Retrofit Instructions

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SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution can result in injury to personnel and damage to components.

Always wear approved safety glasses, work gloves, and other recommended Personal Protective Equipment (PPE) when working with refrigerants.

Avoid spilling liquid refrigerant on skin or getting it into the eyes. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately flush eyes with water and consult a physician.

Inhalation of high concentrations of vapor is harmful; provide adequate ventilation in accordance with ANSI/ASHRAE 15.

INTRODUCTION

⚠ CAUTION

These instructions are intended to be used with R-513A only with application to the 30HXC product line.

Other refrigerants have not been approved for use with the 30HXC product line at this time.

This document is to be used in conjunction with the 30HXC Installation Instructions as a supplement. It provides specific information for 30HXC units where it is desired to understand the possibility and potential scope of change associated with a refrigerant change from R-134a to R-513A.

Situation

The NACO Packaged Chiller Builder Version 3.73 builder was released June 24, 2024. This builder has 30HXC chiller performance with R-513A refrigerant. It is advised that customers confirm their specific 30HXC R-513A configuration performance will meet current specification before moving forward with an R-513A retrofit. If unit uses any other controller it must be retrofit with a PIC6 or PIC6.1 prior to charging with R-513A.

In general, the customer can expect an approximate gain of 2.0% in capacity and an approximate loss of 2.5% in full load efficiency.

The refrigerant retrofit to R-513A requires either a PIC6 or PIC6.1 controller with updated controls software.

The chiller may use a PIC6 or PIC6.1 controller. The software on either controller will need to be updated accordingly. It is also required to update refrigerant labeling to R-513A labeling and, for 161-271 ton units, change filter drier cores. It may also involve other changes as described below and will require review for each individual application.

Solution

R-513A consists of 56% R-1234yf and 44% R-134a. It is classified by ASHRAE as an A1 refrigerant, which is the same classification as R-134a. R-513A is an azeotrope (a mixture with a constant boiling point). The main advantage of introducing R-513A as a refrigerant is its lower global warming potential (GWP) when compared with R-134a. R-134a has a GWP of approximately 1300 whereas R-513A has a value of approximately 573.

REQUIRED ITEMS

- Safety glasses
- Gloves
- Refrigerant service gauges
- Digital thermometer or similar device to measure temperature
- Electronic leak detector
- Vacuum pump capable of pulling a vacuum of 0.3 mbar / 250 microns or lower
- Refrigerant recovery unit including appropriate amount of refrigerant cylinders
- R-513A pressure temperature chart (Table 1 on page 5)
- Replacement liquid line filter driers (4 per chiller) P/N KH29EZ050 (only for 161-271 ton units)
- R-513A refrigerant
- R-513A refrigerant label - P/N CU000010-01
- USB drive (Preferably 4, 16 or 32 GB)
- If controller is a PIC6, software SCG-SR-20W820140 or later. If controller is a PIC6.1, software SCG-SR-20Y820140 or later.

RETROFIT INSTRUCTIONS

Step 1 — Establish Baseline Performance

Establish baseline performance with current refrigerant.

1. Collect system performance data while the R-134a refrigerant is still in the system.
2. Check for correct charge and operating conditions. At minimum, the following data should be recorded with R-134a:
   - Compressor inlet and outlet pressures and temperatures
   - Cooler outlet temperatures
   - Outdoor temperature
   - Liquid temperatures near electronic expansion valve.

   Use Table 1 on page 5 as a reference for calculating superheat and subcooling. Use Table 2 on page 6 and Table 3 on page 7 to record measurements for superheat, subcooling, and pressure ratio for comparison when the system is operational with the newly installed R-513A refrigerant.

Step 2 — Record Factory Parameters

In Table 4 on page 7 record all factory configuration parameters. Refer to Table 5 on page 8 for instructions and help setting factory parameters on PIC6.1 for future use in Step 11.

Using the path *Login -> Factory Login -> Main Menu -> Configuration -> Factory Parameters.*

1. Log in to Factory level access using the bar-code generated password code.
2. Click on the main menu icon and choose Configuration.
3. Click on the “Factory Parameter” menu. See Fig. 1-6.

NOTE: For further technical guidance with PIC6.1 functionality and access, please reference the controls document available on HVACpartners.com.

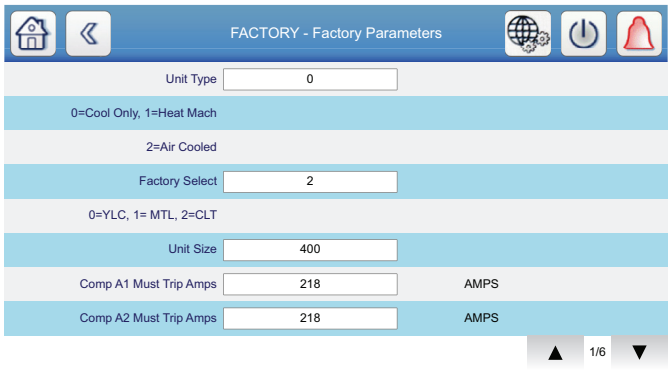

Fig. 1 — Factory Parameters Screen 1

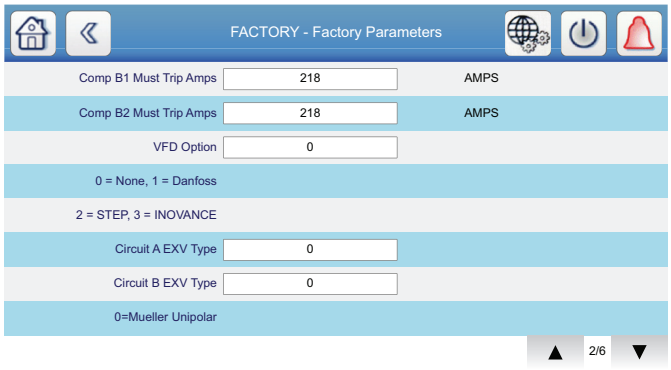

Fig. 2 — Factory Parameters Screen 2

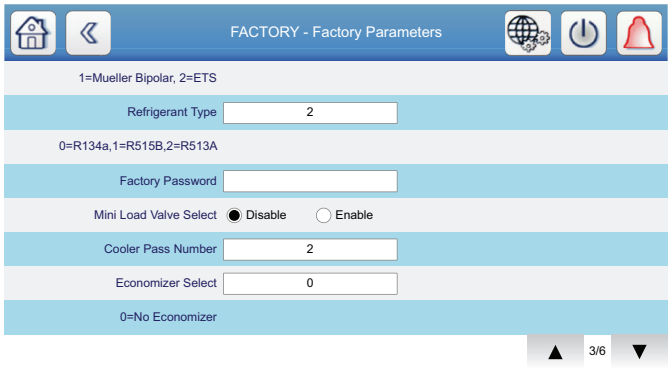

Fig. 3 — Factory Parameters Screen 3

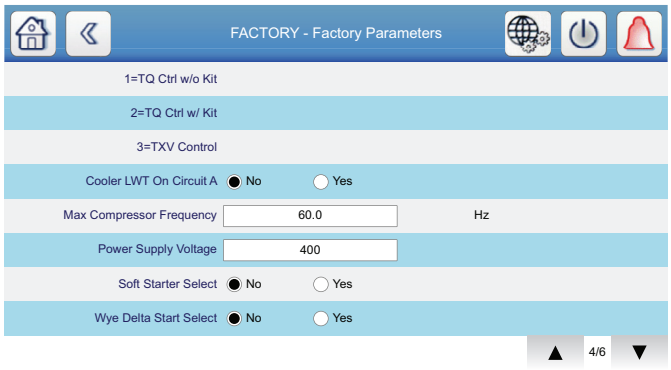

Fig. 4 — Factory Parameters Screen 4

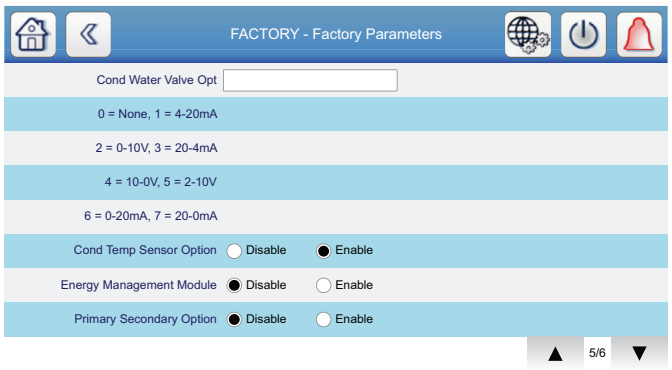

Fig. 5 — Factory Parameters Screen 5

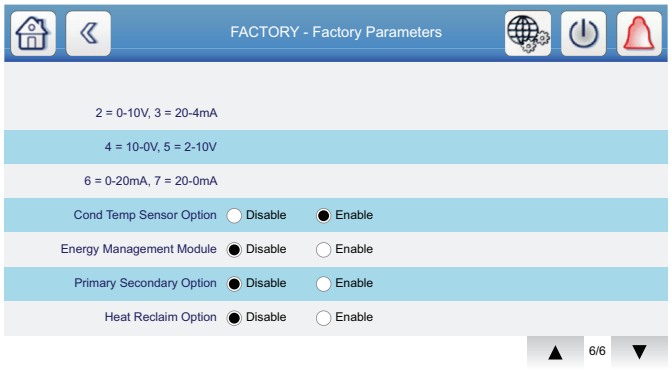

Fig. 6 — Factory Parameters Screen 6

Step 3 — Disconnect Power

Disconnect electrical power to system.

⚠ WARNING

Electrical shock can cause personal injury and death. Shut off all power to this equipment during installation and service. There may be more than one disconnect switch. Tag all disconnect locations to alert others not to restore power until work is completed.

Step 4 — Remove Refrigerant

Remove refrigerant from system into a recovery cylinder.

1. Properly remove the R-134a refrigerant from the system with the use of a recovery machine and appropriate refrigerant cylinders. No refrigerant should be vented during this process.
2. During the refrigerant removal process, water should be run through both evaporator and condenser when removing charge in order to prevent freezing tubes in either heat exchanger.
3. Once all charge has been removed from the system, measure and record the total charge quantity removed from the system. This will be a helpful starting point for adding the R-513A refrigerant back to the system in Steps 11-12.

Step 5 — Change Filter Driers for Tonnages 161-271

Change the liquid line filter drier core P/N KH29EZ050 in each circuit.

1. Filter drier cover plate should have all bolts initially installed in a cross-torqued pattern to 10 ft-lb.
2. Once all bolts have been initially tightened, repeat the sequence a second time to a final torque of 20 ft-lb.

Step 6 — Evacuate Refrigeration Circuits

Evacuate each refrigeration circuit to 500 microns.

1. It is recommended to evacuate the system from both sides of the refrigeration system, ensuring removal of air and all other non-condensables. Evacuating a system with the vacuum pump connected to the suction side alone will not result in adequate removal of moisture and other non-condensables.
2. It is suggested to perform a standing vacuum rise test to confirm the system is dry and leak free. With the unit in a deep vacuum (500 microns or less), isolate the vacuum pump from the system. Then observe the rate of rise of the vacuum in the system over a 30-minute period.
3. If the vacuum rises by more than 50 microns in a 30-minute period, then continue the dehydration process. Maintain a vacuum on the system until the standing vacuum requirement is met.

Step 7 — Check for Leaks

Check the system for leaks, applying normal service practices.

Step 8 — Confirm Controller Version

With power on, confirm which controller is installed. If it is a PIC6, ensure software version SCG-SR-20W820140 or later is installed. If it is a PIC6.1, ensure software version SCG-SR-20Y820140 or later is installed.

Upgrade software if necessary.

Step 9 — Update PIC6/PIC6.1 Software

Using a USB drive, update PIC6 or PIC6.1 Software.

IMPORTANT: Prior to upgrading software, connect to controller via NSTV or ProView and upload its configuration files.

1. Format a blank USB drive (preferably a 4, 16, or 32 GB drive) to FAT/FAT32.
   a. Open File Explorer (Windows 10) or Windows Explorer (Windows 7).
   b. Navigate to the View tab. Check the box next to File name extensions in the menu box at the top of the screen.
   c. Be sure that there is nothing on the drive that must be kept. Formatting the drive will erase all the contents.
   d. Right-click on USB drive on the directory side of the window and select Format.
   e. Another window will appear. Under File System, select FAT/FAT32.
   f. Click the Start button to start the format process.
2. Download the required software from HVACPartners to a designated file on the computer being used. Contact a Carrier representative for assistance in obtaining the correct software, if required.
   a. Once downloaded, right-click on the zip file and select Extract All. A new window will open with the default location of the existing folder where the zip file is located.
   b. Select Extract at the bottom of that window. There will be three files in your designated folder, in which the zip file was originally downloaded: For PIC6, those files will be SCG-SR-20W820140.pic6fw, fwupgrade.bin, and fwupgrade.conf. For PIC6.1, those files will be SCG-SR-20Y820140.pic6fw, fwupgrade.bin, and fwupgrade.conf.
   c. Copy and paste the two “fwupgrade” files to the FAT/FAT32 Formatted USB drive.
3. Plug the USB drive into any USB port on the PIC6 or PIC6.1 panel.

4. Power OFF the PIC6 or PIC6.1 panel and wait 30 sec.
5. Power ON the PIC6 or PIC6.1 panel. Upon Power ON of the controller it will go into USB firmware upgrade. The core board will upgrade first followed by a soft reboot. On restart it will go into UI board upgrade.
6. Once this is complete power OFF the PIC6/PIC6.1 and remove the USB drive.

NOTE: After loading the display, the .conf file on the USB drive will change to bkp_fwupgrade.conf automatically. The file will need to be renamed to fwupgrade.conf prior to upgrading another controller.

Step 10 — Reapply Power and Load Factory Parameters

1. Unlock the controller at Factory Level Access and navigate through Configuration to the Factory Parameters.
2. Enter the correct values based on what was recorded in Step 2 "Record Factory Parameters" on page 2.
3. Set the refrigerant type in the factory parameters to R-513A.
4. Select SAVE, then select Reboot UI at bottom of the screen.
5. Enter the remaining unit configurations and parameters as necessary according to what was previously uploaded via NSTV or Pro View prior to the upgrade.

Step 11 — Recharge System

Recharge the system with R-513A.

1. The refrigerant should be added back through the liquid line service valves. Remove only liquid refrigerant from the charging cylinder while charging.
2. As charge is being added back in the system, water should be run through both evaporator and condenser in order to prevent freezing tubes in either heat exchanger. It is suggested to charge approximately 90% of the total R-513A charge quantity at this time.
3. Record the charge quantity you have added before proceeding to the next step.

NOTE: The final R-513A charge quantity will be approximately the same as previously charged R-134a quantity.

Step 12 — Start System

Start the system and allow for stability.

1. Once stability has been obtained, slowly begin to add refrigerant to the system through the refrigerant access fitting between the Main EXV and the cooler to match the performance/temperatures previously recorded in Step 2 before the removal of the legacy R-134a refrigerant.
2. R-513A charge quantity will be approximately the same as the previously charged R-134a quantity. The final R-513A charge quantity should be recorded and documented for future service reference.

Step 13 — Apply Refrigerant Labeling

As a final step, apply proper R-513A refrigerant labeling over current R-134a labeling. Use the R-513A refrigerant label – P/N CU000010-01.

IMPORTANT: These instructions are intended to be used with R-513A only with application to the 30HXC product line. Other refrigerants have not been approved for use with the 30HXC product line at this time.

Table 1 — Saturation Table

SATURATION TEMPERATURE (°F)	R-134a	R-513A	
	Pressure (psig)	Liquid Pressure (psig)	Vapor Pressure (psig)
0	6.48	9.58	9.52
2	7.49	10.68	10.63
4	8.54	11.83	11.77
6	9.63	13.01	12.96
8	10.76	14.24	14.18
10	11.93	15.50	15.45
12	13.14	16.81	16.76
14	14.40	18.17	18.12
16	15.70	19.56	19.51
18	17.04	21.00	20.96
20	18.43	22.49	22.45
22	19.86	24.03	23.98
24	21.35	25.61	25.57
26	22.88	27.24	27.21
28	24.46	28.93	28.89
30	26.09	30.66	30.63
32	27.77	32.45	32.42
34	29.51	32.29	34.26
36	31.30	36.18	36.15
38	33.14	38.13	38.11
40	35.05	40.14	40.11
42	37.00	42.20	42.18
44	39.02	44.33	44.30
46	41.10	46.51	46.49
48	43.24	48.75	48.73
50	45.44	51.06	51.04
52	47.70	53.42	53.41
54	50.03	55.86	55.84
56	52.42	58.35	58.34
58	54.88	60.92	60.90
60	57.41	63.55	63.54
62	60.01	66.24	66.24
64	62.67	69.01	69.01
66	65.41	71.85	71.85
68	68.22	74.76	74.76
70	71.11	77.75	77.74
72	74.07	80.81	80.80
74	77.11	83.94	83.94
76	80.22	87.15	87.15
78	83.42	90.44	90.44
80	86.69	93.81	93.81
82	90.05	97.26	97.26
84	93.49	100.79	100.79
86	97.01	104.40	104.40
88	100.62	108.10	108.10
90	104.32	111.88	111.88
92	108.10	115.75	115.75
94	111.98	119.70	119.70
96	115.94	123.75	123.75
98	120.00	127.89	127.88
100	124.16	132.12	132.11
102	128.40	136.44	136.43
104	132.75	140.85	140.85
106	137.19	145.37	145.36
108	141.73	149.98	149.97
110	146.38	154.68	154.67
112	151.12	159.49	159.48
114	155.98	164.40	164.39
116	160.93	169.42	169.40
118	165.99	174.53	174.51
120	171.17	179.76	179.74

Table 1 — Saturation Table (cont)

SATURATION TEMPERATURE (°F)	R-134a	R-513A	
	Pressure (psig)	Liquid Pressure (psig)	Vapor Pressure (psig)
122	176.45	185.09	185.06
124	181.84	190.53	190.50
126	187.35	196.08	196.05
128	192.98	201.74	201.71
130	198.72	207.52	207.48
132	204.72	213.41	213.37
134	210.55	219.42	219.38
136	216.65	225.55	225.50
138	222.88	231.80	231.75
140	229.23	238.17	238.11
142	235.70	244.67	244.60
144	242.31	251.29	251.22
146	249.04	258.04	257.96
148	255.91	264.91	264.84
150	262.92	271.92	271.81

Table 2 — Measurement Record Table

DESCRIPTION	R-134a MEASUREMENTS	R-513A MEASUREMENTS
Circuit A - Compressor Suction Pressure		
Circuit A - Compressor Discharge Pressure		
Circuit A - Liquid Pressure		
Circuit A - Compressor Suction Temperature		
Circuit A - Compressor Discharge Gas Temperature		
Circuit A - Compressor Motor Temperature		
Circuit A - Cooler Outlet Temperature		
Circuit A - EXV Economizer Temperature		
Circuit A - Liquid Temperature @ the EXV		
Circuit B - Compressor Suction Pressure		
Circuit B - Compressor Discharge Pressure		
Circuit B - Liquid Pressure		
Circuit B - Compressor Suction Temperature		
Circuit B - Compressor Discharge Gas Temperature		
Circuit B - Compressor Motor Temperature		
Circuit B - Cooler Outlet Temperature		
Circuit B - EXV Economizer Temperature		
Circuit B - Liquid Temperature @ the EXV		

Table 3 — Compressor Motor Current

DESCRIPTION	R-134a			R-513A		
	L1	L2	L3	L1	L2	L3
Circuit A - Compressor 1						
Circuit A - Compressor 2 (only for 30HXC206-271)						
Circuit B - Compressor						

Table 4 — Factor Configuration Parameter Record Table

DESCRIPTION	PARAMETER VALUE
Unit Type	
Factory Select	
Unit Size	
Comp A1 Must Trip Amps	
Comp A2 Must Trip Amps	
Comp B1 Must Trip Amps	
Comp B2 Must Trip Amps	N/A, no B2 compressor for 30HXC
VFD Option	
Circuit A EXV Type	
Circuit B EXV Type	
Refrigerant Type	
Factory Password	
Mini Load Valve Select	
Cooler Pass Number	
Economizer Select	
Cooler LWT On Circuit A	
Max Compressor Frequency	
Power Supply Voltage	
Soft Starter Select	
Wye Delta Start Select	
Cond Water Valve Opt	
Cond Temp Sensor Option	
Energy Management Module	
Primary Secondary Option	
Heat Reclaim Option	

Table 5 — Controls Parameters

FACTORY PARAMETER	OPTION TO SELECT
Unit Type	Enter 0 for cool only
Factory Select	Enter 2 for Charlotte
Unit Size	Enter the tonnage of the unit. For example, for 30HXC076, enter 75
Comp A1 Must Trip Amps	Refer to “Compressor Must Trip Amp (MTA) Settings” section on 30HXC Series 9 Controls, Start-Up, Operation, Service, and Troubleshooting document
Comp A2 Must Trip Amps	Refer to “Compressor Must Trip Amp (MTA) Settings” section on 30HXC Series 9 Controls, Start-Up, Operation, Service, and Troubleshooting document
Comp B1 Must Trip Amps	Refer to pages “Compressor Must Trip Amp (MTA) Settings” section on 30HXC Series 9 Controls, Start-Up, Operation, Service, and Troubleshooting document
Comp B2 Must Trip Amps	N/A, no B2 compressor for 30HXC
VFD Option	For fixed speed enter 0, for variable speed retrofits enter 1
Circuit A EXV Type	Enter 1 for Mueller Bipolar
Circuit B EXV Type	Enter 1 for Mueller Bipolar
Refrigerant Type	Enter 2 for R-513A
Mini Load Valve Select	Select “Disable” or “Enable” depending on whether unit has minimum load control installed
Cooler Pass Number	Enter the number of cooler passes
Economizer Select	Enter 3 for TXV control on units 161-271
Cooler LWT On Circuit A	Select Yes
Max Compressor Frequency	Enter 60.0 Hz
Power Supply Voltage	Enter 208, 230, 460, or 575 depending on what unit has installed
Soft Starter Select	Select No
Wye Delta Start Select	Select “No” or “Yes” depending on if system has Y-Delta starter
Cond Water Valve Opt	Enter 2 (0-10V option) or 5 (2-10V option)
Cond Temp Sensor Option	Select “Disable” or “Enable” depending on whether system has a condenser temperature sensor installed
Energy Management Module	Select “Disable” or “Enable” depending on whether system has an energy management module installed
Primary/Secondary Option	Select “Disable” or “Enable” depending on whether system has the Primary/Secondary Option installed
Heat Reclaim Option	Select “Disable” or “Enable” depending on whether system has a heat reclaim option installed