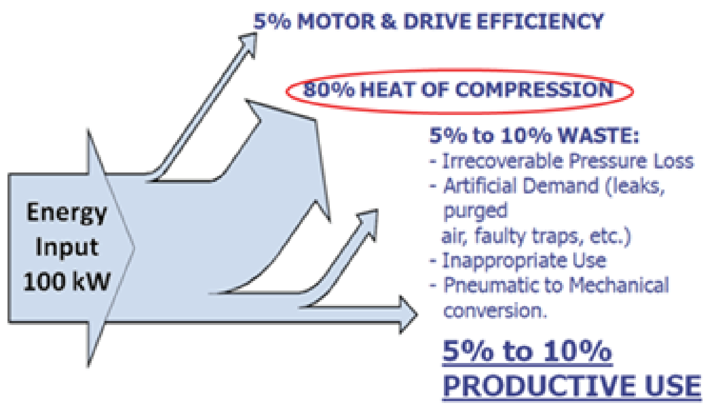
RODAN
Energy Solutions

APPLICATION NOTE 20171812

EMIS ARCHETYPE FOR A COMPRESSED AIR SYSTEM

Compressed air is a very expensive form of energy mainly due to its inefficiencies. In effect, during its lifetime, the main compressor cost is not its initial cost but rather its energy costs which 90% to 95% is actually lost to the atmosphere.




There are multiple ways to reduce its operating costs but, in order to achieve those savings, one needs to continuously monitor the compressed air system performance via a number of meters, sensors and gauges measuring air flows, pressures, temperatures across its supply, distribution and demand side components.

## 1. What to Monitor and Where to Locate Meters, Sensors and Gauges

### Supply Side

**(PM)** Power (energy) meters (for each compressor if above 50 kW each) and hours run meters (that differentiate between on-load and off-load running times) on each compressor drive.

**(P)** Pressure Sensors (preferable to pressure gauges) at each compressor discharge and on each receiver discharge or main branch line and differential gauges across dryers, filters, etc. to obtain a pressure profile across the system and identify high pressure loss areas.

**(F)** Flow meters (with temperature and pressure compensation – Thermal Mass Flow meters offer best accuracy and lowest pressure drop) to measure the quantity of air produced, overall, by compressor or large user

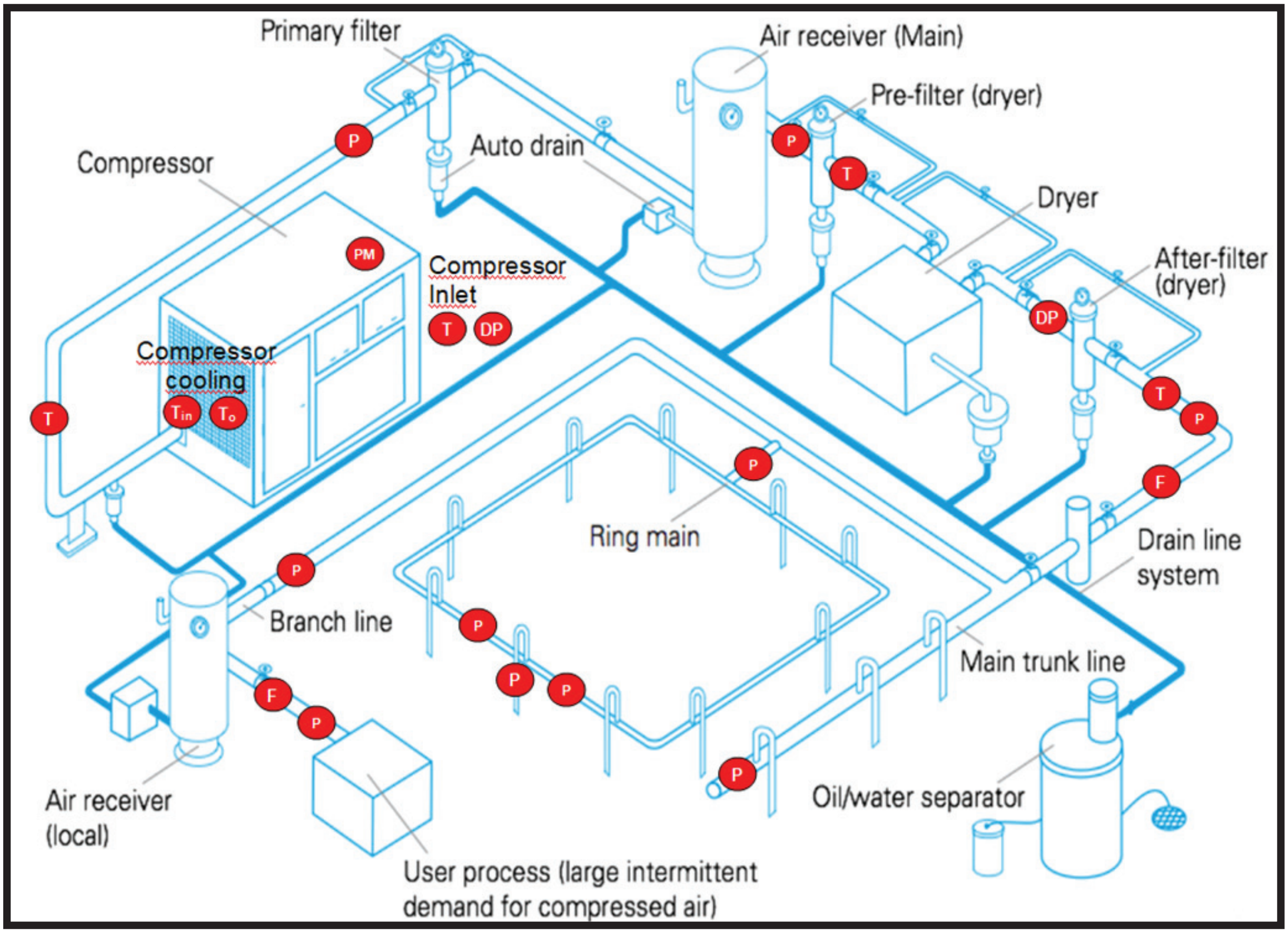
**(T)** Temperature gauges across the compressor and its cooling system to detect fouling and blockages.

**(DP)** Dew point temperature gauges to monitor the effectiveness of air dryers.

## Distribution System, Demand Side & End-User

**(F)** Flow meters (with temperature and pressure compensation) for large loads.

- o Production data from other manufacturing information system
- o Overall plant production
- o Production by user process or department – corresponding to large user flow metering
- o Person hours – overall of by large user.



| Model Description | Form of Model | Enabled Operational Opportunities |
|---|---|---|
| Overall Compressor Power & Energy vs Production | Power = function (production hours)<br><br>• Linear model with non-zero intercept | Plant air utilization efficiency as a KPI |
| Overall Compressor Power (& Energy) vs Air Flow<br><br>• &/or by individual compressor in multi compressor situation | Power = function ( F, P, T )<br><br>• Multi-variable linear model with non-zero intercept | • Compressor sequencing efficiency (baseload vs trim compressor)<br><br>• Compressor operational efficiency (filters, cooling etc)<br><br>• Individual compressor efficiency & set point tuning |
| Overall Air Flow vs Production<br>• &/or by large End User(s) | Flow = function (production, hours)<br><br>• Linear model with non-zero intercept | • Air utilization efficiency when in production – reducing inappropriate uses, isolate equipment when not used<br><br>• Reduction in air leakage (non-productive air usage) |
| Air generated vs treated (sent to distribution) | Simple ratio (air out / air in) | Treatment air efficiency (important for desiccant dryers) |

| Parameter to Trend | Description |
|---|---|
| Power (and Energy) | While the best measure of a compressor efficiency is power vs flow, there is value in monitoring time series trends of power in multi compressor plants – where proper load sharing is important |
| Flow (adjusted for T & P)<br>• Overall<br>• By compressor<br>• By large user | Monitoring air flow trends provides insight into the demand placed upon the system. While the energy models of air vs production provide a good view of utilization efficiency, time series trending is valuable in isolating transient loads, properly sizing receivers and simply monitoring leakage rates during non-production time. |
| Pressure<br>• At compressor<br>• Inlet & outlet of compressors<br>• Inlet & outlet of driers<br>• To distribution<br>• At large uses & other strategic distribution pointsPress | Overall system pressure is the KPI with which most compressed air system operators are familiar. There are more aspects to system pressure than simply maintaining a minimum pressure level. On average, power consumption in screw compressors increases 0.5% for every increase in psi in discharge pressure. Similarly, unregulated compressed air flows increase at a rate of 1% for every increase in psi. Abnormal pressure trends can help to isolate faults |
| Dew Point | Variations in the dew point are the first warning of impending malfunctions, including the total failure of the dryer control system. |
| Temperature | Temperature trending of the compressor and its cooling system to detect fouling and blockages. |

More Information

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