METROPOLITAN NY CHAPTER
Refrigeration Service Engineers Society

Continuing Education for the HVAC/R Industry

"Better Service Through Knowledge"

May 2018

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Starting a Stuck Reciprocating Compressor

One of the common problems found while troubleshooting reciprocating compressors is that they simply fail to start. This could be the result of many different causes, both electrical and mechanical. One common mechanical cause is a stuck piston. Mechanically the piston cannot overcome an internal resistance to move. ***Normally*** when this is found to be the problem, the compressor will need to be replaced. However there are some "tricks of the trade" which a technician can use to try to free a stuck piston. If any of these tricks solve the problem, it may be only a temporary fix as the defect within the compressor can cause it to lock up once again.

On single-phase compressors with a permanent split capacitor motor, a hardstart kit can be added to the compressor's motor wiring. This kit consists of a starting relay and start capacitor. This will give the motor additional torque at startup and may allow the compressor to start. It is normally best to contact the compressor manufacturer to determine the correct size start relay and start capacitor to use. There are universal hard-start kits available which can be used on multiple size and style compressors. Check with the manufacturer or local supplier of these universal hardstart kits for the right size to use.

Another "trick" which can be used on single-phase compressors is to reverse the start and run leads of the compressor and ***momentarily*** energize the compressor. This may also help to free the piston. Only do this for a few seconds and then switch both the run and start leads back to their original position. Applying continuous voltage to a compressor in this fashion will damage it.

Another procedure can be used on three-phase reciprocating compressors. Switching any two leads may help to free up the piston or pistons. On a three-phase compressor you do not need to switch the leads back. They can be left reversed. Do not use this technique on scroll compressors as they are not designed to operate in this fashion.

If you are working a 120 volt compressor you can try to energize the compressor with 220 volts. This may help free the piston. Do this for only one or two seconds as it could further damage the compressor's motor.

One other method to try is to simply strike the top of the compressor with a hammer while starting the compressor. If you are lucky maybe it will start. More than likely it will not, but it certainly is worth a try.

Trying to free a stuck compressor does not always yield positive results, but occasionally it will allow a technician to get a compressor started. Again, if any of these tricks do solve the problem, it ***might*** only be a temporary, as it is possible that the defect will once again cause the compressor to lock up.

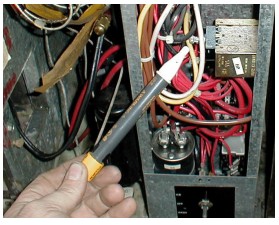
Safeties

Refrigeration, heating and air conditioning systems contain various types of safety devices which are designed to protect both the equipment and the people operating the equipment. Never leave a safety device bypassed. This could present a very dangerous situation and could easily lead to serious personal injury or equipment damage.

If, while inspecting a system, you notice that a safety device has been bypassed, notify the owner of the system. This dangerous situation should not continue—the safety device should be placed back in operation.

Electrical Safety

When replacing or repairing any electrical components, always verify that the voltage source is truly disconnected from the circuit. Test the circuit for the presence of voltage with some type of voltmeter or voltage indicator ***AT THE COMPRESSOR***. Do not solely rely on the electrical disconnect to ensure the voltage is disengaged. Always verify this yourself.



It is possible that the disconnect may be defective or may have been bypassed by others. It is also possible that there may be another voltage source supplying the circuit not controlled by the disconnect shut down.

LET'S BE SAFE OUT THERE

Airflow Formulas

CFM = Duct Area (sq. ft.) x Velocity

$$\text{Air Changes/hr.} = \frac{\text{CFM x 60}}{\text{Room Volume cu.ft.}}$$

Standard Air = 70°F 50% @ 29.92" Hg
1 cu. ft. = 0.075 pounds
1 pound = 13.33 cu. ft.

$$\text{CFM} = \text{Room Volume (cu. ft.)} \times \frac{\text{Air Chnages/hr}}{60}$$

$$\text{VP} = \left(\frac{\text{V}}{4005}\right)^2$$

$$\text{Velocity} = 4005 \times \sqrt{\text{VP}}$$

$$\text{Density} = 0.075 \times \frac{530}{460 + \text{Temp}} \times \frac{\text{Bar.}}{29.92}$$

$$\text{Velocity} = 1096.7 \times \sqrt{\frac{\text{VP}}{\text{Den}}}$$

Sensible Heat Formula

$$\text{BTU sensible} = \text{CFM} \times 1.08 \times \text{delta T} \times \frac{\text{Density}}{0.075}$$

Total Heat Formula

$$\text{BTU total} = \text{CFM} \times \text{Enthalpy in BTU per pound} \times 4.5 \times \frac{\text{Density}}{0.075}$$

Economizer Settings

$$\%\text{OA} = \frac{\text{RAT - MAT}}{\text{RAT - OAT}} \times 100$$

$$\text{MAT} = \frac{(\%\text{OA} \times \text{OAT}) + (\%\text{RA} \times \text{RAT})}{100}$$

$$\text{OAT} = \frac{(\text{MAT} \times 100) - (\%\text{RA} \times \text{RAT})}{\%\text{OA}}$$

$$\text{RAT} = \frac{(\text{MAT} \times 100) - (\%\text{OA} \times \text{OAT})}{\%\text{RA}}$$

O = Outside • **R =** Return • **T =** Temperature • **A =** Air • **M =** Mixed

Motors

New Motor Sheave Size

$$\text{Dia. new} = \text{Dia. old} \times \frac{\text{RPM new}}{\text{RPM old}}$$

$$\text{Max. Fan Sheave Dia.} = \frac{\text{Esting Fan Sheave Dia.}}{\sqrt[3]{\frac{\text{Max. BHP}}{\text{Existing Est. BHP}}}}$$

$$\text{Max. Motor Sheave Dia.} = \text{Existing Motor Sheave Dia.} \times \sqrt[3]{\frac{\text{Max. BHP}}{\text{Existing Est. BHP}}}$$

New Fan Sheave Size

$$\text{Dia. new} = \text{Dia. old} \times \frac{\text{RPM old}}{\text{RPM new}}$$

$$\frac{\text{RPM Fan}}{\text{RPM Motor}} = \frac{\text{Pitch dia. motor sheave}}{\text{Pitch dia. fan sheave}}$$

$$\text{Estimated BHP} = \frac{\text{Am x Vm}}{745.7}$$

$$\text{Three Phase BHP} = \frac{1.732 \times \text{Am x Vm} \times \text{Eff.} \times \text{PF} \times \text{L}}{745.7}$$

$$\text{Single Phase BHP} = \frac{\text{Am x Vm} \times \text{Eff.} \times \text{PF}}{745.7}$$

Fan Laws

$$\frac{\text{CFM new}}{\text{CFM old}} = \frac{\text{RPM new}}{\text{RPM old}}$$

$$\text{CFM new} = \text{CFM old} \times \frac{\text{RPM new}}{\text{RPM old}}$$

$$\text{RPM new} = \text{RPM old} \times \frac{\text{CFM new}}{\text{CFM old}}$$

$$\left(\frac{\text{CFM new}}{\text{CFM old}}\right)^2 = \frac{\text{SP new}}{\text{SP old}}$$

$$\text{CFM new} = \text{CFM old} \times \sqrt{\frac{\text{Sp new}}{\text{SP old}}}$$

$$\text{SP new} = \text{SP old} \times \left(\frac{\text{CFM new}}{\text{CFM old}}\right)^2$$

$$\left(\frac{\text{RPM new}}{\text{RPM old}}\right)^2 = \frac{\text{SP new}}{\text{SP old}}$$

$$\text{RPM new} = \text{RPM old} \times \sqrt{\frac{\text{Sp new}}{\text{SP old}}}$$

$$\text{SP new} = \text{SP old} \times \left(\frac{\text{RPM new}}{\text{RPM old}}\right)^2$$

$$\left(\frac{\text{CFM new}}{\text{CFM old}}\right)^3 = \frac{\text{BHP new}}{\text{BHP old}}$$

$$\text{CFM new} = \text{CFM old} \times \sqrt[3]{\frac{\text{BHP new}}{\text{BHP old}}}$$

$$\text{BHP new} = \text{BHP old} \times \left(\frac{\text{CFM new}}{\text{CFM old}}\right)^3$$

$$\left(\frac{\text{RPM new}}{\text{RPM old}}\right)^3 = \frac{\text{BHP new}}{\text{BHP old}}$$

$$\text{RPM new} = \text{RPM old} \times \sqrt[3]{\frac{\text{BHP new}}{\text{BHP old}}}$$

$$\text{BHP new} = \text{BHP old} \times \left(\frac{\text{RPM new}}{\text{RPM old}}\right)^3$$

COMING TOPICS

Identifying and Correcting Voltage Leakage Problems w/VFD Motors & Drives

What Else is New in Motor Technology for the HVAC Industry

The Latest in Compressor Technology

New Technology for Controlling Humidity

If you have any suggestions or requests for FUTURE EDUCATIONAL PROGRAMS, please let us know!

METROPOLITAN NEW YORK CHAPTER, RSES

For Information Call: Stan Hollander, CMS (718) 232-6679

INTERESTING BUT USELESS FACTS WHICH MAY INTEREST TO YOU

- A cat has 32 muscles in each ear.
- A dime has 118 ridges around the edge.
- A dragonfly has a life span of 24 hours.
- A duck's quack doesn't echo, and no one knows why.
- A goldfish has a memory span of three seconds.
- A shark is the only fish that can blink with both eyes.
- Al Capone's business card said he was a used furniture dealer.
- All 50 states are listed across the top of the Lincoln Memorial on the back of the $5 bill.
- All porcupines float in water.
- An ostrich's eye is bigger than its brain.
- Blueberry Jelly Bellies were created especially for Ronald Reagan.
- Cats have over one hundred vocal sounds, while dogs only have about ten.
- A cat's urine glows under a black light.

Wednesday May 9th, 2018

at 7:30pm

at

RICCARDO'S

21-01 24th Avenue, Astoria NY 11102

Identifying and Correcting Voltage Leakage Problems w/VFD Motors & Drives

Andy Kressbach - Aegis

PRESIDENT'S MESSAGE

Where did the year go? More importantly where is Spring?
Hopefully warm, if not hot weather is just around the corner. I hope you have learned something at our meetings. Stan Hollander CMS and Rich Bruno have scheduled some very informative speakers and if you missed them, then that is your loss. It is not only the speaker and educational portion you missed but the contacts and relationships you can establish with the speaker. We can only provide the educational opportunity, we cannot make you come. Perhaps we are not covering topics of interest to you. If so, let us know by emailing any suggestions to Stan at **EducationalDirector@metronyrses.org**. He is working on setting up next year's educational speakers and is interested in any suggestions you may have. Remember, as you do your servicing this summer, keep your eyes open for new topics & applications that you think would be of interest to your fellow members.

On behalf of the Board of Directors and myself,

Have a Great, Prosperous and Safe Summer