OPTIMIZE COMPRESSED AIR USAGE TO ACHIEVE ENERGY SAVINGS

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The compressed air system nowadays is an indispensable part of Automation of the plant. Whatever is the process control system upgraded and fitted to the process, the final control element is driven by Compressed Air- CA system only. If the CA utility is kept monitored, then its usage is in our control. If CA system is left wild to work without monitoring, then its misuse by excess feed & abuse by leakage will swallow your industry profits.

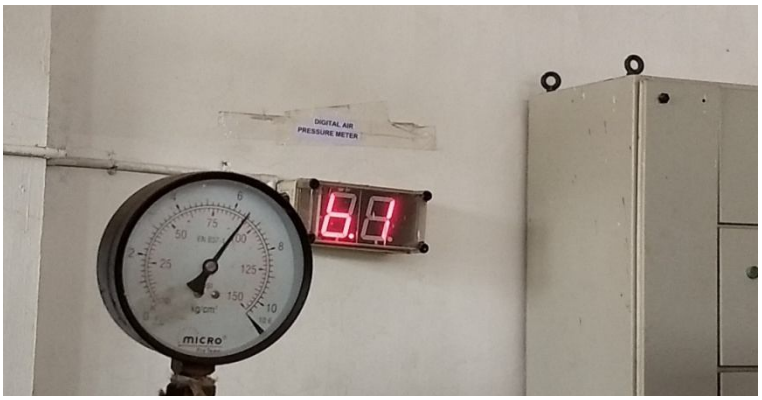
The user industry can now optimize the compressed air pressure and flow requirements to the machines, in consultation with the Machine OEM. First, the user needs to discuss with the machine OEM, how to reduce compressed air pressure & flow profile in their running equipment. We are discussing few ways to optimize the same, here.

The user industry has ensured in the compressed air generation, that their daily compressor house package KWh to deliver the required CFM is around 150 to 180 Watts per CFM at 7 Kgsc pressure. In fact at 5 Kgsc rated pressure, the compressor OEM has come out with 130 Watts per CFM compressor at lower pressure applications. The user is already discussing with the compressor OEM, to improve compressor generation efficiency routinely every year.

Also, the user industry is continuously modifying the compressed air layout, with PPR, Aluminum, SS material in piping, long bends etc instead of sharp fittings, added Feed Forward Air Receivers in each and every dept, apart from tail end receivers to buffer the compressed air transport, minimize the header end to end pressure drop of less than 0.5 Kgsc in the distribution.

EXISTING COMPRESSED AIR DEMANDS TO REDUCE NOW:-

1. The compressed air demand by the machine is either steady or steadily fluctuating, or dynamically varying depending on the machine needs like sudden bulk air flow demands.
2. Generically, the process variables in the given process system, Pressure, flow variables are dynamically varying & Fast responding type, compared to Level or Temperature variable type which are slow responding type.
3. The pressure fluctuations or pressure drops are happening in the given machine's inlet due to sudden & instantaneous bulk demand from process downstream or due to similar bulk air demands from adjacent machines / processes in nearby network.
4. The air demands shoots up suddenly, for example, in heavy pneumatic actuators, due to heavy applications like the splicing in autoconers in textile mills, or due to bulk air demand to transfer in the moulding machines in the foundry industry.



I Image – Digital pressure gauge in a textile mill at the Autoconer QPRO machine is what many of the machine OEM are implementing now. Since they give priority to digital monitoring of their air pressure requirements, let the OEM further pro-actively plan to reduce their pressure & flow requirements by 0.5 to 1 Kgsc down without compromising on the pneumatic functioning of their equipment and help the industry to save energy ultimately.

II Image – Digital pressure indicator with Mega Display & with alarm is set in the main process access of the mill at M/s.PRIMA Products, unit of Premier Group textile mill at Coimbatore. Now many industries talk compressed air pressure in high resolution say in Decimals only like 6.1 Kgsc instead of digits say 6 Kgsc or 7 Kgsc. This is a welcome trend now.

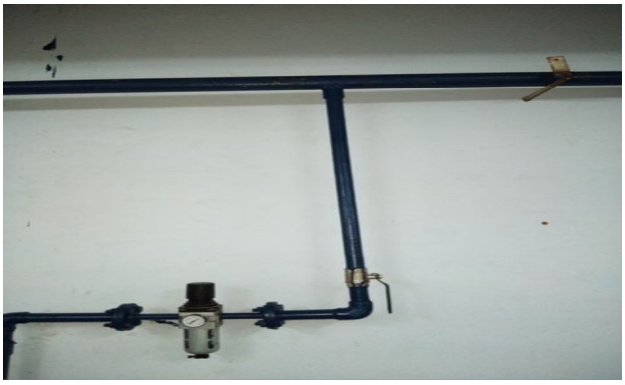
5. What is the machine's specs towards compressed air requirements during commissioning and how much the wear & tear, the worn-out pneumatic components cause excess air consumption gradually? OEM to give time schedule to regrease / replace.
6. What is the annual lubrication, replacement of pneumatic components / parts like O rings in Poppet type valves, actuator assembly, Pneumatic junction points etc so as to sustain and reduce the same air consumption for many years?

7. One of the reasons for the gradual excess air consumption is that the malfunctioning of Air dryer (either Refrigerated dryer version or others), thereby water in compressed air in the pipelines increase pressure drop, choke the Restriction Orifice in the regulators etc, ultimately leading to pneumatic components failure inside machine.

SPOT AIR RECEIVER:-

1. Cost effectively if we plan to add, in consultation with the OEM, the adequately sized Air bottle or mini Receiver in conjunction with the solenoids at every compressed air consuming equipment, we ensure uninterrupted flow of air at constant pressure to the equipment and its working is not disturbed due to want of air. When machine is OFF, the solenoid operated Ball valve must close automatically.
2. Depending on the user machine physical size, the industry can retrofit either horizontal or vertical 4 inch pipe for say 6 meters length ; this equals to 50 liters buffer air tank, surrounding / across the machine periphery. This cant' be done by the machine OEM at their factory, but can be done during the erection of machine at user site. This enables the machine to shallow breathe in, the compressed air, instead of starving for few minutes in between.
3. This Receiver is similar to capacitor retrofit at load end. Load end Capacitor reduces the voltage drop from Incoming Mains to the machine end. Like this, the spot receiver at each machine, helps to avoid air pressure sudden drops to the machine inside.
4. This retrofit due to its buffer stock at load end, helps to reduce header pressure say around 1 Kgsc more than the equipment operating pressure. For example, if we ran existing CA system on 7 Kgsc settings, and now let us retrofit air receivers at load ends. Now we can alter the settings to 6.5 Kgsc. **BEE bulletins say every 1 KGSC reduction say from 8 to 7 KGSC brings down power consumption by 7 % and here we envisage more.**

Compressed Air line Pressure Regulator wrongly sized & Fitted and located Wrongly. DON'TS !



I Line Press. Regulator, wrongly sized & located wrongly. II "High Precision PRV Internal Balancing" type gives savings.

I Image - shows the compressed air pressure regulator is fitted in the wrong location, and wrongly sized i.e. Line size is bigger and regulator is fitted in smaller size. The idea is to provide regulated pressure to the machine. But problems came due to frequent water in the bowl, pressure drop across the regulator when the machine demanded full air flow.

II Image – PRV " High Precision Pressure Regulator with Internal Balancer " in 6 inch pipe line feeding from the air compressors' package of 1700, 1000 & 750 CFM air delivery & dryers; and feeding to the Main Air receiver to the loads like PICANOL & DORNIER Looms. The compressors consume more than half the mill's electricity consumption at the Textile mill M/s. R.B. WOVENS P Ltd Erode

The total compressed air consumption was 13000 units per day before at 5.7 Kgsc. After installing this at a cost of less than Rs.1 Lakh, the mill achieved 320 units saving per day on this six monthly average and maintaining a steady air pressure 5.0 Kgsc downstream now. The same is achieved & Energy savings recorded for slightly equal Kilo Picks. Simple Payback period was just One month only and First Year Savings is Rs.8 Lakhs.

EACH MACHINE TO HAVE AIR MINI SUB HEADER:-

1. Each machine must have a Stand-Alone & Stand-Apart Mini Air sub header located outside the machine and its panel. The user, can daily drain the air header bottom leg located at the bottom most point, or preferably fix automatic drain valve and bowl, to trap the water drained out.
2. The air header to have Pressure gauge to show the Incoming pressure is OK. If the machine air consumption is varying type, to plan for say 1 inch flow meter on the pipeline to suit to size & flow, and fix in the pipe location of smooth laminar flow instead of turbulence. This flowmeter costs less than Rs.20,000/- now.
3. Just like any electrical machine needs a volt & current meters, to show the voltage is ok till the machine input, current consumption variations inside the machine is within normal values. The air pressure is similar to volts and air flow is similar

to the current. So the pressure band is narrow say between 6 to 7 Kgsc. But the flow band is broad, may vary from say 0 to 130 cfm for 1 inch line. So both are important to be pressure monitored & flow recorded daily.

4. Bright LED Public Scroll type Display board to show "Air consumed per day in Rs." be shown to user near the heavy drawing equipment / plant / cleaning applications. This can be kept in many areas where huge air consumption exists.

COMPRESSED AIR FOR CLEANING APPLICATION:-

1. The compressed air for cleaning purposes, need to be segregated from the main air utility header.
2. Many industries have realized that their compressed air pressure fluctuates heavily leading to failures of pneumatic actuators / mechanisms in other machines, due to this extreme pressure fluctuation by fully opened blunt nylon hoses.

Why we use air blow guns instead of blunt nylon hose ?

- The flow through a leak is similar to an orifice in that the flow is determined by the pressure immediately upstream of the opening.
- The pressure drops in the line supplying air to the leak based on line's ability to support rate of flow.
- For example, the air flow across a 1/4" orifice at 90 psig is 94 scfm
- but the flow through ten feet of 1/4" I.D. copper tube at 90 psig will be less than 40 scfm because the pressure will drop to 35 psig in the tube.

I image – COANDA Energy Efficient Nozzle based Portable Air gun is very much effective practically now.

II image – The user can also make a Jugaad by fixing a 10 feet / 3 meter tubing spiral at the point of start of cleaning hose from the branch header. This will act as a Fixed Pressure Restrictor and limit the flow thro this spiral as only as 40 %. This spiral will do the job of pressure regulator and steady minimum flow at low air pressure will be available at the other end of the air cleaning hose at the point of cleaning.

3. The user can first introduce a clean air receiver near the cleaning area, step down the pressure using the pressure regulator ahead of the receiver, and maintain low pressure clean air receiver.
4. The user can plan for cleaning air Low Pressure header Ring Main thro out the industry and this cleaning header to be equipped with intermediate receivers to buffer the cleaning fluctuations.
5. Permanent solution is to provide a Low pressure Screw compressor rated 5 Kgsc, as the latest compressor produces around 8 CFM per KW of consumption now. By this, we can save in the aspects of cleaning compressed air generation, distribution, and in usage areas here after.
6. Also taking a clue from automobile garages, the user industry can very well stop using the nylon braided hose; hose clamps etc hereafter, and plan for Poly Urethane PU hose material for cleaning applications. The PU ¼ inch hose along with Energy efficient air gun, helps the industry to conserve the air loss in cleaning applications up to 40 %.

DISCUSS WITH OEM TO REDUCE AIR PRESSURE REQUIREMENTS:-

1. The machine-OEM always works for their machine safety. But many OEMs are extra cautious to demand minimum air pressure say above 6 Kgsc. Whereas, OEM is very much aware that his machine can work at and upto 5 Kgsc as the Safe Minimum Working Pressure. So they provide a Low Pressure setting to switch off the machine when the pressure goes down less than 6 Kgsc.
2. This leads to energy loss due to higher header pressure, say 0.5 Kgsc causing 4 % power KWH losses. Because of this batch of machines, the entire compressed air header pressure is kept say a minimum of 0.5 to 1 Kgsc above the minimum machine demanded air pressure.
3. Here, let us assume one industry is operating compressed header pressure at 6.7 Kgsc. What we propose here now is that, to introduce at each machine control circuit, one more Pressure switch setting to trip the machine at & below 5.5 Bar strictly. This trip circuit will be in series with the existing pressure switch of 6 Kgsc trip setting. Provide a Off-Delay Timer for varying time delay of say 2 to 5 Seconds across this pressure switch, the function is introduce Time Delay to Trip. So when there is dip or sudden drop in branch header pressure 6.7 Kgsc to the band of 5.6 to 6.0 Kgsc for few seconds, this machine will not trip due to low pressure. If the same low pressure value is sustaining for say 2 to 5 seconds, then the machine will trip.
4. By this sustained-low pressure trip mechanism the machine safety is not compromised. As well, double protection is there now say 1. Sustainable trip at 6 Kgsc. (this switch's other contact can be used as an ALERT visual Latchable alarm with amber color tag and 2. Sudden trip at 5.5 Kgsc with Red color tag. After implementing this trial and confirming the safety and

optimum pneumatic operations, now the user can bring down his compressor header pressure from 6.7 Kgsc to 6.2 Kgsc. When compressors consume 1000 units per day, this exercise will give 50 units per day minimum energy savings on header pressure reduction exercise. This will reduce the leakage % as well happening from 6.7 Kgsc to say 6.2 6Kgsc. The investment towards this sustainable retrofit is Rs.3000/- per machine only. First year Savings will be Rs.1.25 Lakhs.

CONCLUSION:-

We find now, that the wakeup call is given to the industry to cautiously use the precious & costly air utility. Our mind set is" After all, Air only is wasted", this casual attitude should go out of the industry otherwise, much causality in the form of equipment breakdowns would crop up suddenly.

Assume you are asked to go 5th floor of building, now you are climbing up through staircase steps (no lifts, Please) to 7th floor and then climbing down to 5th floor. You face the agony, time waste, and pains. Similar is how you pump up your compressor to7 Kgsc delivery, to use the air at the 5 Kgsc @ machine end.

The industry has understood it has abused Air till date, now the industry needs to use compressed Air as Colorless Gold.

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The Objective:- SHARING KNOWLEDGE TO SAVE OUR ENERGY! CONSERVING OUR ENERGY IS OUR COLLECTIVE RESPONSIBILITY TODAY, FOR A BETTER TOMORROW!