WET & DRY AIR RECEIVERS IN COMPRESSOR HOUSE CAN YIELD ENERGY SAVINGS.

The industry can concentrate on the compressed air treatment now after the compressor, in the compressor house and achieve smooth, steady non-pulsating cool dry air as feed to the pneumatic actuated loads; the bye-product is energy savings. The industry has adopted the compressor installation and the compressed air treatment workings in consultation with the compressor OEM, but they can now give a thought of improving compressed air parameters like pressure drops and temperature drops, before the CA header leaves the compressor house.

WHAT IS THE PREVAILING CONDITION IN THE EXISTING COMPRESSOR ROOM AIR LAY OUT?

Nine out of ten industries have compromised on the compressed air layout with only one receiver inside the compressor house. Some industry has gone for only Wet type air receiver and some other industry has gone for only dry air receiver. This resulted in the frequent but partial choking of the water separator / filters which goes unnoticed by the user. In fact, the user assumes the frequent load & unloads are due to that process load demands. The user is not aware till date that the partly choked Water Separator is also a factor to create artificial pressure drop, thus inducing cyclic fast compressed air pressure fluctuations from the compressor.

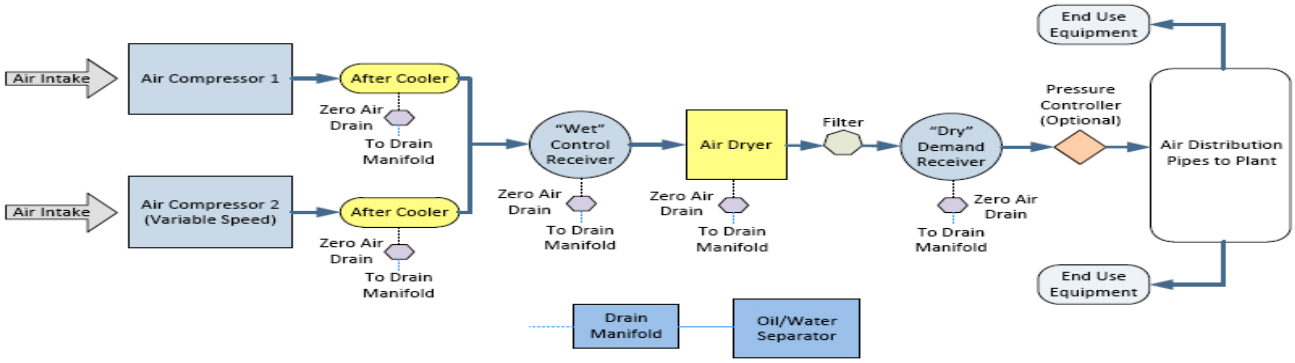

Fig 1 – Compressor & compressed air treatment sub systems to stand alone with buffer as two air receivers.

The compressed air generation cost goes up to 5 % due to poor performance of Water Separators, excess pressure drops across the filters, added to this is the artificial pressure cyclic load unload fluctuations. Allow each of the compressed air treatment sub system to stand alone, breathe well and with a buffer in between in them thro the two receivers.

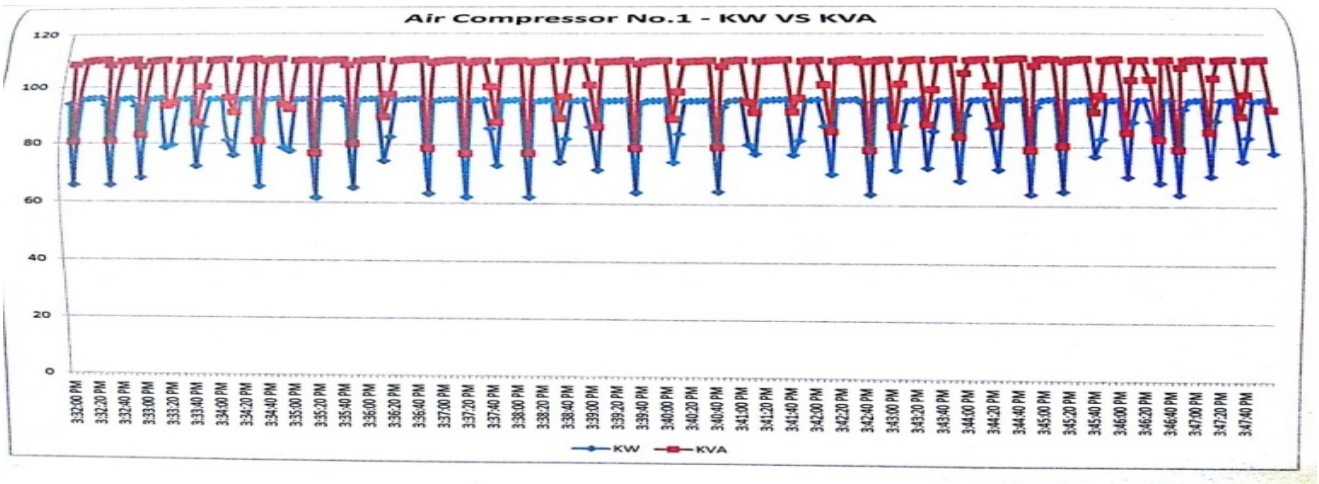

Fig 2 – Chart shows compressor hunts every one minute due to load & unload due to artificial pressure drops inside.

WHY DO WE NEED TWO RECEIVERS AFTER COMPRESSOR AND DRYER?

BENEFITS OF THE WET CONTROL AIR RECEIVER:

1. The wet receiver to be directly connected to the compressor post air cooler with no water separator / filter in between.
2. Damping pulsations caused by the load & unload pressures in the compressor KW zig zag chart can be avoided.
3. Providing a location for free water and lubricant to settle at bottom of receiver so as to be removed by Auto drain valve.

4. Reducing load/unload or start/stop cycle frequencies to help compressors run more efficiently.
5. Slowing system pressure changes to allow better compressor control and more stable system & header pressures.
6. Performing the above, this receiver smoothens the harsh compressor loading pattern, improving the compressor systems' health and avoiding the break downs inside the hood.
7. This wet receiver acts as buffer to post air cooler, aiding its slow & steady heat transfer efficiently.
8. Once the temperature is reduced near to the ambient at wet receiver, the downstream dryer will not de-rate more.

BENEFITS OF DRY DEMAND AIR RECEIVER:-

1. The dry receiver will act as a demand buffer between the load demands and compressor delivery pressure.
2. The load unload pressure control sensor to be fixed in the dry receiver as this will take directly the user demand.
3. The dryer functioning will improve as the dry receiver acts as a buffer to flatten the process demand spikes.
4. To provide general pressure stability in systems with undersized / Tee connections etc in distribution piping
5. The refrigerated dryer improves allowing the steady drying with minimum pressure drop across the dryer.
6. Thus ensures the safety working of dryer even catering to the highly fluctuating downstream loads.

WHAT IS NEED FOR RELOCATION OF WATER SEPARATOR AFTER THE WET AIR RECEIVER?

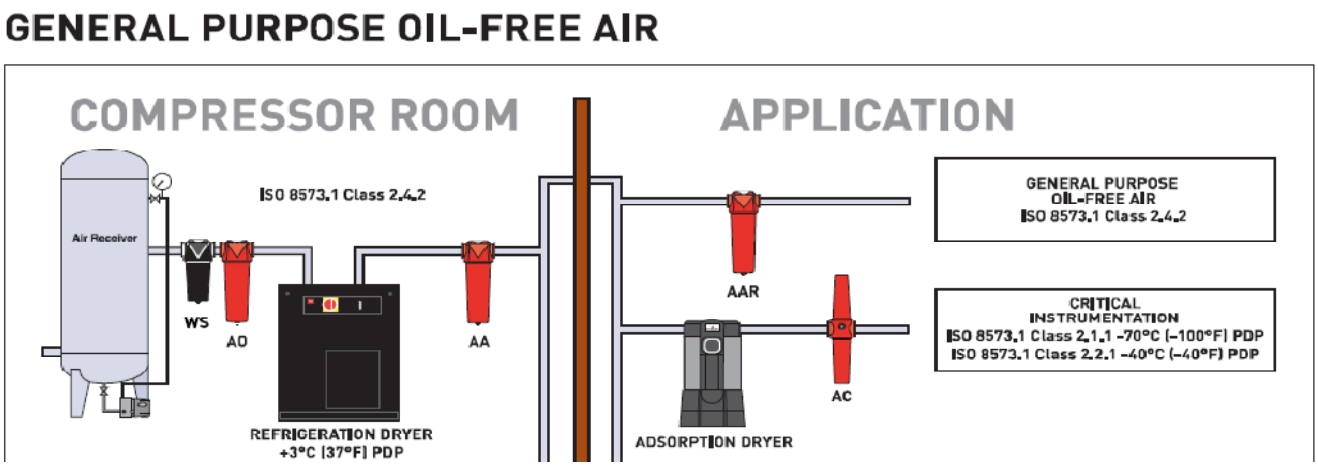

Fig.3.– Location of WS after the wet receiver & before Dryer - Reference Parkar compressed air treatment manual.

The above figure explains that WS – the water Separator + AO filter works better after the wet receiver and not in between the compressor and receiver. The compressor OEM gives the same in the package of compressor, post air cooler, Water Separator, and the integral refrigerated dryer. This All in One package sometimes becomes inefficient gradually in the long run, due to the poor workings of compressor downstream sub systems. So it is better to physically isolate the post air cooler from the compressor, shift the Water Separator from entry point of wet receiver to the exit of receiver and before the refrigerated dryer for healthy sub systems workings. The discharge air from compressor, immediately after the compression, gets cooled instantly at the post air cooler. Here the wet receiver after the post cooler will act as a buffer and allow the discharge to stabilize first before entering Water Separator. Presently water separator @ current location just outside post air cooler or after the hood, is prone to choke often inducing artificial pressure drops.

The same is explained in the case study in an Indian Textile Group Mill group as elaborated in the hyperlink, http://knowledgeplatform.in/portfolio/textile/ Workshop on Knowledge Exchange Platform reference the site www:Knowledgeplatform.in, – Energy Efficiency Best Practices by Raymonds, India in the year 2015.

This company achieved a lot of savings in energy due to the uniform loading of six compressors because of this repositioning of microfilters from the location in between the compressor & receiver to the location of receiver outlet as common filter bank. Here too, instead of putting multiple small filters in each sub header say six in number, to put duplex & sized filters as one main and other as standby suiting to more-than-rated cfm of compressors. One big sized filter instead of multiple small filters gives minimum pressure drop and the operating efficiency is better here. The oversized filter / fridge dryer at the time of installation of compressors leads to minimum pressure drops in compressor house.

IS THE POST AIR COOLER WORKING OK INSIDE THE COMPRESSOR HOOD?

The post air cooler functioning is very much important for the health and safety of compressor, as this reduces the load & pressure drop across the refrigerated dryer. Refer In a 160 KW 1000 cfm rated screw compressor, around 1000 liters of water is sucked inside over 48 hours running weekly. Out of which Post Air cooler removes 68 % of water say 735 liters at 35

degree C. The % values may vary from place to place but the % removal of say around 70 % removal is done by the Air cooler. But inside a compressor hood, the HX poorly transfers the heat as it sucks only the hotter air from the compressor sub systems inside the hood.

The compressor OEM & user to discuss on this aspect to decide about laterally shifting the heat exchanger position say by 200 to 300 mm away from the compressor hood and connect to the other subsystems by extended piping. By this, we see to it that we provide abundant ambient air supply surrounding the compressor hood to effect better heat transfer and heat exchange at the air cooler.

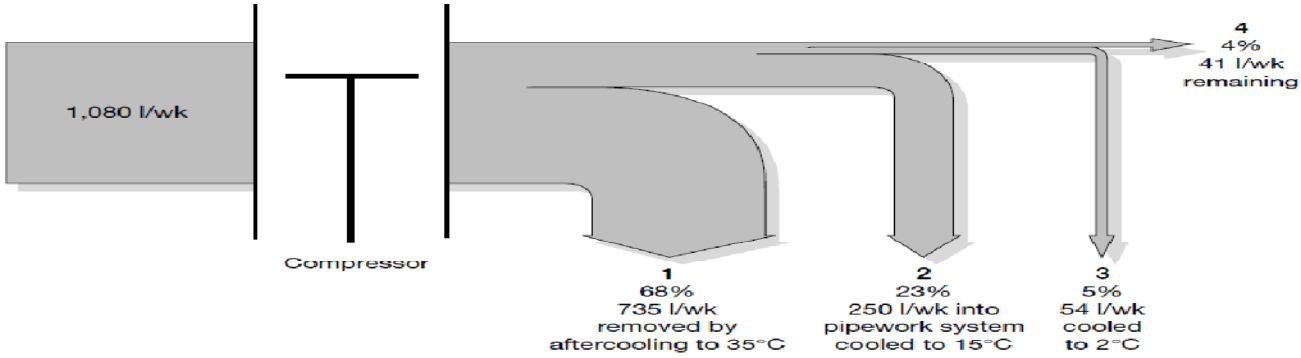

Fig 4. Ref – Good Practice Guide 216 – Energy saving in Drying of compressedAir – 68 % water removal in Air cooler
Water removal each week from 500 l/sec of 7 bar(g) air. Since ambient air contains 12.5 g of water vapour for each m3 of free saturated air at 15°C, a 500 l/s (1,000 cfm) compressor will inhale 1,080 litres of water vapour per 48-hour week. This quantity is still present in the air at terminal pressure and discharge temperature. The vapour will begin to condense as the air temperature is cooled to, or below, that of the pipework downstream of the compressor.

WHAT THE COMPRESSOR OEM NEEDS TO GUIDE THE USER IN THE INSTALLATION?

Practically we understand that the compressor OEM has to ship the compressor-in-hood as package. But the OEM can instruct his site team or a knowledgeable buyer & user to Partially knock down the sub systems and protrude the Air intake filter, keep out the Post air cooler HX, remotely shift the Pressure control sensor to the Dry receiver so that the compressor obeys to the process pressure needs thro pressure commands. The compressor can suck cool dry outer air in the compressor house instead of starving on hot harsh air inside.

1. The Post air cooler inhales and exhales better now outside the hood instead of poor heat transfer inside.
1. The remote pressure sensing gives steady process air pressure input to the compressor load & unload logic and not the pulsating pressures as measured now, since it is now inside the compressor hood before the after cooler.
2. In fact, stand alone post air cooler will be more efficient than an inbuilt post air cooler inside the dryer. This leads to ease of maintenance, monitor routinely the pressure drop & the temperature drop across the air cooler. Efficiency is visualized with higher the temperature drop and lower the pressure drop across the post air cooler.

CONCLUSION:-

The industry thinks daily that they are losing energy in their compressor KW / CFM. They can concentrate on the compressed air treatment at the compressor air intake pre- filter to the existing filter, and at the compressor delivery air. Let us revisit to the basics of compressor & air treatment and suit this condition monitored approach towards energy saving, routinely. Give attention to the OEM guidelines to each of the compressor sub systems and to the compressed air treatment.

THANKS TO THE TECHNICAL INPUTS FROM:-

1. http://knowledgeplatform.in/portfolio/textile/ Workshop on Knowledge Exchange Platform reference the site www:Knowledgeplatform.in, – Energy Efficiency Best Practices by Raymonds, India in the year 2015.
2. COMPRESSED AIR Energy Efficiency Reference Guide by (CEATI) Customer Energy Solutions Interest Group (
3. Air filter OEM Parker compressed air treatment
4. Good Practice Guide 216 – Energy saving in Drying of compressed Air

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