Introduction to Rotary Screw Air Compressors *and* Compressed Air Management

3rd Edition

Price: $ 55.00

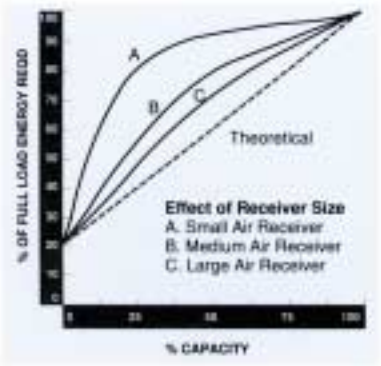
PSI POWER SUPPLY INDUSTRIES

Evaluating Screw Compressors

Compare the efficiency of each Capacity Control

On Line/Off Line Control

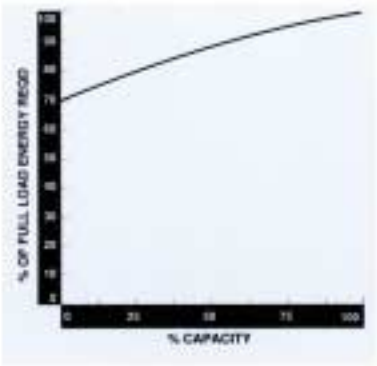
- This is a simple control system to operate. Machine either runs at full load or no load. Pressure switches are typically set at 103 PSI to unload machine and at 90 PSI to load machine (for 100 PSI rated machine). One disadvantage is the user must accept the over and under pressures in the system with this control.
- To take advantage of this control system, the machine must run unloaded, which will require air storage capacity. This will allow compressor to make and store more air than is being used.
- The larger the air storage tank, the longer the cycle time and the greater the savings. Without proper air storage, the machine will cycle too frequently, causing the oil to foam. This leads to excess oil carryover and serious maintenance problems. Also, without adequate air storage the savings you would get running unloaded are negated.
- For example, as shown below, to receive 75% efficiency at 70% capacity as typically publicized, a 40 minute cycle is required. A 40 minute cycle at 70% capacity will require a storage volume of 9-1/2 times the rated CFM.



Note: This curve is shown as a dotted line because this system does not operate at a fixed flow. For example: The value for 70% capacity is the average power to operate at 100% flow 70% of the time and unloaded 30% of the time.

Modulating Capacity Control

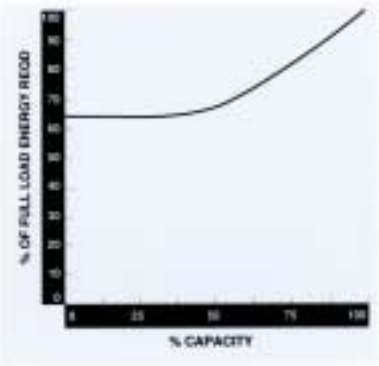
- At less than full capacity, a partially closed throttle restricts the opening and creates a vacuum at the inlet. This lowers the inlet pressure. For example, at sea level: a partial vacuum of 4.7 lowers inlet pressure to 10 PSIA from 14.7 PSI atmospheric.
- More work is now required to raise the inlet pressure to the final discharge pressure. Now, to compress to 100 PSIG (114.7 PSIA) requires a higher compression ratio. (Ratio between discharge and inlet pressures.) System was 114.7 ÷ 14.7 = 7.8 and now at part load is 114.7 ÷ 10 = 11.5.
- Overall, less power is required to compress the smaller volume of air, but with the above inefficiencies, more energy must be expended per cubic foot of air.
- This system is best used for base load applications only, where system needs rarely drop below 70%.



The inherent inefficiency of lowering the inlet air pressure is seen in the shape of the above curve. As air output declines, power requirements drop only slightly.

Turn Valve Capacity Control

- Unlike Modulating Control, the patented Turn Valve Control does not restrict the inlet of the compressor. Air entering the unit is always at atmospheric.
- Since the inlet air pressure is unchanged at part load, the compression ratio remains unchanged.
- Like Modulating Control, Turn Valve Control automatically regulates to match system demand with no over and under pressuring.
- The most efficient and reliable control system for any part load application above a 40% load cycle.



As air output declines, power requirements decline almost proportionally, down to 40% capacity.

Cost of Compressed Air

Points to consider

Air is Free, Right?

Compressed Air is often overlooked as having a price.

High operating costs justify energy saving equipment.

100 HP Compressor

Over a 1 year period . . .

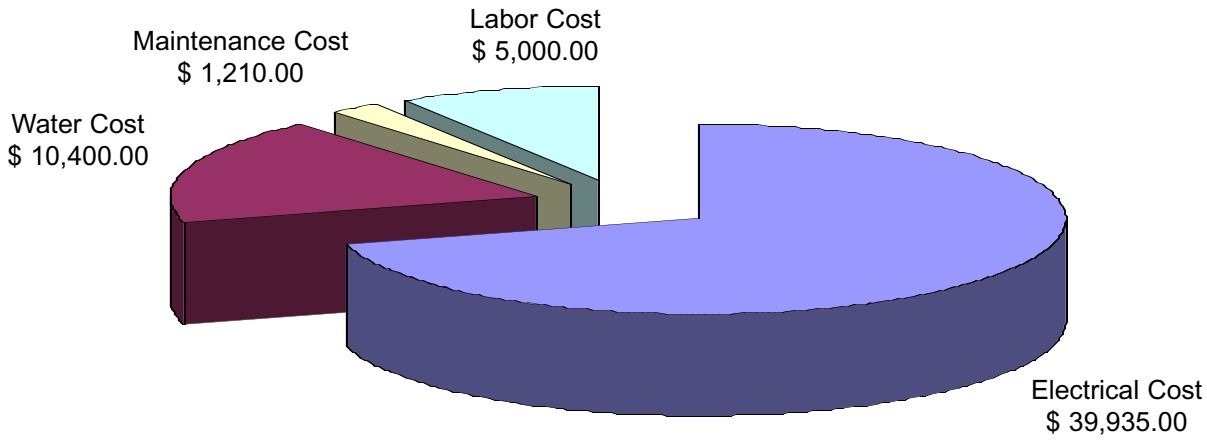
Power at $ 0.05 per kw Hour
Electrical Cost: $ 39,935.00

Cooling water at $ 1.80 per thousand
Water Cost: $ 10,400.00

Oil Change, Air and Oil Filter change. (preventative maintenance)
Maintenance Cost: $ 1,210.00

Labor Cost: $ 5,000.00

TOTAL YEARLY OPERATING COST: $ 56,545.00



Compressor Oil

Points to consider

This is the lifeblood of your compressor. Keep it clean and cool

Use Quality compressor oil and change it as necessary.

Check oil level -
add only if level reads “ADD OIL”

Do not mix different types of oil

Replace oil filter every 1000 hours

Filling after a complete drain may show “excess oil”
after start up oil will fall to green operating range
Use Only Manufacturers Oil

Gardner Denvers'' AEON 9000 synthetic lubricant.

The Importance of Lubricant in a Rotary Screw Compressor:

An oil flooded, rotary screw air compressor can’t operate effectively without proper lubrication. The oil in this type compressor cycles hundreds, even thousands of times daily. It absorbs the heat caused by compression and is cooled before being reused. The oil is sheared by the rotors as it seals the rotor clearances.

Always use the proper weight and grade of lubricant, as specified by the manufacturer. Also, follow the recommended change intervals to prevent oil breakdown, which causes increased wear.
Synthetic lubricants are recommended by most manufacturers for compressor applications.
Synthetic lubricants may cost 4-8 times more than conventional petroleum-based lubricants. However, the increased cost is offset by improved compressor operating efficiency, extended drain intervals, increased safety due to a higher flashpoint, and decreased maintenance.

Finally, with the increased concern for the environment, the disposal of lubricants is being regulated. Synthetic lubricants have less handling problems and costs due to their less frequent change interval.

General rules of Compressed Air System Installations

1) Pressure drop is irrecoverable.

2) Limit pressure drop to less than 10%.

3) Arrange piping to avoid strains of :
   weight of pipe
   thermal expansion and contraction
   internal pressure.

4) Provide proper ventilation and cooling.

5) Don't place your refridgerated dryer in an over.

6) Stable pressure reduces the waste of over pressurization.

7) Install Amp meters as a minimum to help trouble shoot your system.

8) Install Flow meters at cost centers to encourage conservation.

9) Install back-up equipment.

10) Install a relief valve.

11) Install bypass line on equipment that will need maintenance.

12) Install air receivers.

13) Locate header outlets close to points of use.

14) Slope pipes away from compressor toward traps.

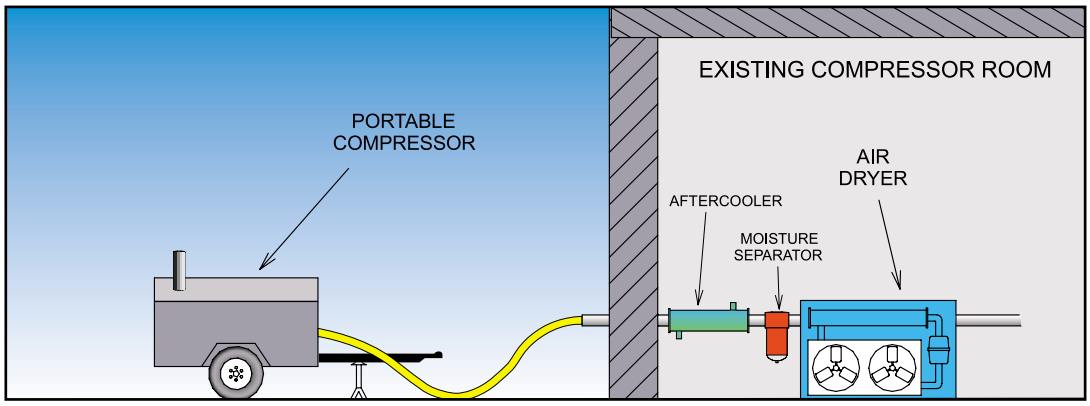
15) Install Separate Auto-Drains for each line.

<u>Points to consider</u>

Pay attention when sizing and purchasing auxiliary equipment. Low cost and high pressure drop go hand in hand.

How much does it cost for your system to be down?

Do you have an emergency bypass?



Provide a direct connection to your air system in the event of an emergency.

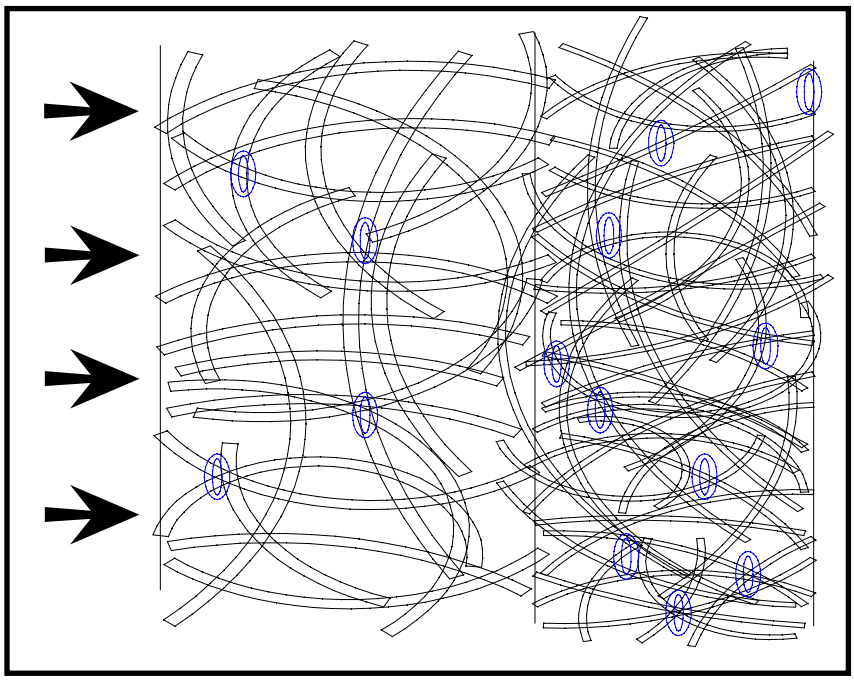
Coalescing Filters

Coalescence - liquid aerosols flow through in-depth filter and collect on glass fibers. Droplets travel along the fibers to the intersections. Droplets combine until large and heavy enough to drop to bottom of filter.

Remove aerosols as small as .01 micron.

Efficient even at reduced flow rates.

Glass fibers retain original properties indefinitely.



Points to consider

Coalescing filters are designed for steady usage and are affected by air surges.

Rotary screw compressors discharge 2-10 PPM oil carryover.

This equates to about 5 gallons of oil per 8760 hours on a 100 HP (500 CFM) compressor at 2 PPM.

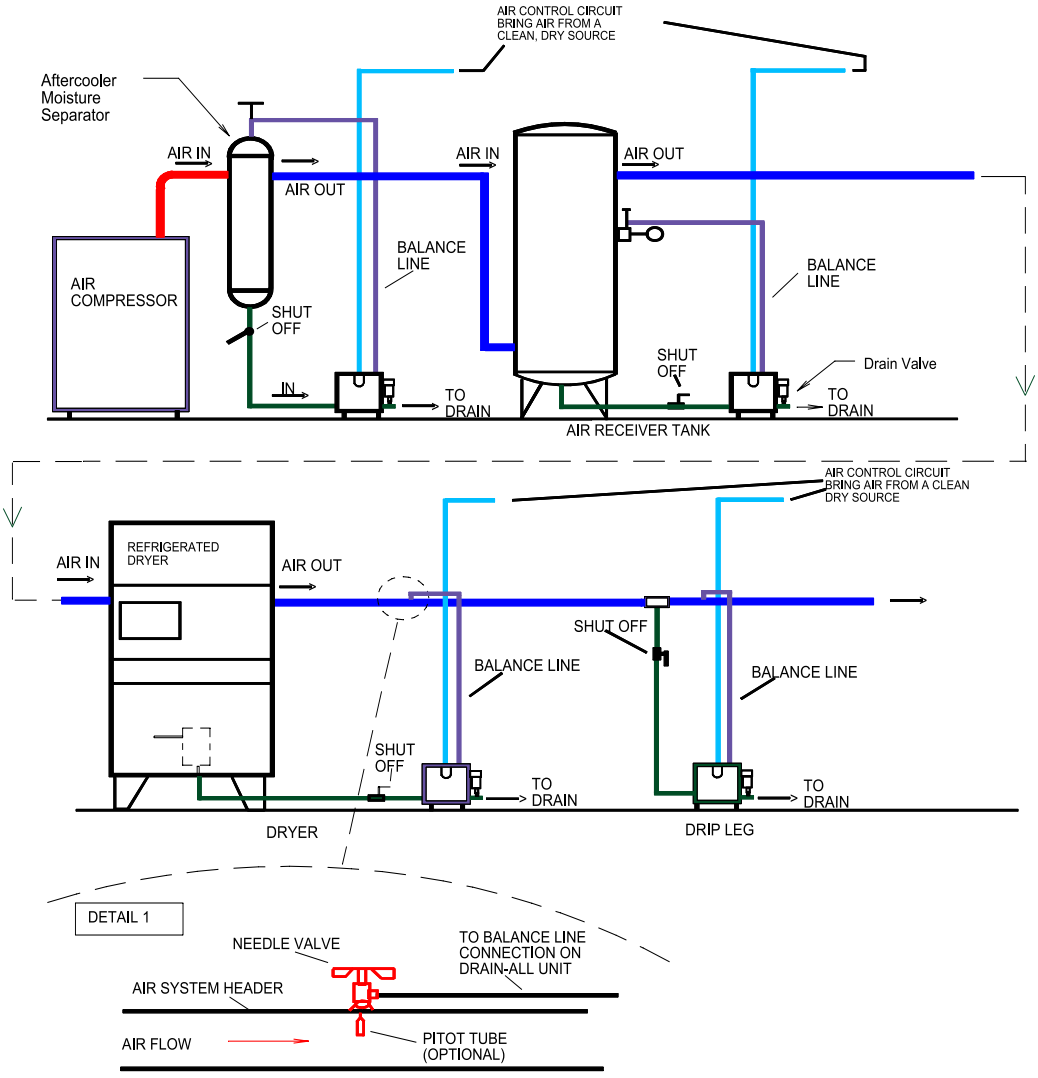
Airless Drain Locations in the compressed air system

Points to consider

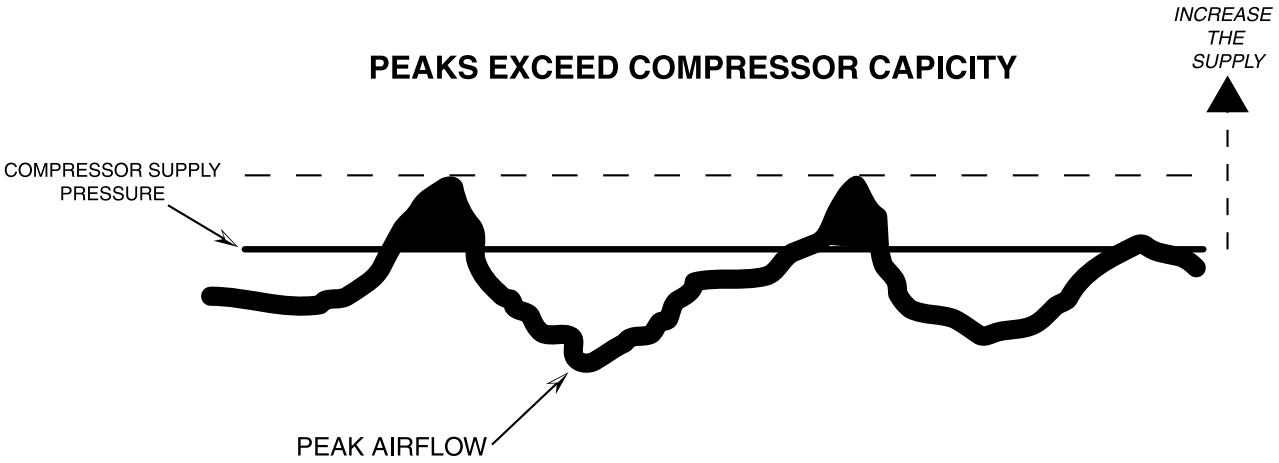
1/4" drain valve ($150.00) blowing to atmosphere will cost approximately $3000 per year.

An airless drain valve ($650.00) will not waste one cubic foot of air.

The best aftercoolers and dryers can be defeated with improper an/or inadequate drains.



Important Note About Balance Line and Control Air Line:
-Multiple drains should not be hooked together via a "T" connection.
-Control air should come from cleanest driest available source.
-Balance line allows air in reservoir to move back into compressed air system.

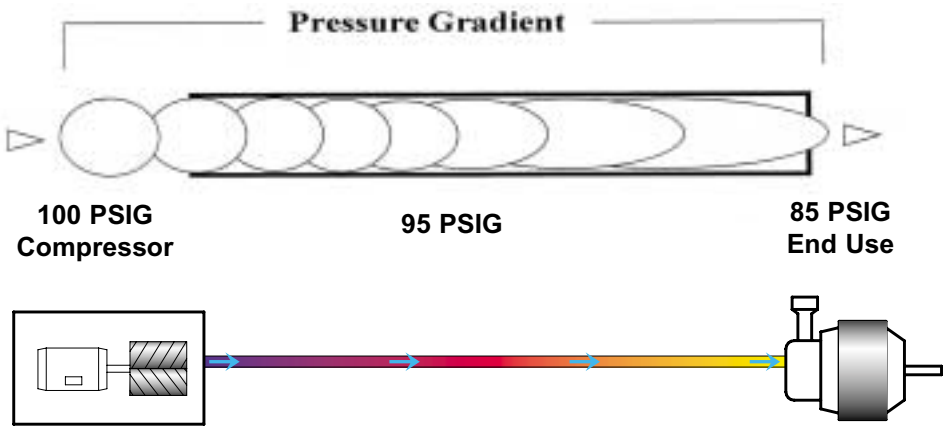


INCREASING THE SUPPLY TO COMPENSATE WASTES ENERGY!

CUMULATIVE PEAK LOADING MUST BE SATISFIED FROM ENERGY STORED IN THE PIPING DISTRIBUTION SYSTEM.. A PROPERLY MANAGED AIR SYSTEM USES STORAGE TO SATISFY PERIODS OF PEAK USAGE.

THIS ACTION IS COMPARABLE TO CRUISE CONTROL FOR YOUR AIR SYSTEM

AIR DRAWN FROM THE PIPE HEADER EXPANDS AS IT TRAVELS THROUGH THE SYSTEM!



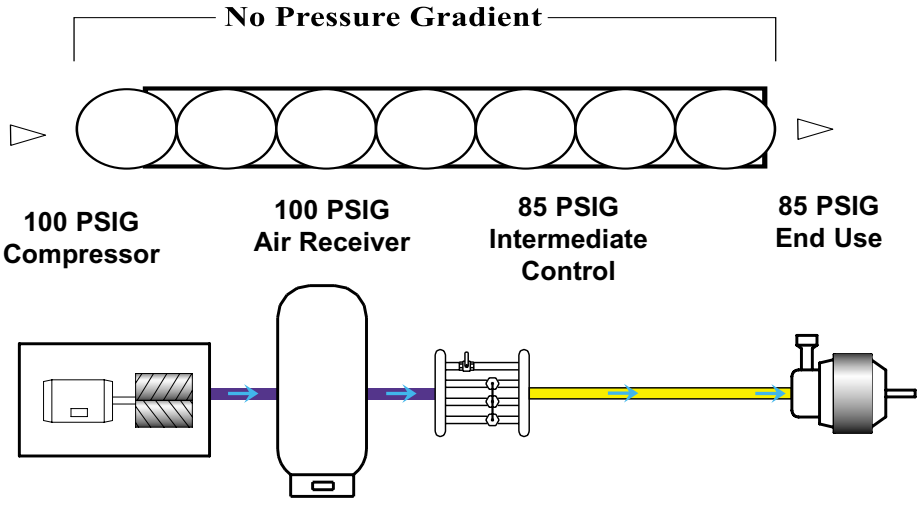
MASS STAYS CONSTANT.

DENSITY DECREASES.

VOLUME INCREASES.

FRICTIONAL LOSSES INCREASE.

AIR REPLENISHED INTO THE PIPE HEADER AT THE SAME RATE AS IT IS CONSUMED!



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"AiR SYSTEM CRUISE CONTROL."

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