



Container Refrigeration



ANNUAL INSPECTION For **NaturaLINE 69NT40-601** Container Refrigeration Units



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For
NaturaLINE 69NT40-601
Container Refrigeration Units

TABLE OF CONTENTS

PURPOSE	1
TOOLS REQUIRED	2
WARNINGS AND NOTES	2
UNIT NAMEPLATE	3
REAR OF UNIT	4
FRONT OF UNIT	10
OPERATIONAL INSPECTION	19
APPENDIX	23

PURPOSE

This annual maintenance manual has been written to assist owners and operators of Carrier Transcold Container equipment in obtaining the maximum operating life from the equipment. It is recommended that all units are serviced with these procedures annually to obtain maximum operating time from the equipment.

This manual is to be used in conjunction with the operations & service manuals supplied with the equipment. Reference is made throughout these pages to the operations & service manuals, which are posted electronically on the Carrier Transcold Container website:

<http://www.container.carrier.com/>

Once at the website, under SERVICE & SUPPORT, click on Literature. Then, use the DOCUMENT FINDER to locate the manual.

The screenshot displays the Carrier Container Refrigeration website. At the top, the Carrier logo and "CONTAINER REFRIGERATION" are visible. A navigation bar includes "PRODUCTS", "SERVICE & SUPPORT" (highlighted with a red box), "MEDIA CENTER", "SUSTAINABILITY", and "ABOUT". Below the navigation bar, the "SERVICE & SUPPORT" section is expanded, showing a list of options: "Service Network", "CareMAX", "SeaCare", "Literature" (highlighted with a red box), "TechLINE", and "Service Login". To the right of this list are three featured tiles: "Service Center Locator" (Access to over 400 locations worldwide), "Container Training" (View training schedule & register for courses), and "Mobile Web Application" (Alarm look up). Below the main content area, there are buttons for "SERVICE NETWORK", "CAREMAX", "SEACARE", "LITERATURE" (highlighted with a red box), and "TECHLINE". At the bottom, a "DOCUMENT FINDER" section is highlighted with a red box, containing a search prompt "Search by product type" and three dropdown menus: "Product Type", "Select Model", and "All Documents".

TOOLS REQUIRED

- Wrench Set
- Screwdrivers: Flat, Phillips, and Pozi-Drive
- Torque Wrench and Sockets
- CO₂ Refrigerant Leak Detector (07-00529-00)
- CO₂ Refrigeration Gauge Set (07-00527-00)
- Fin Combs (8 and 16 Fins per Inch)
- Megohm Meter
- Multimeter



WARNINGS AND NOTES

1. Before opening any panels for inspection or replacing any electrical component in the system, apply the Lock Out / Tag Out procedure:
 - a. Turn the unit off.
 - b. Open the unit circuit breaker (CB1).
 - c. Unplug the unit from main power.
 - d. Apply a locking device to ensure the system cannot be plugged in during the maintenance procedure.
2. Carrier Transicold recommends wearing the appropriate safety equipment such as safety glasses, gloves, etc. whenever working on refrigeration equipment. Personnel should be aware of the dangers inherent in servicing equipment and assure they have read the relevant operations and service manual for any unit.
3. To prevent damage to aluminum, it is recommend to use low pressure fresh water cleaning.
4. All local requirements for recovery and safe disposal of refrigerants and oils must be followed.
5. If any leak repair is made on the unit, it **MUST** be leak tested using the CO₂ leak detector and full refrigerant charge on the system.

REAR OF UNIT

1. Remove the back access panel on the back of the unit to gain access to the evaporator components.
2. **Evaporator Coil.** Refer to **Figure 1**.
 - a. Clean with low pressure water. If the evaporator coil is noted to have green patina or white powder, it is recommended to wash the coil with cleaner P/N NU4371-88.

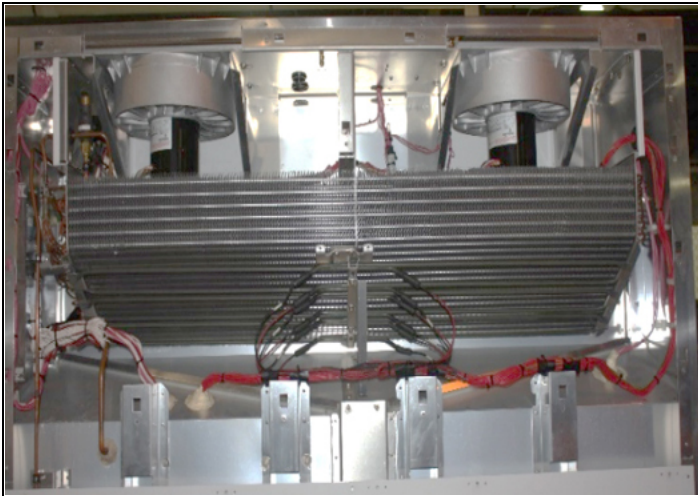
Refer to the [TechLINE December 2010 issue](#) for Evaporator Section Cleaning.

- b. Straighten any fin damage using the correct fin comb (8 fins per inch).
 - c. Check for any signs of leaks or corrosion and repair / replace as necessary.

NOTE

For certain cargos exposed to fumigation, it is recommended after the trip to carefully wash all internal parts in the evaporator section to avoid potential corrosion.

Figure 1 Evaporator Coil



3. **Evaporator Motor and Stator.** Refer to **Figure 2**.
 - a. Slowly spin the evaporator fan blade and feel for any significant bearing drag. Replace the bearing if it is bad.
 - b. Check that the evaporator motor clamp brackets are secured. If not accessible, refer to step 17.

- c. Check for excessive corrosion on the stator. If cleaning is needed, refer to step 2a.
4. **Evaporator Fan Blade.** Refer to **Figure 2**.
 - a. Check for cracking or wear. Replace the fan blade as necessary.

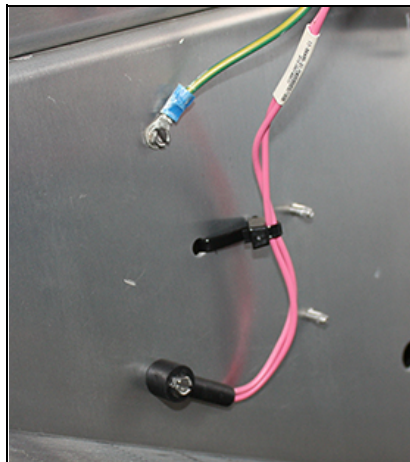
Figure 2 Evaporator Motor and Fan Blade



5. **Wire Harnesses.**

- a. Examine for any worn or damaged wires and repair as required.
 - b. Ensure wire harnesses are properly secured.
6. **Defrost Termination Sensor (DTS).** Refer to **Figure 3**.
- a. Ensure the DTS is properly secured to the unit and free of damage. Replace or repair if necessary.

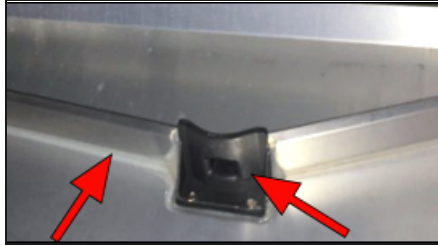
Figure 3 Defrost Termination Sensor (DTS)



7. Defrost Drain.

- a. Inspect the drain cup and drain gutters. Refer to **Figure 4**. Repair as required.

Figure 4 Defrost Drain Cup and Gutters



- b. Clean the defrost drain lines using a low pressure water hose to flush debris contained in the drain. Check that the water is running freely from the outside drain. Refer to **Figure 5**.

Figure 5 Outside Drain



8. Electronic Expansion Valve (EEV). Refer to **Figure 6**.

- a. Check for refrigerant leaks and corrosion.
- b. Verify that the EEV coil is connected to the stepper drive powerpack.

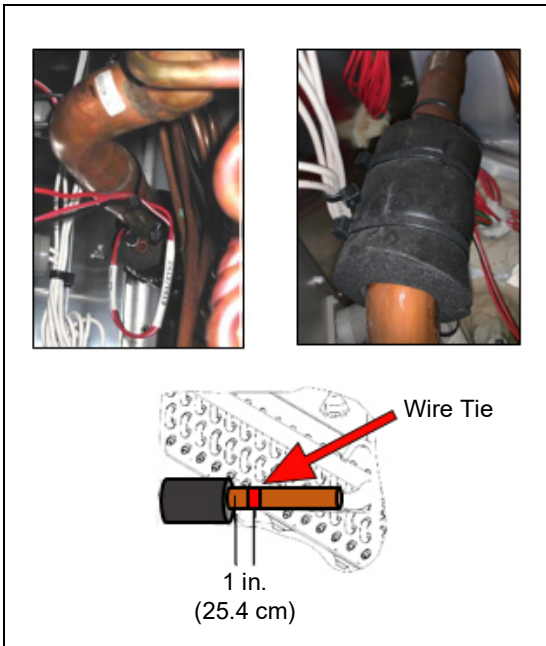
Figure 6 Electronic Expansion Valve (EEV)



9. **Evaporator Temperature Sensor (ETS).** Refer to **Figure 7.**

- a. Ensure that the wire tie is in position and insulation is in place.

Figure 7 Evaporator Temperature Sensor (ETS)



10. Heaters and Heater Brackets. Refer to **Figure 8**.

- a. Check for damage.
- b. Ensure that the heaters are properly positioned in the retaining clips.
- c. Inspect wiring for correct connections, and repair if required.

Refer to the [TechLINE June 2014 issue](#) for heater Megaohm testing.

Figure 8 Heaters



11. Heater Termination Thermostat (HTT). Refer to **Figure 9**.

- a. Check for proper positioning and damage.
- b. Replace as necessary.

Figure 9 Heater Termination Thermostat (HTT)



12. **USDA and Interior Communication Sockets.** Refer to **Figure 10.**

- a. Check that connectors are clean, dry and have the caps fitted.
- b. If corroded or cap is missing, repair or replace as needed.

Figure 10 USDA

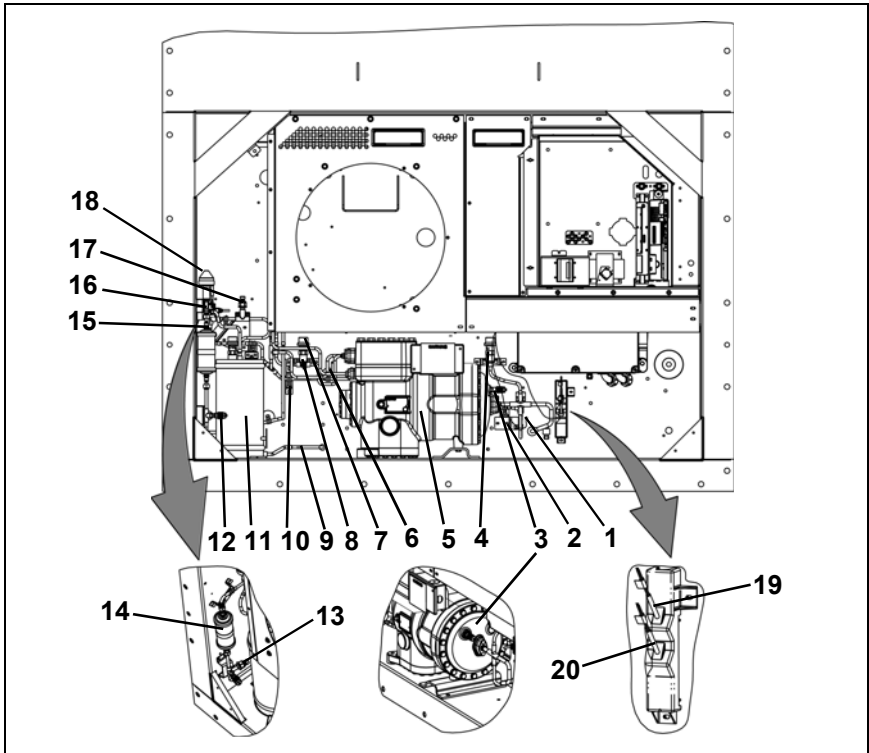


13. **Air Flow.**

- a. Check channels or "T" bars on the floor and under the lower air baffle / kick plate for cleanliness.
- b. Channels must be free of debris for proper air circulation.
- c. Clean floor drains.
- d. Ensure that the kick plate is correctly installed and in good condition for correct air flow.

FRONT OF UNIT

Refer to the **Warnings and Notes** section in this manual before proceeding with these instructions.



- | | |
|---------------------------------------------------|-----------------------------------------------|
| 1. Ambient Temperature Sensor (AMBS) | 11. Flash Tank |
| 2. Unloader Solenoid Valve (USV) | 12. Service Fitting, Discharge |
| 3. Service Fitting, Suction | 13. Discharge Pressure Transducer (DPT) |
| 4. Low Side Pressure Relief Valve (LS PRV) | 14. Filter Drier |
| 5. Compressor | 15. Flash Tank Pressure Relief Valve (FT PRV) |
| 6. Compressor Discharge Temperature Sensor (CPDS) | 16. Economizer Solenoid Valve (ESV) |
| 7. High Side Pressure Relief Valve (HS PRV) | 17. Flash Tank Pressure Transducer (FPT) |
| 8. High Pressure Switch (HPS) | 18. High Pressure Expansion Valve (HPXV) |
| 9. Plug | 19. Supply Recorder Sensor (SRS) |
| 10. Gas Cooler Temperature Sensor (GCTS) | 20. Supply Temperature Sensor (STS) |

14. Remove or Open Exterior Panels.

15. Leak Checking.

- a. Examine the unit for traces of oil residue. Leak check the unit using an electronic leak detector. Leaks are typically found as a dirty / oily residue near the leak location. All mechanical joints to be leak tested can be found in the **Appendix**. Repair as required and clean the unit using low pressure water.

16. Corrosion.

Perform on-going corrosion maintenance if corrosion found on any painted surface. Perform these steps:

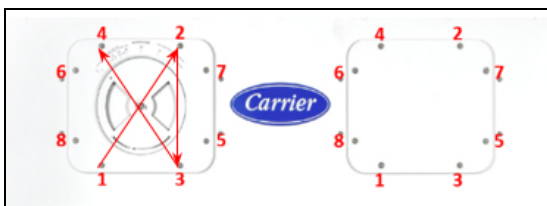
- a. Remove loose corrosion material.
- b. Lightly scuff up the surface with a Scotch-Brite Heavy Duty Scour Pad (or similar).
- c. Wipe down with isopropyl alcohol to remove loose material and any grease.
- d. Paint using the following standard paint specifications (purchase locally).

Part	Color	Brand	Paint
Compressor / Flash Tank	Grey	DNT	V-TOP #188
Frame	White Cloud	Rust-Oleum	9100 System

17. Access Panels. Refer to **Figure 11**.

- a. Remove the left and right hand evaporator access panels.
- b. Check that the access panel seals are present and in good condition to provide a good seal.
- c. Check for excessive shaft end play on the evaporator motor.
- d. Replace panels on completion assuring all hardware (including the Mylar washer) is installed.
- e. When reinstalling the panels, use a torque setting of 60 +5 in-lbs. (6.8 N-M) and the pattern shown in **Figure 11**.

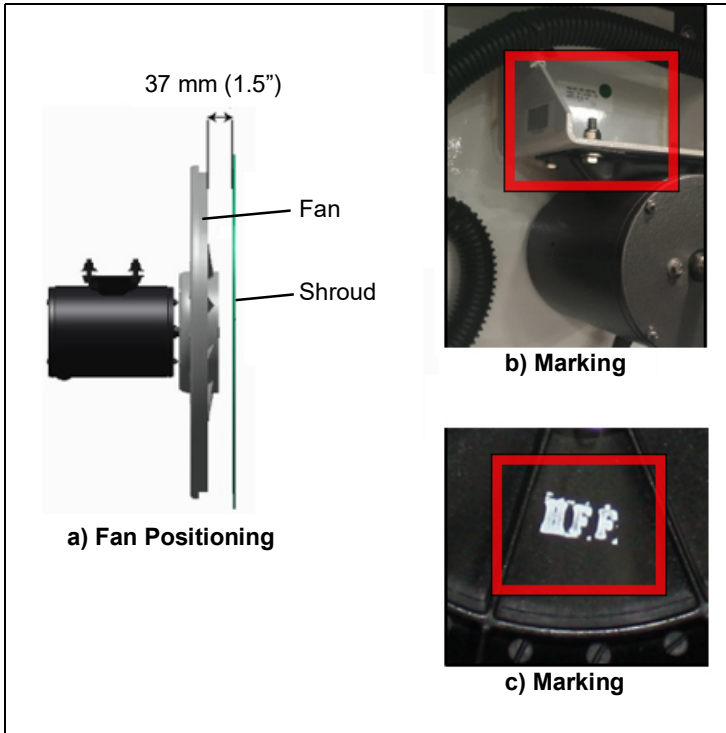
Figure 11 Access Panels



18. Gas Cooler Motor and Fan Blade. Refer to **Figure 12**.

- a. Check for cracking or wear on the fan blade. Replace as necessary.
- b. Check for proper fan positioning in the shroud. See **Figure 12 (a)** for reference.
- c. Slowly spin the fan blade, feeling for any bearing drag. Replace the motor if the fan is unable to freely rotate.
- d. Examine the fan motor for signs of overheating or physical damage. Repair or replace as necessary.
- e. Check the motor mounting bracket for cracking where welded to the frame. See **Figure 12 (b)**. Repair if necessary.
- f. Verify the fan has HFF marked on the hub which is raised and painted. See **Figure 12 (c)**.

Figure 12 Gas Cooler Fan Position and Markings



19. Gas Cooler Coil.

- a. Check for any signs of leaks. Repair or replace as necessary.
- b. Straighten any fin damage using fin comb (16 FPI).

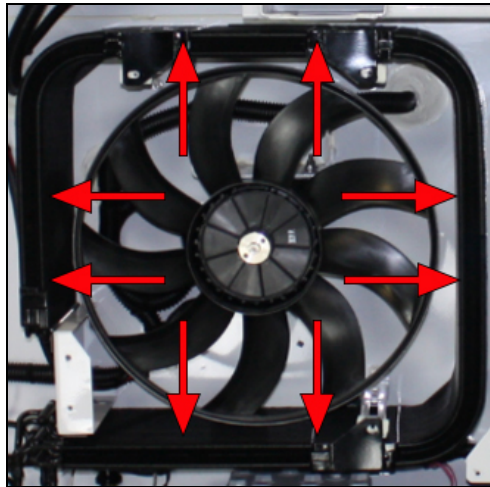
- c. Clean the coil using a low pressure water hose. The preferred wash direction is inside to outside. Refer to **Figure 13**. The direction is opposite to air flow direction.

NOTE

Static application of container units may require more frequent cleaning due to subjected environment conditions.

- d. Check for signs of excessive corrosion to the fins and tube sheets. Replace as necessary.

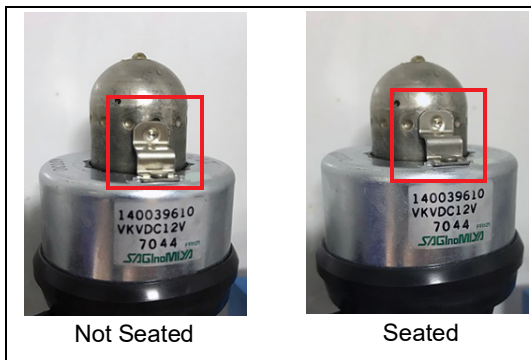
Figure 13 Gas Cooler Coil Cleaning



20. High Pressure Expansion Valve (HPXV). Refer to **Figure 14**.

- a. Make sure the HPXV coil is snapped down fully and the coil retention tab is properly seated in one of the valve body dimples.
- b. Ensure that the coil boot is properly fitted over the valve body.

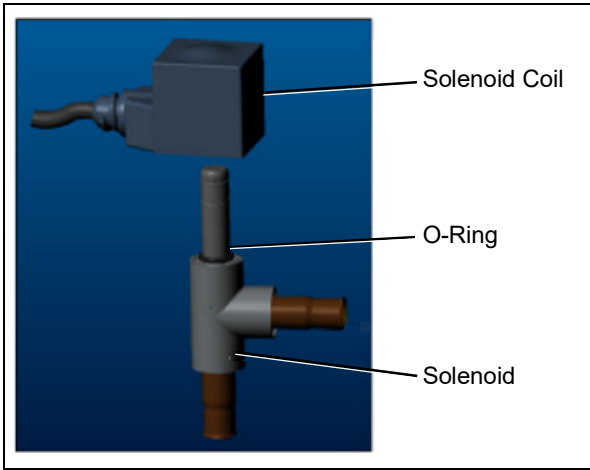
Figure 14 High Pressure Expansion Valve (HPXV) and Coil



21. **Economizer and Unloader Valve (ESV / USV).** Refer to **Figure 15.**

- a. Remove the solenoid coil.
- b. Verify that the O-ring is seated on the valve stem.
- c. Press the coil onto the valve stem ensuring that it is pressed all the way down, engaging with the O-ring.

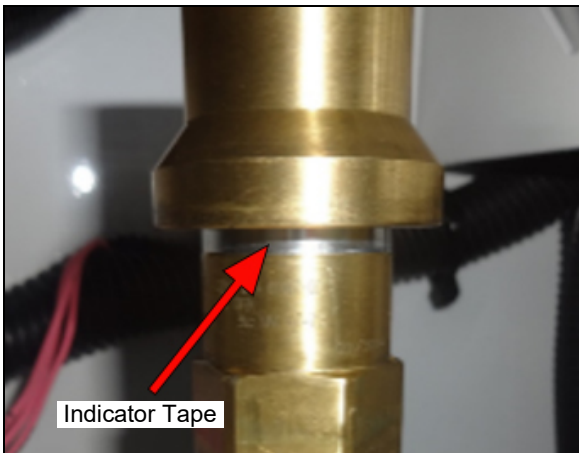
Figure 15 Economizer and Unloader Valve (ESV / USV)



22. **Pressure Relief Valves (LS, FT & HS).** Refer to **Figure 16.**

- a. Inspect the pressure relief valves for any indication of release on the indicator tape. If there is indication of a release, replace the pressure relief valves.

Figure 16 Pressure Relief Valves (LS, FT & HS)



23. Filter Drier. Refer to **Figure 17.**

- a. Check for excessive corrosion or physical damage of the filter drier and replace as required.

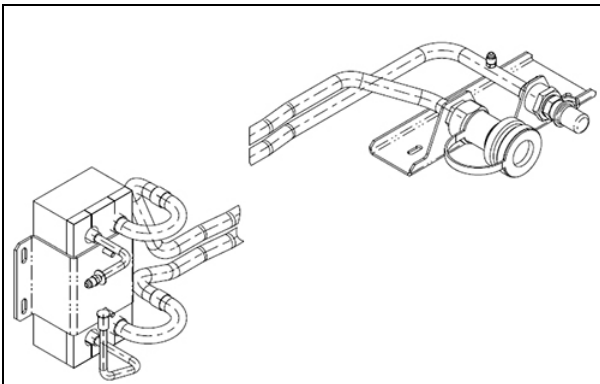
Figure 17 Filter Drier



24. Water-Cooled Condenser (Optional). Refer to **Figure 18.**

- a. Inspect assembly for excessive corrosion or physical damage. Repair or replace as necessary.
- b. Check the water connections for damage and the collar on the female fitting to ensure it moves freely.

Figure 18 Water-Cooled Condenser



25. Power Cables.

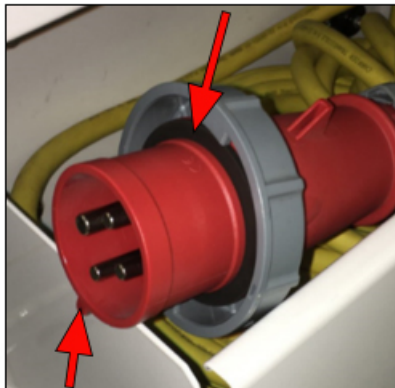
- a. Check that the cable is securely attached to the unit and the clamp is in position. See **Figure 19**.

Figure 19 Cable Clamp



- b. Inspect the cable for any physical damage.
- c. Replace the cable if more than one repair splice is found.
- d. Examine the plug gasket for any cracking / damage and replace if necessary. See **Figure 20**.
- e. Inspect the male pins. Replace if evidence of arcing / pitting or if the locating lug is missing. See **Figure 20**.

Figure 20 Gasket / Locating Lug



- f. Disassemble the plug from the cable and tighten wires to the pins. Reassemble the plug making sure the cable gland is tight and sealing the cable.

- g. Carry out a Megohm test from the power plug ground pin to the ground plate in the control box. The Megohm reading of this test should be zero.
- h. Carry out a Megohm test from each power plug pin to ground. The Megohm reading for the power plug ground pin should be zero and infinity for the other power plug pins.

26. Electrical Control Box.

- a. Interior should be dry and free from signs of damage, overheating, and corrosion. Repair any damage to the control box door gasket if needed.
- b. Secure all loose wires with wire ties.
- c. Examine contacts for severe pitting, and replace the contactor if necessary.
- d. Check to make sure wiring diagrams and schematics are present and legible. Replace if missing or damaged.
- e. Inspect for damage and check tightness on all wire harnesses and connections using a Pozi drive (star) screwdriver.
- f. All instructional labels and placards should be in place and legible. Refer to **Figure 21**.

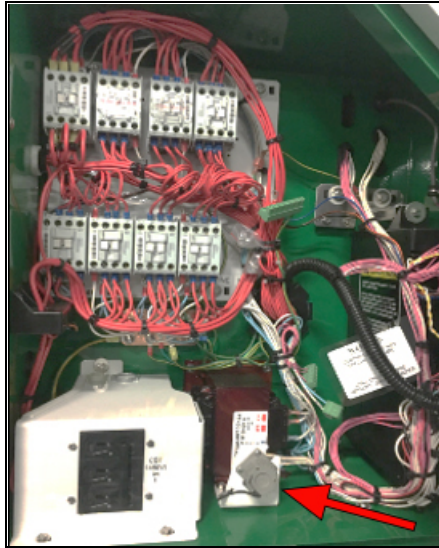
Figure 21 Instructional Labels and Placards



27. Interrogation Sockets. Refer to **Figure 22.**

- a. Ensure ports are secure and free from damage and corrosion.
- b. Make sure the caps are properly tethered to the unit.
- c. Repair or replace if damaged or missing.

Figure 22 Interrogation Sockets



28. Wiring.

- a. Examine loose wires and wire harnesses outside of the control box for routing neatness and condition. Replace or repair as necessary.

29. Frame.

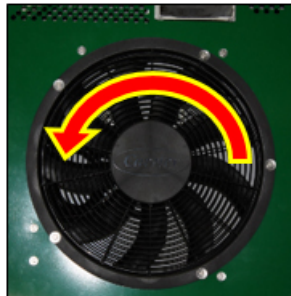
- a. Inspect structural integrity of the unit. Check unit for cracks, damage and missing structural items. Repair as required. If painting is required, refer to step 16.

OPERATIONAL INSPECTION

Refer to **Warnings and Notes** on page 2 before proceeding.

30. Remove the Lock Out / Tag Out device and plug the unit in to power supply.
31. Install the manifold gauge set.
32. Turn unit power on and change the setpoint to 32°F (0°C).
33. Check that voltage is good on all 3 phases of CH Contactor.
 - a. Check Cd07.
 - b. Acceptable ranges are: 50Hz, 360-460V & 60Hz, 400-500V.
34. Verify the container software / model / ID / time.
 - a. Check Cd18 to verify the software installed (57xx). It is recommend to always have the latest software installed.
 - b. Check Cd20 to verify the model number. This should match the last 5 digits of the model number on the nameplate (i.e. for 69NT40-601-001 the display will show 01001).
 - c. Check Cd40 to verify the Container ID to ensure correct set up.
 - d. Check dC32, dC33, dC34 to verify the clock is set to the current Greenwich Mean Time (GMT).
35. Check fans for proper rotation.
 - a. Check the gas cooler fan by placing a piece of paper on the gas cooler grill and verify it is blowing out. Refer to **Figure 23**.

Figure 23 Gas Cooler Fan Rotation



- b. Check the evaporator fans by verifying that air is pushing out by the bottom kick plate and sucking in on the top grille. Refer to **Figure 24**.

Figure 24 Evaporator Fan Rotation



- c. Check the VFD fan by placing a piece of paper over the fan grille to verify it pulls in. Refer to **Figure 25**.

Figure 25 VFD Fan Rotation



36. Enter a DataCORDER Trip Start. Refer to **Figure 26**.
 - a. By entering a trip start first, all test data will be included as part of the maintenance record.
 - b. Press the ALT MODE key. When the left display shows "dC", press the ENTER key.
 - c. Use the Arrow keys to scroll to Code dC30.
 - d. Press and hold the ENTER key for five seconds.
 - e. The "Trip Start" event will be entered in the DataCORDER.

Figure 26 Trip Start



37. Check the discharge and suction pressures on the manifold gauge set. Refer to the **Appendix** for R744 Pressure-Temperature Chart.
38. Ensure that User Selectable ML3 codes 27-37 are set to the customer specific default values to be advised by the customer. Factory default settings are below.

Code	Title	Default	Options
Cd27	Defrost Interval	Auto	Auto, Off, 3, 6, 9, 12, 24
Cd28	Standard Temperature Units	Celsius	F, C, --- (lockout option)
Cd29	User Selectable Failure Response Code	d = Full System Shutdown	A = Evap Fan Only d = Full System Shutdown
Cd30	In-Range Tolerance	4 = $\pm 2.0^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$)	1 = $\pm 0.5^{\circ}\text{C}$ ($\pm 0.9^{\circ}\text{F}$) 2 = $\pm 1.0^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$) 3 = $\pm 1.5^{\circ}\text{C}$ ($\pm 2.7^{\circ}\text{F}$) 4 = $\pm 2.0^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$)
Cd32	System Current Limit	21 Amps	15, 17, 19, 21, 23
Cd33	Humidity Setpoint	Option - Refer to CnF04	-
Cd35	Bulb Mode	Option - Refer to CnF28	----, nOr, bULb
Cd36	Evaporator Fan Speed	Bulb Mode	----, Alt, LOW, HI
Cd37	Variable DTT Setting	Bulb Mode	----, nOr

39. Initiate Auto 2 PTI.
40. During pull-down, check the unit for unusual noise / vibrations (i.e. loose connections). If found, investigate and repair.
41. Allow the unit to complete testing. Refer to the operation & service manual for any failed PTI test and repair.
42. Perform an Upper Vent Position Sensor calibration (optional equipment).
- Rotate the vent to the 0 CMH / CFM position. Cd45 will automatically display.

- b. Press the ENTER key and hold for five seconds. After the ENTER key has been pressed, the display reads "CAL" (for calibration).
43. Press the ALT MODE key and hold for five seconds. After the calibration has been completed, Cd45 will display 0 CMH / CFM.
44. Download (interrogate) the unit DataCORDER using a PCMCIA downloading card, USB adapter or DataLINE. It is recommended to get an "ALL DATA" download for records. The minimum should be "LAST TRIP START" to ensure all PM temperature and PTI data is obtained.
45. Turn the unit off and disconnect from the power supply.
46. Print out the trip report and retain it as a permanent record of the PM.
47. Retain the download and inspection sheet as a record of the annual inspection.

APPENDIX

Table 1–1 Torque Values

Component		Torque (Ft. Lbs.)	Torque (Nm)
Pressure Relief Valves	Low Side PRV	65-71	88-96
	Flash Tank PRV	22-24	30-32
	High Side PRV	38-42	52-57
Pressure Transducers	Suction Pressure Transducer (SPT)	19-21	26-28
	Flash Tank Pressure Transducer (FTPT)	7-8	10-11
	Discharge Pressure Transducer (DPT)	7-8	10-11
Service Fittings	Suction Service Fitting	19-21	26-28
	Discharge Service Fitting	7-8	10-11
Pressure Switch	High Pressure Switch	13-14	18-19
Bolts	Compressor Flange Bolts	26-28	36-38

Table 1–2 Mechanical Joints for Leak Inspection

Component	Location
Compressor	1st Stage Suction Flange
	1st Stage Discharge Flange
	2nd Stage Suction Flange
	2nd Stage Discharge Flange
Pressure Relief Valves	Low Side PRV
	Flash Tank PRV
	High Side PRV
Pressure Transducers	Compressor
	Flash Tank
	Discharge
Charging Port	Low Side
	High Side
High Pressure Switch	Plug located on Flash Tank Liquid Line (if equipped)
Filter Drier	Inlet
	Outlet

Table 1–3 Sensor Resistance - CPDS

°C	°F	OHMS		°C	°F	OHMS
-40	-40	849,822		18	64.4	136,705
-38	-36.4	834,450		20	68.0	124,876
-36	-32.8	819,079		22	71.6	114,101
-34	-29.2	803,707		24	75.2	104,352
-32	-25.6	788,336		25	77	100,000
-30	-22.0	772,964		26	78.8	95,585
-28	-18.4	757,593		28	82.4	87,619
-26	-14.8	742,221		30	83.0	80,447
-24	-11.2	726,849		32	89.6	73,931
-22	-7.6	711,478		34	93.2	68,000
-20	-4.0	696,106		36	96.8	62,599
-18	-0.4	680,735		38	100.4	57,657
-16	3.2	665,363		40	104.0	53,200
-14	6.8	649,992		42	107.6	49,117
-12	10.4	620,224		44	111.2	45,367
-10	14.0	563,722		46	114.8	41,965
-8	17.6	507,219		48	118.4	38,840
-6	21.2	450,717		50	122.0	35,991
-4	24.8	403,140		52	125.6	33,369
-2	28.4	365,427		54	129.2	30,967
0	32.0	327,715		56	132.8	28,753
2	35.6	295,834		58	136.4	26,733
4	39.2	267,922		60	140.0	24,867
6	42.8	241,618		62	143.6	23,152
8	46.4	219,659		64	147.2	21,570
10	50.0	198,927		66	150.8	20,827
12	53.6	180,987		68	154.4	20,112
14	57.2	164,687		70	158.0	18,768
16	60.8	149,680		72	161.6	16,375

NaturaLINE Unit Inspection
Manual Reference: T-349 & T-370

Unit Detail	Customer	
	Unit Serial #	
	Container #	
	Port / Location of Inspection	
	Person Inspecting Unit	
	Date & Time of Inspection	
	Compressor Run Time (hrs)	
	Software Revision	

Test			Comments
	Perform Auto 2 PTI	Collect and provide download along with actions required for it to pass	
Active Alarms (If Any)			

Leak Inspection: (Use Tool Part Number 07-00529-00)	Component	Location	Leak?	Comments
	Compressor	1st Stage Suction		
		1st Stage Discharge		
		2nd Stage Suction		
		2nd Stage Discharge		
	Pressure Relief Valves	Compressor (LS)		
		Flash Tank (MS)		
		Discharge (HS)		
	Pressure Transducer	Compressor		
		Flash Tank		
		Discharge		
	Charging Port	Low Side		
		High Side		
	High Pressure Switch			
	Sight Glass Plug (If Equipped)			
Filter Drier	Inlet			
	Outlet			

Photos	Location	Comments
	Front of Unit	
	Compressor	
	Flash Tank	
	Gas Cooler	
	Oil Residue (If Any)	
	Corrosion (If Any)	

General Comments	
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INDEX

A

Access Panels 11
Air Baffle / Kick Plate 9
Air Flow 9
Auto 2 PTI 21

C

Cd07 19
Cd18 19
Cd20 19
Cd40 19
CH Contactor 19
Channels 9
Circuit Breaker CB1 2
CO2 Refrigerant Leak Detector 2
CO2 Refrigeration Gauge Set 2
Container Carrier Transicold website 1
Corrosion 11

D

DataCORDER Trip Start 20
dC30 20
dC32, dC33, dC34 19
Defrost Drain 6
Defrost Drain Lines 6
Defrost Termination Sensor (DTS) 5
Drain Cup 6
Drain Gutters 6

E

Economizer and Unloader Valve (ESV /
USV) 14
EEV Coil 6
Electrical Control Box 17
Electronic Expansion Valve (EEV) 6
Electronic Leak Detector 11

Evaporator Access Panels 11
Evaporator Coil 4
Evaporator Fan Blade 4, 5
Evaporator Fans 19
Evaporator Motor 11
Evaporator Motor and Stator 4
Evaporator Motor Clamp Brackets
4
Evaporator Temperature Sensor
(ETS) 7

F

Filter Drier 15
Fin Comb 12
Fin Combs 2
Floor Drains 9
Frame 18

G

Gas Cooler Coil 12
Gas Cooler Fan Blade 12
Gas Cooler Fan Motor 12
Gas Cooler Motor and Fan Blade
12
Gas Cooler Motor Mounting Bracket
12

H

Heater Termination Thermostat
(HTT) 8
Heaters and Heater Brackets 8
HFF 12
High Pressure Expansion Valve
(HPXV) 13
HPXV coil 13

INDEX

I

Instructional Labels and Placards 17

Interrogation Sockets 18

K

Kick Plate 9

L

Leak Checking 11

Lock Out / Tag Out 2, 19

M

Manifold Gauge Set 19

Mechanical Joints for Leak Inspection
23

Megohm Meter 2

Megohm test 17

Multimeter 2

N

NaturalINE Unit Inspection 25

O

Outside Drain 6

P

Parts Identification Number (PID) 3

Power Cables 16

Pressure Equipment Directive (PED)
Compliance Label 3

Pressure Relief Valves (LS, FT & HS)
14

S

Screwdrivers 2

Shroud 12

Solenoid Coil 14

Stator 5

T

Tools Required 2

Torque Setting 11

Torque Values 23

Torque Wrench and Sockets 2

Trip Start 20

U

Unit Nameplate 3

Upper Vent Position Sensor calibration
21

USDA and Interior Communication
Sockets 9

User Selectable ML3 codes 21

V

VFD fan 20

W

Water-Cooled Condenser 15

Wire Harnesses 5

Wiring 18

Wrench Set 2

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Carrier Transicold
P.O. Box 4805
Syracuse, NY 13221 USA

www.carrier.transicold.com