Opteon™ XP10
Refrigerant

Opteon™ XP10 Retrofit Guidelines to Replace R-134a

Introduction

Opteon™ XP10 is a low global warming potential (GWP) hydrofluoro-olefin (HFO)-based refrigerant developed to replace R-134a in medium-temperature refrigeration systems. Opteon™ XP10 is the registered trade name for a blend of HFC-134a/HFO-1234yf (44/56 wt%) with an ANSI/ASHRAE Standard 34 refrigerant designation of R-513A. It is a nonflammable azeotropic mixture with negligible temperature glide. It is commercially available for both retrofit of existing R-134a equipment as well as a suitable replacement option in new equipment. Opteon™ XP10 offers improved environmental properties versus R-134a, with a GWP* of 573 (compared to 1300 for R-134a). Opteon™ XP10 refrigerant has a zero ozone depletion potential (ODP).

Using these retrofit guidelines, many R-134a systems can be converted to operate using Opteon™ XP10, allowing existing equipment to continue to operate safely and efficiently with a greatly reduced environmental impact.

Important Safety Information

Like all Freon™ refrigerants, Opteon™ XP10 is safe to use when handled properly. However, any refrigerant can cause injury or even death when mishandled. Please review the following guidelines and consult the product Safety Data Sheet (SDS), including proper personal protective equipment recommendations, before using any refrigerant. At a minimum, appropriate hand (gloves) and eye (safety glasses) protection should be used.

- Do not work in high concentrations of refrigerant vapors. Always maintain adequate ventilation in the work area. Do not breathe vapors. Do not breathe lubricant mists from leaking systems. Ventilate the area well after any leak before attempting to repair equipment.
- Do not use handheld leak detectors to check for breathable air in enclosed working spaces. These detectors are not designed to determine if the air is safe to breathe. Use oxygen monitors to ensure adequate oxygen is available to sustain life.
- Do not use flames or halide torches to search for leaks. Open flames (e.g., halide torches or brazing torches) in the presence of any fluorocarbon refrigerant can decompose the refrigerant, forming hazardous acidic compounds. Halide torches are not effective as leak detectors for HFO/HFC refrigerants, as they only detect the presence of chlorine in the refrigerant. Chlorine is not present in Opteon™ XP10; and, consequently, these detectors will not detect the presence of these refrigerants. Use an electronic leak detector designed to find the refrigerants you are using.

If you detect a visible change in the size or color of a flame when using brazing torches to repair equipment, stop work immediately and leave the area. Ventilate the work area well and stop any refrigerant leaks before resuming work. These flame effects may be an indication of very high refrigerant concentrations, and continuing to work without adequate ventilation may result in injury or death.

*GWP = IPCC Fifth Assessment Report (AR5)

Chemours™

LOW GWP ©

Table 1: Comparison of Performance Data

Medium Temperature Conditions $T_{Condenser}$ = 104 °F, $T_{Evaporator}$ = 14 °F, Liquid Subcool = 7 °R, Return Gas = 50 °F, Compressor Isentropic Efficiency = 70%									
Refrigerant	Evap P (psig)	Cond P (psig)	Disch T (°F)	Avg Glide (°R)	Vol Cap (Btu/ft³)	Cap Rel to R-134a	EER (Btu/watt-hour)	EER Rel to R-134a	Mass Flow Rel to R-134a
R-134a	14.5	133	178	0.0	39.1	100%	10.19	100%	100%
Opteon™ XP10	17.5	140.5	165	0.0	40.8	104%	10.04	99%	119%

Note: Any refrigerant can be hazardous if used improperly. Hazards include liquid or vapor under pressure as well as frostbite from the escaping liquid.

Overexposure to high concentrations of refrigerant vapor can cause asphyxiation or cardiac arrest. Please read all safety information before handling any refrigerant.

Refer to the Opteon™ XP10 SDS for more specific safety information. Safety Bulletin AS-1 also gives additional information for safe handling of refrigerants.

Flammability

Opteon™ XP10 is nonflammable in air under normal conditions. When mixed with high concentrations of air or oxygen under elevated pressure, however, this product can become combustible in the presence of an ignition source. This product should not be mixed with air to check for system leaks.

General Retrofit Information: R-134a to Opteon™ XP10

Expected Performance of Opteon™ XP10 vs. R-134a

Table 1, based on thermodynamic cycle analysis, provides a comparison of R-134a and Opteon™ XP10 performance data for a number of key system variables. Actual performance for a specific system depends on a number of factors, including equipment conditions and operating environment.

System Modifications

Lubricant

For most systems operating on R-134a, the polyolester (POE) lubricant currently in the system should be suitable for use with Opteon™ XP10. If there are questions about the lubricant, or tests indicate it is contaminated or has a high acid number, then the lubricant should be changed. Consult with the compressor manufacturer for specific recommendations on viscosity and brand of lubricant.

Compressor

Overall system performance (capacity and energy efficiency) will be similar when operating on Opteon™ XP10 versus R-134a.

Compressor suction and discharge pressures for Opteon™ XP10 will differ slightly from R-134a, and it may be necessary to adjust system pressure set points and cutouts to avoid exceeding the operating limits of the compressor. Consult with the specific system manufacturer for guidance.

Opteon™ XP10 also has lower compressor discharge temperature than R-134a. Again, you should consult with your compressor manufacturer for details regarding operation of your specific compressor on Opteon™ XP10.

Expansion Device

Opteon™ XP10 has slightly higher mass flow rate than R-134a, but should be within the usable range of a properly sized and installed R-134a expansion device. Some adjustment to the expansion valve(s) may be needed in order to reset the superheat following conversion of the system. Use the PT chart (dew point [saturated vapor] values) at the end of this guide for correct measurement and setting of evaporator superheat. If you have further questions, consult with the expansion device manufacturer for correct valve sizing and superheat adjustments.

Line Sizing

Opteon™ XP10 has slightly higher mass flow rates and slightly lower liquid density compared to R-134a. It is always recommended that the existing refrigerant line sizing be checked to verify that the system pressure drops and line velocities are acceptable with the new refrigerant. Correct pipe sizing is important in order to ensure adequate refrigeration capacity and sufficient oil return to the compressor.

Condenser and Evaporator

Due to the differences in suction pressure between Opteon™ XP10 and R-134a, it may be necessary to reset evaporator pressure regulators (EPR) and pressure cutouts to properly operate the system. The discharge pressure of Opteon™ XP10 is slightly higher than R-134a, and may require slight adjustments to condenser fans and head pressure controls.

Opteon™ XP10 is an azeotropic refrigerant; so, there are negligible differences between the dew point and bubble point. However, it is good industry practice to use the dew point (saturated vapor) in the PT chart when setting superheat. Similarly, the bubble point (saturated liquid) should be used for measuring subcooling.

System Controls

Many supermarkets use refrigeration control systems and methodologies that rely on the pressure-temperature relationship of a specific refrigerant for proper operation. During conversions from R-134a to Opteon™ XP10, although the controls will likely function adequately, for optimal performance they should be updated for operation using Opteon™ XP10 refrigerant properties. Consult with the control system manufacturer for guidance on updating refrigerant data or operating instructions when using Opteon™ XP10 (R-513A).

Retrofit of R-134a Systems to Opteon™ XP10

The following detailed steps are the recommended procedure for retrofitting R-134a systems to Opteon™ XP10:

1. **Establish Baseline Performance with R-134a**
   Collect system performance data while R-134a refrigerant is in the system. Check for correct refrigerant charge and operating conditions. The baseline data of temperatures and pressures at various points in the system (evaporator, condenser, compressor suction and discharge, evaporator vapor superheat, and condenser liquid subcool) at normal operating conditions will be useful in noting any deficiencies in system operation and when optimizing operation of the system with Opteon™ XP10. A System Data Sheet is included at the back of this bulletin to record baseline data.
2. **Check Lubricant**
   For most systems operating on R-134a, the POE lubricant currently in the system should be suitable for use with Opteon™ XP10. If there are questions about the lubricant, or tests indicate it is contaminated or has a high acid number, then the lubricant should be changed. Consult with the compressor manufacturer for specific recommendations on viscosity or brand of lubricant.
3. **Remove the R-134a Charge into Recovery Cylinders**
   Remove the entire R-134a refrigerant from the system into a recovery cylinder(s). Weigh the amount removed to use as a guide for the quantity of Opteon™ XP10 to be charged to the system.
4. **Replace Filter Drier**
   It is routine practice to replace the filter drier during system maintenance.
5. **Perform Other System Modifications**
   Perform any system modifications or upgrades as needed for the system.
6. **Evacuate System and Check for Leaks**
   To remove air or other non-condensable gases and any residual moisture from the system, evacuate the system to full vacuum (<1000 microns [<29.88 in Hg vacuum] [<1.33 mbar]). If the system is not able to hold vacuum, it may be an indication of a leak. After vacuum test, pressurize the system with dry nitrogen, taking care not to exceed the system design maximum pressure, and check for leaks. Do not use mixtures of refrigerant and air to check for leaks, as these mixtures can become combustible. After leak checking, remove residual nitrogen with a vacuum pump.

7. Charge System with Opteon™ XP10

Opteon™ XP10 is a blend, so it is important to remove liquid only from the charging cylinder. (If the cylinder does not have a valve with a dip tube, invert the cylinder so that the valve is underneath the cylinder.) The proper cylinder position is often indicated by arrows on the cylinder and the cylinder box. Once liquid is removed from the cylinder, the refrigerant can be allowed to enter the refrigeration system as liquid or vapor as desired.

WARNING: Do not charge liquid refrigerant into the suction line. This can cause irreversible damage to the compressor. Use the manifold gauges or a throttling valve to flash the liquid refrigerant to a vapor prior to entering the suction line.

In general, refrigeration systems will require a similar to slightly smaller charge size of Opteon™ XP10 than the original R-134a charge. The optimum charge will vary depending on the system design and operating conditions. The initial charge should be approximately 85% of the standard charge size for R-134a. After startup and adjustment, the final charge amount will be approximately 97% of the R-134a charge.

8. Start Up System and Check Operation

- Monitor and adjust TXV and/or charge size to achieve optimum superheat/subcooling.
- Monitor oil levels in compressor. Add oil as required to maintain proper levels.

9. Label System with New Refrigerant and Lubricant

Appendix I. Opteon™ XP10 Pressure-Temperature Data (Eng)

P	Sat Liq T	Sat Vap T	P	Sat Liq T	Sat Vap T	P	Sat Liq T	Sat Vap T
psig	°F	°F	psig	°F	°F	psig	°F	°F
-2.5	-27.8	-27.5	66	62.2	62.2	190	124.0	124.0
-1.2	-24.1	-23.8	68	63.7	63.7	195	125.8	125.8
0	-20.6	-20.4	70	65.1	65.1	200	127.6	127.6
1	-17.9	-17.8	72	66.5	66.5	205	129.3	129.3
2	-15.4	-15.2	74	67.9	67.9	210	131.0	131.0
3	-13.0	-12.8	76	69.2	69.2	215	132.7	132.7
4	-10.7	-10.6	78	70.5	70.5	220	134.3	134.4
5	-8.5	-8.4	80	71.8	71.8	225	136.0	136.0
6	-6.4	-6.2	82	73.1	73.1	230	137.6	137.6
7	-4.4	-4.2	84	74.4	74.4	235	139.1	139.2
8	-2.4	-2.3	86	75.6	75.6	240	140.7	140.7
9	-0.5	-0.4	88	76.9	76.9	245	142.2	142.2
10	1.4	1.5	90	78.1	78.1	250	143.7	143.8
11	3.1	3.3	92	79.3	79.3	255	145.2	145.2
12	4.9	5.0	94	80.5	80.5	260	146.7	146.7
13	6.6	6.7	96	81.6	81.6	265	148.1	148.2
14	8.2	8.3	98	82.8	82.8	270	149.5	149.6
15	9.8	9.9	100	83.9	83.9	275	150.9	151.0
16	11.3	11.4	102	85.0	85.0	280	152.3	152.4
17	12.8	12.9	104	86.1	86.1	285	153.7	153.7
18	14.3	14.4	106	87.2	87.2	290	155.1	155.1
19	15.8	15.8	108	88.3	88.3	295	156.4	156.4
20	17.2	17.2	110	89.3	89.3	300	157.7	157.8
21	18.5	18.6	112	90.4	90.4	305	159.0	159.1
22	19.9	19.9	114	91.4	91.4	310	160.3	160.3
23	21.2	21.3	116	92.4	92.4	315	161.6	161.6
24	22.5	22.6	118	93.4	93.4	320	162.8	162.9
25	23.8	23.8	120	94.4	94.4	325	164.1	164.1
26	25.0	25.1	122	95.4	95.4	330	165.3	165.4
27	26.2	26.3	124	96.4	96.4	335	166.5	166.6
28	27.4	27.5	126	97.4	97.4	340	167.7	167.8
29	28.6	28.6	128	98.3	98.3	345	168.9	169.0
30	29.8	29.8	130	99.3	99.3	350	170.1	170.1
32	32.0	32.0	132	100.2	100.2	355	171.3	171.3
34	34.2	34.2	134	101.1	101.1	360	172.4	172.5
36	36.3	36.3	136	102.1	102.1	365	173.5	173.6
38	38.3	38.4	138	103.0	103.0	370	174.7	174.7
40	40.3	40.4	140	103.9	103.9	375	175.8	175.8
42	42.3	42.3	142	104.8	104.8	380	176.9	176.9
44	44.2	44.2	144	105.6	105.7	385	178.0	178.0
46	46.0	46.0	146	106.5	106.5	390	179.1	179.1
48	47.8	47.8	148	107.4	107.4	395	180.1	180.2
50	49.5	49.6	150	108.2	108.3	400	181.2	181.2
52	51.2	51.3	155	110.4	110.4	410	183.3	183.3
54	52.9	52.9	160	112.4	112.4	420	185.3	185.4
56	54.5	54.6	165	114.5	114.5	430	187.4	187.4
58	56.1	56.2	170	116.4	116.4	440	189.3	189.4
60	57.7	57.7	175	118.4	118.4	450	191.3	191.3
62	59.2	59.3	180	120.3	120.3	460	193.2	193.2
64	60.7	60.8	185	122.1	122.2	470	195.0	195.1

Opteon™ XP10 Temperature-Pressure Data (Eng)

Temp	Sat Liq P	Sat Vap P	Temp	Sat Liq P	Sat Vap P	Temp	Sat Liq P	Sat Vap P
°F	psig	psig	°F	psig	psig	°F	psig	psig
-40	-5.9	-6.0	24	25.2	25.1	89	109.4	109.4
-39	-5.6	-5.7	25	26.0	26.0	90	111.3	111.3
-38	-5.4	-5.5	26	26.8	26.8	91	113.2	113.2
-37	-5.1	-5.2	27	27.6	27.6	92	115.2	115.2
-36	-4.9	-4.9	28	28.5	28.4	93	117.1	117.1
-35	-4.6	-4.7	29	29.3	29.3	94	119.1	119.1
-34	-4.3	-4.4	30	30.2	30.2	95	121.1	121.1
-33	-4.0	-4.1	31	31.1	31.1	96	123.2	123.2
-32	-3.7	-3.8	32	32.0	32.0	97	125.2	125.2
-31	-3.4	-3.5	33	32.9	32.9	98	127.3	127.3
-30	-3.1	-3.2	34	33.8	33.8	99	129.4	129.4
-29	-2.8	-2.9	35	34.8	34.7	100	131.5	131.5
-28	-2.5	-2.6	36	35.7	35.7	101	133.7	133.7
-27	-2.2	-2.3	37	36.7	36.6	102	135.9	135.9
-26	-1.9	-2.0	38	37.7	37.6	103	138.1	138.1
-25	-1.5	-1.6	39	38.6	38.6	104	140.3	140.3
-24	-1.2	-1.3	40	39.7	39.6	105	142.5	142.5
-23	-0.9	-0.9	41	40.7	40.7	106	144.8	144.8
-22	-0.5	-0.6	42	41.7	41.7	107	147.1	147.1
-21	-0.1	-0.2	43	42.8	42.7	108	149.4	149.4
-20	0.2	0.1	44	43.8	43.8	109	151.8	151.8
-19	0.6	0.5	45	44.9	44.9	110	154.1	154.1
-18	1.0	0.9	46	46.0	46.0	111	156.5	156.5
-17	1.4	1.3	47	47.1	47.1	112	159.0	158.9
-16	1.8	1.7	48	48.2	48.2	113	161.4	161.4
-15	2.2	2.1	49	49.4	49.4	114	163.9	163.8
-14	2.6	2.5	50	50.5	50.5	115	166.4	166.3
-13	3.0	2.9	51	51.7	51.7	116	168.9	168.9
-12	3.4	3.4	52	52.9	52.9	117	171.4	171.4
-11	3.9	3.8	53	54.1	54.1	118	174.0	174.0
-10	4.3	4.3	54	55.3	55.3	119	176.6	176.6
-9	4.8	4.7	55	56.6	56.5	120	179.3	179.2
-8	5.2	5.2	56	57.8	57.8	121	181.9	181.9
-7	5.7	5.6	57	59.1	59.1	122	184.6	184.6
-6	6.2	6.1	58	60.4	60.4	123	187.3	187.3
-5	6.7	6.6	59	61.7	61.7	124	190.0	190.0
-4	7.2	7.1	60	63.0	63.0	125	192.8	192.8
-3	7.7	7.6	61	64.3	64.3	126	195.6	195.6
-2	8.2	8.1	62	65.7	65.7	127	198.4	198.4
-1	8.7	8.7	63	67.1	67.1	128	201.3	201.2
0	9.3	9.2	64	68.5	68.5	129	204.2	204.1
1	9.8	9.7	65	69.9	69.9	130	207.1	207.0
2	10.4	10.3	66	71.3	71.3	131	210.0	209.9
3	10.9	10.9	67	72.7	72.7	132	213.0	212.9
4	11.5	11.4	68	74.2	74.2	133	216.0	215.9
5	12.1	12.0	69	75.7	75.7	134	219.0	218.9
6	12.7	12.6	70	77.2	77.2	135	222.1	222.0
7	13.3	13.2	71	78.7	78.7	136	225.1	225.1
8	13.9	13.8	72	80.2	80.2	137	228.3	228.2
9	14.5	14.4	73	81.8	81.8	138	231.4	231.3
10	15.1	15.1	74	83.4	83.4	139	234.6	234.5
11	15.8	15.7	75	85.0	85.0	140	237.8	237.7
12	16.4	16.4	76	86.6	86.6	141	241.0	240.9
13	17.1	17.1	77	88.2	88.2	142	244.3	244.2
14	17.8	17.7	78	89.9	89.9	143	247.6	247.5
15	18.5	18.4	79	91.5	91.5	144	250.9	250.8
16	19.2	19.1	80	93.2	93.2	145	254.3	254.2
17	19.9	19.8	81	94.9	94.9	146	257.7	257.6
18	20.6	20.6	82	96.7	96.7	147	261.1	261.0
19	21.3	21.3	83	98.4	98.4	148	264.6	264.5
20	22.1	22.0	84	100.2	100.2	149	268.1	268.0
21	22.8	22.8	85	102.0	102.0	150	271.6	271.5
22	23.6	23.6	86	103.8	103.8			
23	24.4	24.4	87	105.7	105.7			
24	25.2	25.1	88	107.5	107.5			

System Data Sheet

Type of System/Location: _____

Equipment Mfg.: _____ Compressor Mfg.: _____

Model No.: _____ Model No.: _____

Serial No.: _____ Serial No.: _____

Date of Manufacture: _____ Date of Manufacture: _____

Original Charge Size: _____ Lubricant Type: _____

Lubricant Charge Size: _____ Drier Mfg.: _____

Drier Type: _____ Condenser Cooling Medium: _____

Expansion Device (check one):

☐ Capillary Tube: _____ ☐ Expansion Valve: _____

If Expansion Valve:

Manufacturer: _____ Model No.: _____

Control/Set Point: _____ Location of Sensor: _____

Other System Controls (e.g., head pressure control): _____

_____

Date/Time				
Refrigerant				
Charge Size (lb)				
Ambient Temperature (°F)				
Compressor				
Suction Temperature (°F)				
Suction Pressure (psig)				
Discharge Temperature (°F)				
Discharge Pressure (psig)				
Evaporator				
Coil Air/H_2O In T (°F)				
Coil Air/H_2O Out T (°F)				
Operating Service Temperature (°F)				
Condenser				
Coil Air/H_2O In T (°F)				
Coil Air/H_2O Out T (°F)				
Superheat and Subcool (derived values)				
Refrigerant T at Superheat Ctl. Pt. (°F)				
Calculated Superheat (°R)				
Expansion Device Inlet T (°F)				
Calculated Subcool (°R)				
Motor Amps (if rack: total)				

Checklist for Opteon™ XP10 Retrofit

- ☐ Establish baseline performance while operating on R-134a (see data sheet for recommended data)
- ☐ Consult the original equipment manufacturer of the system components for their recommendation on the following:
  - Plastics compatibility
  - Elastomeric compatibility
  - Lubricant (viscosity, manufacturer, additives)
  - Thermal expansion device sizing
  - Retrofit procedures to sustain warranty, if applicable
- ☐ Check quality of existing POE oil, and change if necessary
- ☐ Complete system modifications (TXV, line sizing, etc.) based on engineering analysis
- ☐ Replace filter drier with new drier approved for use with retrofit refrigerant
- ☐ Reconnect system, and evacuate with vacuum pump to full vacuum
  (<1000 microns [<29.88 in Hg vacuum] [<1.33 mbar])
- ☐ Leak check system (re-evacuate system following leak check)
- ☐ Charge system with Opteon™ XP10 (R-513A) refrigerant
  - Initially charge ~85% by weight of original equipment manufacturer specified R-134a charge
  - Amount of refrigerant charged: _____
- ☐ Start up equipment, and adjust charge until desired operating conditions are achieved
  - If low in charge, add in increments of 2–3% by weight
  - Amount of refrigerant charged: _____
  - Total refrigerant charged: _____
- ☐ Label components and system for type of refrigerant and lubricant
- ☐ Conversion is complete!

For more information on the Opteon™ family of refrigerants , or other Chemours refrigerants products, visit opteon.com, call (800) 235-7882, or follow us on Twitter@RefrigChemours.

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