DuPont™ ISCEON® 9 Series

REFRIGERANTS

Technical Information
ART-44

Retrofit Guidelines for DuPont™ ISCEON® 9 Series Refrigerants

DuPont™ ISCEON® MO59 (R-417A)
DuPont™ ISCEON® MO79 (R-422A)

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Retrofit Guidelines for DuPont™ ISCEON® 9 Series Refrigerants

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Introduction

DuPont™ ISCEON® 9 Series refrigerants have proven to be easy-to-use, reliable, and cost-effective non-ozone-depleting retrofit refrigerants. In many cases, systems retrofitted with these refrigerants are operating with the same mineral oil or alkylbenzene lubricant that was used with the previous CFC or HCFC refrigerant, and have been shown to provide similar system performance (as when operating with the previous refrigerant). Using these retrofit guidelines stationary air conditioning and refrigeration systems containing R-22, R-502 or HCFC-containing blends can be easily and economically retrofitted to the appropriate ISCEON® 9 Series retrofit refrigerant. This allows existing equipment to continue operating safely and effectively for the remainder of its useful life.

Retrofit Choice for R-22 Air-Conditioning and Medium-Temperature Refrigeration Systems

ISCEON® MO59 is an easy-to-use, non-ozone-depleting HFC retrofit refrigerant for R-22 in direct expansion stationary air conditioning (AC) and medium-temperature commercial refrigeration systems. **ISCEON® MO59 is compatible with traditional and new lubricants; in most cases no change of lubricant type during retrofit is required.**

Oil return is determined by a number of operating and design conditions - in some systems with complex piping configurations, POE may need to be added. Minor equipment modifications (e.g., seal replacement) or expansion device adjustments may be required in some applications.

Broad field experience has shown that ISCEON® MO59 provides performance that meets customer requirements in most properly retrofitted systems. ISCEON® MO59 provides required cooling capacity in most systems, however, some systems may experience reduced capacity. ISCEON® MO59 has been shown to offer energy savings in some systems. Actual performance depends on system design and operating conditions.

Retrofit Choice for Low and Medium Temperature Refrigeration Systems Containing R-22, R-502 or HCFC-containing Blend Refrigerants.

ISCEON® MO79 is an easy-to-use, non-ozone-depleting HFC refrigerant for replacing R-22, R-502, and HCFC-containing refrigerant blends in medium and low-temperature commercial and industrial direct expansion refrigeration systems. **ISCEON® MO79 is compatible with traditional and new lubricants, in most cases no change of lubricant type during retrofit is required.** ISCEON® MO79 is an easier retrofit option than R-404A.

ISCEON® MO79 provides improved cooling capacity and energy efficiency over R-22 in many systems, especially at low temperature conditions. It also provides comparable cooling capacity and energy efficiency to R-404A. Actual performance depends on a number of system design and operating conditions. ISCEON® MO79 operates at significantly lower discharge temperatures vs. R-22.

ISCEON® MO79 is compatible with traditional and new lubricants – mineral oil, alkylbenzene and polyol ester; in most cases no change of lubricant type during retrofit is needed. Oil return is determined by a number of operating and design conditions – in some systems with complex piping configurations, POE may need to be added. Minor equipment modifications (e.g., seal replacement) or expansion device adjustments or replacements may be required in some applications.

ISCEON® MO59 and MO79 can be topped off during service without removing the entire refrigerant charge. Note: When servicing critically charged AC systems, all of the refrigerant charge should be removed. This is the same practice recommended for HCFC-22.

Easy Steps to Retrofit

The following provides a summary of the basic retrofit steps for ISCEON® MO59 and MO79.

Select the Retrofit Checklist from the Appendix for the refrigerant you are replacing.

1. Establish baseline performance with existing refrigerant
2. Remove all refrigerant from the system into a recovery cylinder. Weigh the amount removed.
3. Replace the filter/drier.

   Note: Some systems may require expansion valve adjustments or replacement. Experience shows conversions in older refrigeration systems often require replacement of seals to minimize risk of leaks
4. Evacuate system and check for leaks.
5. Charge with ISCEON® MO59 or MO79.
   - Remove liquid only from charging cylinder.
   - Refer to **Table 5** for typical charge amount.
6. Start up system, adjust TXV and/or charge size to achieve optimum superheat.
7. Monitor oil levels in compressor. Add oil as required to maintain proper levels
8. Label system for the refrigerant and lubricant used.

Retrofit Complete

Important Safety Information

Like CFCs and HCFCs, ISCEON® 9 Series refrigerants are safe to use when handled properly. However, any refrigerant can cause injury or even death when mishandled. Please review the following guidelines before using any refrigerant.

- **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 (eg. Halide detection torches, or brazing torches) can release large quantities of acidic compounds in the presence of all refrigerants, and these compounds can be hazardous. Halide torches are not effective as leak detectors for HFC refrigerants; they detect the presence of Chlorine, which is not present in ISCEON® MO59 and MO79, 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.

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

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

For more detailed information on the properties, uses, storage, and handling of ISCEON® refrigerants, see DuPont Technical Bulletin K-10927 or other literature specific to these products. Refer to the appropriate Material Safety Data Sheet (MSDS) for more safety information about each refrigerant. DuPont Safety Bulletin AS-1 also gives additional information for safe handling of refrigerants.

Flammability

ISCEON® MO59 and MO79 are non-flammable in air under normal conditions. However, mixtures of these products with high concentrations of air or oxygen at elevated pressure and/or temperature can become combustible in the presence of an ignition source. **These products should not be mixed with air to check for leaks.**

Lubricant and Filter Drier Information

Lubricants

Lubricant selection is based on many factors, including compressor wear characteristics, material compatibility, and lubricant/refrigerant solubility (which can affect oil return to the compressor). ISCEON® MO59 and MO79 are compatible with traditional and new lubricants – **in most retrofit situations no change of oil type is required.**

Field experience has shown that ISCEON® MO59 and MO79 will work successfully with the existing mineral oil in most systems. In systems where oil return is a potential concern such as flooded evaporators or in systems where the suction line accumulator acts as a low pressure receiver, replacement of all, or part (~25%) of the compressor oil charge with an OEM approved polyol ester is recommended.

Filter Drier

Change the filter drier during the retrofit. This is a routine system maintenance practice. There are two types of filter driers commonly used, solid core and loose filled. Replace the drier with the same type currently in use in the system. The drier label will show which refrigerants can be used with that drier. Select a drier specified to work with HFC refrigerants. (Many driers sold today are "universal" – they will work with most fluorocarbon refrigerants.) Check with your DuPont Distributor for the correct drier to use in your system.

General Retrofit Information

System Modifications

The compositions of the ISCEON® 9 Series refrigerants have been selected to provide performance comparable to the refrigerants they are replacing in terms of both capacity and energy efficiency. As a result, minimal system modifications are anticipated with retrofitting. The ISCEON® 9 Series refrigerants discussed in this bulletin are near-azeotropes, therefore the vapor composition in the refrigerant cylinder is different from the liquid composition. For this reason, ISCEON® 9 Series refrigerants should be transferred from the container from the liquid phase during system charging (or when transferring from one container to another).

In general, ISCEON® MO59 and MO79 refrigerants are not recommended for use in centrifugal compressor systems or for chillers with flooded evaporators or low pressure receivers.

Retrofits of R-22, R-502 or HCFC-containing blend systems with non-ozone-depleting alternative refrigerants such as R-404A, R-407C, etc. will require multiple oil changes and possibly more extensive modifications to the existing equipment. For some systems, the cost of conversion may be large. ISCEON® MO59 and MO79 provide the service contractor and equipment owner with a cost effective way to retrofit an existing system.

Note: ISCEON® MO59 and MO79 should not be mixed with other refrigerants or additives that have not been clearly specified by DuPont or the system equipment manufacturer. Mixing these refrigerants with CFC or HCFC refrigerants, or mixing two different alternative refrigerants, may have an adverse effect on system performance. "Topping off" a CFC or HCFC refrigerant with any Suva® or ISCEON® 9 Series refrigerant is strictly not recommended.

System Superheat

Desired system performance after a retrofit with DuPont™ ISCEON® MO59 and MO79 requires correct setting of the system superheat. This is discussed in the detailed retrofit procedures given below.

System Oil Management

In many situations, systems retrofitted with ISCEON® MO59 and MO79 have operated routinely using the mineral oil or Alkylbenzene that was used with the original CFC or HCFC refrigerant. With complex systems, in a small number of cases, the oil may not return consistently to the compressor (or compressor rack).

It is important that oil levels in the compressors (or oil management system in the case of compressor racks) be monitored during initial operation with the ISCEON® MO59 and MO79. If the oil level falls below the minimum allowed, top up the oil to the minimum level with the existing oil type. Do not fill to maximum as the level may rise again. Should the oil level fall continuously, or suffer large oscillations during an operating cycle, addition of POE lubricant has proven effective in restoring adequate oil return rates.

POE lubricant should be progressively added to the system. An initial addition of 10% (of the total oil charge) should be made. This should be followed by 5% increments until the oil level returns to normal.

It is important to ensure that, when adding POE oil to the system, the oil level (immediately after addition) is kept below the system mid-point (e.g. mid-sight glass) oil level.

It is also important to keep accurate records of how much oil is added to avoid over-filling.

Refrigerant Recovery Information

Most recovery or recycle equipment used for R-22, R-502 or HCFC-containing blends can be used for ISCEON® MO59 and MO79. Use standard procedures to avoid cross contamination when switching from one refrigerant to another. Most recovery or recycle machines can use the same compressor oil that was used for the CFC or HCFC refrigerant. However, some modifications may be necessary, such as a different kind of drier or a different moisture indicator. Consult the equipment manufacturer for specific recommendations.

In the United States, DuPont will take back (for reclaim) the ISCEON® 9 Series refrigerants discussed in this bulletin. In other regions contact your DuPont refrigerant distributor for details of the refrigerant reclaim program.

Expected Performance After Retrofit

Tables 1 to **6** show approximate system performance changes following a retrofit and are general guidelines for system behavior. These values are based on field experience, calorimeter testing and thermodynamic property data; and assume equal compressor efficiency. Actual performance will vary depending on system design and operating conditions.

Cooling capacity and energy efficiency depend greatly on system design , operating conditions and the actual condition of the equipment. ISCEON® MO59 provides required cooling capacity in most systems, however some systems may experience reduced capacity. ISCEON® MO79 provides improved cooling capacity over R-22 in many systems, especially at lower evaporator temperatures. Both ISCEON® MO59 and MO79 will operate at significantly lower compressor discharge temperatures than R-22.

Table 1
ISCEON® MO59 vs. R-22;
Discharge Temperature: °F (°C)

	At 40°F (4°C) Evaporator Temp.	At 0°F (–18°C) Evaporator Temp.
R-22	204 (96)	*275 (135)
ISCEON® MO59	161 (72)	219 (104)

*Assumes auxiliary cooling to limit compressor discharge temperature

Condensing Temperature = 110°F (43°C)

Table 2
ISCEON® MO59 vs. R-22;
Discharge Pressure: psia (bar)

R-22	257 (1.8)
ISCEON® MO59	236 (1.6)

Condensing Temperature = 110°F (43°C)
Evaporator Temperature = 40°F (4°C)

Table 3
ISCEON® MO59 vs. R-22: Cooling Capacity

ISCEON® MO59	**5–15% lower

** Experience indicates many air-to-air systems typically have 10 – 15% more capacity than required.

Table 4
ISCEON® MO79 vs. R-22 and R-502;
Discharge Temperature: °F (°C)

	At 40°F (4°C) Evaporator Temp.	At 0°F (–18°C) Evaporator Temp.	At –20°F (–29°C) Evaporator Temp.
R-22	204 (96)	*275 (135)	*275 (135)
R-502	169 (76)	233 (112)	270 (132)
ISCEON® MO79	156 (69)	208 (98)	238 (114)

*Assumes auxiliary cooling to limit compressor discharge temperature

Condensing Temperature = 110°F (43°C)

Table 5
ISCEON® MO79 vs. R-22 and R-502;
Discharge Pressure: psia (bar)

R-22	257 (1.8)
R-502	280 (1.9)
ISCEON® MO79	308 (2.1)

Condensing Temperature = 110°F (43°C)
Evaporator Temperature = 40°F (4°C)

Table 6
ISCEON® MO79 and R-502 vs. R-22:
Cooling Capacity

	At 40°F (4°C) Evaporator Temp.	At 0°F (–18°C) Evaporator Temp.	At –20°F (–29°C) Evaporator Temp.
R-502	0–5% lower	5–10% higher	10–15% higher
ISCEON® MO79	0–5% lower	5–10% higher	10–15% higher

Retrofit of R-22 Air- Conditioning and Medium Temperature Refrigeration Systems to ISCEON® MO59; and Medium and Low Temperature Refrigeration Systems Containing R-22, R-502 or HCFC-containing blends to ISCEON® MO79

(Refer to the retrofit checklist at the back of this bulletin)

1. **Establish baseline performance with current refrigerant.** Collect system performance data while the old 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, superheat and subcool, etc.) at normal operating conditions will be useful when optimizing operation of the system with the ISCEON® MO59 or MO79. A System Data Sheet is included at the back of this bulletin to record baseline data.

2. **Remove refrigerant from the system into a recovery cylinder.** The existing charge should be removed from the system and collected in a recovery cylinder using a recovery device capable of pulling 10–15 in Hg vacuum (30–35 kPa). If the recommended charge size for the system is not known, weigh the amount of refrigerant removed. The initial quantity of ISCEON® MO59 or MO79 to charge to the system can be estimated from this amount. (See step 5)

   Ensure that any residual refrigerant dissolved in the compressor oil is removed by holding the system under vacuum. Break the vacuum with dry Nitrogen.

3. **Replace the filter/drier.** It is routine practice to replace the filter/drier during system maintenance. Replacement filter-dryers are available that are compatible with ISCEON® MO59 and MO79. See page 2 of this manual for additional information on dryers. (Replace "O"rings on sight glasses, etc. if needed. Replacement is likely to be needed in old systems.)

3A. **Expansion valve changes when retrofitting from R-22 to ISCEON® MO79.** When converting from R-22 to ISCEON® MO79 it is recommended to change the thermostatic expansion valve to one suitable for use with R-404A. In many cases this will be possible by changing the expansion valve power element but where this is not possible a new valve will need to be installed. It is not necessary to change the expansion valve when retrofitting from R-502 or a low temperature HCFC containing blend e.g. R-402A but adjustment of the superheat setting may be required.

4. Evacuate system and check for leaks. Use normal service practices. To remove air or other noncondensables and any residual moisture from the system, evacuate the system to near full vacuum (29.9 inHg vacuum [500 microns] or less than 10 kPa), isolate the vacuum pump from the system and observe the vacuum reading. If the system does not maintain vacuum it is an indication that there might be a leak.Pressurize the system with nitrogen taking care not to exceed the system design maximum pressure and check for leaks. Do not use mixtures of air and refrigerant under pressure to check for leaks; these mixtures can be combustible.

5. Charge with ISCEON® MO59 or MO79. Remove liquid only from charging cylinder. The proper cylinder position for liquid removal is indicated by arrows on the cylinder and cylinder box. Once liquid is removed from the cylinder, the refrigerant can be charged to the system as liquid or vapor as desired. Use the manifold gauges or a throttling valve to flash the liquid to vapor if required.

WARNING

Do not charge liquid refrigerant into the compressor. This will cause serious irreversible damage.

In general, the refrigeration system will require less weight of the ISCEON® 9 Series refrigerant than of the original CFC or HCFC refrigerant , although some will require slightly more. The optimum charge will vary depending on the system design and operating conditions. See **Table 7** for charge amount recommendations.

Note: These values apply provided no changes to mechanical components of the system (which could significantly affect the system's internal volumetric capacity) will be made during the retrofit.

6. Start up system, adjust charge size. Start the system and let conditions stabilize. If the system is undercharged (as indicated by the level of superheat at the evaporator exit, or by the amount of sub-cool at the condenser exit) add more ISCEON® MO59 or MO79 in small amounts (still by transferring as liquid from the charging cylinder) until the system conditions reach the desired level. See the pressure-temperature charts in this bulletin to compare pressures and temperatures in order to calculate superheat or sub-cooling for the refrigerant you are using.

   Sight glasses in the liquid line can be used in most cases as a guide to system charge, but correct system charge must be determined by measuring system operating conditions (discharge and suction pressures, suction line temperature, compressor motor amps, superheat, etc.). Attempting to charge until the sight glass is "clear" may result in overcharging the refrigerant. Please read "How to Determine Suction Pressure, Superheat and Subcool."

   Ensuring that the correct compressor suction superheat is set is very important for reliable system operation with ISCEON® MO59 or MO79. Experience has shown that superheat (at the compressor inlet) for ISCEON® MO59 and MO79 should be the same as for the refrigerant being replaced.

7. Monitor oil levels. *During initial operation of the system it is very important to monitor the level of oil in the compressor (or compressor oil management system) to verify that oil is returning to the compressor (or compressor rack) in an adequate manner.*

   - If the oil level falls below the minimum allowed level, top up to the minimum level with the existing oil type. Do not fill to the maximum level as the level may rise again.
   - Should the oil return appear to be erratic as evidenced by large swings in oil level during the refrigeration system cycle it is recommended that some of the oil be removed from the system and replaced with POE oil. Replacement of up to 25% of the oil with POE will help maintain oil return. The exact amount of oil to be changed will depend on the system itself (evaporating temperatures, physical geometry, etc.)
   - POE lubricant should be progressively added to the system. An initial addition of 10% (of the total oil charge) should be made. This should be followed by 5% increments until the oil level returns to normal.
   - It is important to ensure that, when adding POE oil to the system, the oil level (immediately after addition) is kept below the system mid-point (e.g. mid-sight glass) oil level.

8. Label the system to clearly and permanently show the refrigerant in the system and any oil(s) present in the system.

Pressure/Temperature Charts

How to Read the Pressure/ Temperature Tables

The following pages contain pressure/temperature charts for the refrigerants discussed in this bulletin.

Three temperatures are shown at a given pressure:

- Saturated Liquid Temperature (Bubble Point)—In the condenser, this is the temperature at which the last bit of vapor has condensed. Below this temperature, the refrigerant will be subcooled liquid. This temperature should also be used when determining the pressure/temperature value of product in a refrigerant cylinder.
- Saturated Vapor Temperature (Dew Point)—In the evaporator, this is the temperature at which the last drop of liquid has just boiled. Above this temperature, the refrigerant will be superheated vapor.
- Average Coil Temperature—The evaporator and condenser will perform like it is operating at this constant temperature. It is an average of the bubble and dew point temperatures determined from either the suction or condenser pressure. Use this average temperature to compare coil temperatures with the refrigerant you are replacing. **Note:** this is an approximation of the average temperature for low glide refrigerants.

How to Determine Suction Pressure, Superheat, and Subcool

Suction Pressure

Determine the expected evaporator temperature using the R-22, R-502 or HCFC blend column (from the baseline data you collected prior to the retrofit). Find the same expected evaporator temperature in the Average Coil Temperature column for ISCEON® MO59 or MO79. Note the corresponding pressure for this temperature. This is the suction pressure at which the system should operate.

Superheat

Using the saturated vapor pressure tables for ISCEON® MO59 or MO79, determine the saturated vapor temperature (dew point) for the measured suction pressure. Measure the suction temperature and subtract the previously determined dew point temperature for ISCEON MO59 or MO79 to give the amount of vapor superheat.

Subcool

Using the saturated liquid pressure tables for ISCEON® MO59 or MO79, determine the saturated liquid temperature (bubble point) for the measured discharge temperature. Measure the refrigerant liquid line temperature and subtract it from the previously determined bubble point temperature for ISCEON® MO59 or MO79 to give the amount of liquid subcool.

Retrofit Checklist for Converting CFC or HCFC Systems to DuPont™ ISCEON® MO59 or MO79

_____ 1. Establish baseline performance with existing refrigerant.

- Use the System Data sheet given below.
- Note the oil type in use and system operating data (if system is operating properly).
- Check for existing leaks and repair.

_____ 2. Remove existing refrigerant charge from system. (Need 10–15 in. Hg [50–67 kPa] vacuum to remove charge.)

- Use recovery cylinder (DO NOT vent to atmosphere).
- Weigh amount removed (if possible): _____.
- Break the vacuum with dry nitrogen.

_____ 3. Replace the filter dryer.

- Check elastomeric seals (O-rings, sight glasses, etc.).
- Evaluate need to change TXV.
- Check that oil is in good condition; replace if necessary.

_____ 4. Evacuate system and check for leaks.

- Does the system hold a vacuum?
- Break vacuum with dry nitrogen, pressurize to below the system design pressure.
- Does the system hold pressure?
- Check for any leaks.

_____ 5. Charge system with ISCEON® 9 Series refrigerant.

- Remove *liquid only* from cylinder.
- Initial charge:
  - ISCEON® MO59 - See **Table 5**
  - ISCEON® MO79 - See **Table 5**
- Note amount of refrigerant charged_____.

_____ 6. Adjust TXV and/or refrigerant charge to achieve the same superheat as the original system.

_____ 7. Monitor oil levels in compressor. If necessary add original oil to attain normal operating level (mid-sight glass).

- If a sudden surge in oil level occurs (e.g., during/just-after defrost) remove a small (approximately 10%) quantity of the mineral oil and replace with POE oil. Repeat if necessary.
- If the oil levels falls below the minimum, top-up to the minimum level with the existing oil type.
- If the oil level continuously falls or large oscillations occur during operation, add a sufficient amount of an equivalent POE until oil return becomes normal.

_____ 8. Label system clearly. Ensure System Data sheet is completed and filed securely.

Retrofit is complete!

System Data Sheet

Type of System/Location: _____

Equipment Mfg.: _____ Compressor Mfg.: _____

Model No.: _____ Model No.: _____

Serial No.: _____ Serial No.: _____

Original Charge Size: _____ Lubricant Type: _____

_____ Lubricant Charge Size: _____

Drier Mfg.: _____ Drier Type (check one):

Model No.: _____ Loose Fill: _____

_____ Solid Core: _____

Condenser Cooling Medium (air/water): _____

Expansion Device (check one): Capillary Tube: _____

Expansion Valve: _____

If Expansion valve:

Manufacturer: _____

Model No.: _____

Control/Set Point: _____

Location of Sensor: _____

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

_____

(circle units used where applicable)

Date/Time				
Refrigerant				
Charge Size (lb, oz/g)				
Ambient Temp. (°F/°C)				
Relative Humidity				
Compressor:				
Suction T (°F/°C)				
Suction P (psi/kPa/bar)				
Discharge T (°F/°C)				
Discharge P (psi/kPa/bar)				
Box/FixtureT (°F/°C)				
Evaporator:				
Refrigerant Inlet T (°F/°C)				
Refrigerant Outlet T (°F/°C)				
Coil Air/H_2O In T (°F/°C)				
Coil Air/H_2O Out T (°F/°C)				
Refrigerant T at Superheat Ctl. Pt. (°F/°C)				
Condenser:				
Refrigerant Inlet T (°F/°C)				
Refrigerant Outlet T (°F/°C)				
Coil Air/H_2O In T (°F/°C)				
Coil Air/H_2O Out T (°F/°C)				
Exp. Device Inlet T (°F/°C)				
Motor Amps				
Run/Cycle Time				
Comments: _____				
_____				

Table 7
Refrigerant Charge Amount Recommendations for Retrofit

Current Refrigerant	Retrofit Refrigerant	Approximate Initial Charge (% of Standard Charge Weight of Current Refrigerant)	Approximate Final Charge (% of Standard Charge Weight of Current Refrigerant)
R-22	ISCEON® MO59	85	95
R-22	ISCEON® MO79	85	95
R-502	ISCEON® MO79	85	95
R-402A (HP80)	ISCEON® MO79	90	100
R-408A	ISCEON® MO79	90	105

Note: These values apply provided no changes to mechanical components of the system (which could significantly affect the system's internal volumetric capacity) will be made during the retrofit.

Table 8
Physical Properties of ISCEON® MO59 and ISCEON® MO79

Physical Property	Unit	ISCEON® MO59	ISCEON® MO79	R-22	R-502
Boiling Point (1 atm.)	°C	–39	–47	–41	–45
	°F	–39	–52	–41	–50
Vapor Pressure at 25°C (77°F)	kPa abs	985	1274	1041	1162
	psia	143	185	151	168
Liquid Density at 25°C (77°F)	kg/m^3	1149	1136	1193	1217
	lb/ft^3	71.7	70.9	74.5	75.9
Density, Satd. Vapor at 25°C (77°F)	kg/m^3	47.7	74.3	44.9	67.3
	lb/ft^3	2.98	4.64	2.8	4.2
Ozone Depletion Potential	CFC-11 = 1.0	0	0	0.05	0.23
Global Warming Potential	CO_2 = 1	1950	2530	1700	5494

Table 9
Composition of ISCEON® MO59 and ISCEON® MO79 (Wt.%)

	HFC-125	HFC-134a	butane	isobutane
ISCEON® MO59	46.6	50	3.4	
ISCEON® MO79	85.1	11.5		3.4

Appendix

Table 10
Pressure – Temperature Chart (ENG Units): R–22 and ISCEON® MO59

Pressure psig	R-22 Sat. Temp °F	ISCEON® MO59 Sat. Liquid Temp °F	ISCEON® MO59 Sat. Vapor Temp °F	ISCEON® MO59 Avg. Coil Temp °F
20*	–79	–76	–66	–71
15*	–66	–63	–54	–58
10*	–56	–53	–44	–49
5*	–48	–45	–36	–41
0	–41	–38	–29	–33
2	–36	–33	–24	–28
4	–31	–28	–19	–24
6	–27	–24	–15	–20
8	–23	–20	–12	–16
10	–20	–17	–8	–12
12	–16	–13	–5	–9
14	–13	–10	–2	–6
16	–10	–7	1	–3
18	–7	–4	4	0
20	–5	–1	7	3
22	–2	1	9	5
24	0	4	12	8
26	3	6	14	10
28	5	8	16	12
30	7	11	18	15
32	9	13	20	17
34	12	15	23	19
36	14	17	24	21
38	16	19	26	23
40	17	21	28	25
42	19	23	30	26
44	21	25	32	28
46	23	26	34	30
48	25	28	35	32
50	26	30	37	33
55	30	34	41	37
60	34	38	45	41
65	38	41	48	45
70	41	45	52	48
75	45	48	55	51
80	48	51	58	55
85	51	54	61	58
90	54	57	64	61
95	57	60	67	63
100	59	63	69	66
105	62	66	72	69
110	65	68	74	71
115	67	71	77	74
120	69	73	79	76
125	72	76	82	79
130	74	78	84	81
135	76	80	86	83
140	79	82	88	85
145	81	85	90	87
150	83	87	92	89
155	85	89	94	91
160	87	91	96	93
165	89	93	98	95
170	91	95	100	97
175	93	97	102	99
180	94	98	104	101
185	96	100	105	103
190	98	102	107	105
195	100	104	109	106
200	102	105	110	108
205	103	107	112	110
210	105	109	114	111
215	106	110	115	113
220	108	112	117	114
225	110	114	118	116
230	111	115	120	118
235	113	117	121	119
240	114	118	123	120
245	116	120	124	122
250	117	121	126	123
255	119	123	127	125
260	120	124	128	126
265	122	125	130	128
270	123	127	131	129
275	124	128	132	130
280	126	130	134	132
285	127	131	135	133
290	128	132	136	134
295	130	134	138	136
300	131	135	139	137
310	133	137	141	139
320	136	140	144	142
330	138	142	146	144
340	141	145	148	146
350	143	147	150	149
360	145	149	153	151
370	148	151	155	153
380	150	154	157	155
390	152	156	159	157
400	154	158	161	159

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

* Inches Hg, vacuum

Table 11
Pressure – Temperature Chart (ENG Units): R–22, R–502 and ISCEON(R) MO79

Pressure psig	R-22 Sat. Temp °F	ISCEON® MO79 Sat. Liquid Temp °F	ISCEON® MO79 Sat. Vapor Temp °F	ISCEON® MO79 Avg. Coil Temp °F	R-502 Sat. Temp °F
20*	–79	–88	–83	–86	–88
15*	–66	–76	–71	–73	–75
10*	–56	–66	–61	–64	–65
5*	–48	–58	–54	–56	–56
0	–41	–51	–47	–49	–49
2	–36	–46	–42	–44	–44
4	–31	–42	–38	–40	–39
6	–27	–38	–34	–36	–35
8	–23	–34	–30	–32	–31
10	–20	–31	–27	–29	–27
12	–16	–27	–23	–25	–24
14	–13	–24	–20	–22	–21
16	–10	–21	–18	–19	–18
18	–7	–19	–15	–17	–15
20	–5	–16	–12	–14	–12
22	–2	–13	–10	–12	–10
24	0	–11	–7	–9	–7
26	3	–9	–5	–7	–5
28	5	–6	–3	–5	–2
30	7	–4	–1	–2	0
32	9	–2	1	0	2
34	12	0	3	2	4
36	14	2	5	4	6
38	16	4	7	5	8
40	17	6	9	7	10
42	19	7	11	9	12
44	21	9	13	11	14
46	23	11	14	13	16
48	25	13	16	14	17
50	26	14	18	16	19
55	30	18	21	20	23
60	34	22	25	23	27
65	38	25	29	27	31
70	41	29	32	30	34
75	45	32	35	34	38
80	48	35	38	37	41
85	51	38	41	40	44
90	54	41	44	42	47
95	57	44	47	45	50
100	59	46	49	48	53
105	62	49	52	50	55
110	65	51	54	53	58
115	67	54	57	55	60
120	69	56	59	58	63
125	72	59	61	60	65
130	74	61	63	62	68
135	76	63	66	64	70
140	79	65	68	66	72
145	81	67	70	69	74
150	83	69	72	71	76
155	85	71	74	73	78
160	87	73	76	74	80
165	89	75	78	76	82
170	91	77	79	78	84
175	93	79	81	80	86
180	94	81	83	82	88
185	96	82	85	84	90
190	98	84	86	85	92
195	100	86	88	87	94
200	102	87	90	89	95
205	103	89	91	90	97
210	105	91	93	92	99
215	106	92	94	93	100
220	108	94	96	95	102
225	110	95	97	96	104
230	111	97	99	98	105
235	113	98	100	99	107
240	114	100	102	101	108
245	116	101	103	102	110
250	117	103	105	104	111
255	119	104	106	105	113
260	120	105	107	106	114
265	122	107	109	108	116
270	123	108	110	109	117
275	124	110	111	110	118
280	126	111	113	112	120
285	127	112	114	113	121
290	128	113	115	114	122
295	130	115	116	116	124
300	131	116	118	117	125
310	133	118	120	119	128
320	136	121	122	122	130
330	138	123	125	124	132
340	141	125	127	126	135
350	143	128	129	128	137
360	145	130	131	131	139
370	148	132	133	133	142
380	150	134	135	135	144
390	152	136	137	137	146
400	154	138	139	139	148

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

* Inches Hg, vacuum

Table 12
Pressure – Temperature Chart (SI Units): R–22 and ISCEON® MO59

Pressure Bar (g)	R-22 Sat. Temp °C	ISCEON® MO59 Sat. Liquid Temp °C	ISCEON® MO59 Sat. Vapor Temp °C	ISCEON® MO59 Avg. Coil Temp °C
–0.7	–64	–62	–57	–59
–0.6	–59	–57	–52	–55
–0.5	–55	–53	–48	–51
–0.4	–51	–50	–45	–47
–0.3	–48	–47	–42	–44
–0.2	–46	–44	–39	–42
–0.1	–43	–42	–37	–39
0	–41	–39	–34	–37
0.1	–39	–37	–32	–35
0.2	–37	–35	–31	–33
0.3	–35	–34	–29	–31
0.4	–34	–32	–27	–30
0.5	–32	–30	–26	–28
0.6	–31	–29	–24	–26
0.7	–29	–27	–23	–25
0.8	–28	–26	–21	–24
0.9	–26	–25	–20	–22
1	–25	–23	–19	–21
1.1	–24	–22	–18	–20
1.2	–23	–21	–16	–19
1.3	–22	–20	–15	–18
1.4	–21	–19	–14	–17
1.5	–20	–18	–13	–15
1.6	–18	–17	–12	–14
1.7	–17	–16	–11	–13
1.8	–17	–15	–10	–12
1.9	–16	–14	–9	–12
2	–15	–13	–8	–11
2.1	–14	–12	–8	–10
2.2	–13	–11	–7	–9
2.3	–12	–10	–6	–8
2.4	–11	–9	–5	–7
2.5	–10	–8	–4	–6
2.6	–10	–8	–4	–6
2.7	–9	–7	–3	–5
2.8	–8	–6	–2	–4
2.9	–7	–5	–1	–3
3	–7	–5	–1	–3
3.1	–6	–4	0	–2
3.2	–5	–3	1	–1
3.3	–4	–2	2	0
3.4	–4	–2	2	0
3.5	–3	–1	3	1
3.6	–2	0	4	2
3.7	–2	0	4	2
3.8	–1	1	5	3
3.9	0	1	5	3
4	0	2	6	4
4.2	1	3	7	5
4.4	3	5	8	6
4.6	4	6	9	8
4.8	5	7	11	9
5	6	8	12	10
5.2	7	9	13	11
5.4	8	10	14	12
5.6	9	11	15	13
5.8	10	12	16	14
6	11	13	17	15
6.2	12	14	17	16
6.4	13	15	18	17
6.6	14	16	19	18
6.8	15	17	20	18
7	15	18	21	19
7.2	16	18	22	20
7.4	17	19	23	21
7.6	18	20	23	22
7.8	19	21	24	23
8	20	22	25	23
8.2	20	23	26	24
8.4	21	23	27	25
8.6	22	24	27	26
8.8	23	25	28	26
9	23	26	29	27
9.5	25	27	31	29
10	27	29	32	31
10.5	29	31	34	32
11	30	32	35	34
11.5	32	34	37	35
12	33	36	38	37
12.5	35	37	40	38
13	36	38	41	40
13.5	38	40	43	41
14	39	41	44	43
14.5	40	43	45	44
15	42	44	47	45
15.5	43	45	48	47
16	44	46	49	48
16.5	46	48	50	49
17	47	49	51	50
17.5	48	50	53	51
18	49	51	54	52
18.5	50	52	55	54
19	51	53	56	55
19.5	52	55	57	56
20	53	56	58	57
20.5	54	57	59	58
21	56	58	60	59
21.5	57	59	61	60
22	58	60	62	61
22.5	59	61	63	62
23	59	62	64	63
23.5	60	63	65	64
24	61	64	65	65
24.5	62	64	66	65
25	63	65	67	66
25.5	64	66	68	67
26	65	67	69	68
26.5	66	68	70	69
27	67	69	71	70
27.5	68	70	71	71
28	68	71	72	71
28.5	69	71	73	72
29	70	72	74	73
29.5	71	73	74	74
30	72	74	75	74
30.5	72	75	76	75
31	73	75	77	76
31.5	74	76	77	77
32	75	77	78	77
32.5	75	78	79	78
33	76	78	79	79
33.5	77	79	80	80
34	78	80	81	80
34.5	78	80	81	81
35	79	81	82	82

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

Table 13
Pressure – Temperature Chart (SI Units): R–22; R–502 and ISCEON® MO79

Pressure Bar (g)	R-22 Sat. Temp °C	ISCEON® MO79 Sat. Liquid Temp °C	ISCEON® MO79 Sat. Vapor Temp °C	ISCEON® MO79 Avg. Coil Temp °C	R-502 Sat. Temp °C
–0.7	–64	–69	–66	–67	–68
–0.6	–59	–64	–61	–63	–63
–0.5	–55	–60	–57	–59	–59
–0.4	–51	–57	–54	–55	–56
–0.3	–48	–54	–51	–53	–53
–0.2	–46	–51	–49	–50	–50
–0.1	–43	–49	–46	–48	–48
0	–41	–47	–44	–46	–45
0.1	–39	–45	–42	–44	–43
0.2	–37	–43	–41	–42	–41
0.3	–35	–41	–39	–40	–40
0.4	–34	–40	–37	–38	–38
0.5	–32	–38	–36	–37	–36
0.6	–31	–37	–34	–35	–35
0.7	–29	–35	–33	–34	–33
0.8	–28	–34	–32	–33	–32
0.9	–26	–33	–30	–31	–31
1	–25	–31	–29	–30	–29
1.1	–24	–30	–28	–29	–28
1.2	–23	–29	–27	–28	–27
1.3	–22	–28	–26	–27	–26
1.4	–21	–27	–25	–26	–25
1.5	–20	–26	–24	–25	–24
1.6	–18	–25	–23	–24	–23
1.7	–17	–24	–22	–23	–22
1.8	–17	–23	–21	–22	–21
1.9	–16	–22	–20	–21	–20
2	–15	–21	–19	–20	–19
2.1	–14	–20	–18	–19	–18
2.2	–13	–19	–17	–18	–17
2.3	–12	–18	–17	–18	–16
2.4	–11	–18	–16	–17	–15
2.5	–10	–17	–15	–16	–14
2.6	–10	–16	–14	–15	–14
2.7	–9	–15	–13	–14	–13
2.8	–8	–15	–13	–14	–12
2.9	–7	–14	–12	–13	–11
3	–7	–13	–11	–12	–11
3.1	–6	–12	–11	–12	–10
3.2	–5	–12	–10	–11	–9
3.3	–4	–11	–9	–10	–8
3.4	–4	–10	–9	–9	–8
3.5	–3	–10	–8	–9	–7
3.6	–2	–9	–7	–8	–6
3.7	–2	–8	–7	–8	–6
3.8	–1	–8	–6	–7	–5
3.9	0	–7	–5	–6	–4
4	0	–7	–5	–6	–4
4.2	1	–5	–4	–5	–3
4.4	3	–4	–3	–3	–1
4.6	4	–3	–1	–2	0
4.8	5	–2	0	–1	1
5	6	–1	1	0	2
5.2	7	0	2	1	3
5.4	8	1	3	2	4
5.6	9	2	4	3	5
5.8	10	3	5	4	6
6	11	4	6	5	7
6.2	12	5	6	6	8
6.4	13	6	7	7	9
6.6	14	7	8	7	10
6.8	15	7	9	8	11
7	15	8	10	9	12
7.2	16	9	11	10	13
7.4	17	10	12	11	13
7.6	18	11	12	12	14
7.8	19	12	13	12	15
8	20	12	14	13	16
8.2	20	13	15	14	17
8.4	21	14	15	15	18
8.6	22	15	16	15	18
8.8	23	15	17	16	19
9	23	16	18	17	20
9.5	25	18	19	19	22
10	27	19	21	20	23
10.5	29	21	23	22	25
11	30	23	24	23	27
11.5	32	24	26	25	28
12	33	26	27	26	30
12.5	35	27	28	28	31
13	36	29	30	29	33
13.5	38	30	31	31	34
14	39	31	33	32	36
14.5	40	33	34	33	37
15	42	34	35	34	38
15.5	43	35	36	36	40
16	44	36	37	37	41
16.5	46	37	39	38	42
17	47	39	40	39	43
17.5	48	40	41	40	45
18	49	41	42	41	46
18.5	50	42	43	43	47
19	51	43	44	44	48
19.5	52	44	45	45	49
20	53	45	46	46	50
20.5	54	46	47	47	51
21	56	47	48	48	52
21.5	57	48	49	49	53
22	58	49	50	50	54
22.5	59	50	51	51	55
23	59	51	52	51	56
23.5	60	52	53	52	57
24	61	53	54	53	58
24.5	62	54	55	54	59
25	63	55	55	55	60
25.5	64	55	56	56	61
26	65	56	57	57	62
26.5	66	57	58	58	63
27	67	58	59	58	64
27.5	68	59	60	59	64
28	68	60	60	60	65
28.5	69	60	61	61	66
29	70	61	62	61	67
29.5	71	62	63	62	68
30	72	63	63	63	68
30.5	72	63	64	64	69
31	73	64	65	64	70
31.5	74	65	65	65	71
32	75	66	66	66	72
32.5	75	67	67	67	72
33	76				73
33.5	77				74
34	78				74
34.5	78				75
35	79				

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

Table 14
Pressure – Temperature Chart (ENG Units): DuPont™ ISCEON® MO79 and DuPont™ Suva® 408A (R–408A)

Pressure psig	ISCEON® MO79 Sat. Liquid Temp °F	ISCEON® MO79 Sat. Vapor Temp °F	ISCEON® MO79 Avg. Coil Temp °F	Suva® 408A Sat. Liquid Temp °F	Suva® 408A Sat. Vapor Temp °F	Suva® 408A Avg. Coil Temp °F
20*	–88	–83	–86	–85	–84	–85
15*	–76	–71	–73	–72	–72	–72
10*	–66	–61	–64	–62	–62	–62
5*	–58	–54	–56	–54	–54	–54
0	–51	–47	–49	–48	–47	–48
2	–46	–42	–44	–43	–42	–43
4	–42	–38	–40	–38	–37	–38
6	–38	–34	–36	–34	–33	–34
8	–34	–30	–32	–30	–29	–30
10	–31	–27	–29	–27	–26	–27
12	–27	–23	–25	–23	–23	–23
14	–24	–20	–22	–20	–19	–20
16	–21	–18	–19	–17	–16	–17
18	–19	–15	–17	–14	–14	–14
20	–16	–12	–14	–12	–11	–12
22	–13	–10	–12	–9	–8	–9
24	–11	–7	–9	–6	–6	–6
26	–9	–5	–7	–4	–3	–4
28	–6	–3	–5	–2	–1	–2
30	–4	–1	–2	1	1	1
32	–2	1	0	3	3	3
34	0	3	2	5	5	5
36	2	5	4	7	7	7
38	4	7	5	9	9	9
40	6	9	7	11	11	11
42	7	11	9	13	13	13
44	9	13	11	14	15	15
46	11	14	13	16	17	17
48	13	16	14	18	19	19
50	14	18	16	20	20	20
55	18	21	20	23	24	24
60	22	25	23	27	28	28
65	25	29	27	31	32	32
70	29	32	30	35	35	35
75	32	35	34	37	38	38
80	35	38	37	41	42	42
85	38	41	40	44	45	45
90	41	44	42	47	48	48
95	44	47	45	50	51	51
100	46	49	48	53	53	53
105	49	52	50	55	56	56
110	51	54	53	58	58	58
115	54	57	55	60	61	61
120	56	59	58	63	63	63
125	59	61	60	65	66	66
130	61	63	62	67	68	68

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point
* Inches Hg, vacuum

Pressure psig	ISCEON® MO79 Sat. Liquid Temp °F	ISCEON® MO79 Sat. Vapor Temp °F	ISCEON® MO79 Avg. Coil Temp °F	Suva® 408A Sat. Liquid Temp °F	Suva® 408A Sat. Vapor Temp °F	Suva® 408A Avg. Coil Temp °F
135	63	66	64	70	70	70
140	65	68	66	72	72	72
145	67	70	69	74	74	74
150	69	72	71	76	76	76
155	71	74	73	78	79	79
160	73	76	74	80	81	81
165	75	78	76	82	82	82
170	77	79	78	84	84	84
175	79	81	80	86	86	86
180	81	83	82	88	88	88
185	82	85	84	89	90	90
190	84	86	85	91	92	92
195	86	88	87	93	93	93
200	87	90	89	95	95	95
205	89	91	90	96	97	97
210	91	93	92	98	98	98
215	92	94	93	100	100	100
220	94	96	95	101	102	102
225	95	97	96	103	103	103
230	97	99	98	104	105	105
235	98	100	99	106	106	106
240	100	102	101	107	108	108
245	101	103	102	109	109	109
250	103	105	104	110	111	111
255	104	106	105	112	112	112
260	105	107	106	113	113	113
265	107	109	108	114	115	115
270	108	110	109	116	116	116
275	110	111	110	117	118	118
280	111	113	112	119	119	119
285	112	114	113	120	120	120
290	113	115	114	121	122	122
295	115	116	116	122	123	123
300	116	118	117	124	124	124
310	118	120	119	126	127	127
320	121	122	122	129	129	129
330	123	125	124	131	131	131
340	125	127	126	133	134	134
350	128	129	128	136	136	136
360	130	131	131	138	138	138
370	132	133	133	140	141	141
380	134	135	135	142	143	143
390	136	137	137	144	145	145
400	138	139	139	147	147	147

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

Table 15
Pressure – Temperature Chart (ENG Units): DuPont™ ISCEON® MO79 and Suva® HP80 (R–402A)

Pressure psig	ISCEON® MO79 Sat. Liquid Temp °F	ISCEON® MO79 Sat. Vapor Temp °F	ISCEON® MO79 Avg. Coil Temp °F	Suva® HP80 Sat. Liquid Temp °F	Suva® HP80 Sat. Vapor Temp °F	Suva® HP80 Avg. Coil Temp °F
20*	–88	–83	–86	–94	–89	–92
15*	–76	–71	–73	–81	–77	–79
10*	–66	–61	–64	–71	–67	–69
5*	–58	–54	–56	–63	–59	–61
0	–51	–47	–49	–57	–53	–55
2	–46	–42	–44	–52	–48	–50
4	–42	–38	–40	–47	–44	–46
6	–38	–34	–36	–43	–40	–42
8	–34	–30	–32	–39	–36	–38
10	–31	–27	–29	–36	–33	–35
12	–27	–23	–25	–33	–29	–31
14	–24	–20	–22	–29	–26	–28
16	–21	–18	–19	–26	–23	–25
18	–19	–15	–17	–24	–21	–23
20	–16	–12	–14	–21	–18	–20
22	–13	–10	–12	–18	–15	–17
24	–11	–7	–9	–16	–13	–15
26	–9	–5	–7	–14	–11	–13
28	–6	–3	–5	–11	–8	–10
30	–4	–1	–2	–9	–6	–8
32	–2	1	0	–7	–4	–6
34	0	3	2	–5	–2	–4
36	2	5	4	–3	0	–2
38	4	7	5	–1	2	1
40	6	9	7	1	4	3
42	7	11	9	3	6	5
44	9	13	11	5	7	6
46	11	14	13	6	9	8
48	13	16	14	8	11	10
50	14	18	16	10	12	11
55	18	21	20	13	16	15
60	22	25	23	17	20	19
65	25	29	27	21	24	23
70	29	32	30	24	27	26
75	32	35	34	28	30	29
80	35	38	37	31	33	32
85	38	41	40	33	36	35
90	41	44	42	37	39	38
95	44	47	45	39	40	40
100	46	49	48	42	44	43
105	49	52	50	44	46	45
110	51	54	53	47	49	48
115	54	57	55	50	52	51
120	56	59	58	52	54	53
125	59	61	60	54	56	55
130	61	63	62	57	59	58
135	63	66	64	59	61	60
140	65	68	66	61	63	62
145	67	70	69	63	65	64
150	69	72	71	65	67	66
155	71	74	73	67	69	68
160	73	76	74	69	71	70
165	75	78	76	71	73	72
170	77	79	78	73	75	74
175	79	81	80	75	77	76
180	81	83	82	77	78	78
185	82	85	84	78	80	79
190	84	86	85	80	82	81
195	86	88	87	82	84	83
200	87	90	89	83	85	84
205	89	91	90	85	87	86
210	91	93	92	87	88	88
215	92	94	93	88	90	89
220	94	96	95	90	92	91
225	95	97	96	91	93	92
230	97	99	98	93	95	94
235	98	100	99	94	96	95
240	100	102	101	96	97	97
245	101	103	102	97	99	98
250	103	105	104	99	100	100
255	104	106	105	100	102	101
260	105	107	106	102	103	103
265	107	109	108	103	104	104
270	108	110	109	104	106	105
275	110	111	110	106	107	107
280	111	113	112	107	108	108
285	112	114	113	108	110	109
290	113	115	114	110	111	111
295	115	116	116	111	112	112
300	116	118	117	112	114	113
310	118	120	119	115	116	116
320	121	122	122	117	118	118
330	123	125	124	119	121	120
340	125	127	126	122	123	123
350	128	129	128	124	125	125
360	130	131	131	126	127	127
370	132	133	133	128	130	129
380	134	135	135	131	132	132
390	136	137	137	133	134	134
400	138	139	139	135	136	136

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point
* Inches Hg, vacuum

Table 16
Pressure – Temperature Chart (SI Units): DuPont™ ISCEON® MO79 and Suva® 408A (R–408A)

Pressure bar (g)	ISCEON® MO79 Sat. Liquid Temp °C	ISCEON® MO79 Sat. Vapor Temp °C	ISCEON® MO79 Avg. Coil Temp °C	Suva® 408A Sat. Liquid Temp °C	Suva® 408A Sat. Vapor Temp °C	Suva® 408A Avg. Coil Temp °C
–0.7	–69	–66	–67	–67	–67	–67
–0.6	–64	–61	–63	–62	–62	–62
–0.5	–60	–57	–59	–58	–58	–58
–0.4	–57	–54	–55	–55	–54	–55
–0.3	–54	–51	–53	–52	–51	–52
–0.2	–51	–49	–50	–49	–49	–49
–0.1	–49	–46	–48	–47	–46	–47
0	–47	–44	–46	–45	–44	–44
0.1	–45	–42	–44	–43	–42	–42
0.2	–43	–41	–42	–41	–40	–40
0.3	–41	–39	–40	–39	–38	–39
0.4	–40	–37	–38	–37	–37	–37
0.5	–38	–36	–37	–36	–35	–35
0.6	–37	–34	–35	–34	–34	–34
0.7	–35	–33	–34	–33	–32	–32
0.8	–34	–32	–33	–31	–31	–31
0.9	–33	–30	–31	–30	–30	–30
1	–31	–29	–30	–29	–28	–29
1.1	–30	–28	–29	–28	–27	–27
1.2	–29	–27	–28	–26	–26	–26
1.3	–28	–26	–27	–25	–25	–25
1.4	–27	–25	–26	–24	–24	–24
1.5	–26	–24	–25	–23	–23	–23
1.6	–25	–23	–24	–22	–22	–22
1.7	–24	–22	–23	–21	–21	–21
1.8	–23	–21	–22	–20	–20	–20
1.9	–22	–20	–21	–19	–19	–19
2	–21	–19	–20	–18	–18	–18
2.1	–20	–18	–19	–17	–17	–17
2.2	–19	–17	–18	–16	–16	–16
2.3	–18	–17	–18	–16	–15	–15
2.4	–18	–16	–17	–15	–14	–15
2.5	–17	–15	–16	–14	–14	–14
2.6	–16	–14	–15	–13	–13	–13
2.7	–15	–13	–14	–12	–12	–12
2.8	–15	–13	–14	–12	–11	–11
2.9	–14	–12	–13	–11	–11	–11
3	–13	–11	–12	–10	–10	–10
3.1	–12	–11	–12	–9	–9	–9
3.2	–12	–10	–11	–9	–8	–9
3.3	–11	–9	–10	–8	–8	–8
3.4	–10	–9	–9	–7	–7	–7
3.5	–10	–8	–9	–7	–6	–7
3.6	–9	–7	–8	–6	–6	–6
3.7	–8	–7	–8	–5	–5	–5
3.8	–8	–6	–7	–5	–4	–5
3.9	–7	–5	–6	–4	–4	–4
4	–7	–5	–6	–4	–3	–3
4.2	–5	–4	–5	–2	–2	–2
4.4	–4	–3	–3	–1	–1	–1
4.6	–3	–1	–2	0	0	0
4.8	–2	0	–1	1	2	2
5	–1	1	0	2	3	3
5.2	0	2	1	3	4	4
5.4	1	3	2	4	5	5
5.6	2	4	3	5	6	6
5.8	3	5	4	6	7	7
6	4	6	5	7	8	8
6.2	5	6	6	8	9	9
6.4	6	7	7	9	9	9
6.6	7	8	7	10	10	10
6.8	7	9	8	11	11	11
7	8	10	9	12	12	12
7.2	9	11	10	13	13	13
7.4	10	12	11	14	14	14
7.6	11	12	12	14	15	15
7.8	12	13	12	15	15	15
8	12	14	13	16	16	16
8.2	13	15	14	17	17	17
8.4	14	15	15	18	18	18
8.6	15	16	15	18	18	18
8.8	15	17	16	19	19	19
9	16	18	17	20	20	20
9.5	18	19	19	22	22	22
10	19	21	20	23	24	23
10.5	21	23	22	25	25	25
11	23	24	23	27	27	27
11.5	24	26	25	28	28	28
12	26	27	26	30	30	30
12.5	27	28	28	31	31	31
13	29	30	29	33	33	33
13.5	30	31	31	34	34	34
14	31	33	32	35	36	35
14.5	33	34	33	37	37	37
15	34	35	34	38	38	38
15.5	35	36	36	39	39	39
16	36	37	37	40	41	41
16.5	37	39	38	42	42	42
17	39	40	39	43	43	43
17.5	40	41	40	44	44	44
18	41	42	41	45	45	45
18.5	42	43	43	46	47	46
19	43	44	44	47	48	48
19.5	44	45	45	49	49	49
20	45	46	46	50	50	50
20.5	46	47	47	51	51	51
21	47	48	48	52	52	52
21.5	48	49	49	53	53	53
22	49	50	50	54	54	54
22.5	50	51	51	55	55	55
23	51	52	51	56	56	56
23.5	52	53	52	56	57	57
24	53	54	53	57	58	58
24.5	54	55	54	58	59	58
25	55	55	55	59	59	59
25.5	55	56	56	60	60	60
26	56	57	57	61	61	61
26.5	57	58	58	62	62	62
27	58	59	58	63	63	63
27.5	59	60	59	64	64	64
28	60	60	60	64	65	64
28.5	60	61	61	65	65	65
29	61	62	61	66	66	66
29.5	62	63	62	67	67	67
30	63	63	63	68	68	68
30.5	63	64	64	68	68	68
31	64	65	64	69	69	69
31.5	65	65	65	70	70	70
32	66	66	66	71	71	71
32.5	67	67	67	71	71	71
33				72	72	72
33.5				73	73	73
34				73	74	74

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

Table 17
Pressure – Temperature Chart (SI Units): DuPont™ ISCEON® MO79 and Suva® HP80 (R–402A)

Pressure bar (g)	ISCEON® MO79 Sat. Liquid Temp °C	ISCEON® MO79 Sat. Vapor Temp °C	ISCEON® MO79 Avg. Coil Temp °C	Suva® HP80 Sat. Liquid Temp °C	Suva® HP80 Sat. Vapor Temp °C	Suva® HP80 Avg. Coil Temp °C
–0.7	–69	–66	–67	–72	–69	–70
–0.6	–64	–61	–63	–67	–64	–66
–0.5	–60	–57	–59	–63	–61	–62
–0.4	–57	–54	–55	–59	–57	–58
–0.3	–54	–51	–53	–56	–54	–55
–0.2	–51	–49	–50	–54	–52	–53
–0.1	–49	–46	–48	–51	–49	–50
0	–47	–44	–46	–49	–47	–48
0.1	–45	–42	–44	–47	–45	–46
0.2	–43	–41	–42	–45	–43	–44
0.3	–41	–39	–40	–44	–42	–43
0.4	–40	–37	–38	–42	–40	–41
0.5	–38	–36	–37	–40	–39	–39
0.6	–37	–34	–35	–39	–37	–38
0.7	–35	–33	–34	–37	–36	–37
0.8	–34	–32	–33	–36	–34	–35
0.9	–33	–30	–31	–35	–33	–34
1	–31	–29	–30	–34	–32	–33
1.1	–30	–28	–29	–32	–31	–31
1.2	–29	–27	–28	–31	–30	–30
1.3	–28	–26	–27	–30	–28	–29
1.4	–27	–25	–26	–29	–27	–28
1.5	–26	–24	–25	–28	–26	–27
1.6	–25	–23	–24	–27	–25	–26
1.7	–24	–22	–23	–26	–24	–25
1.8	–23	–21	–22	–25	–23	–24
1.9	–22	–20	–21	–24	–23	–23
2	–21	–19	–20	–23	–22	–22
2.1	–20	–18	–19	–22	–21	–22
2.2	–19	–17	–18	–21	–20	–21
2.3	–18	–17	–18	–21	–19	–20
2.4	–18	–16	–17	–20	–18	–19
2.5	–17	–15	–16	–19	–18	–18
2.6	–16	–14	–15	–18	–17	–17
2.7	–15	–13	–14	–17	–16	–17
2.8	–15	–13	–14	–17	–15	–16
2.9	–14	–12	–13	–16	–15	–15
3	–13	–11	–12	–15	–14	–15
3.1	–12	–11	–12	–15	–13	–14
3.2	–12	–10	–11	–14	–12	–13
3.3	–11	–9	–10	–13	–12	–12
3.4	–10	–9	–9	–12	–11	–12
3.5	–10	–8	–9	–12	–10	–11
3.6	–9	–7	–8	–11	–10	–10
3.7	–8	–7	–8	–11	–9	–10
3.8	–8	–6	–7	–10	–9	–9
3.9	–7	–5	–6	–9	–8	–9
4	–7	–5	–6	–9	–7	–8
4.2	–5	–4	–5	–7	–6	–7
4.4	–4	–3	–3	–6	–5	–6
4.6	–3	–1	–2	–5	–4	–5
4.8	–2	0	–1	–4	–3	–4
5	–1	1	0	3	–2	1
5.2	0	2	1	–2	–1	–2
5.4	1	3	2	–1	0	–1
5.6	2	4	3	0	1	1
5.8	3	5	4	1	2	2
6	4	6	5	2	3	3
6.2	5	6	6	3	4	4
6.4	6	7	7	4	5	5
6.6	7	8	7	5	6	6
6.8	7	9	8	6	7	7
7	8	10	9	6	8	7
7.2	9	11	10	7	8	8
7.4	10	12	11	8	9	9
7.6	11	12	12	9	10	10
7.8	12	13	12	10	11	11
8	12	14	13	11	12	12
8.2	13	15	14	11	12	12
8.4	14	15	15	12	13	13
8.6	15	16	15	13	14	14
8.8	15	17	16	14	15	15
9	16	18	17	14	15	15
9.5	18	19	19	16	17	17
10	19	21	20	19	20	20
10.5	21	23	22	21	22	21
11	23	24	23	22	23	23
11.5	24	26	25	24	25	24
12	26	27	26	25	26	26
12.5	27	28	28	27	28	27
13	29	30	29	28	29	29
13.5	30	31	31	30	30	30
14	31	33	32	31	32	31
14.5	33	34	33	32	33	33
15	34	35	34	33	34	34
15.5	35	36	36	35	35	35
16	36	37	37	36	37	36
16.5	37	39	38	37	38	37
17	39	40	39	38	39	38
17.5	40	41	40	39	40	40
18	41	42	41	40	41	41
18.5	42	43	43	41	42	42
19	43	44	44	42	43	43
19.5	44	45	45	43	44	44
20	45	46	46	44	45	45
20.5	46	47	47	45	46	46
21	47	48	48	46	47	47
21.5	48	49	49	47	48	48
22	49	50	50	48	49	49
22.5	50	51	51	49	50	50
23	51	52	51	50	51	51
23.5	52	53	52	51	52	51
24	53	54	53	52	53	52
24.5	54	55	54	53	54	53
25	55	55	55	54	54	54
25.5	55	56	56	55	55	55
26	56	57	57	56	56	56
26.5	57	58	58	56	57	57
27	58	59	58	57	58	57
27.5	59	60	59	58	59	58
28	60	60	60	59	59	59
28.5	60	61	61	60	60	60
29	61	62	61	60	61	61
29.5	62	63	62	61	62	61
30	63	63	63	62	62	62
30.5	63	64	64	63	63	63
31	64	65	64	63	64	64
31.5	65	65	65	64	65	64
32	66	66	66	65	65	65
32.5	67	67	67	66	66	66

Note: Saturated Liquid Temperature = Bubble Point
Saturated Vapor Temperature = Dew Point

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