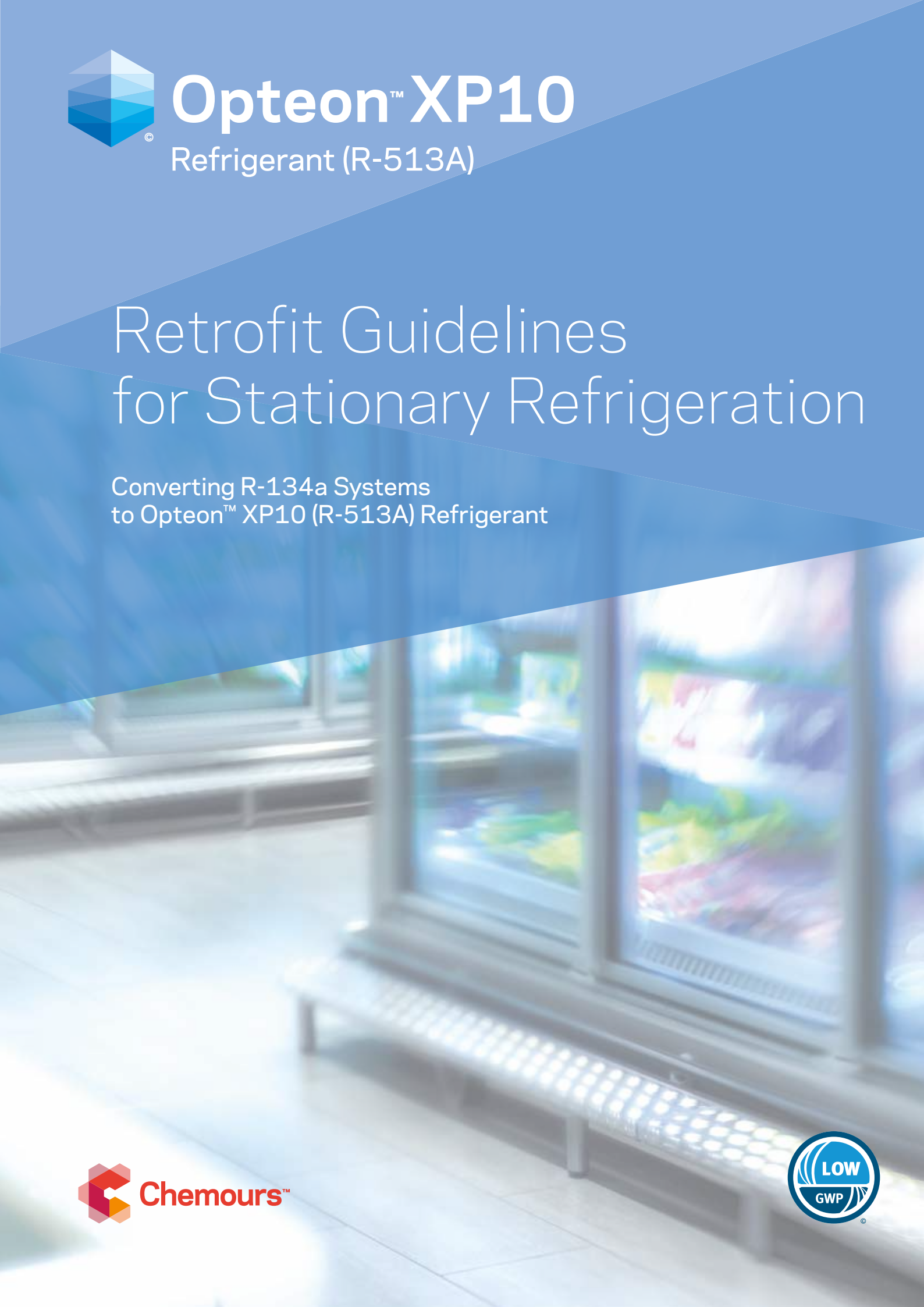
# Opteon™ XP10

Refrigerant (R-513A)

# Retrofit Guidelines for Stationary Refrigeration

## Converting R-134a Systems to Opteon™ XP10 (R-513A) Refrigerant



Chemours™

LOW GWP

# Opteon™ XP10

## Refrigerant (R-513A)

LOW GWP

BETTER PERFORMANCE
FOR YOUR BUSINESS.
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## Introduction

R-134a was developed as a non-ozone depleting hydroflurocarbon (HFC) refrigerant to replace R-12 in medium temperature refrigeration applications and has been in used many types of equipment since the 1990's. Due to existing and potential legislation and regulation related to the direct Global Warming Potential (GWP) of refrigerants, there is increased interest by equipment owners in using lower GWP refrigerant options in order to reduce these systems' total carbon footprint.

Opteon™ XP10 is a reduced 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 ASHRAE designation 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 an AR4 Global Warming Potential (GWP) of 631* (vs. 1430 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 detection torches, or brazing torches) can release large quantities of acidic compounds in the presence of all fluorocarbon refrigerants, and these compounds can be hazardous. 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

*GWP Value given is in accordance the IPCC Fourth Assessment Report (AR4) which is valid for the EU 517/2014 (F-Gas) Regulation. These values have been superseded by the IPCC Fifth Assessment Report (AR5) which gives GWP values of R-134a = 1300 & Opteon™ XP10 = 573.

Table 1: Comparison of performance data

| Expected Performance at $T_{Condenser}$ = 40 °C, $T_{Evaporator}$ = -10 °C, Liquid Subcool = 4 K, Return Gas = 10 °C, Compressor Isentropic Efficiency = 70% | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Evap (kPa) | Cond (kPa) | Disch T (°C) | Avg Glide (K) | Cap ($kJ/m^3$) | Cap Rel to R-134a | COP | COP Rel to R-134a | Mass Flow Rel to R-134a |
| R-134a | 201 | 1,017 | 81 | 0.0 | 1,457 | 100% | 2.986 | 100% | 100% |
| Opteon™ XP10 | 223 | 1,070 | 74 | 0.0 | 1,520 | 104% | 2.944 | 99% | 119% |

indication of very high refrigerant concentrations, and continuing to work without adequate ventilation may result in injury or death.

***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. Chemours Safety Bulletin AS-1 also gives additional information for safe handling of refrigerants.

## Flammability

Opteon™ XP10 is non-flammable 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 for R-134a and Opteon™ XP10 for a number of key performance factors. 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 as to that when using R-134a.

Compressor suction and discharge pressures for Opteon™ XP10 will differ slightly from R-134a and it may be necessary to adjust 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 to R-134a, and should be within the usable range of a properly sized and installed R-134a expansion device and should not require replacement. 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 (sat 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 assure 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 pressure regulators 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 sub cooling.

### 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 sub cool) 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 < 1.32 mbar (EN378). 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.) Once liquid is removed from the cylinder, the refrigerant can be allowed to enter the refrigeration system as liquid or vapor as desired.

   *IMPORTANT: 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. Startup System and Check Operation
   - Monitor and adjust TXV and/or charge size to achieve optimum superheat/sub cooling.
   - Monitor oil levels in compressor. Add oil as required to maintain proper levels.

9. Label System with New Refrigerant and Lubricant

# Checklist for Opteon™ XP10 Retrofit

☐ 1. Establish baseline performance while operating on R-134a. (See data sheet for recommended data.)

☐ 2. 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

☐ 3. Check quality of existing POE oil and change if necessary

☐ 4. Complete system modifications (TXV, line sizing, etc.) based on engineering analysis

☐ 5. Replace filter drier with new drier approved for use with retrofit refrigerant

☐ 6. Reconnect system and evacuate with vacuum pump

(Evacuate to full vacuum [132 Pa (1.32 mbar) per EN 378-4:2013]).

☐ 7. Leak check system. (Re-evacuate system following leak check.)

☐ 8. 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: _____

☐ 9. 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: _____

☐ 10. Label components and system for type of refrigerant and lubricant

☐ 11. Conversion is complete!

# 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:_____ Manufacturer:

Model No.:

Control/Set Point:

Location of Sensor:

Other System Controls (ex.: head press control): _____

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| | | | | |
|---|---|---|---|---|
| Date/Time | | | | |
| Refrigerant | | | | |
| Charge Size (kg) | | | | |
| Ambient Temp. (°C) | | | | |
| **Compressor** | | | | |
| Suction T (°C) | | | | |
| Suction P (MPa/bar) | | | | |
| Discharge T (°C) | | | | |
| Discharge P (MPa/bar) | | | | |
| **Evaporator** | | | | |
| Coil Air/$H_2O$ In T (°C) | | | | |
| Coil Air/$H_2O$ Out T (°C) | | | | |
| Operating Service Temperature (°C) | | | | |
| **Condenser** | | | | |
| Coil Air/$H_2O$ In T (°C) | | | | |
| Coil Air/$H_2O$ Out T (°C) | | | | |
| **Superheat and Subcool (derived values)** | | | | |
| Refrigerant T at Superheat Ctl. Pt (°C) | | | | |
| Calculated Superheat (K) | | | | |
| Exp. Device Inlet T (°C) | | | | |
| Calculated sub-cool (K) | | | | |
| **Motor Amps (if rack: total)** | | | | |

Appendix I.

# Opteon™ XP10 Temperature-Pressure Data (SI)

| Temp °C | Sat Liq P kPa | Sat Vap P kPa |
|---|---|---|
| -20 | 150.81 | 150.34 |
| -19 | 157.14 | 156.68 |
| -18 | 163.68 | 163.23 |
| -17 | 170.43 | 169.98 |
| -16 | 177.39 | 176.96 |
| -15 | 184.58 | 184.15 |
| -14 | 191.99 | 191.57 |
| -13 | 199.62 | 199.22 |
| -12 | 207.49 | 207.10 |
| -11 | 215.60 | 215.22 |
| -10 | 223.95 | 223.58 |
| -9 | 232.55 | 232.19 |
| -8 | 241.41 | 241.06 |
| -7 | 250.52 | 250.18 |
| -6 | 259.89 | 259.57 |
| -5 | 269.53 | 269.22 |
| -4 | 279.44 | 279.14 |
| -3 | 289.63 | 289.35 |
| -2 | 300.11 | 299.84 |
| -1 | 310.87 | 310.61 |
| 0 | 321.93 | 321.68 |
| 1 | 333.28 | 333.05 |
| 2 | 344.94 | 344.72 |
| 3 | 356.90 | 356.70 |
| 4 | 369.18 | 368.99 |
| 5 | 381.79 | 381.60 |
| 6 | 394.71 | 394.54 |
| 7 | 407.97 | 407.81 |
| 8 | 421.56 | 421.42 |
| 9 | 435.49 | 435.36 |
| 10 | 449.77 | 449.65 |
| 11 | 464.41 | 464.30 |
| 12 | 479.40 | 479.30 |
| 13 | 494.75 | 494.67 |
| 14 | 510.48 | 510.40 |
| 15 | 526.58 | 526.51 |
| 16 | 543.06 | 543.00 |
| 17 | 559.93 | 559.88 |
| 18 | 577.19 | 577.15 |
| 19 | 594.85 | 594.82 |
| 20 | 612.92 | 612.89 |
| 21 | 631.39 | 631.37 |
| 22 | 650.28 | 650.27 |
| 23 | 669.59 | 669.58 |
| 24 | 689.34 | 689.33 |
| 25 | 709.51 | 709.51 |
| 26 | 730.13 | 730.13 |
| 27 | 751.20 | 751.20 |
| 28 | 772.71 | 772.71 |
| 29 | 794.69 | 794.69 |
| 30 | 817.13 | 817.13 |
| 31 | 840.05 | 840.04 |
| 32 | 863.44 | 863.43 |
| 33 | 887.32 | 887.31 |
| 34 | 911.70 | 911.67 |
| 35 | 936.6 | 936.54 |
| 36 | 961.9 | 961.90 |
| 37 | 987.8 | 987.78 |
| 38 | 1014.2 | 1014.20 |
| 39 | 1041.2 | 1041.1 |
| 40 | 1068.6 | 1068.5 |
| 41 | 1096.6 | 1096.5 |
| 42 | 1125.2 | 1125.1 |
| 43 | 1154.3 | 1154.1 |
| 44 | 1183.9 | 1183.8 |
| 45 | 1214.2 | 1214.0 |
| 46 | 1245.0 | 1244.8 |
| 47 | 1276.3 | 1276.1 |
| 48 | 1308.3 | 1308.1 |
| 49 | 1340.9 | 1340.6 |
| 50 | 1374.1 | 1373.8 |
| 51 | 1407.9 | 1407.5 |
| 52 | 1442.3 | 1441.9 |
| 53 | 1477.3 | 1476.9 |
| 54 | 1513.0 | 1512.6 |
| 55 | 1549.3 | 1548.8 |
| 56 | 1586.3 | 1585.8 |
| 57 | 1623.9 | 1623.4 |
| 58 | 1662.2 | 1661.6 |
| 59 | 1701.2 | 1700.6 |
| 60 | 1740.8 | 1740.2 |
| 61 | 1781.2 | 1780.5 |
| 62 | 1822.2 | 1821.5 |
| 63 | 1864.0 | 1863.3 |
| 64 | 1906.5 | 1905.7 |
| 65 | 1949.7 | 1948.9 |
| 66 | 1993.7 | 1992.8 |
| 67 | 2038.4 | 2037.5 |
| 68 | 2083.9 | 2083.0 |
| 69 | 2130.2 | 2129.2 |
| 70 | 2177.2 | 2176.2 |
| 71 | 2225.1 | 2224.0 |
| 72 | 2273.7 | 2272.6 |
| 73 | 2323.2 | 2322.0 |
| 74 | 2373.5 | 2372.3 |
| 75 | 2424.6 | 2423.4 |
| 76 | 2476.6 | 2475.3 |
| 77 | 2529.5 | 2528.1 |
| 78 | 2583.2 | 2581.8 |
| 79 | 2637.9 | 2636.4 |
| 80 | 2693.4 | 2692.0 |
| 81 | 2749.9 | 2748.4 |
| 82 | 2807.3 | 2805.8 |
| 83 | 2865.8 | 2864.2 |
| 84 | 2925.1 | 2923.6 |

# Opteon™ XP10 Pressure-Temperature Data

| P bar (g) | Sat Lip T °C | Sat Vap T °C |
|---|---|---|
| 0.0 | -29.5 | -29.4 |
| 0.2 | -25.4 | -25.3 |
| 0.4 | -21.8 | -21.7 |
| 0.6 | -18.6 | -18.5 |
| 0.8 | -15.6 | -15.6 |
| 1.0 | -13.0 | -12.9 |
| 1.2 | -10.5 | -10.4 |
| 1.4 | -8.2 | -8.1 |
| 1.6 | -6.0 | -6.0 |
| 1.8 | -3.9 | -3.9 |
| 2.0 | -2.0 | -2.0 |
| 2.2 | -0.2 | -0.1 |
| 2.4 | 1.6 | 1.6 |
| 2.6 | 3.3 | 3.3 |
| 2.8 | 4.9 | 4.9 |
| 3.0 | 6.4 | 6.4 |
| 3.2 | 7.9 | 7.9 |
| 3.4 | 9.3 | 9.3 |
| 3.6 | 10.7 | 10.7 |
| 3.8 | 12.0 | 12.0 |
| 4.0 | 13.3 | 13.3 |
| 4.2 | 14.6 | 14.6 |
| 4.4 | 15.8 | 15.8 |
| 4.6 | 17.0 | 17.0 |
| 4.8 | 18.2 | 18.2 |
| 5.0 | 19.3 | 19.3 |
| 5.2 | 20.4 | 20.4 |
| 5.4 | 21.5 | 21.5 |
| 5.6 | 22.5 | 22.5 |
| 5.8 | 23.5 | 23.5 |
| 6.0 | 24.5 | 24.5 |
| 6.2 | 25.5 | 25.5 |
| 6.4 | 26.5 | 26.5 |
| 6.6 | 27.4 | 27.4 |
| 6.8 | 28.3 | 28.3 |
| 7.0 | 29.2 | 29.2 |
| 7.2 | 30.1 | 30.1 |
| 7.4 | 31.0 | 31.0 |
| 7.6 | 31.9 | 31.9 |
| 7.8 | 32.7 | 32.7 |
| 8.0 | 33.5 | 33.5 |
| 8.2 | 34.3 | 34.3 |
| 8.4 | 35.1 | 35.1 |
| 8.6 | 35.9 | 35.9 |
| 8.8 | 36.7 | 36.7 |
| 9.0 | 37.5 | 37.5 |
| 9.2 | 38.2 | 38.2 |
| 9.4 | 39.0 | 39.0 |
| 9.6 | 39.7 | 39.7 |
| 9.8 | 40.4 | 40.4 |
| 10.0 | 41.1 | 41.1 |
| 10.2 | 41.8 | 41.8 |
| 10.4 | 42.5 | 42.5 |
| 10.6 | 43.2 | 43.2 |
| 10.8 | 43.9 | 43.9 |
| 11.0 | 44.5 | 44.5 |
| 11.2 | 45.2 | 45.2 |
| 11.4 | 45.8 | 45.8 |
| 11.6 | 46.5 | 46.5 |
| 11.8 | 47.1 | 47.1 |
| 12.0 | 47.7 | 47.7 |
| 12.2 | 48.4 | 48.4 |
| 12.4 | 49.0 | 49.0 |
| 12.6 | 49.6 | 49.6 |
| 12.8 | 50.2 | 50.2 |
| 13.0 | 50.8 | 50.8 |
| 13.2 | 51.4 | 51.4 |
| 13.4 | 51.9 | 51.9 |
| 13.6 | 52.5 | 52.5 |
| 13.8 | 53.1 | 53.1 |
| 14.0 | 53.6 | 53.7 |
| 14.2 | 54.2 | 54.2 |
| 14.4 | 54.7 | 54.8 |
| 14.6 | 55.3 | 55.3 |
| 14.8 | 55.8 | 55.8 |
| 15.0 | 56.4 | 56.4 |
| 15.2 | 56.9 | 56.9 |
| 15.4 | 57.4 | 57.4 |
| 15.6 | 57.9 | 58.0 |
| 15.8 | 58.5 | 58.5 |
| 16.0 | 59.0 | 59.0 |
| 16.2 | 59.5 | 59.5 |
| 16.4 | 60.0 | 60.0 |
| 16.6 | 60.5 | 60.5 |
| 16.8 | 61.0 | 61.0 |
| 17.0 | 61.5 | 61.5 |
| 17.2 | 61.9 | 62.0 |
| 17.4 | 62.4 | 62.4 |
| 17.6 | 62.9 | 62.9 |
| 17.8 | 63.4 | 63.4 |
| 18.0 | 63.8 | 63.9 |
| 18.2 | 64.3 | 64.3 |
| 18.4 | 64.8 | 64.8 |
| 18.6 | 65.2 | 65.3 |
| 18.8 | 65.7 | 65.7 |
| 19.0 | 66.1 | 66.2 |
| 19.2 | 66.6 | 66.6 |
| 19.4 | 67.0 | 67.1 |
| 19.6 | 67.5 | 67.5 |
| 19.8 | 67.9 | 67.9 |
| 20.0 | 68.3 | 68.4 |
| 20.2 | 68.8 | 68.8 |
| 20.4 | 69.2 | 69.2 |
| 20.6 | 69.6 | 69.7 |
| 20.8 | 70.1 | 70.1 |
| 21.0 | 70.5 | 70.5 |
| 21.2 | 70.9 | 70.9 |
| 21.4 | 71.3 | 71.3 |
| 21.6 | 71.7 | 71.7 |
| 21.8 | 72.1 | 72.2 |
| 22.0 | 72.5 | 72.6 |
| 22.2 | 72.9 | 73.0 |
| 22.4 | 73.3 | 73.4 |
| 22.6 | 73.7 | 73.8 |
| 22.8 | 74.1 | 74.2 |
| 23.0 | 74.5 | 74.5 |
| 23.2 | 74.9 | 74.9 |
| 23.4 | 75.3 | 75.3 |
| 23.6 | 75.7 | 75.7 |
| 23.8 | 76.1 | 76.1 |
| 24.0 | 76.4 | 76.5 |
| 24.2 | 76.8 | 76.8 |
| 24.4 | 77.2 | 77.2 |
| 24.6 | 77.6 | 77.6 |
| 24.8 | 77.9 | 78.0 |
| 25.0 | 78.3 | 78.3 |
| 25.2 | 78.7 | 78.7 |
| 25.4 | 79.0 | 79.1 |
| 25.6 | 79.4 | 79.4 |
| 25.8 | 79.8 | 79.8 |
| 26.0 | 80.1 | 80.1 |
| 26.2 | 80.5 | 80.5 |
| 26.4 | 80.8 | 80.9 |
| 26.6 | 81.2 | 81.2 |
| 26.8 | 81.5 | 81.6 |
| 27.0 | 81.9 | 81.9 |
| 27.2 | 82.2 | 82.2 |
| 27.4 | 82.6 | 82.6 |
| 27.6 | 82.9 | 82.9 |
| 27.8 | 83.2 | 83.3 |
| 28.0 | 83.6 | 83.6 |
| 28.2 | 83.9 | 83.9 |
| 28.4 | 84.2 | 84.3 |
| 28.6 | 84.6 | 84.6 |

For more information on the Opteon™ family of refrigerants or other Chemours Refrigerants products vist **opteon.com**