METROPOLITAN NY CHAPTER

Refrigeration Service Engineers Society

Continued Education for the HVAC/R Industry

"Better Service Through Knowledge"

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Determining Recovery Cylinder MAXIMUM Capacities

Working with refrigerant recovery cylinders is a basic part of servicing refrigeration systems. Technicians need to work safely when handling these cylinders.

A potential hazard can result from overfilling these cylinders. To prevent overfilling, recovery cylinders should not be filled to more than 80% of their internal volume.

Most technicians will accomplish this by placing their recovery cylinders on an electronic scale and monitoring the weight of the cylinder during the recovery process. When the recovery cylinder reaches a weight equal to 80% of its total capacity a technician will stop the recovery process and change cylinders, if needed. In order to use this method effectively a technician must know the cylinder's weight that would equal 80% of its maximum capacity. This maximum weight will vary slightly because different refrigerants are used in a recovery cylinder, and different refrigerants have different liquid densities.

There are two basic ways to accurately determine the maximum weight of a recovery cylinder: 1) the recovery cylinder manufacturer can publish this data for various refrigerants, or 2) a technician can calculate this value.

To determine this value, use the following procedure:

First, calculate the internal volume of the recovery cylinder being used. This can be accomplished by dividing the water capacity of the cylinder by the density of water, which is 62.5 lb/ft^3. The water capacity of a recovery cylinder will normally be stamped on the outside of the cylinder.

For example, if a recovery cylinder has a water capacity of 47.17 lbs., then its internal volume will be 0.75 ft^3 (47.17 lbs ÷ 62.5 lb/ft^3 = 0.75ft^3).

Next, for the refrigerant to be recovered, determine its liquid density at a saturation temperature of 130°F. Refrigerant manufacturers publish the various saturation properties of their refrigerants which includes the liquid density at various saturation temperatures. For example, if R-134a were the refrigerant to be recovered, its liquid density at a 130°F saturation temperature is 67.46 lb/ft^3.

Next, determine the tare weight of the recovery cylinder, which is the weight of the cylinder if it were empty. This is also stamped on the outside of the recovery cylinder. For example, if using a nominal 50 lbs. recovery cylinder, the tare weight would be 24 lbs.

Next, use the following formula to determine the maximum cylinder weight:

MCW = (v * d * 0.08) + Tw

MCW = Maximum cylinder weight
v = Cylinder Volume
d = Liquid density of the refrigerant at 130°F
Tw = Tare weight

For example, if the cylinder holding R-134a with a liquid density of 67.46 lb/ft^3 at 130°F saturation temperature had a water capacity of 47.17 lbs. and a tare weight of 24 lbs, the maximum cylinder weight would be:

Cylinder volume = water capacity ÷ 62.5 lb/ft^3

Cylinder volume = 47.17 lbs ÷ 62.5 lb/ft^3 = 0.75ft^3

MCW = (v * d * 0.08) + Tw

MCW = (0.75ft^3 X 67.46 lb/ft^3 x 0.08) + 24 lbs

MCW = 64.48 lbs.

For safe operation a technician should not continue to fill this recovery cylinder once its weight has exceeded 64.48 lbs.

Again, overfilling a recovering cylinder can lead to very serious injury.

EPA Requirements for Leak Repair

Owners of commercial refrigeration systems containing 50 pounds of CFC or HCFC refrigerants are required by the Environmental Protection Agency (EPA) to repair refrigerant leaks when the leak rate equals or exceeds 35% of the total system charge over a one-year period. It is the leak *rate* and not the total amount of refrigerant lost that the EPA uses to determine when a leak must be repaired. For example, if a system containing 100 pounds of refrigerant loses 5 pounds of refrigerant over a month's period, it would exceed the 35% trigger rate. Although a 5 pound loss is only 5% of the total system charge, if left un-repaired it would lose 60 pounds over a year which is 60% of the total system charge.

In order to comply with this regulation, equipment owners must keep accurate service records, documenting the date and type of service as well as the quantity of refrigerant added to these systems. These records should be maintained on site for a minimum of three years. There are several refrigerant log booklets and software programs available to aid an owner in these record keeping requirements.

In order to determine the leak rate of a system, the full refrigerant charge of the system must first be determined. This full charge value will be used as the baseline when determining the leak rate of a system. There are several ways an owner can determine the full refrigerant charge of a system. If available, they can rely of the documentation provided by the equipment manufacturer. They could record the amount of refrigerant added to a system after all the refrigerant has been recovered, the system evacuated and then recharged. They can calculate the full charge based on the component sizes, refrigerant density, volume of piping, and other considerations. They could also use other baseline data available as long as they document how they determine the full charge of the system.

Once the full refrigerant charge of a system has been determined, the following formula can be used to calculate the leak rate of a system:

$$\text{Leak Rate (\%/year)} = \frac{\text{lbs. refrigerant added}}{\text{lbs. refrigerant in full charge}} \times \frac{365 \text{ days}}{\text{Smaller between the number of days since refrigerant was last added or 365 days}} \times 100$$

For example, if a commercial refrigeration system with a full refrigerant charge of 135 pounds has lost 15 lbs. of refrigerant over the last 90 days, the leak rate per year for this system would be:

$$\text{Leak Rate (\%/year)} = \frac{15 \text{ lbs.}}{135 \text{ lbs.}} \times \frac{365 \text{ days}}{90 \text{ days}} \times 100 = 45\%$$

This exceeds the EPA's 35% trigger rate, and the refrigerant leak would need to be located and repaired—which the owner has 30 days to do. This requirement can be waived if, within 30 days of discovery, the owner develops a one-year retrofit or retirement plan for the leaking system.

Some equipment owner may not be aware of these EPA regulations. Refrigeration contractors and their technicians need to inform their customers of this regulation when servicing and maintaining these systems. Refrigeration contractors should also be of assistance to their customers both in the record keeping requirements and when a leak rate has been exceeded. This can be a great opportunity for refrigeration contractors, allowing them to build a solid relationship with their customers and grow their customer base.

For more information on complying with the EPA's regulation on refrigerant leaks as well as other refrigerant regulations, visit their website at http://www.epa.gov/ozone.

HAVE YOU TAKEN A CM OR CMS EXAM LATELY?

It's an 'elite' status in RSES that you'll be very proud of *and* it could be a good reason for your boss to give you a raise! Contact our Educational Chairman and ask him/her when the next one will be. It's *free* the first time. So don't delay and do take the challenge.

Have you thought of sending in a question to the RSES Journal?

It's free, plus you'll get your question and an answer printed in the Journal. *Everyone learns from it!*

COMING EVENTS

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Defrost Differential Regulating Valves & Oil Analysis

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Copeland Digital Discus Compressors

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Air Filtration Basics (You Thought You Knew It All)

If you have any suggestions or requests for future programs, please let us know!

METROPOLITAN NEW YORK CHAPTER, RSES

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

Our congratulations to all the students who successfully completed the RSES Technical Institute Educational Program. The Certificates will be presented at the September meeting. PLEASE ATTEND.

Wednesday September 14th, 2011 at 7:30pm

at

RICCARDO'S
21-01 24th Avenue, Astoria NY 11102

Unique Features and Application of New TXV's plus Scroll Compressor Update

by

Scott Redmond of Danfoss, Inc.

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EDUCATIONAL PROGRAM
Wednesday September 7th, 2011
at 7:30pm
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Metropolitan New York Chapter
Refrigeration Service Engineers Society
241 Halsey Street
Brooklyn, NY 11216