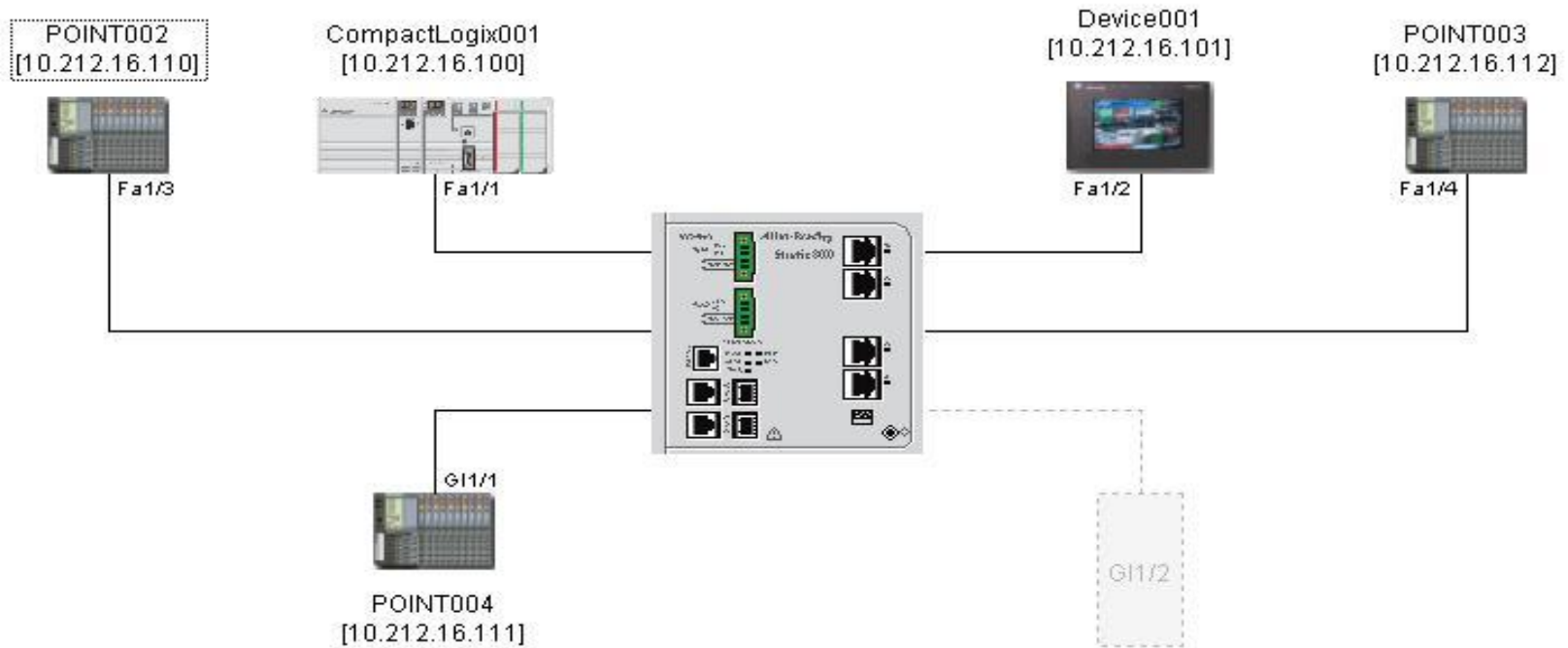
# Pressure/Flow Regulating Station



**Higher Pressure = Higher Power**

- Prioritize plants
  - Higher number of compressors
  - Higher running horsepower
  - Higher energy costs
- Gather data
  - System configuration
  - P&IDs
  - Current operating data and control strategy
  - OEM manuals
  - Pressure profile
  - Critical pressure
  - Energy costs

EtherNet/IP001/Switch001





- 1-1768-PA3
- 1-1768-ENBT
- 1-1768-L43 Processor
- 2-1769-IF8
- 1-1769-IT6
- 1-1769-OF4CI
- 3-1769-IQ16
- 3-1769-OW16
- 1-1769-PA2



- 1-1734-PA3
- 1-1734-AENT
- 2-1734-IE2C
- 1-1734-IT2I
- 1-1734-OE2C
- 1-1734-IEB4
- 2-1769-OB4

PACViewME - AirPAC Demo - MainOverview

In Auto ECT Control      Load: 0.60      9/3/2010 11:19:45 AM

Seating & Storage Plant      Component Plant      Panel Plant

PT-003 120 psig  
 FT-004 0 cfm

Comp\_06 VFD 0  
 kW 0 Pd 0

Comp\_07 TV 100  
 IV 1  
 kW 120 Pd 126

Master Sequencer 1  
 SP Header 120 psig  
 Pd Header 120 psig  
 Header SP  
 PrePack 120.0

PT-002 120 psig  
 FT-002 0 cfm  
 FT-003 0 cfm

Comp\_03 TV 100  
 IV 100  
 kW 150 Pd 130

Comp\_04 TV 100  
 IV 100  
 kW 92 Pd 124

Comp\_05 TV 100  
 IV 100  
 kW 94 Pd 124

PT-001 120 psig  
 FT-001 0 cfm

Comp\_01 TV 0  
 IV 100  
 kW 0 Pd 0

Comp\_02 TV 0  
 IV 0  
 kW 90 Pd 124

Alarm List    Diag List    Config Trans    Master Status    Config Master1    Config Master2    Flow & Pressure    Hour Trends    Day Trends    Change User    Color Code

PACViewME - AirPAC Demo - MainOverview

## Comp\_03.

Loaded

Run Hours: 36      Load Hours: 16

Oper Locked Out    IVO  
 Auto Seq    IVC  
 Off Line    TVO  
 Hand On    TVC  
 LV1  
 LV2  
 LV3  
 LV4

JT-101 150.0 kW

PT-101 129.9 psig  
 TT-101 0.0 °F  
 TT-102 0.0 °F

Running    Fault  
 Stopped    Alarm  
 Ok to Start    Blow Down Closed  
 Interlocks

Start Disabled

Reset Alarms

Close    Alarm List    Test Panel    Test Timers    Config

PACViewME - AirPAC Demo - MainOverview

## Master\_HeaderConfig1. Configuration

Start Bias 5.0	Time (sec) required for PV < SP before starting next compressor in sequence Start Next Time 5 Sec	Time (sec) required for stop condition to exist before Master stops next unit Stop Delay 180 Sec
PrePac Offset 5.0	Time (sec) between successive starts : Motor to motor Next Comp Start 60 Sec	Time (sec) between successive stops : Motor to motor Stop Stop delay 120 Sec
Stop Flow Thsh 150.0	SP value for Emergency Start. If PV < SP then E-Start is true. SP E-Start 95.0	Pre Pac time interval to operate at elevated header pressure Pre Pac 30 Sec
Config Seq Load Table Sequence		
Config Seq UnLoad Table Sequence		
Config Seq Stop Table Sequence		

Close Alarm List Config Pheader Config UserFlow

PACViewME - AirPAC Demo - MainOverview

## Comp\_03.

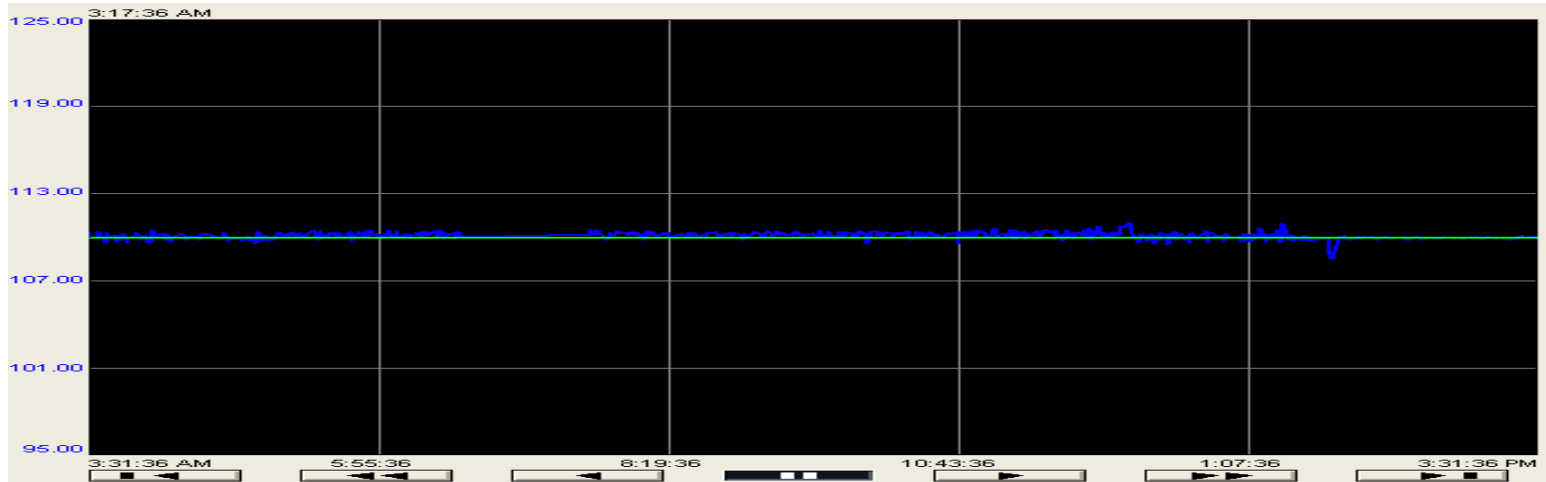
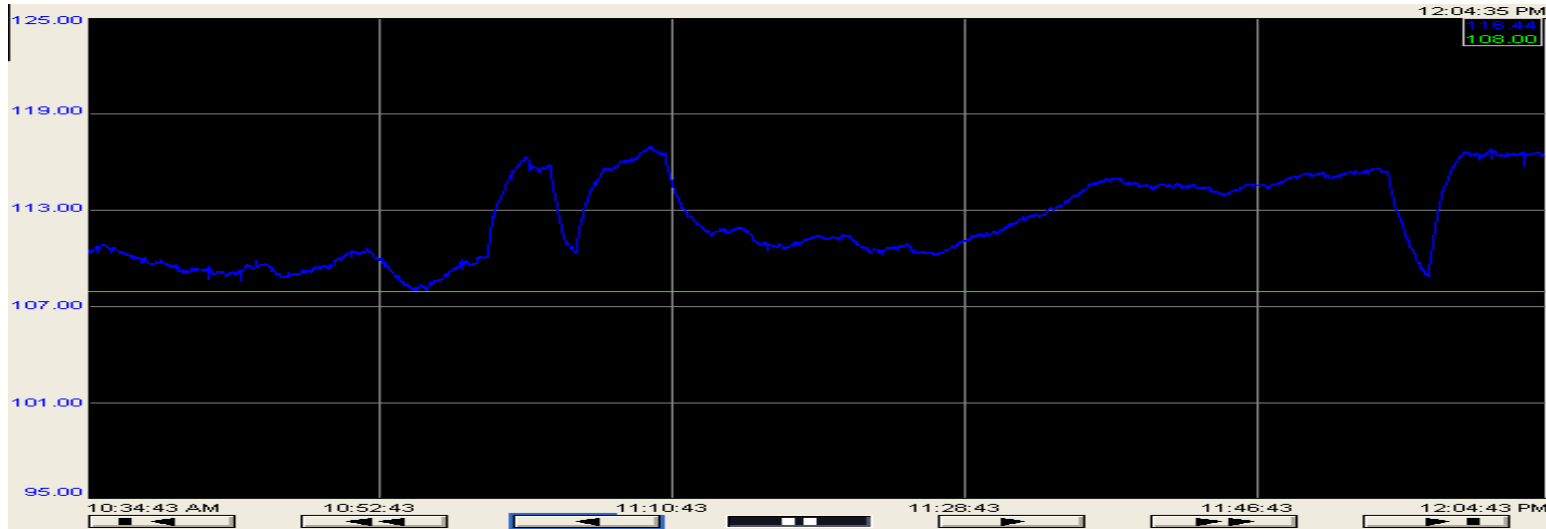
Enable Compressor

Compressor No 3.0	KW High SP 180.0	Start to Stop 10.0 Min	Accel Time 15 Sec
Compressor Type 0.0	KW Loaded 98.0	Unload Stop 5.0 Min	Short Cycle 0 Sec
Pd High SP 135.0	KW Unloaded 63.0	Unload Load 30 Sec	Blow Down 2.0 Min
Shrt Cyc Thshld 0.0	BD opens on unload Press to change	Stop to Start 60 Sec	Reset Motor Timers

Config KW Config Pd Config Flow Config DewP Config Td Config Toil Valve Config

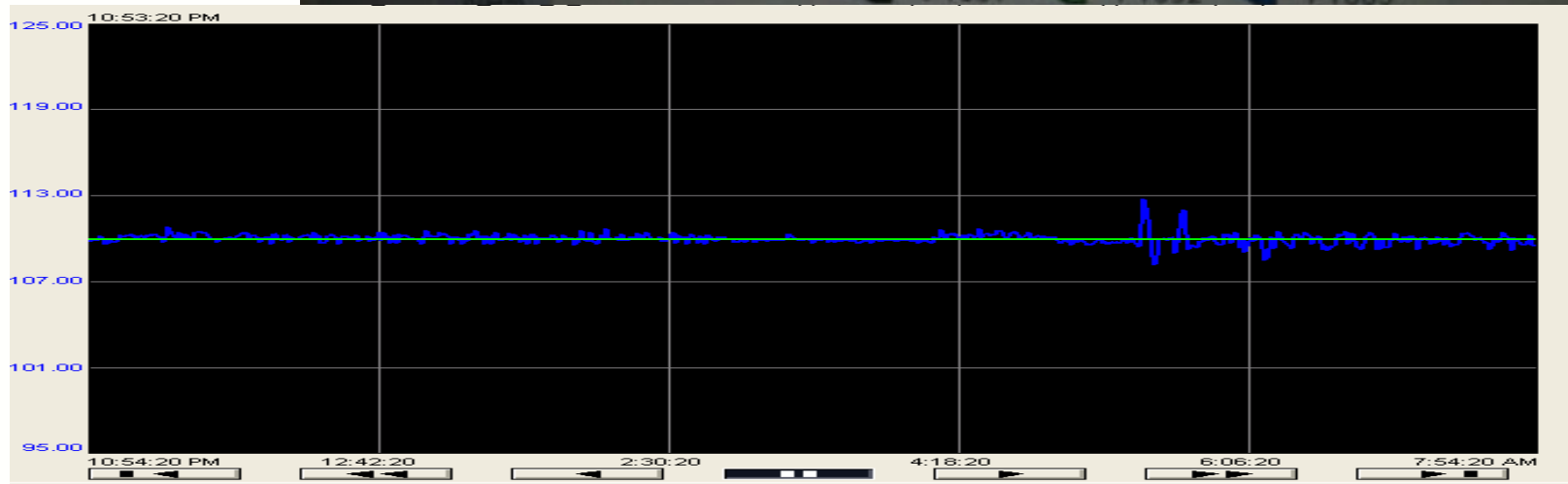
Close Alarm List

# Header Pressure Response Before and After

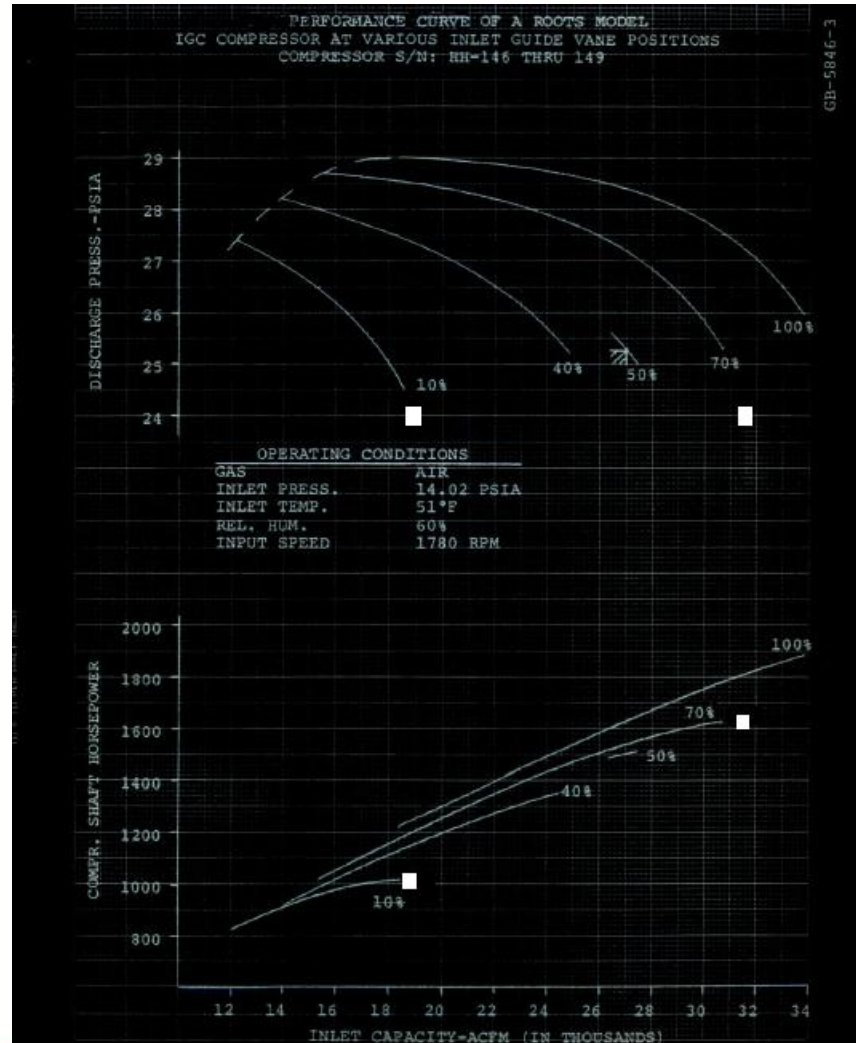


- Operate at the lowest possible pressure
- Fewer number of compressors on line
- System redundancy
- Open system using Rockwell Automation Logix platform
  - AOI software blocks, templates for HMI and ACD Logix project
- Compressed Air Energy Management system
  - Power Flex 700 VFD
  - Power Monitor 1000
  - Endress and Hauser transmitters
  - Integration of dryers, coolers
  - FactoryTalk ViewPoint data monitoring
- Reduced operation costs
- Provides the highest ROI to customers

- Rockwell Automation Powermonitor 1000 was installed on all the compressors to record energy consumption
- Customer ran tests to capture energy consumption using ECT and OEM system over few months
- Customer calculated energy savings of ~ \$260/day
- Translates to annual savings of \$94,000 (@ 365 days operation)
- Calculated payback ~ 14 months

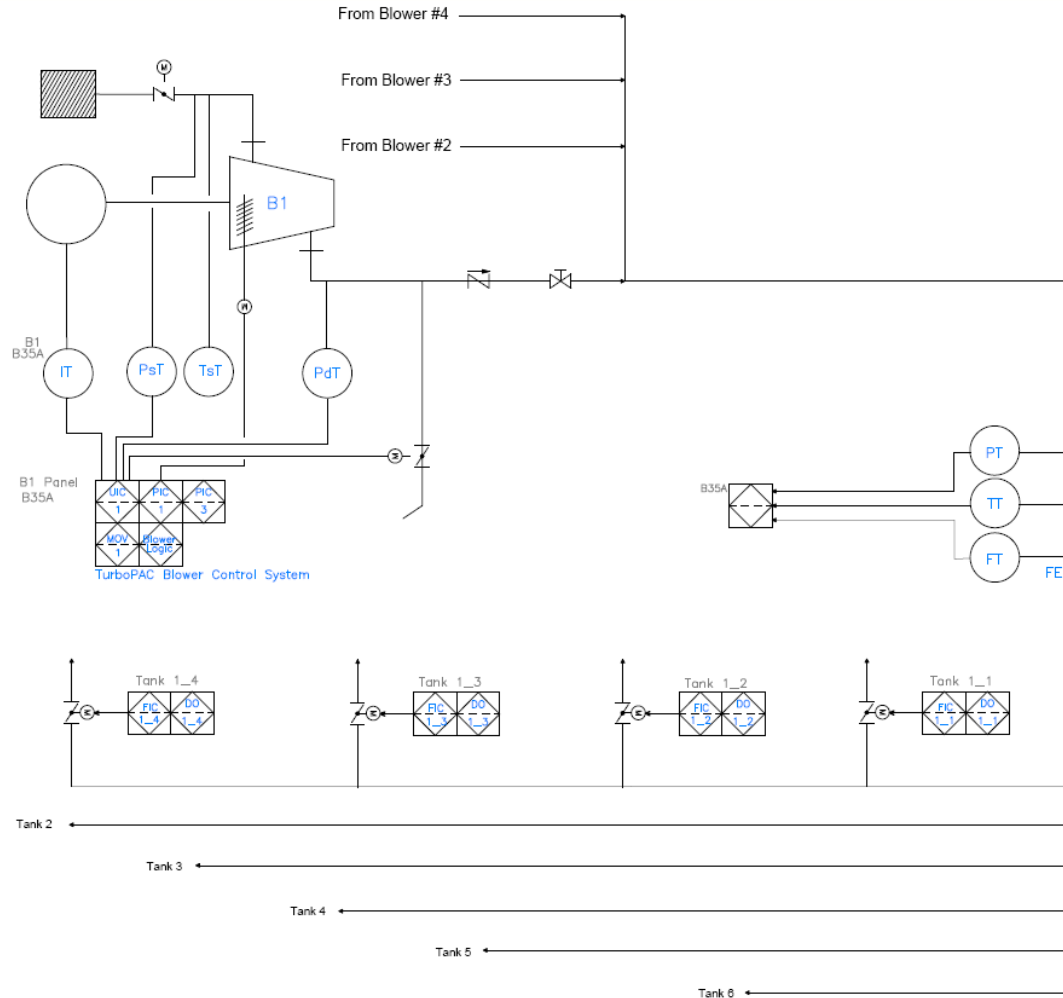


- Reduced Energy Costs
  - Minimize energy consumed by blowers
- Automated Operation
  - Blowers
  - Aeration Basins
- Instrumentation Upgrade for Obsolescence
  - BOVs, Vibration System, SLCs
  - Panel Annunciator, Switches, PBs and Lamps
- Local and Centralized Control
  - Common OIP and PCS screens for operations



- Savings up to \$180,000 per year after installation of fine bubble diffusers
- Additional savings based on less frequent two blower operation – more than \$100,000 per year
- \$125,000 MidAmerican Energy Bid Award

# System Configuration



# System Architecture

