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The Millennium Edition

AN EXCHANGE OF TECHNICAL INFORMATION  
ABOUT CARRIER TRANSCOLD CONTAINER PRODUCTS

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### Testing your knowledge....

Imagine being called to a unit, reported as not pulling down. Cargo temperature is high, its loaded and everyone wants it running and running now.

So what do you do?

You have no history on the unit except what is in front of you, model number 69NT40-511-302

Did someone else change something?

When was it last working correctly?

So you start at the beginning

1. Power the unit off and restart it and find that everything starts up correctly.
2. Install manifold gauges. OK, unit suction side pressure shows a deep vacuum on the compressor. This would explain why the unit is not pulling down temperature.
3. Check code select 01 on the microprocessor, indicating modulation valve expected position, and it shows 100 percent open.

With this information, you change the microprocessor and the unit starts operating correctly.

Was this the correct diagnosis? If not why?

(Give this some thought, then turn to page three for the answer.)

### FAQ

### Filter Driers

**Q:** The last filter-dryer that I had to replace in a Carrier unit came with O-rings in the package. Is this a different filter-dryer, and why do we need the O-rings on a flare connection?

**A:** Carrier Transicold recently introduced an improved filter drier into OEM production equipment that utilizes both the flare seal and also an O-ring seal at the midpoint of each flare seal, see drawing right. The primary reason was to introduce a double seal making the filter drier seal more reliable.

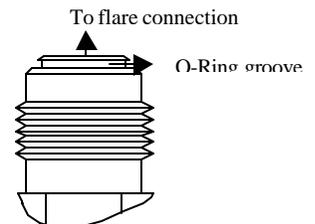
Both, the old filter drier, part number, 66U1-7472-1 and the new one, part number 14-

00284-02 are completely interchangeable. If you have stock of the old style filter drier they can be used up on any Carrier Transicold container equipment. New stock from parts warehouses will be of the old style until stock is consumed at which time all orders will be filled with the new style filter drier.

The picture above shows the groove where the O-ring should be placed before installation.

*Note: O-ring and flare **must** be lubricated with refrigerant oil prior to assembly.*

Z.Asprovsi



**TechTip**

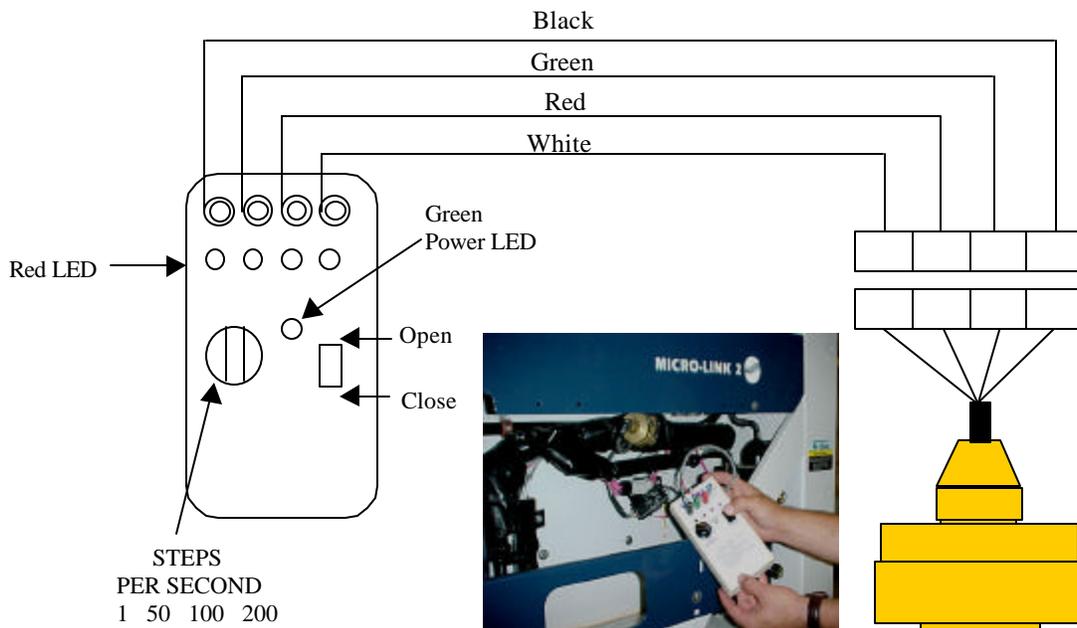
## STEPPER VALVE CHECKOUT (INTERNAL)

In the last addition of TechLine (Volume 5, Number 4) we addressed the electrical troubleshooting of the stepper valve assembly. In this addition we will finish the checkout procedure by troubleshooting the internal section of the stepper valve assembly.

Required Tools: Stepper Motor Tester CTD (P/N 07-00375-00)  
Manifold Gauge Assembly

1. Assure unit is powered off.
2. Install suction manifold gauge on the suction service port of the compressor and mid-seat valve.
3. Connect the stepper tester output connection to the stepper drive motor (*see diagram*).
4. Assure stepper drive tester has power (2 nine-volt batteries). Press the “open” or “closed” button on the tester. The green LED on the tester will light if batteries are installed.
5. Set the “steps per second” switch to 1 and press either the “open” or “closed” button. Each of the LED’s on the tester will sequentially light until all four are lit.  
*The “steps per second” switch determines the speed at which the valve will react. The higher the setting, the faster the valve will respond.*  
*Failure of this to occur indicates a poor electrical connection. Check connections and repair or replace.*
6. Set the stepper drive to the 200 steps per second setting.
7. Power unit on and set the temperature set point substantially below the box temperature so that the unit goes into full cool.
8. Note the suction pressure on the manifold gauge.
9. Press the “closed” button on the stepper tester and hold for one minute.
10. Check the suction pressure on the manifold gauge. The pressure will drop into a vacuum. This is an indication that the valve is closing.  
*If the pressure does not drop, then the internal piston in the valve is not moving. Check voltage of the tester, as weak batteries will cause the valve not to respond. If the batteries are found correct, then proceed to step 12.*
11. Press the “open” button on the stepper drive tester and hold for one minute to open the valve.
12. Check the suction pressure on the manifold gauge. The pressure will rise. This will indicate that the valve is opening.  
*If the pressure does not increase, then the internal piston in the valve is not moving. Proceed to step 13.*
13. If the valve is found to be faulty (not responding), then perform a low side pump down on the unit. Remove and replace with a new assembly, torque nut to 35 ft-lbs, evacuate low side, and open all service valves.
14. If the valve responds correctly, disconnect tester, reconnect stepper drive module and remove the manifold gauges.

This completes the checkout of the stepper motor assembly. For additional assistance either refer to the unit’s proper service manual or contact the regional Service Engineer



## Testing your knowledge.... (Continued from page one)

With the unit now working correctly, the problem is diagnosed as the microprocessor. You walk away writing up a work sheet for a controller and ready for the next job.

So now lets go back and follow the logic and find out what is really wrong with this unit

1. Powering the unit off and then on again is the perfect way to start. Always start from the beginning, make all your own decisions based on what you have observed for yourself.
2. Installing gauges should be done as a matter of course when a unit will not control or pull down temperature. In this case very low suction pressures are shown determining why the unit will not pull down. With no gas flow, the compressor has pumped all the refrigerant that is available to it and is now running stalled.
3. Check code 01 for suction modulation valve position. This is only one of many checks that could be done to determine what is restricting the gas flow in the system. Some others are
  - Lack of refrigerant, seen as a low or nil level in the receiver. If the receiver is full then there is a valve closed against the system and the system has pumped down.
  - Plugged filter drier, verifiable by a temperature difference across the filter drier
  - TXV jammed closed ..... and many others

But lets stay with the explanation from page 1. The microprocessor is saying 'I want the modulation valve to open fully', 100% shown at code select 01 but something is restricting the flow of refrigerant to the compressor, low suction pressure reading on the gauge set. Why change out the microprocessor? It knows the temperature is above set point by trying to open the modulation valve full open. That in fact is ALL it can do to bring the temperature down, start the compressor and open the modulation valve full. Which it has done, just because the modulation valve doesn't open is not the fault of the controller in most cases. So what can cause this to happen?

There are two different modulation valves used on Carrier units

1. Analog suction modulation valve, direct connected to the microprocessor
2. Stepper drive suction modulation valve, connected through the stepper drive assembly.

Signals and configuration are different between these two valves, a unit configured for an analog modulation valve will not drive a stepper motor modulation valve or vice versa. Checking Code 18, software revision and code 20 model configuration, is the fastest way to determine whether the microprocessor is set up correctly. In the case under discussion code 20 gives 11114, 69NT40-511-114, a unit equipped with an analog modulation valve not the correct 11302, 69NT40-511-302, a unit equipped with a stepper motor modulation valve. There was no way that this microprocessor could operate a stepper modulation valve configured this way.

### Moral of this story

Always check the software level loaded into the microprocessor and the configuration model before starting to diagnose a unit that is not operating correctly.

□ P. Hoover

### General

Training School Schedule

Here is a brief look at container training being offered for the next 3 months.

The 2001 brochure will be mailed out shortly.

Additional training information is posted on the Internet. This information shows schools for the next 6 – 7 months. And is updated monthly Don't wait for the 2001 brochure, check available schools and Register online.

Access it from the bottom of the Service Center locator page at:

**www.carrier.transicold.com**

Date	Program	Location	Class I.D.	Language
<b>DECEMBER 2000</b>				
4 - 8	1 week Container	San Juan, Puerto Rico	519	English/Spanish
7 - 8	2-day Container	Nagoya, Japan	521	English/Japanese
11 - 15	1-week Container	Syracuse, USA	522	English
<b>JANUARY 2001</b>				
8 - 10	3 day Product update	Chennai, India	524	English
8 - 12	1 week Container	Seattle, USA	525	English
8 - 9	2 day Container	Kobe, Japan	526	English/Japanese
10 - 12	3 day Container	Kobe, Japan	527	English /Japanese
15 - 16	2 day CA Container	Mumbai, India	530	English
18 - 19	2 day Container	Calcutta, India	531	English
22 - 26	1 week Container	Chittagong, Bangladesh	533	English
22 - 26	1 week Container	Mombasa, Kenya	534	English
29 - 31	3 day Container	Marseille, France	535	English
<b>FEBRUARY 2001</b>				
1 - 2	2 day Container	Marseille, France	538	English
1 - 2	2 day Container	New Orleans, USA	539	English
5 - 9	1 week Container	Melbourne, Australia	540	English

## DATAREADER

Data that has been recorded and stored in the DataCorder of a 69NT unit can be retrieved using the Carrier Transicold handheld DataReader (P/N 12-00377-00). The data can then be uploaded from the DataReader to a personal computer, where it can be viewed using the Carrier Transicold DataView program.

### Data extraction using the DataReader

1. Connect the DataReader to the unit interrogator connector using Download Cable (P/N 22-01737-00 or 22-02418-02). To allow data retrieval, the reefer unit must be powered on, or the controller must be “awakened” by pushing the Battery Power button on units with the battery backup option.
2. Press the “ON” button of the DataReader.
3. The cursor in the DataReader display will be flashing on “Connect to...”
4. Press the “Enter” button on the DataReader. This will connect the communications link between the DataReader and the unit. The display will show the container I.D. and the unit type (ML1, ML2, or ML2i) as determined by the connection link.
5. Press the “Enter” button.
6. The cursor in the DataReader display will be flashing on “Extract Data”.
7. Press the “Enter” button.
8. Use the up or down arrow keys to choose one of the four methods of extracting data. The choices are:
  - Extract by Trip
  - Extract by Date
  - Last 30 Days
  - Extract all Data
9. After selecting the extraction method, press the “Enter” button.
10. If Extract by Date is chosen, the display will show a “From” date, which can be changed by using the arrow keys. When the date has been set, press the “Enter” button. The display will now show a “To” date. Set the desired date and press the “Enter” button.
11. The data will be transferred from the unit to the DataReader and “Extraction Done” will be displayed upon completion. Press the “Esc” button and turn off the DataReader. Disconnect the cable from the DataReader and unit.

### Transferring data from the DataReader to a P.C.

Carrier Transicolds DataView software program must be installed on your personal computer to allow transfer and viewing of data from the DataReader. Connect the DataReader to the P.C. using the Upload Cable (P/N 22-01743-00).

1. Press the “On” button of the DataReader.  
The DataReader should be turned on, and “Transfer Data” selected, **BEFORE** starting the DataView program in your P.C.
2. Use the down arrow to scroll to “Transfer Data”, press the “Enter” button.
3. Start the Dataview program in your P.C.  
For optimal performance, it is recommended to operate your P.C. in DOS only mode while running the DataView program.
4. The DataView program will open at the Main Screen. There should be a message stating that the “DataReader is connected”, and there will be a list of files present.  
*If the connection is not made, there will be instructions on the Main Screen to “Retry the Connection”. Repeat steps 1-3 above and then push F9 or ALT 9 on your P.C. to retry the connection. There is also a chance that the Dataview program will open the Microlink Selection Screen when it is started. In this case, choose a model type and select “Go”, this will bring you to the Main Screen. When you have a connection to the DataReader, continue as follows.*
5. On the Main Screen, type **D** to select “DataReader”. This will bring you to the DataReader Interface Screen. The files present in the DataReader will be listed on this screen. The container number is used as the file name, for example: CCMC9421. The working directory where the files will be stored on your P.C. will also be identified on this screen. Make note of this directory for future reference. Example: C:\Dataview\Data.
6. Highlight the file that you want to transfer and then type **U** to select “Upload”. The file will be transferred and placed in the working directory on your P.C. Repeat for other files if required.  
**Note:** When the files are transferred to the working directory, the file names will automatically be converted to a DCX format. For example: CCMC9421 will become MC9421AA.DCX

### Viewing the transferred data

Refer to the Data Retrieval Operating Instruction manual 62-02575-05, section 6.5 for details on viewing the transferred data.

## Refrigerant Controls Overview

**A refrigerant control is the device used in a refrigeration system to change the pressure of the refrigerant.**

Recall from March/April TechLine article on Mechanical Refrigeration, that several types of metering (control) devices are available for use in mechanical refrigeration systems. The selection of the metering device (also known as expansion device) is of particular importance to the operation of the refrigeration system because it regulates refrigerant flow into the evaporator.

These expansion devices can be divided into four general categories:

1. **Fixed area restrictor.** Used on small air conditioning and refrigeration systems
2. **Automatic (constant pressure) expansion valve (AEV).** Used in applications with constant evaporator loading.
3. **Thermostatic expansion valves (TXV or TEV).** Most widely used control device because it regulates the refrigerant flow by maintaining nearly constant superheat at the evaporator outlet. This type of regulation allows the evaporator to remain as nearly fully active as possible under any load conditions.
4. **Electric expansion valve (EEV).** Devices that are used in applications with sophisticated system control design. An electronic circuit controls the EEV.

Depending on the principle used while operating, the refrigerant control devices can also be divided into three principle classes:

- Control based on pressure changes.
- Control based on temperature changes.
- Control based on volume or quantity changes.

Combination of controls may also be used. In fact, the thermostatic expansion valves (TXV) that are commonly used in refrigeration systems are controlling the flow through the valve and into the evaporator by both, low-side pressure and temperature of the evaporator outlet.

### TXV Types

Thermostatic expansion valves (TXV or TEV) are available in different sizes, different materials, and can have different sensing element charges. They can also have adjustable or non-adjustable superheat settings and be of hermetic or semi-hermetic construction. Regardless of the material type, or if the valve is hermetic or not, you have to choose the correct sensing element charge and valve size for the particular application .

TXV's can be classified in two general classes:

1. Sensing bulb
2. Thermal-electric

The sensing bulb type is further divided into four types:

1. Liquid charged
2. Gas charged
3. Liquid-cross charged
4. Gas-cross charged

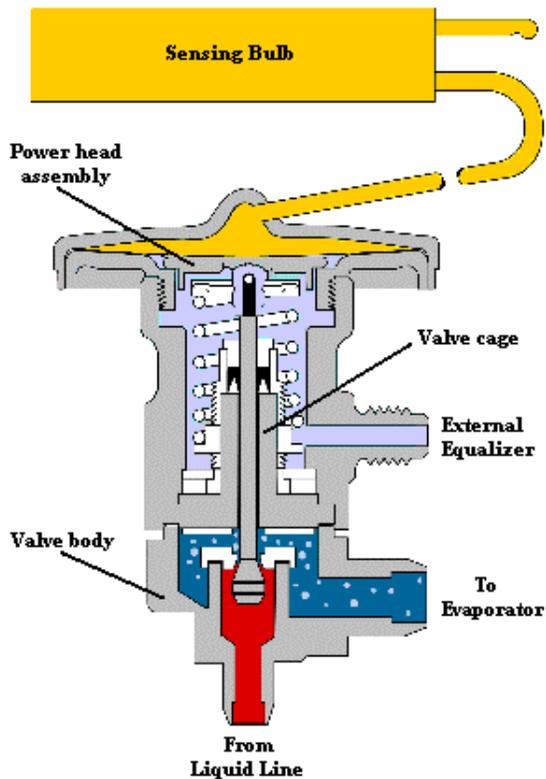
In the liquid and gas charged elements, the bulb charge is the same refrigerant type as is used in the system. Cross-charged means that the fluid in the sensing bulb is different than the refrigerant in the system.

### TXV Layout and Component Functionality

As mentioned above, the most commonly used metering (controlling) device in the reefer container is the thermostatic expansion valve. The current OEM Carrier Transicold container units use liquid-cross charged hermetic, non-adjustable TXV's.

A cross section of a typical TXV assembly is shown below.

The three main TXV components and their functionality are described below:



### Valve body:

The valve body is the brass portion that is soldered into the system liquid line before the evaporator and seldom needs service or replacement. It physically connects the liquid line with the evaporator line. Normally when replacing a TXV, only the power head and cage assembly is replaced. In the case of a hermetic TXV however, the complete valve is replaced, as the main components are inseparable. The hermetic TXV body may be constructed of a different material, i.e. stainless steel.

### Power head and sensing bulb assembly:

The power head holds the diaphragm that acts on the valve pin. The function of the sensing bulb is to sense the temperature of the refrigerant vapor as it leaves the evaporator. The pressure in the sensing bulb increases as bulb temperature increases and vice-versa. The vapor pressure travels down the capillary tube to the top of the diaphragm that acts on the valve pin to open the valve. The valve will open if the sensing bulb pressure is high enough (open valve is shown in the figure left). This is the only force that can open the valve

### Cage assembly:

The cage assembly is made up of the superheat spring and the valve assembly. It is the superheat spring force (pressure) that acts to keep the valve pin and orifice closed.

## How It Works

The TXV controls the flow of liquid refrigerant entering the evaporator by maintaining a constant *superheat* of the refrigerant vapor at the outlet of the evaporator.

*Superheat is the difference between the refrigerant vapor temperature and its saturation temperature.*

By controlling superheat, the TXV keeps nearly the entire evaporator surface active while not permitting liquid refrigerant to return to the compressor.

There are three fundamental pressures acting on the valve's diaphragm that affect its operation: sensing bulb pressure, superheat spring pressure, and equalizer pressure. The last two are acting together underneath the diaphragm causing the valve to move to a more closed position.

Equalizer pressure is the actual evaporator pressure that is transmitted to the underside of the diaphragm. This can be done by either an internal passageway within the valve body, or by an external equalizing line. (Valve shown in the figure above is an externally equalized TXV).

During normal valve operation, the sensing bulb pressure must equal the equalizer pressure plus the superheat spring pressure.

An increase in the heat load on the evaporator causes refrigerant to evaporate at a faster rate. As a result, the refrigerant vapor and bulb temperature increase, causing bulb pressure to rise and the valve to move in the opening direction until the three pressures are in balance. Conversely, a reduction in the heat load on the evaporator will cause the vapor and bulb temperature to fall and the valve to move in a closed direction until the three pressures are in balance.

*Next article: TXV diagnostics and what needs to be done before actual TXV replacement.*