

Tech Topics

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Ten Tips for a Successful Installation

The best way to avoid problems with a refrigeration system is to *get it right the first time*. But that's not as easy as it may sound. Whether you are new in the field or have been installing refrigeration systems for years, anyone can benefit from some installation refresher tips. We talked to the experts—who get problem calls every day—to find out where most problems tend to occur, and how to avoid them. Here are their suggestions in our list of *Ten Tips for a Successful Refrigeration System Installation*.

Tip 1

Read the Installation Manual

You've all seen it before, the booklet that comes shipped with every piece of equipment. You may have put it in a file or even thrown it out, but have you ever read through it? It contains helpful information that can save you time and money. Instructions along with drawings, charts and diagrams help you get the most out of your equipment.

According to service engineer Galen Holzhausen, "A majority of the questions and problems I hear every day could be answered or prevented by consulting the installation manual." It covers the basics, but it also provides specific guidelines for special situations that you may not have run across before. Look through it and chances are you will find something useful.



Tip 2

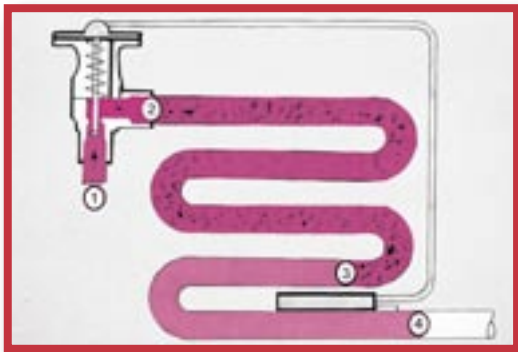
Expansion Valve Selection & Adjustment

Where the nozzle is a distribution device, the expansion valve is a metering device. Proper thermal expansion valve adjustment for superheat can increase the efficiency of the evaporator, give you better system balance and more efficient operation. Steve Holmes, Cold Storage Product Specialist for

(Expansion Valve Selection & Adjustment cont...)

Heatcraft Refrigeration Products LLC explains: “The expansion valve basically controls the volume of refrigerant entering the evaporator coil. This is accomplished by controlling the superheat leaving the evaporator. A properly sized and adjusted expansion valve will adjust to the varying evaporator load and frosting conditions, allowing the evaporator to function at maximum capacity.”

An improperly adjusted expansion valve can reduce the capacity and the efficiency of the



High pressure liquid refrigerant enters the expansion valve (1), converts into a low pressure liquid/vapor and enters the coil (2), circulates through the coil until it reaches the refrigerant saturation point (3). Superheated refrigerant vapor exits the coil (4).

refrigeration system. “For example,” Holmes explains, “if the system is operating with an expansion valve that is too small, the evaporator will be starved, lacking adequate refrigerant, preventing the system from cooling enough.” That can also happen with a poorly adjusted expansion valve that allows high superheat to leave the evaporator. By contrast, if the expansion valve is too large, the valve will tend to “hunt” or have large swings in superheat temperatures, leaving the system off balance and negatively affecting system capacity and efficiency.

“The expansion valve should be selected for the condensing unit capacity and not the evaporator capacity,” explains Robert Thornton, application engineer. “The condensing unit compressor dictates the volume of refrigerant entering the TEV.”

Service engineer Archie Nalbandian, adds, “Many people believe that expansion valves are preset by the manufacturer. They are not, however, preset for your specific application.”

Make sure you know the capacity of your condensing unit and follow the tables for expansion valve selection found on pages four through seven in the Installation & Operation Manual.

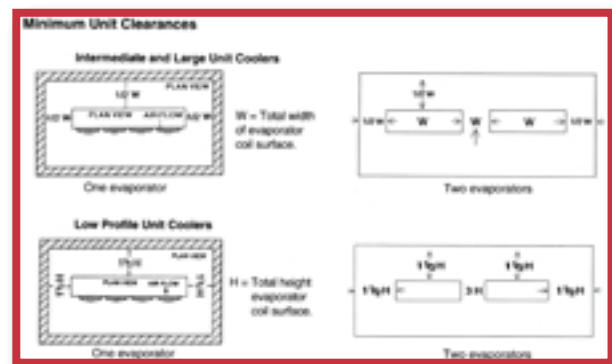
Tip 3 Evaporator Placement

“Refrigeration equipment refrigerates air within an insulated space,” points out Holmes. “The air in turn refrigerates the product, so proper air distribution and circulation is critical.”

Often times poor product temperature is blamed on refrigeration equipment when the problem is actually poor air distribution and circulation. The best way to prevent this is by correctly configuring evaporator placement. From the evaporator, air must freely circulate in and around the product and return back to the evaporator.

You have two useful resources to help you get the best evaporator placement. First, the installation manual outlines minimum space requirements away from walls and between units. It also provides tips like, “Always avoid placement of unit coolers directly above doors and door openings.”

Second, talk to your end user. Make sure you have complete understanding of where product will be stacked, where light fixtures will be placed,



and where shelves and racks will be located. Once you know this, you can adjust equipment placement accordingly. If there is a conflict between optimal unit placement and end-user use intentions, make sure you address this while compromises can still be made by both you and the end user. Remember, the end user will call you if the product is not holding temperature.

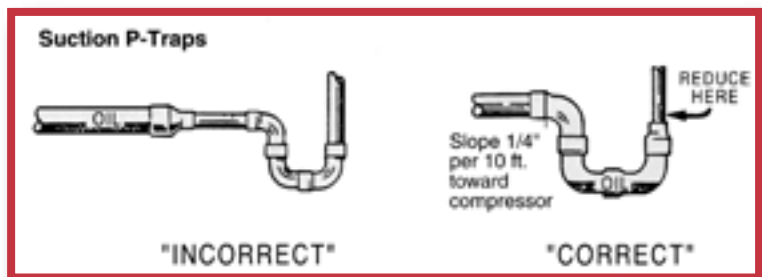
Also, take into consideration accessibility to the unit for future service and maintenance. It is not enough to get the unit in place, you must have access to end panels, drain pan, etc. to be able to work on it later.

Tip 4 Piping Practices

Correct system piping is essential for proper system operation and adequate oil return to the compressor. From Tech Topics volume three, number one: “For oil return, the suction pipe is the most critical. The suction pipe should slope toward the compressor and should be sized for minimum pressure drop and proper refrigerant velocities.”

Select pipe sizes carefully. If the pipe size selected is too large, the refrigerant velocity becomes insufficient to carry oil vertically up to the compressor when the compressor is above the evaporator. The oil must pass freely through the entire system and reach a state of equilibrium to maintain stable oil levels in the compressor. Heatcraft publishes refrigerant line sizing charts in the Installation & Operation Manual, pages 22-28.

Equally important in system piping design is the use of traps in the suction line. Mike Jarrell, Manager of Sales Engineering Services notes, “Most people get the pipes properly pitched downhill so that the oil flows down toward the condensing unit, but you get into situations where



the oil has to go up, so you can't rely on gravity. You have to rely on a trap that will be a collection point for the oil and aids in moving that oil up and away from the coil.”

A p-trap should be used at the base of any suction riser greater than three to four feet in length. A suction riser is any vertical line which has upward refrigerant flow. In long suction risers, p-traps should be used for each 20 feet of vertical rise.

In addition, it is good practice to install a p-trap at the outlet of the evaporator if the suction line rises above the bottom of the evaporator. This trap will insure that oil can flow freely out of the evaporator.

Without effective traps you can log oil. “If you log oil at an evaporator and don't get to the compressor, this will cause capacity problems,” says Jarrell. “Sometimes the oil will come back at one time after a defrost eventually causing compressors to break down.”

Setting Defrost

Defrost must be adjusted to the usage of the refrigerated space. Again, this is something you need to discuss with the end user. Ask - “How do you use this space, what are your busy times, when do you load the box?” Then you can make a good estimate as to what time of day you want to go into defrost and how many times a day you need to.

You should never set the defrost to occur under the heaviest activity, like when stocking normally takes place. “Wait until the loading's over,” encourages Thornton, “because when they're loading, the door is open, letting in moisture and warm air.”

“A good rule of thumb for starting out your defrost is four times a day, every six hours,” recommends Thornton. “Every time you open the door to a freezer, you let moisture in. The heavier the usage, the more moisture you're going to collect on the coil surface. More defrost periods may be needed.

“You may end up having to go to six defrosts per day. The contractor really needs to do a follow up

check on that box and see how it's doing.”

On the other hand, the box might be closed up and not open for days. Overheating the evaporator is not a good situation either because it throws heat off into the refrigerated space, which can create steam and droplets on the ceiling and other surfaces. If the box isn't getting much traffic, you may cut back to two or three defrosts a day, which will also save energy.

Another important consideration is defrost termination. Some systems require more manual setting than others. Most of the smaller Heatcraft evaporators come with fixed defrost, with adjustable defrost available as an option. The larger units come standard with adjustable defrost. Adjustable defrost units require fan delay setting. Heatcraft units are preset at 20°F.

“You need an idle time between when the compressor starts running, coming out of defrost, and when the fans come on,” explains Thornton. “After the ice melts, a film of water is left on the coil surface. If the fans come on immediately, it just pulls water through the fan and blows it all over the product, the ceiling, everywhere.” The

compressor needs to run long enough to refreeze any moisture left on the coil before the fans are energized.

A good rule for setting the defrost termination switch is to watch your coil in defrost. After all the ice has melted, give it one minute more,

and then start adjusting your defrost termination switch to kick it into refrigeration. Thornton advises, “Just a minute or two after all that ice is melted is all that is needed.”

More detailed instruction on setting defrost and defrost termination is provided in the Installation and Operation Manual on page 5.

Tip 6

Wiring

Prior to an installation, you need to evaluate your system and determine the type and gauge of wire required for that particular job. For each length of wire, you should consider all loads that will be powered on that circuit including relays, contactors, and solenoids. Add up all of these loads to determine the proper gauge wire. Measure how long your wire runs are and make sure you have sufficient amperage capability in your transformer and your wire gauge to pull in the contactors. The longer the length, the higher the gauge you need to pull the same amperage. The transformer should also be checked to ensure that its VA rating is sufficient.

For long runs of low voltage power such as a 24 Vac class II control circuit, determining the correct wiring and transformers is critical for the correct operation of low voltage components. You may find that the wire powering a microprocessor control also powers relays and

contactors. The wire and transformer should be sized so the operation of the components does not affect the operation of the microprocessor.

Jim Kitchen, Product Manager-Highside Products, provides a scenario: “One sign of undersized wiring to a microprocessor is the display resetting or flickering when a contactor or relay is energized. This often appears as an intermittent problem that you would see only at the moment the contactor is energized.”

In this case, check the transformer’s VA rating first and then make sure all of your terminal connections are tight. If all seems OK, you most likely need a heavier gauge wire. In addition, always refer back to the Installation & Maintenance Guide for the manufacturer’s recommendations.

Once you know what gauge wire you will need for that particular job, make sure and have it available on your truck.

Full Load Currents for Single Phase Transformers

Transformer Rating	24 Volts	120 Volts
25 VA	1.04 A	0.21 A
50 VA	2.08 A	0.42 A
75 VA	3.13 A	0.63 A
100 VA	4.17 A	0.83 A
200 VA	8.33 A	1.67 A
300 VA	12.5 A	2.50 A

Tip 7

Proper Tools for the Job

Everyone should have a good set of general hand tools with them whenever they go out to a job site. Along with good general tools, these should also be included:

- A service valve wrench - normal wrenches will destroy the valve stems
- A brazing torch and materials
- A vacuum pump to evacuate air and moisture from the system. (Be sure to service your vacuum pump before use.)
- A volt-amp meter to make sure proper voltage is available and that proper amperages are being pulled. It is also good for troubleshooting.

(Proper Tools cont...)

- A gauge manifold to measure head and suction pressures, and to aid in superheat measurement. It is also used for troubleshooting and to ensure proper system operation.

A digital thermometer for superheat measurement and adjustment.

Be sure to purchase quality instruments and keep them properly calibrated. Repair or replace worn or damaged instruments and know how to properly use all equipment before you get to a job site. You will also need lifting equipment for evaporator and condensing unit placement.

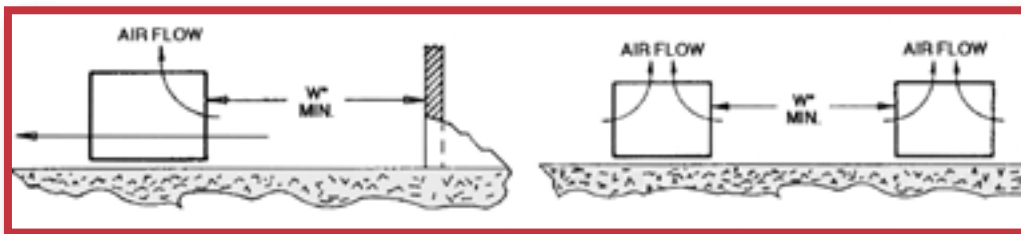
Tip 8 Outdoor Unit Placement

When placing your condensing unit or remote condenser, allow for plenty of outside air to get to your unit. That includes space away from walls, fences, and other units. Also, make sure one unit's exhaust is not feeding into another unit's intake.

Each unit should be located so air may circulate freely and not be re-circulated. For proper airflow and access, all sides of the unit should be a minimum of the width of the unit "W" away from any wall or obstruction. It is preferred that this distance be increased whenever possible. Also make

sure you are providing yourself enough clearance to come back and service the unit. Make sure all panels can open freely and that you have space to maneuver tools and equipment. And don't forget to look up, overhead obstructions need to be avoided for proper airflow and safety.

Without proper clearance for air circulation, you will eventually run into problems like loss of capacity and higher head pressures, which cause poor operation and potential failure of equipment. More detailed information on unit placement along with drawings can be found in the Installation & Operation Manual on page 11.



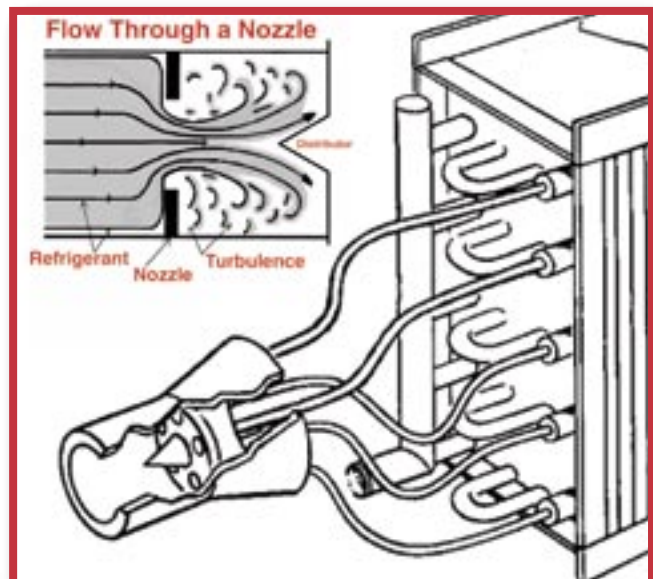
Proper outdoor unit placement guidelines include allowing a distance equal to the width of the unit "W" away from walls or other units.

Tip 9 Nozzle Selection

Before you install the expansion valve on the distributor of the evaporator, the proper distributor nozzle must be installed. Most evaporators come with at least two distributor nozzles, one for R-22 and another for most other refrigerants. The nozzles that are shipped with the evaporator are sized to meet most standard applications. The nozzles supplied the majority of applications. The Installation & Operation Manual provides exceptions and formulas for sizing nozzles on page eight, should special conditions apply like subcooling, or different T.D.s

Tech Topics volume 4, number 3 explains the effects of pressure and using nozzles. It states: "The distributors in Heatcraft's evaporators require nozzles which create pressure drop and help mix the liquid/gas refrigerant. The nozzle also helps ensure the refrigerant entering

The correct nozzle is installed to create refrigerant turbulence, allowing all distributor coils to be fed evenly.



(Nozzle Selection cont...)

the evaporator from the expansion valve is evenly distributed to all circuits.” The distributor nozzle creates a turbulence which spins refrigerant equally into all of the distributor tubes. This insures that the entire evaporator coil gets fed evenly.

If the nozzle is oversized, the refrigerant tends to take the flow of gravity, going through the oversized opening, dropping to the bottom tubes. You’ll notice one portion fed more than another, in coil freezing or sweating. “Without proper feeding, the evaporator cannot accept a full load condition. You’re basically

just going to build frost unevenly until you have a frozen up coil with a snowball effect of low suction pressure and floodback on the compressor,” says Thornton.

If your nozzle is too small, it acts like a restriction in the system. Thornton explains, “You starve your coil and end up running very low suction pressures, high superheat, and high discharge temperature, which can also overheat the compressor and eventually cause compressor failure.”

Tip 10 Insulating Lines

A refrigeration system involves a delicate balance of fluid volumes at a particular temperature and pressure flowing through a carefully designed system. To function optimally, fluid temperatures must not pick up or lose heat from the surrounding environment until they are supposed to. Therefore, after the final leak test, refrigerant lines exposed to high or low temperature environment conditions should be insulated to reduce subcooling in the liquid line or heat gain in the suction line. Proper insulation maintains consistent refrigerant temperatures, allowing the expansion valve and nozzle to work properly.

“It goes back to the expansion valve and nozzle sizing,” says Jarrell. “You base expansion valve size on a certain liquid temperature. Now if they take a liquid line, which is just a copper tube and run it through a freezer, and it’s -10° in that freezer, by the time that liquid travels 40 feet, it can go from 80° to as low as 40°. By then, standard components like expansion valves and nozzles are

just way oversized and will not operate properly.”

Suction lines should be insulated with no less than 3/4” wall Armstrong “Armaflex” or equal. Liquid lines should be insulated with 1/2” wall insulation or better. The insulation located in outdoor environments should be protected from UV exposure to prevent deterioration of insulating value.

“Insulation on the suction line will ensure cooler refrigerant return gas temperature to the compressor for more cooling. This also keeps the motor in the compressor cool,” says Holzhausen.

The thickness is determined by the environment the pipe is going through. It may be a boiler room, a freezer, or it may go outside of the building. Suction line Insulation must be thick enough to prevent condensation on the outside of the insulation. This is determined by the temperature of the suction line you are running and by the R factor of the insulation.