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COMPRESSED AIR SYSTEMS EFFICIENCY

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Presentation Outline

Compressed Air equipment
Air Systems
Summary Information

Format: Sample Case

Typical Plant

10-15 % electricity is used for compressed air

Operating Cost Factors:

- System age
- Equipment sizing
- Standby capacity
- Power costs
- Hours operated
- Type of dryer
- Condition of equipment
- Distribution system design
- Compressor duty

Example System:

100 Hp water cooled, oil flooded, rotary screw

Load Profile:

100% for 1800hr
75% for 1800 hr
50% for 1800 hr
00% for 1800 hr

Example System Output

~ 450,000 hp-hr / yr

Operating cost: $33,000 / yr, plus maintenance

or

Air Cost: ~ $0.25/1000 cfm

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Example System Load Profile:

25% - Full load
25% - 3/4 load
25% - 1/2 load
25% - 0 load

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Substitute 3x50hp compressors

Hrs.	#1	#2	#3
1800	100%	100%	standby
1800	100%	50%	standby
1800	100%	standby	standby
1800	0%	standby	standby

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Substitute 3x50hp compressors

Power cost: $30,360 (8 % savings*)

* Excluding demand savings

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Waste Heat Recovery

80 - 90% of nominal hp is waste heat

89 - 90% of waste heat is available

Ex: Use waste heat for winter heating results in a $3500 savings in heat costs.

High efficiency drive motor:

Saves an additional $1150 per year in power costs

Convert to air cooling:

Assume cooling water costs $2.00 / 1000 gal:

Savings in water costs*: $6235/year

Example System Air Dryer

- -- Rated at 500 cfm continuous duty
- -- Heaterless
- -- Regenerative desiccant
- -- Dries air to -40F dew point
- -- Operating on a fixed cycle

Air dryer improvements

Note: Dryers are usually designed for maximum moisture load at compressor full load.

Actual moisture load is 20 - 30% design

Convert from a fixed cycle to a demand control cycle:

Purge air savings: $3130/yr in power costs

Air Dryer improvement:

Convert the coalescing prefilter to a high efficiency prefilter.

Benefit: Reduce pressure drop: 5psi.

Net savings: $700 / yr.

Note: 1) Avoid *two* prefilters in series.

2) Similar savings achieved by keeping compressor suction filters clean.

Excessive Compressor Suction Temperature

Keep compressor room below 110F

Air System Problems

- -- Moisture accumulation (water hammer, corrosion, regulator fouling, ...)
- -- Pressure waves
- -- Excessive pressure drop

Excessive pressure drop

-- Line & valve sizing
-- Excessive number of ells and tees

System Line Sizing*

cfm	1/2	3/4	1	11/4	11/2	2
10	6	1	.3			
30	58	9	2.5	.6	.3	
50		25	7	2	.7	.2
80		64	18	4	2	.5
125			49	10	5	1
200				26	11	3

* psi drop per 1000' of pipe

System Sizing: Fittings*

Pipe Size	Gate valve	LR ell	Std ell	tee(side)
1/2	.36	.62	1.5	3.1
3/4	.48	.82	2.1	4.1
1	.61	1.1	2.6	5.2

* Equivalent feet of pipe

Example System

Assume 2 1/2" piping is adequate for the header (1000 ft)

Substitute 3" piping

- Losses decrease from 6.0 psig to 1.9 psig
- Net power savings $450/yr

Cost of Air Leaks (100 psig system)

Orifice Size	CFM	Annual Cost
1/64	0.41	$44
1/32	1.6	$172
1/16	6.5	$702
1/8	26	$2,800
1/4	104	$11,232

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Quick Diagnostics

1). Check compressor duty when plant is down.
2). Check system pressure drop.
3). Observe compressor duty.
4). Observe blow down.
5). Measure compressor room temperature.
6). Inspect suction filter.
7). Inspect compressor coolers.
8). Observe compressor oil consumption.

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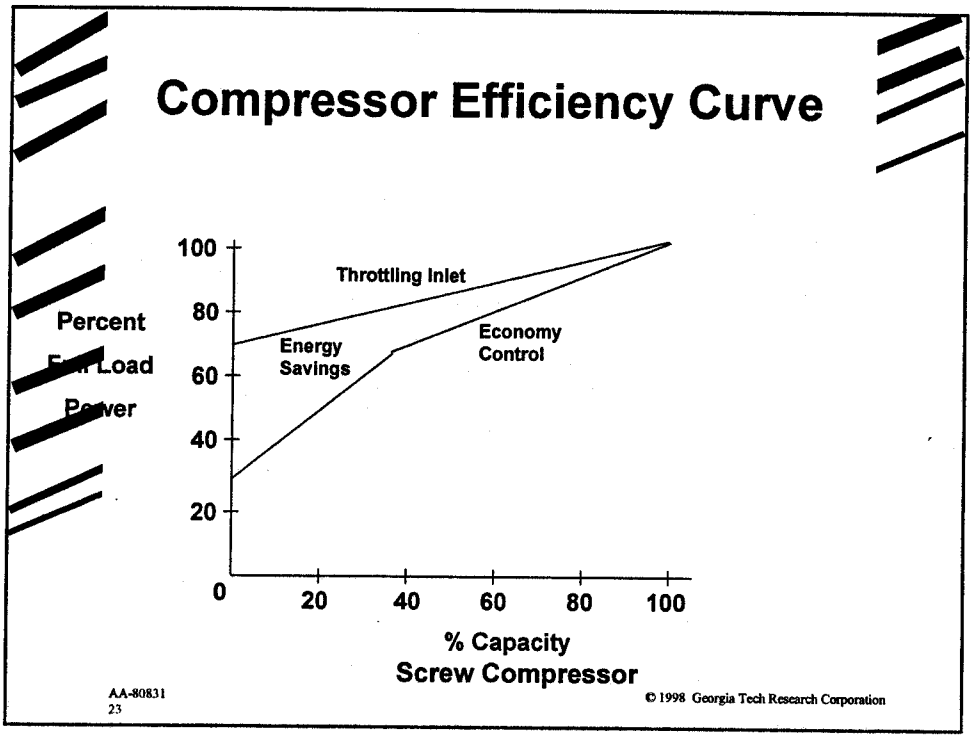
Compressor Efficiency Curve
Percent
Full Load
Power
100
80
60
40
20
0
Throttling Inlet
Energy
Savings
Economy
Control
20
40
60
80
100
% Capacity
Screw Compressor
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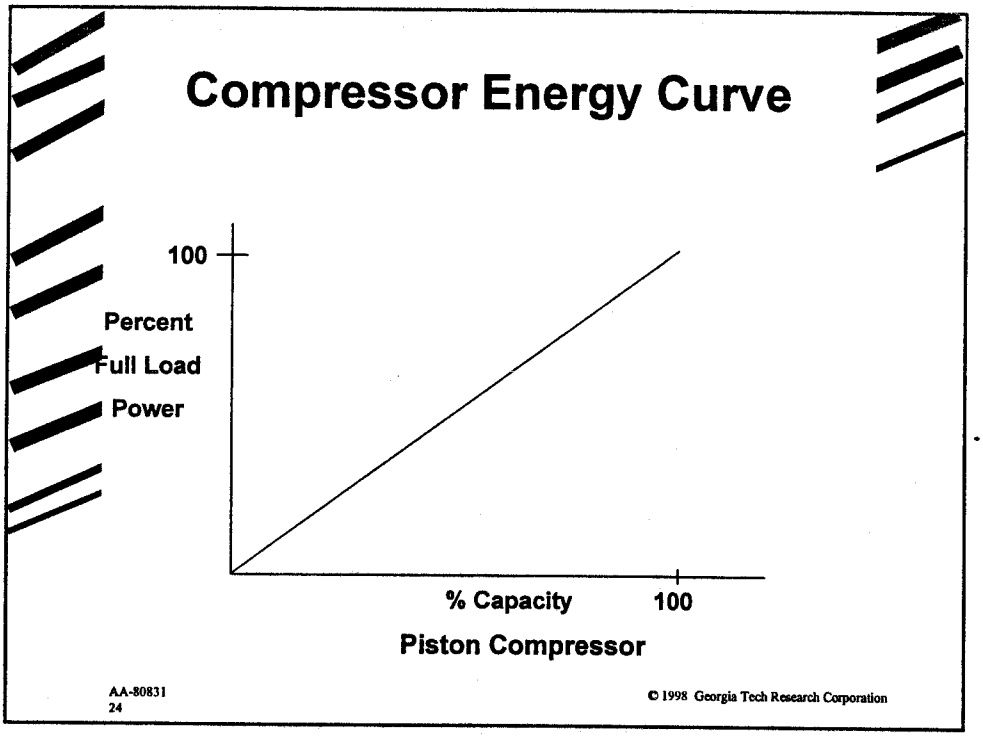
Compressor Energy Curve
100
Percent
Full Load
Power
% Capacity
100
Piston Compressor
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