# COMPRESSED AIR

# SOLUTIONS

# REGARDING

# PNEUMATIC CONTROL

# SYSTEMS

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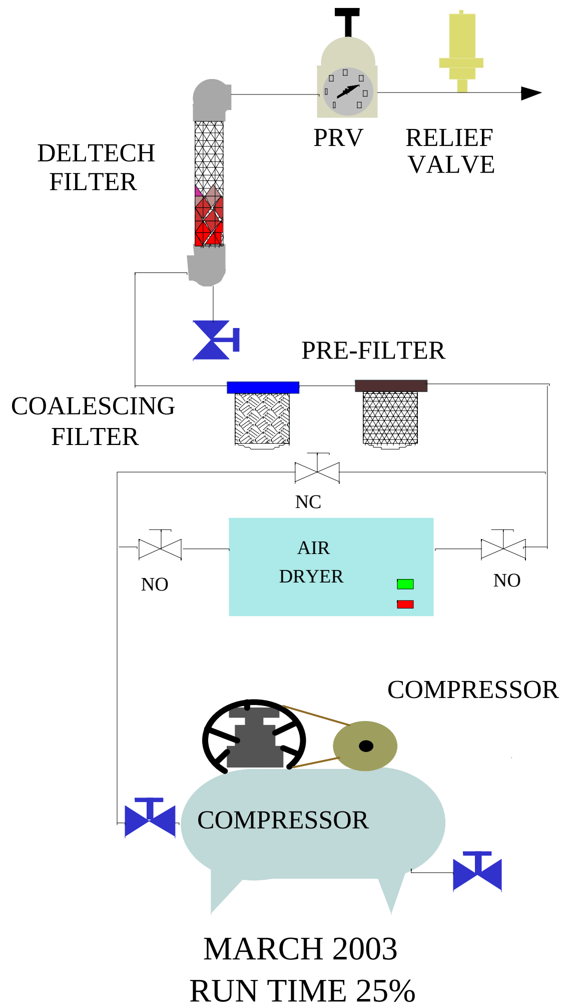


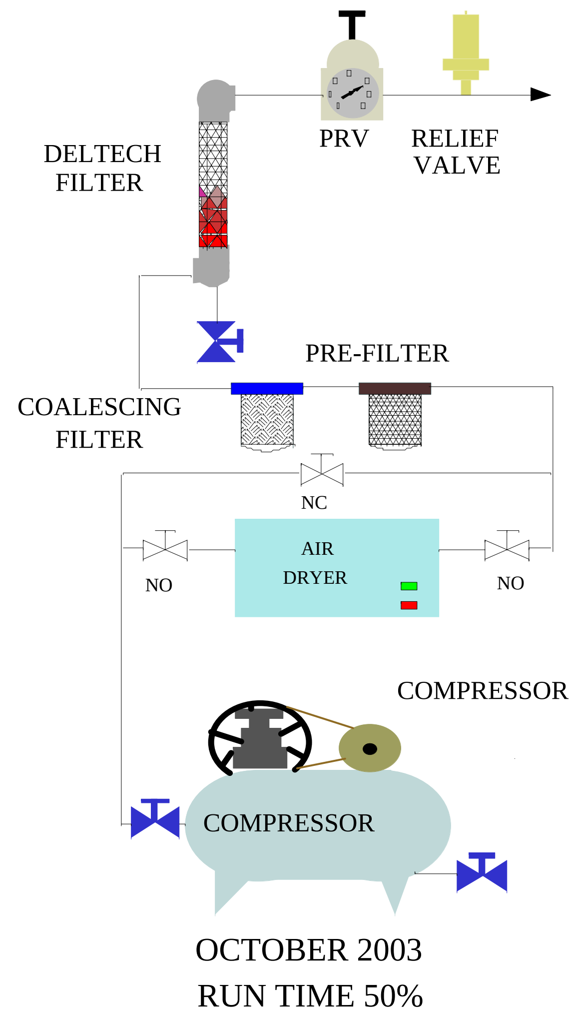


You time the compressor in March and the run time is 25%.

You time the compressor in October and the run time is 50%.

Do you spend labour looking for a leak to find that the compressor pump requires replacement?

Do you replace the compressor pump, to find that the pump was fine, but there is a leak in the system?

How will you determine what to do?

If you determine that there is a leak in the system, what logical approach will you employ to find the leak(s)?

FIGURE A

*ANALYSTS OF PNEUMATIC SYSTEMS LIMITED (APS)*
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| | |
|---|---|
| **JOB** | TYPICAL AIR STATION |
| **SYSTEM** | FILTER STATION |
| **ADDRESS** | |
| **DATE** | |
| **ENGINEER** | |
| **CONTRACTOR** | |
| **DESIGNER** | DS |
| **DRAWN** | LS |
| **REVISIONS** | |
| **DRAWING #** | |

# *SUPPLY AIR CARE FOR CONTROL SYSTEMS*

## *THE PROBLEM*

Most pneumatic control systems have no means of alerting building operators to air leaks. Excessive compressor run time is normally the only indicator available, which may result from deterioration of the compressor or air leaks in the control system. **Both generate the same symptom. Which is causing the current problem?**

**Some causes of leaks in your control system are:**

(1) Diaphragms rupture in control components.

(2) Vandals break thermostats off walls.

(3) Renovation workers break airlines.

(4) Cable installers break airlines.

**Leaks in your control system will:**

(1) Cause poor control in areas of low pressure.

(2) Cause changeover controllers to be on the wrong mode for summer/winter or day/night.

(3) Cause your compressor to run excessively.

**Excessive run time on the compressor will:**

(1) Shorten the life expectancy of your compressor.

(2) Waste electricity.

(3) Over-heat the pump, increasing the probability of passing destructive oil in to the control system.

**Having no means to assess the cause of your compressor's excessive run time, you may:**

(1) Choose to change the compressor pump finding that the new unit runs excessively as well. The real problem being air leaks in the control system.

(2) Choose to dedicate days of labour looking for air leaks that do not exist. The real problem being a deteriorated compressor pump.

**This report contains a simple solution allowing you complete confidence and control, identifying which path leads to correcting your problem.**

# *THE SOLUTION*

***Do a compressor station analysis complete with a new air flow meter and CAD drawing documenting your system.***

**The benefits enjoyed are:**

(1) A current database is created relating to your compressed air station performance relative to a new unit.

Figure "C", page eight, is a sample data sheet from a building with this advantage.

(2) The flow meter provides a simple visual indicator of air leak problems in the system. Operators can identify when air leaks appear in a system immediately allowing correction before associated problems occur.

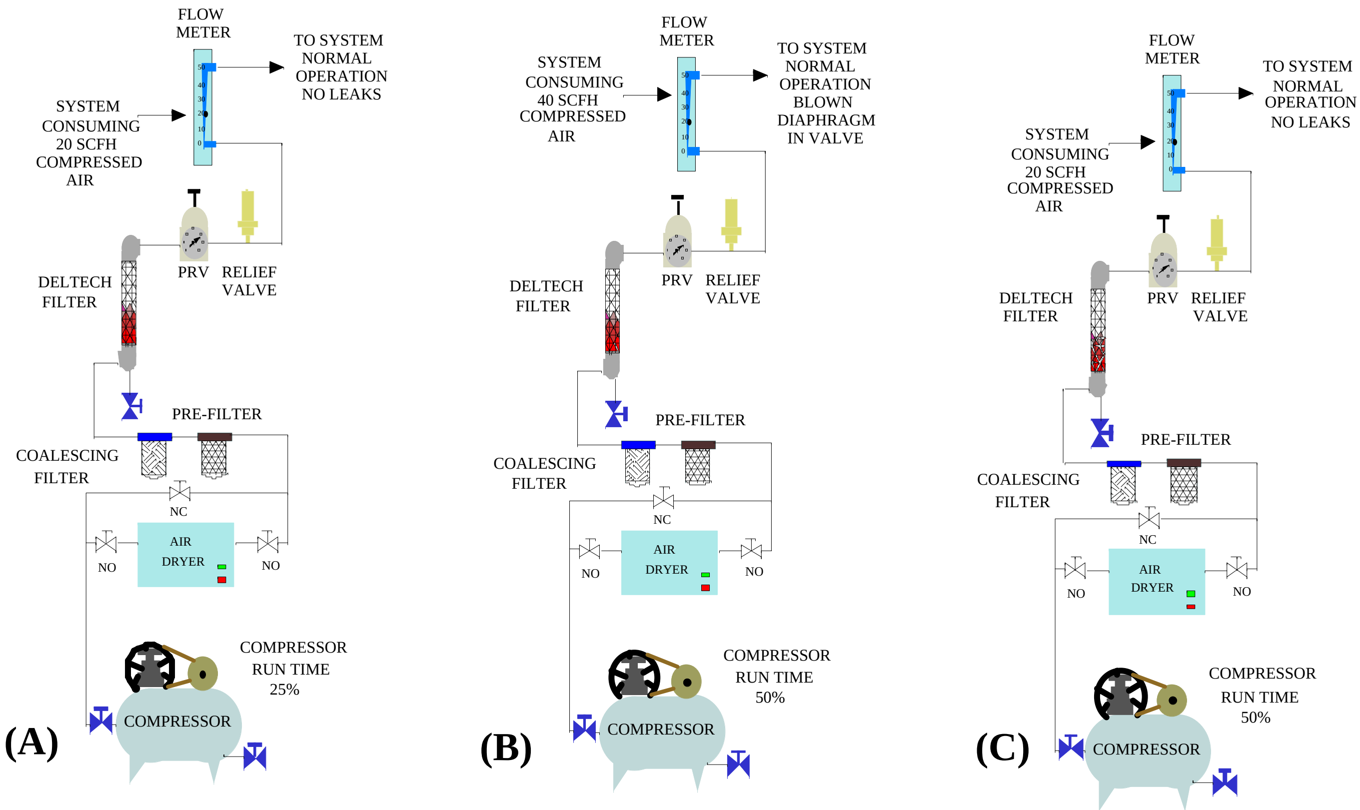
Figure "B", page four, is a document illustrating the assessment procedure determining if excessive compressor run time is the result of air leaks or compressor deterioration.

(3) The flow meter provides critical information during the search for air leaks making the procedure logical and as efficient as possible.

The procedure is explained on pages five, six and seven.

Compressor service data sheets, similar to the one on page nine, might be used establishing a documented history of the performance of your compressor station.

1.4




## THE PROBLEM

-In this example the compressor run time is normally 25% as illustrated in (A); however, the run time has increased to 50% as illustrated in (B) and (C). **The excessive run time wastes energy, shortens the compressor life expectancy and increases the probability of getting oil into the control system.**

## THE QUESTION

-Is the excessive run time the symptom of a leak in the control system or a decrease in the compressor performance? **Both conditions create the same symptom at the compressor.**

## THE ANALYSIS

-The flow meter in scenario (A) indicates that the system normally consumes 20 CFH (Cubic Feet Per Hour) of air, at a compressor run time of 25%, which you initially recorded when you installed the meter.
-If (B) illustrates your current situation with the flow meter reading 40 CFH, at a compressor run time of 50%, you know that the problem is a leak in the control system as it normally should only consume 20 CFH.
-If (C) illustrates your current situation with the flow meter reading 20 CFH, at a compressor run time of 50% you know there is a problem with your compressor station as the control system is consuming its normal 20 CFH.

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| | |
|---|---|
| **JOB** | TYPICAL AIR STATION |
| **SYSTEM** | SYSTEM ASSESSMENT |
| **ADDRESS** | |
| **DATE** | |
| **ENGINEER** | |
| **CONTRACTOR** | |
| **DESIGNER** | DS |
| **DRAWN** | LS |
| **REVISIONS** | |
| **DRAWING #** | |

# *LEAK ANALYSIS VIA A FLOW METER*

Looking for an air leak in a large building can be like looking for a needle in a haystack, if a logical approach is not employed.

We suggest using the information provided by a flow meter in the main air supply line of the control system. When using the flow meter information, one can break the building down into three potential areas where the leaks may occur.

(1) The exhaust fans.

(2) The supply fan systems.

(3) The thermostat loops associated with the main air distribution system.

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# *CHECKING FOR LEAKS AT THE EXHAUST FANS*

(1) Using walkie-talkies have one person at the flow meter and one person at the central control to stop and start the exhaust fans.

(2) Note the airflow reading at the meter with all the exhaust fans turned off. Turn the exhaust fans on one at a time and note the air flow meter reading after each one has started. The person at the meter should notice an initial surge when an exhaust fan with pneumatic actuator starts, but the meter should settle to the same point of the fan not running, after the actuator has filled.

(3) If the airflow reading is the same with the exhaust fans on or off, there is no leak associated with the exhaust fans; therefore, start with the supply fan air leak investigation.

(4) If the air flow meter jumps up when an exhaust fan starts and remains up, you likely have a leak either on the line from the solenoid to the pneumatic actuator or the diaphragm in the actuator has a leak.

(5) If the airflow meter jumps up when an exhaust fan is turned off, you likely have a leak in the solenoid air valve from the normally closed port to the normally open port and the solenoid should be replaced.

## *CHECKING FOR AIR LEAKS AT SUPPLY FANS*

After your control service mechanic has verified that there are no air leaks in your fan systems, turn the units on and off, individually, while reading the normal air consumption for each unit. Use the chart on page eleven of this report to record the normal air consumption for each unit. This information will provide value during future assessments regarding air leaks.

If you have not noted the normal consumption per fan system, you can estimate the consumption by counting the instruments on the system and allow the manufacturer's controller value relating to estimated air consumption per instrument.

Follow the same manning arrangement as with the exhaust fans. One person should be at the flow meter and the other at central control to operate the fans. Stop and start the fans one at a time while noting the air consumption relative to the expected air consumption for each fan system.

If one fan is using more air than expected, investigate the cause at the fan system.

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## *THERMOSTAT LOOPS AND MAIN AIR DISTRIBUTION*

If the exhaust fans and the supply fans prove to have normal consumption, you have narrowed the likely location of the leak(s) to the third and largest component of your pneumatic system, the thermostat loops and main air distribution piping.

The investigation, at this stage, must be approached logically to reduce frustration and costs.

We suggest that you obtain a floor plan of the building to plot the maximum branch pressure readings establishing a pressure picture of the whole piping system. The areas of the lowest pressures are the most likely areas to find significant air leaks.

## *TRAINING YOUR EAR TO THE DIFFERENT SOUNDS OF A THERMOSTAT MAY ASSIST YOU IN FINDING LEAKS*

The normal air usage of a relay thermostat produces a local hissing noise, while air passing through a thermostat relay, to a leaking diaphragm, makes a lower rushing sound.

To train your ear, at a practical level, find a thermostat in a non-critical location.

(1) Turn a direct acting thermostat to full heat and listen to the hissing sound of the pilot air (approximately .5 SCFH of compressed air) which most thermostats are designed to bleed. (Powers "D" stats do not bleed any air except when reducing its branch pressure.)

(2) Turn the setting of the thermostat down and listen to the air rushing through the thermostat relay to fill the diaphragm of the controlled device. The air volume you hear is about 27 SCFH to 70 SCFH, depending on the model. (See T4002 consumption graph, page 16.) The sound of the rushing air will taper off to silence when the diaphragm is completely filled at the main supply line pressure.

(3) Now you are going to simulate a blown diaphragm. Turn the thermostat down completely. Go to the controlled device (valve or damper actuator) and disconnect the airline. Go back to the thermostat and listen to the sound it is making. This is the same sound the thermostat makes while filling the diaphragm, except it does not taper off to silence because the air continues to rush to atmosphere via the simulated (or real) blown diaphragm.

Knowing the difference between the sounds of a thermostat assists greatly in finding and correcting leaks. REMEMBER TO RECONNECT THE BRANCH LINE AT THE VALVE OR DAMPER ACTUATOR AFTER DOING THIS EXERCISE.

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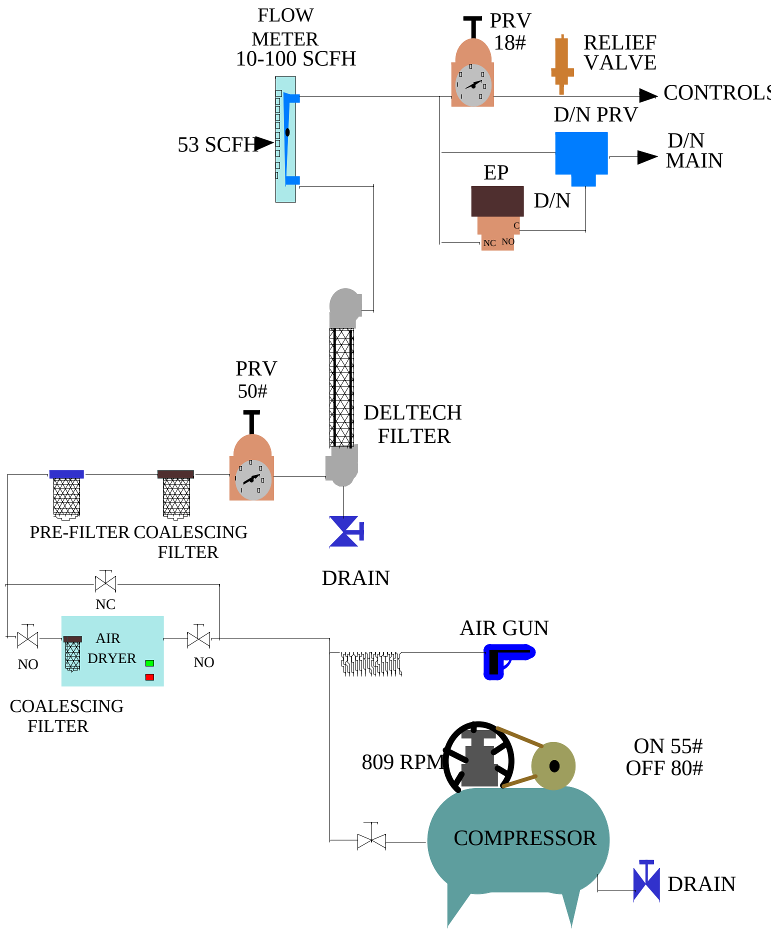
## *CAUTION*

Be sure that you do not turn off an exhaust fan or supply fan without checking with the building management. You may cause serious problems if the wrong fan is turned off at the wrong time.

Be sure to check with the building management for the appropriate time to install the flow meter. Advise the building management of the likely impact on parts of the building when control air is turned off during the meter installation. (For example: The heating will likely open fully, fresh air and exhaust air dampers will close, etc.)

# FIGURE C




**NOTE:**
**ALWAYS TURN OFF THE COMPRESSOR WHILE SERVICING!**

-When the red area on the Deltech filter advances by 1/2" from the last time you had the coalescing element changed, this indicates that oil is passing by the coalescing filter. At this time submit a work order to have the coalescing element changed and mark the top of the red advancing area on the Deltech filter element with a felt pen to guide you for the next 1/2" change to indicate the next required element change.

-When the Deltech filter turns red over about 2/3 of its lower area, submit a work order to have both elements changed.

-Time the compressor's run time once a month. Record this run time as well as the flow meter reading. Send recorded figures to the energy department at end of each year. (Run time/run time + rest time X 100 = % run time)

-Change oil in compressor every six months. FILL TO PROPER LEVEL. EXAMPLES: To check Devilbiss, with dipstick, screw dipstick in all the way. If no dipstick, on Devilbiss, fill to first thread below oil fill port opening. (The correct oil is none detergent 20 that is available from the stock room.)

-Report any unusual sounds, air leaks, large increases in compressor run time or large increases in flow rate at the time of discovery.

-Check compressor belt, with the compressor turned off, for cracking and tension when the oil is being changed. Replace belt at first sign of cracking. The belt should flex by your finger tension about 3/4" at the middle of the belt.

-Use the air gun to clean the air dryer coil. Wear eye safety glasses. Do not use the air gun to clean yourself or your clothing.

| | |
|---|---|
| MANUFACTURER | DEVILBISS |
| MODEL | 123 |
| HORSE POWER | 1 |
| TIME TO FILL TANK (0-80#) | 5 MIN AND 30 SEC. |
| TANK SIZE | 60 GAL |
| PERCENTAGE RUN TIME | 40% |
| UNIT CFM AT 80# | 3.1 CFM |
| BELT | 4L580 |
| INTAKE ELEMENT | M2003 (3" PAPER) |

NOTE:

NEW PUMP DATA SHEETS INDICATE THAT A 123 PUMP PASSES 3.6 CFM AT 80 PSIG WITH .71 HP AT 800 RPM.

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| | |
|---|---|
| **JOB** | PNEUMATIC CONTROLS |
| **SYSTEM** | COMPRESSOR STATION |
| **ADDRESS** | |
| **DATE** | |
| **ENGINEER** | |
| **CONTRACTOR** | |
| **DESIGNER** | DS |
| **DRAWN** | DS |
| **REVISIONS** | |
| **DRAWING #** | |

FIGURE D

# *ANALYSTS OF PNEUMATIC SYSTEMS LIMITED*
# *(APS)*
# COMPRESSOR STATION DATA LOG SHEET

BUILDING ________________________________

| YEAR ________ MONTH | FLOW METER READING | % RUN TIME | BELT CHECK | FILTER ELEMENTS' CHECK | OTHER COMMENT | MECH. INITIALS |
|---|---|---|---|---|---|---|
| | | | | | | |
| **JAN.** | | | | | | |
| **FEB.** | | | | | | |
| **MARCH** | | | | | | |
| **APRIL** | | | | | | |
| **MAY** | | | | | | |
| **JUNE** | | | | | | |
| **JULY** | | | | | | |
| **AUGUST** | | | | | | |
| **SEPT.** | | | | | | |
| **OCTOBER** | | | | | | |
| **NOV.** | | | | | | |
| **DEC.** | | | | | | |

**NOTE:**

- RUN TIME + REST TIME = TOTAL TIME
- RUN TIME/TOTAL TIME x 100 = % RUN TIME
- IF THE % RUN TIME INCREASES BY MORE THAN 10% FROM ANY PREVIOUS MONTH REPORT TO PLANT OFFICIALS.

# SERVICE DATA FOR AIR STATIONS

**BUILDING:** ____________________ **LOCATION:** ____________________

**DATE:** ____________________ **TECHNICIAN:** ____________________

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## COMPRESSOR:

**MANUFACTURER:** ______________________ **MODEL:** ____________ **RATED AMPS**_______

**HORSE POWER:** _______________________ **VOLTAGE:** __________ **PHASE:** _______

**AMPS AT CUT OUT:** ____________________ **FRAME:** __________ **PUMP:** _______

**FILTER ELEMENT:**______________________ **OIL TYPE:** __________ **BELT SIZE:** _______

**AIR FLOW METER READING: NOW**_________________ **AT INSTALLATION**__________________

**% RUN TIME**_______________ **CHANGE OIL**_________ **CHANGE INTAKE FILTER**____________

**BELT**________ **SPACE FROM WALL**________ **TANK CHECK**________ **UNLOADER**____________

**GENERAL NOTES:** ______________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

## AIR DRYER

**MODEL**_____________ **MOISTURE UNLOADER**_______________ **FREE AIR FLOW**____________

**ROOM TEMP.** ______ **CONDENSER TEMP.** _______________ **CLEAN COIL** ____________

**GENERAL NOTES:** ______________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

## SUPPLY AIR FILTERS:

**PREFILTER---------------------MAKE:** ________________ **ELEMENT:**__________ **CHANGED**_______

**COALESCING FILTER------MAKE:** ________________ **ELEMENT:**__________ **CHANGED**_______

**DELTECH FILTER MODEL**_______________________ **ELEMENT:**__________ **CHANGED** _______

**GENERAL NOTES:**_______________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

***A P S***

3.4

# *FAN SYSTEM NORMAL AIR CONSUMPTION*

| FAN SYSTEM | NORMAL AIR CONSUMPTION (SCFH) |
|---|---|
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# *COMPRESSED AIR FILTRATION*

## *THE PROBLEM*

Most pneumatic air supply stations, for controls, have a coalescing filter. They are excellent filters; however, the indication to change the filter element is based on a pressure drop through the filter at a specific flow rate. (Often a 10 PSIG pressure drop at a 10 SCFM flow rate.)

It is extremely rare to find a control air supply at exactly 10 SCFM; therefore, the pressure drop is not relevant in most cases. (A 7.5 HP compressor, running 33% of the time, should produce approximately 10 SCFM.) Most operators do not have a reliable means to determine when the element requires changing.

We often witness elements saturated to the point of allowing oil into the control system. In one case, the element was laying in the bottom of the filter bowl.

**The operators did not have an indicator to trigger correction of the dangerous situation.**

---

## *THE SOLUTION*

**Install a Deltech filter after your existing filter station to act as an "INDICATOR/SAFETY NET".** (See the photograph on page thirteen.)

As an "**INDICATOR**", the element of the Deltech filter turns a deep red as it absorbs oil from the control air passing through.. The red starts at the bottom of the element and gradually advances to the top. (See photograph on page fourteen.) The red colour will not start its advance until the upstream coalescing filter starts to fail and pass oil.

When the red advances about one-half of an inch, change the coalescing filter element. Follow this procedure with each new coalescing element, until the Deltech filter is red about two thirds of the element's height. At this time, change both the coalescing and Deltech filter elements.

As a "**SAFETYNET**", the Deltech filter captures oil that passes the coalescing filter, as well as filtering particles down to about one micron in size.

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**CLEAN, DRY CONTROL AIR IS THE MOST IMPORTANT REQUIREMENT OF A RELIABLE PNEUMATIC CONTROL SYSTEM. YOU MUST GIVE THIS THE ATTENTION IT DESERVES TO AVOID SEVERE PROBLEMS AND ASSOCIATED COSTS. FIGURE "E" ON PAGE FIFTEEN ILLUSTRATES A SUGGESTED FILTER ARRANGEMENT.**

4.2 

# DELTECH 110 FILTER

# DELTECH 110E FILTER ELEMENTS

**TOP**

**BOTTOM**

NOTE:

New elements range from white to a pinkish white in colour.
Elements turn deep red from the bottom as they load with oil.

4.4

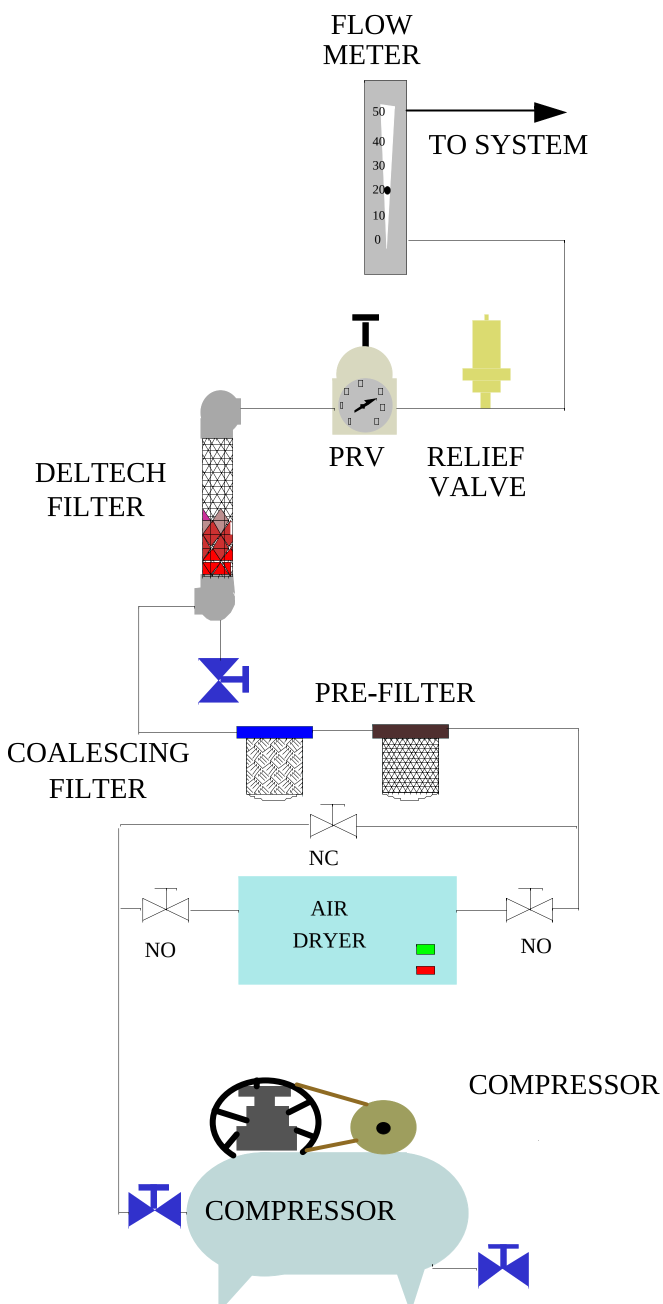
# FIGURE E

**NOTE:**

The Deltech filer element changes colour from a pinkish/white to a deep red as it loads with oil. The change to red gradually climbs up the pinkish/white element over time exposure to oil.

The Deltech filter's intent in this arrangement is to act as a safety net / indicator.

1) As a safety net the Deltech captures and contains oil that passes by the pre-filter and coalescing filter if there is a filter failure.
2) As an indicator, the Deltech filter visually alerts the operator that the coalescing filter is passing oil and it is time to change its element. (The industry means of determining when to change elements of most coalescing filters is a specific pressure drop at a specific air flow rate. This is ineffective in most applications we have observed.)
3) We suggest changing the Deltech filter element when it has become red over approximately two-thirds of its element.

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| | |
|---|---|
| **JOB** | TYPICAL AIR STATION |
| **SYSTEM** | FILTER STATION |
| **ADDRESS** | |
| **DATE** | |
| **ENGINEER** | |
| **CONTRACTOR** | |
| **DESIGNER** | DS |
| **DRAWN** | LS |
| **REVISIONS** | |
| **DRAWING #** | |