Technical Information

ART-37

DuPont™ Suva®
refrigerants

Retrofit Guidelines for Suva® HFC Refrigerants

Suva® 134a for R-12 Retrofit
Suva® HP62 and Suva® 507 for R-502 Retrofit
Suva® HP62 and Suva® 507 for R-22 Retrofit

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Retrofit Guidelines for Suva® HFC Refrigerants

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Introduction

With the phaseout of CFCs and HCFCs, existing refrigeration and air-conditioning equipment operating with CFCs and HCFCs will ultimately need to be either replaced with new equipment or retrofitted with alternative refrigerants. Some service technicians and equipment owners have elected to retrofit to hydrofluorocarbon (HFC) refrigerants such as Suva® 134a, Suva® HP62, or Suva® 507.

Using these procedures, R-12, R-502, and R-22 equipment can be safely and efficiently retrofitted with HFC-based Suva® refrigerants, allowing the equipment to continue in service for the remainder of its useful life. These retrofit guidelines are intended for equipment containing positive displacement compressors.

R-12 Replacement Choices

Suva® 134a (R-134a) is the long-term HFC replacement for R-12 in new equipment and for retrofitting some R-12 systems such as supermarket display cases, commercial refrigeration and air-conditioning equipment, appliances, and transport refrigeration equipment. In stationary equipment Suva® 134a is recommended for retrofit of equipment with evaporator temperatures above 20°F (–7°C) to ensure best performance. Suva® 134a may be used in existing equipment at lower evaporator temperatures, but it can exhibit reduced capacity compared with R-12 unless system modifications are made.

R-502 Replacement Choices

- **Suva® HP62 (R-404A)** is widely recognized as the preferred HFC replacement for R-502 in new equipment and for retrofitting R-502 systems such as supermarket and food service, industrial freezing, and some transport refrigeration. Suva® HP62 offers the closest HFC match to R-502 performance and can be used over the full R-502 operating range. Suva® HP62 also provides lower compressor discharge temperatures than R-502, which can increase compressor reliability and life.
- **Suva® 507 (R-507)** is an HFC replacement option for R-502 in new equipment and for retrofitting R-502 systems. Suva® 507 can also be used over the full R-502 operating range, and provides lower compressor discharge temperatures than R-502, which can increase compressor reliability and life.
- **Suva® 407C (R-407C)** is also an HFC retrofit option for R-502 in certain equipment. Refer to ART-34 “Retrofit Guidelines for Suva® 407C” for details.

R-22 Replacement Choices

Suva® HP62 (R-404A) and **Suva® 507 (R-507)** are HFC retrofit options for R-22 refrigeration equipment, especially for medium and low temperature applications. These products will provide similar cooling capacity at evaporator temperatures in the range of 30°F to 50°F (–1°C to 10°C). At evaporator temperatures below 30°F (–1°C), the cooling capacity is greater than R-22. At 0°F (–18°C) the capacity is about 6% higher; and at –40°F (–40°C) the capacity is about 30% higher.

At evaporator temperatures above 10°F (–12°C) there is an energy efficiency penalty of about 5 to 10%. At evaporator temperatures below 10°F (–12°C) Suva® HP62 and 507 have similar energy efficiency, increasing to about +20% at –40°F (–40°C).

Suva® HP62 and **507** will have higher discharge pressure than R-22, but lower compression ratios; and also lower discharge temperature.

- Suva® 407C (R-407C) should also be considered as a retrofit option for R-22 in medium temperature equipment. It will provide similar cooling capacity and energy efficiency at evaporator temperatures above 25°F (4°C). Refer to ART-34 “Retrofit Guidelines for Suva® 407C” for details

Using HFCs versus Service Refrigerants

Refrigerants such as Suva® MP39, Suva® 409A, Suva® HP80 and Suva® 408A are often selected for retrofit instead of HFCs because these service refrigerants typically involve an easier and more cost-effective retrofit procedure while providing improved performance over the CFCs they replace. The compressor oil change procedures are typically less complicated with the service refrigerants, which results in lower retrofit costs. Refer to DuPont bulletin ART-36 “Retrofit Guidelines for Suva® Service Refrigerants” for full details.

Important Safety Information

Like CFCs, Suva® refrigerants are safe 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.** 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 torches to search for leaks.** Do not use flames in high concentrations of refrigerant. Open flames release large quantities of acidic compounds in the presence of all refrigerants, and these compounds can be hazardous. Do not use torches as leak detectors. Old halide torches detect chlorine, which may not be present with new 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 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 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 Suva® refrigerants, see DuPont Technical Bulletin P-134a or P-HP, 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 gives additional information for safe handling of refrigerants.

Lubricant and Filter Drier Information

Lubricants

Lubricant selection is based on many factors, including compressor wear characteristics, material compatibility, and lubricant/refrigerant miscibility that can affect oil return to the compressor. Before starting a retrofit, consult the compressor manufacturer to determine the correct lubricant for your compressor. Other information sources are DuPont Refrigerant Distributors, lubricant manufacturers, and system manufacturers.

Polyol ester (POE) lubricants must be used with Suva® 134a, Suva® HP62 or Suva® 507 refrigerants. These lubricants are available from DuPont Refrigerant Distributors. To provide optimum oil return, equipment using mineral oil or alkylbenzene must be flushed to remove at least 95% of these oils. See the retrofit procedures below for more information.

Special care should be taken when handling POE lubricants because of their tendency to absorb water. Minimize contact with air and store the lubricant in a sealed container.

Filter Drier

Change the filter drier during the retrofit. This is a routine practice following system maintenance. There are two types of filter driers commonly used, solid core and packed bead.

Replace the drier with the same type you currently use. The drier label will show which refrigerants can be used with that drier. Check with your DuPont Refrigerant Distributor for the correct drier to use in your system.

General Retrofit Information

System Modifications

The compositions of these Suva® refrigerants have been selected to provide performance comparable with the refrigerants they are replacing in terms of both capacity and energy efficiency. As a result, minimal system modifications are anticipated with retrofitting. Suva® HP62 and Suva® 507 are near-azeotropes at most temperatures, therefore the vapor composition in the refrigerant cylinder is slightly different from the liquid composition. This small difference will not affect performance in direct expansion systems, but it could affect performance in systems with flooded evaporators.

You should consult the original equipment manufacturer for recommendations concerning the compatibility of elastomers and plastics used in their system and the new refrigerant. Although many system components used with CFCs are also compatible with Suva® refrigerants, there are exceptions that, if not replaced, can cause refrigerant leakage or system failure.

Field experience has shown that some systems retrofitted directly from R-502 to Suva® HP62 or Suva® 507 can have increased leakage due to shrinkage of elastomers (o-rings, gaskets) following removal of the R-502. This same situation might exist in an R-22 retrofit. Replacement of these elastomers may add additional cost and time to the retrofit.

Retrofits of R-12 or R-502 systems with other alternative refrigerants such as HCFC-22 may require more extensive modifications to the existing equipment, such as replacement of the compressor with multistage compressors or use of liquid injection. For some systems this additional cost may be large. Suva® refrigerants provide the service contractor and equipment owner with a cost-effective way to retrofit an existing system.

Note: Suva® refrigerants were not designed for use in conjunction with other refrigerants or additives that have not been clearly specified by DuPont or the equipment manufacturer. Mixing Suva® refrigerants with other refrigerants, may have an adverse effect on system performance. "Topping off" a different refrigerant with any Suva® refrigerant is not recommended.

Refrigerant Recovery Information

Most recovery or recycle equipment used for R-12, R-502, or R-22 can be used for Suva® refrigerants. Use standard procedures to avoid cross-contamination when switching from one refrigerant to another. Consult the equipment manufacturer for specific recommendations.

In the United States, DuPont will take back for reclaim the Suva® refrigerants discussed in this bulletin.

What to Expect Following a Retrofit

These tables show approximate system performance changes following a retrofit. These values are general guidelines for system behavior, and actual performance will vary with each system.

Suva® 134a is compared to R-12, Suva® HP62 and Suva® 507 are compared to R-502.

Suva® Refrig.	Disch. Press. psi (kPa)	Suct. Press. psi (kPa)	Disch. Temp. °F (°C)	Refrig. Cap'y. (%)
134a	+10 (69.8)	–2 (–13.8)	–10 (–5.6)	–10
HP62	+20 (+137.9)	Same	–10 (–5.6)	Same
507	+30 (+206.8)	Same	–15 (+8.3)	Same

Suva® HP62 is compared to R-22 (evap. temp. = 0°F [–18°C]). **Note:** Suva® 507 provides performance very similar to HP62.

Suva® Refrig.	Disch. Press. psi (kPa)	Suct. Press. psi (kPa)	Compression Ratio (%)	Disch. Temp. °F (°C)	Refrig. Cap'y. (%)
HP62	+45 (+310)	+10 (+69.8)	–5	–64 (–36)	+6

How to read these tables

Example: R-12 to Suva® 134a retrofit. Discharge pressure with 134a will be in the range of 10 psig higher than R-12 (using discharge pressure column above).

Retrofit Summary for HFC Refrigerants

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

1. Establish baseline performance with CFC/HCFC.
2. Drain mineral oil or alkylbenzene (MO/AB) from the system and measure the volume removed. Leave the CFC/HCFC refrigerant in the system.
3. Add POE lubricant; use the same volume as removed in Step 2. Start up system and operate for at least 24 hours, or more if system has complex piping.
4. Drain POE, and repeat steps 2 and 3 at least two more times. Continue flushing until MO/AB is less than 5% by weight or as recommended by compressor manufacturer.
5. Recover the CFC/HCFC charge into a proper recovery cylinder.
6. Replace the filter/drier.
7. Evacuate system and check for leaks.
8. Charge with Suva® refrigerant. Remove liquid only from charging cylinder for Suva® HP62 or Suva® 507. Typical charge is 75–90% by weight of CFC/HCFC charge.
9. Start up system, adjust charge size. Label system for the refrigerant and lubricant used.

Retrofit Complete

Retrofit of R-12 Systems to Suva® 134a

The following detailed discussion is the recommended procedure for retrofitting R-12 systems to Suva® 134a.

1. **Establish baseline performance with CFC.** Collect system performance data while the R-12 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 Suva® refrigerant. A **System Data Sheet** is included at the back of this document to record baseline data.
2. **Drain mineral oil or alkylbenzene from the system and measure the volume removed. Leave the CFC refrigerant in the system.** If mineral oil or alkylbenzene is the existing lubricant, it will have to be drained. This may require removing the compressor from the system, particularly with small hermetic compressors that have no oil drain port. In this case, the lubricant should be drained from the suction port on the compressor after the R-12 has been properly recovered. For an effective flush, it is important to remove at least 50% of the lubricant in all cases. Larger systems may require drainage from additional points in the system, particularly low spots around the evaporator. In systems with an oil separator, any lubricant present in the separator should also be drained.

   In all cases, measure the volume of lubricant removed from the system. Record this information on the Retrofit Checklist (see Appendix). Compare this volume with the compressor/system specifications to ensure that the majority of lubricant has been removed. Consult the compressor manufacturer for recommendations on allowable residual MO/AB in POE lubricant. If poor system performance is noted on start-up, an additional lubricant change may be required.
3. **Add POE lubricant; use the same volume as removed in Step 2. Start up system and operate for at least 24 hours, or more if system has complex piping.** Charge the compressor with the same volume of new lubricant as the amount you removed from the system in step 2. Use a lubricant viscosity and grade recommended by the compressor manufacturer for the Suva® refrigerant you are using; or use a similar viscosity to the oil you removed if compressor information is not available. A typical viscosity is 150 SUS or ISO 32 for many compressors.
4. **Drain POE, and repeat steps 2 and 3 at least two more times. Continue flushing until MO/AB is less than 5% by weight or as recommended by compressor manufacturer.** For an HFC refrigerant to operate properly in a retrofitted system, the residual MO/AB concentration must be very low. Repeatedly removing and replacing the POE will flush the old oil from the refrigeration system, providing that enough time is allowed with each change to circulate oil through the entire system.

5. **Recover the CFC charge into a proper recovery cylinder.** Use normal service practices. If the correct charge size is not known, weigh the amount of refrigerant recovered.
6. **Replace the filter/drier.** It is routine practice to replace the filter/drier following system maintenance. Replacement driers are available that are compatible with Suva® refrigerants. See page 2 of this manual for additional information on driers.
7. **Evacuate system and check for leaks.** To remove air or other noncondensables in the system, evacuate the system to near full vacuum (29.9 inHg vacuum [500 microns] or less than 10 kPa).
8. **Charge with Suva® refrigerant.** In general, the refrigeration system will require less weight of the Suva® 134a than of R-12. The optimum charge will vary depending on the system design and operating conditions. For most systems the best charge size will be 75–90% by weight of the original R-12 charge.

   For best results:

   - It is recommended that the system be initially charged with about 75% by weight of the original charge.
   - Add the initial charge of Suva® refrigerant to the high-pressure side of the system (compressor *not* running) until the system and cylinder pressures equalize. Then connect to the low-pressure side of the system, start the compressor, and load the remainder of the refrigerant slowly to the suction side of the system.
9. **Start up system, adjust charge size. Label system for the refrigerant and lubricant used.** Start the system and let conditions stabilize. If the system is undercharged, add Suva® 134a in small amounts until the system conditions reach the desired level. See the Pressure/Temperature Charts in this bulletin to compare pressures and temperatures.

   Suva® refrigerants are more sensitive to charge size than CFCs. System performance will change quickly if the system is overcharged or undercharged. Sight glasses in the liquid line can be used in most cases as a guide, but system charge should also 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" on page 8.

Retrofit of R-502 Systems to Suva® HP62 or Suva® 507

The following detailed discussion is the recommended procedure for retrofitting R-502 systems to Suva® HP62 or Suva® 507.

1. **Establish baseline performance with CFC.** Collect system performance data while the R-502 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 Suva® refrigerant. A **System Data Sheet** is included at the back of this document to record baseline data.
2. **Drain mineral oil or alkylbenzene from the system and measure the volume removed. Leave the CFC refrigerant in the system.** If mineral oil or alkylbenzene is the existing lubricant, it will have to be drained. This may require removing the compressor from the system, particularly with small hermetic compressors that have no oil drain port. In this case, the lubricant should be drained from the suction port on the compressor after the R-502 has been properly recovered. For an effective flush, it is important to remove at least 50% of the lubricant in all cases. Larger systems may require drainage from additional points in the system, particularly low spots around the evaporator. In systems with an oil separator, any lubricant present in the separator should also be drained.

   In all cases, measure the volume of lubricant removed from the system. Record this information on the Retrofit Checklist (see Appendix). Compare this volume with the compressor/system specifications to ensure that the majority of lubricant has been removed. Consult the compressor manufacturer for recommendations on allowable residual MO/AB in POE lubricant. If poor system performance is noted on start-up, an additional lubricant change may be required.

3. **Add POE lubricant; use the same volume as removed in Step 2. Start up system and operate for at least 24 hours, or more if system has complex piping.** Charge the compressor with the same volume of new lubricant as the amount you removed from the system in step 2. Use a lubricant viscosity and grade recommended by the compressor manufacturer for the Suva® refrigerant you are using; or use a similar viscosity to the MO/AB you removed if compressor information is not available. A typical viscosity is 150 SUS or ISO 32 for many compressors.

4. **Drain POE, and repeat steps 2 and 3 at least two more times. Continue flushing until MO/AB is less than 5% by weight or as recommended by compressor manufacturer.** For an HFC refrigerant to operate properly in a retrofitted system, the residual MO/AB concentration must be very low. Repeatedly removing and replacing the POE will flush the old oil from the refrigeration system, providing that enough time is allowed with each change to circulate oil through the entire system.

5. **Recover the CFC charge into a proper recovery cylinder.** Use normal service practices. If the correct charge size is not known, weigh the amount of refrigerant recovered.

6. **Replace the filter/drier.** It is routine practice to replace the filter/drier following system maintenance. Replacement driers are available that are compatible with Suva® refrigerants. See page 2 of this manual for additional information on driers.

7. **Evacuate system and check for leaks.** To remove air or other noncondensables in the system, evacuate the system to near full vacuum (29.9 inHg vacuum [500 microns] or less than 10 kPa).

8. **Charge with Suva® refrigerant. 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.

   In general, the refrigeration system will require less weight of the Suva® refrigerant than of R-502. The optimum charge will vary depending on the system design and operating conditions, but for most systems the best charge size will be 75–90% by weight of the original charge.

   For best results:

   - It is recommended that the system be initially charged with about 75% by weight of the original charge.
   - Add the initial charge of Suva® refrigerant to the high-pressure side of the system (compressor *not* running) until the system and cylinder pressures equalize. Then connect to the low-pressure side of the system, start the compressor, and load the remainder of the refrigerant slowly to the suction side of the system. You should be removing liquid from the charging cylinder, and therefore should charge slowly to allow the refrigerant to flash (vaporize) before entering the compressor suction and avoid compressor damage.

9. **Start up system, adjust charge size. Label system for the refrigerant and lubricant used.** Start the system and let conditions stabilize. If the system is undercharged, add Suva® HP62 or Suva® 507 in small amounts (still removing 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 for the Suva® refrigerant you are using.

   Suva® refrigerants are more sensitive to charge size than CFCs. System performance will change quickly if the system is overcharged or undercharged. Sight glasses in the liquid line can be used in most cases as a guide, but system charge should also 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" on page 8.

Retrofit of R-22 Systems to Suva® HP62 or Suva® 507

The following detailed discussion is the recommended procedure for retrofitting R-22 systems to Suva® HP62 or Suva® 507.

1. **Establish baseline performance with R-22.** Collect system performance data while the R-22 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 Suva® refrigerant. A **System Data Sheet** is included at the back of this document to record baseline data.

2. **Drain mineral oil or alkylbenzene from the system and measure the volume removed. Leave the R-22 in the system.** If mineral oil or alkylbenzene is the existing lubricant, it will have to be drained. This may require removing the compressor from the system, particularly with small hermetic compressors that have no oil drain port. In this case, the lubricant should be drained from the suction port on the compressor after the R-22 has been properly recovered. For an effective flush, it is important to remove at least 50% of the lubricant in all cases. Larger systems may require drainage from additional points in the system, particularly low spots around the evaporator. In systems with an oil separator, any lubricant present in the separator should also be drained.

   In all cases, measure the volume of lubricant removed from the system. Record this information on the Retrofit Checklist (see Appendix). Compare this volume with the compressor/system specifications to ensure that the majority of lubricant has been removed. Consult the compressor manufacturer for recommendations on allowable residual MO/AB in POE lubricant. If poor system performance is noted on start-up, an additional lubricant change may be required.

3. **Add POE lubricant; use the same volume as removed in Step 2. Start up system and operate for at least 24 hours, or more if system has complex piping.** Charge the compressor with the same volume of new lubricant as the amount you removed from the system in step 2. Use a lubricant viscosity and grade recommended by the compressor manufacturer for the Suva® refrigerant you are using; or use a similar viscosity to the MO/AB you removed if compressor information is not available. A typical viscosity is 150 SUS or ISO 32 for many compressors.

4. **Drain POE, and repeat steps 2 and 3 at least two more times. Continue flushing until MO/AB is less than 5% by weight or as recommended by compressor manufacturer.** For an HFC refrigerant to operate properly in a retrofitted system, the residual MO/AB concentration must be very low. Repeatedly removing and replacing the POE will flush the old oil from the refrigeration system, providing that enough time is allowed with each change to circulate oil through the entire system.

5. **Recover the R-22 charge into a proper recovery cylinder.** Use normal service practices. If the correct charge size is not known, weigh the amount of refrigerant recovered.

6. **Replace the filter/drier.** It is routine practice to replace the filter/drier following system maintenance. Replacement driers are available that are compatible with Suva® refrigerants. See page 2 of this manual for additional information on driers.

7. **Evacuate system and check for leaks.** To remove air or other noncondensables in the system, evacuate the system to near full vacuum (29.9 inHg vacuum [500 microns] or less than 10 kPa).

8. **Charge with Suva® refrigerant. 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.

   In general, the refrigeration system will require less weight of the Suva® refrigerant than of R-22. The optimum charge will vary depending on the system design and operating conditions, but for most systems the best charge size will be 75–90% by weight of the original charge.

   For best results:

   - It is recommended that the system be initially charged with about 75% by weight of the original charge.
   - Add the initial charge of Suva® refrigerant to the high-pressure side of the system (compressor *not* running) until the system and cylinder pressures equalize. Then connect to the low-pressure side of the system, start the compressor, and load the remainder of the refrigerant slowly to the suction side of the system. You should be removing liquid from the charging cylinder, and therefore should charge slowly to allow the refrigerant to flash (vaporize) before entering the compressor suction and avoid compressor damage.

9. **Start up system, adjust charge size. Label system for the refrigerant and lubricant used.** Start the system and let conditions stabilize. If the system is undercharged, add Suva® HP62 or Suva® 507 in small amounts (still removing 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 for the Suva® refrigerant you are using.

   Suva® refrigerants are more sensitive to charge size than R-22. System performance will change quickly if the system is overcharged or undercharged. Sight glasses in the liquid line can be used in most cases as a guide, but system charge should also 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" below.

"Helpful Hints" For Retrofit From R-22 To Suva® HP62 or 507

Both Suva® HP62 and 507 have minimal "temperature glide" and can be used in systems that have flooded evaporators and condensers, as well as those that have direct expansion evaporators.

Since HP62 and 507 have higher cooling capacity than R-22,at lower evaporator temperatures the expansion device may need to be adjusted or replaced to maintain proper flow control and superheat settings. Estimated capacity comparison:

Evaporator Temperature	Capacity
30 to 50°F (–1 to 10°C)	Same
0°F (–18°C)	+6%
–40°F (–40°C)	+30%

Verify that compressor suction and discharge piping is the proper size to maintain proper refrigerant velocity and pressure drop.

Compressor discharge temperature will be lower than R-22.

The compressor discharge pressure will be higher with HP62 and 507. Various pressure switches may need to be adjusted to maintain proper operating conditions; for example:

- Evaporator pressure regulators
- Cut-in and cut-out pressure switches
- Condenser fan cycling pressure switches
- Head pressure controls
- Crankcase pressure regulators
- Others

Due to the higher oil miscibility with HFCs and POE, verify proper compressor oil sump levels.

Check with the compressor manufacturer for proper amperage load ratings.

Pressure/Temperature Charts – Introduction

How to Read the Pressure/Temperature Charts

Tables 1 through **5** contain pressure/temperature charts for the refrigerants discussed in this bulletin.

R-12, R-22 and Suva® 134a are all single component refrigerants with no temperature "glide" in the evaporator or condenser. Suva® HP62 and 507 have very small glide (less than 1F [0.6C]). For field service purposes, this glide can be neglected in calculating superheat and subcool. The evaporator temperature can be considered equal to the saturated vapor temperature at the compressor suction pressure; the condenser temperature can be considered equal to the saturated vapor temperature or the saturated liquid temperature at the compressor discharge pressure. For Suva® HP62 and 507, the saturated vapor temperatures are listed in the tables.

How to Determine Suction Pressure, Superheat, and Subcool

Suction Pressure

Determine the expected evaporator temperature using the R-12, R-502 or R-22 column (from the baseline data you collected prior to the retrofit). Find the same expected evaporator temperature in the column for Suva® 134a, HP62 or 507. Note the corresponding pressure for this temperature. This is the suction pressure at which the system should operate.

Superheat and Subcool

Using the temperature column for Suva® 134a, HP62 and 507, the amount of superheat and subcool is calculated in the same manner as for the CFC or HCFC refrigerant.

Note: The amount of vapor superheat is always calculated from the actual saturated vapor temperature; the amount of liquid subcool is always calculated from the actual saturated liquid temperature.

Retrofit Checklist for Suva® 134a, Suva® HP62, or Suva® 507

_____ 1. Establish baseline performance with R-12, R-502, or R-22. (See data sheet for recommended data.)

_____ 2. Consult the original equipment manufacturer of the system components for recommendations on the following:
- Plastics compatibility
- Elastomers compatibility
- Lubricant (viscosity, manufacturer)
- Retrofit procedure to sustain warranty

_____ 3. Drain lubricant charge from the refrigerant system (unless polyol ester lubricant is already in the system).
- Remove majority of lubricant from system.
- Measure amount of lubricant removed and record: _____.

_____ 4. Charge polyol ester lubricant using amount equivalent to amount of mineral oil removed. Run system with R-12, R-502, or R-22 for 24 hours, minimum.

_____ 5. Repeat lubricant drain and POE charging two more times or until mineral oil content is less than 5%.

_____ 6. Remove R-12, R-502, or R-22 charge from system. (Need 10–20 inHg vacuum [34–67 kPa].)

_____ 7. Replace filter drier with new drier approved for use with Suva® 134a, Suva® HP62, or Suva® 507.

_____ 8. Reconnect system and evacuate with vacuum pump. (Evacuate to full vacuum [29.9 inHg vacuum/0.14 kPa].)

_____ 9. Leak-check system. (Reevacuate system following leak check.)

_____ 10. Charge system with Suva®.
- Initially charge 75% by weight of original equipment manufacturer R-12, R-502, or R-22 charge.
- Amount of refrigerant charged: _____.

_____ 11. Start equipment and adjust charge until desired operating conditions are achieved. If low in charge, add in increments of 2–3% of original R-12, R-502, or R-22 charge.
- Amount of refrigerant charged: _____.
- *Total refrigerant charged:* _____.

_____ 12. Label components and system for type of refrigerant (Suva® 134a, Suva® HP62, or Suva® 507) and lubricant (polyol ester).

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: _____ Original Lubricant:

Type/Mfg: _____

Lubricant Charge Size: _____

New Lubricant: _____

Type/Mfg: _____

1st Charge Size: _____

2nd Charge Size: _____

Additional 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/CaseT (°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: _____				
_____				

Appendix

Table 1
Pressure/Temperature Chart
Suva® 134a/R-12 Saturation Properties

English Units

Pressure, psi	R-12 Saturation Temperature, °F	HFC-134a Saturation Temperature, °F
15*	–49	–40
10*	–38	–30
5*	–29	–22
0	–22	–15
5	–9	–3
10	2	7
15	10	15
20	18	22
25	26	29
30	32	35
35	38	40
40	43	45
45	48	50
50	53	54
55	58	58
60	62	62
65	66	66
70	70	69
75	74	73
80	77	76
85	81	79
90	84	82
95	87	85
100	90	88
110	96	93
120	102	98
130	107	103
140	112	107
150	117	112
165	123	118
180	130	123
195	136	129
210	141	134
225	147	139
240	152	143
255	157	148
270	162	152
285	166	156
300	170	160

*inHg, vacuum

SI Units

Pressure, kPa	R-12 Saturation Temperature, °C	HFC-134a Saturation Temperature, °C
25	–59	–53
50	–45	–40
75	–37	–32
100	–30	–26
125	–24	–21
150	–20	–17
175	–16	–13
200	–12	–10
225	–9	–7
250	–6	–4
275	–4	–2
300	–1	1
325	2	3
350	4	5
375	6	7
400	8	9
450	12	12
500	16	16
550	19	19
600	22	22
650	25	24
700	28	27
750	30	29
800	33	31
900	37	36
1000	42	39
1200	49	46
1400	56	52
1600	62	58
1800	68	63
2000	73	67
2200	78	72
2400	82	76
2600	86	79
2800	90	83
3000	94	86
3200	98	89
3400	101	93
3600	104	95

Table 2
Pressure/Temperature Chart
Suva® HP62/R-502 Saturation Properties

English Units

Pressure, psi	R-502 Sat. Temp, °F	HP62 Sat. Temp, °F	Pressure psi	R-502 Sat. Temp, °F	HP62 Sat. Temp, °F
25*	–108	–107	58	24	22
20*	–88	–87	60	26	23
15*	–75	–75	62	27	25
10*	–65	–65	64	29	26
5*	–56	–57	66	30	28
4*	–55	–56	68	32	29
3*	–54	–54	70	33	30
2*	–53	–53	72	34	32
1*	–52	–52	74	36	33
0	–50	–50	76	37	34
2	–45	–45	78	38	35
4	–40	–41	80	40	36
6	–36	–37	82	41	37
8	–32	–33	84	42	38
10	–29	–30	86	43	40
12	–25	–26	88	45	41
14	–22	–23	90	46	43
16	–19	–20	92	47	44
18	–16	–18	94	48	45
20	–13	–15	96	49	46
22	–11	–12	98	50	47
24	–8	–10	100	51	48
26	–6	–7	105	54	51
28	–3	–5	110	57	53
30	–1	–3	115	60	56
32	1	–1	120	62	58
34	3	2	125	64	60
36	5	3	130	67	63
38	7	5	135	69	65
40	9	7	140	71	67
42	11	9	145	73	69
44	13	11	150	75	71
46	15	12	175	85	81
48	16	14	200	95	89
50	18	16	250	111	104
52	20	17	300	125	118
54	21	19	350	137	129
56	23	20	400	148	140

*inHg, vacuum

SI Units

Pressure, kPa	R-502 Sat. Temp, °C	HP62 Sat. Temp, °C	Pressure kPa	R-502 Sat. Temp, °C	HP62 Sat. Temp, °C
25	–72	–71	1450	34	31
50	–60	–59	1500	35	32
75	–52	–52	1550	37	34
100	–46	–46	1600	38	35
125	–41	–41	1650	39	36
150	–37	–37	1700	41	37
175	–33	–34	1750	42	38
200	–30	–30	1800	43	40
225	–27	–28	1900	46	42
250	–24	–25	2000	48	44
275	–22	–22	2100	50	46
300	–19	–20	2200	52	48
325	–17	–18	2300	54	50
350	–15	–16	2400	56	52
375	–13	–14	2500	58	54
400	–11	–12	2600	60	56
425	–9	–10	2700	62	57
450	–8	–9	2800	64	59
475	–6	–7	2900	65	61
500	–4	–6			
550	–1	–3			
600	2	0			
650	4	2			
700	7	5			
750	9	7			
800	11	9			
850	13	11			
900	15	13			
950	17	15			
1000	19	17			
1050	21	19			
1100	23	20			
1150	25	22			
1200	26	24			
1250	28	25			
1300	29	27			
1350	31	28			
1400	32	30			

Table 3
Pressure/Temperature Chart
Suva® 507/R-502 Saturation Properties

English Units

Pressure, psi	R-502 Sat. Temp, °F	507 Sat. Temp, °F	Pressure psi	R-502 Sat. Temp, °F	507 Sat. Temp, °F
25*	–108	–110	58	24	19
20*	–88	–90	60	26	21
15*	–75	–77	62	27	22
10*	–65	–67	64	29	24
5*	–56	–61	66	30	25
4*	–55	–59	68	32	26
3*	–54	–58	70	33	28
2*	–53	–57	72	34	29
1*	–52	–56	74	36	30
0	–50	–54	76	37	32
2	–45	–48	78	38	33
4	–40	–44	80	40	34
6	–36	–39	82	41	35
8	–32	–36	84	42	37
10	–29	–32	86	43	38
12	–25	–29	88	45	39
14	–22	–26	90	46	40
16	–19	–23	92	47	41
18	–16	–20	94	48	42
20	–13	–17	96	49	43
22	–11	–15	98	50	44
24	–8	–12	100	51	46
26	–6	–10	105	54	48
28	–3	–8	110	57	51
30	–1	–6	115	60	53
32	1	–3	120	62	55
34	3	–1	125	64	58
36	5	1	130	67	60
38	7	3	135	69	62
40	9	4	140	71	64
42	11	6	145	73	66
44	13	8	150	75	69
46	15	10	175	85	78
48	16	11	200	95	87
50	18	13	250	111	102
52	20	15	300	125	115
54	21	16	350	137	127
56	23	18	400	148	137

*inHg, vacuum

SI Units

Pressure, kPa	R-502 Sat. Temp, °C	507 Sat. Temp, °C	Pressure kPa	R-502 Sat. Temp, °C	507 Sat. Temp, °C
25	–72	–72	1000	19	16
50	–60	–61	1050	21	17
75	–52	–53	1100	23	19
100	–46	–47	1150	25	21
125	–41	–43	1200	26	22
150	–37	–39	1250	28	24
175	–33	–35	1300	29	25
200	–30	–32	1350	31	27
225	–27	–29	1400	32	28
250	–24	–26	1450	34	30
275	–22	–24	1500	35	31
300	–19	–22	1550	37	32
325	–17	–19	1600	38	34
350	–15	–17	1650	39	35
375	–13	–15	1700	41	36
400	–11	–14	1750	42	37
425	–9	–12	1800	43	38
450	–8	–10	1900	46	41
475	–6	–9	2000	48	43
500	–4	–7	2100	50	45
550	–1	–4	2200	52	47
600	2	–2	2300	54	49
650	4	1	2400	56	51
700	7	4	2500	58	53
750	9	6	2600	60	54
800	11	8	2700	62	56
850	13	10	2800	64	58
900	15	12	2900	65	59
950	17	14			

Table 4
Pressure/Temperature Chart
Suva® HP62/R-22 Saturation Properties

English Units

Pressure, psi	R-22 Sat. Temp, °F	HP62 Sat. Temp, °F	Pressure psi	R-22 Sat. Temp, °F	HP62 Sat. Temp, °F
25*	–100	–107	58	32	22
20*	–80	–87	60	34	23
15*	–66	–75	62	35	25
10*	–56	–65	64	37	26
5*	–48	–57	66	38	28
4*	–47	–56	68	40	29
3*	–45	–54	70	41	30
2*	–44	–53	72	42	32
1*	–43	–52	74	44	33
0	–41	–50	76	45	34
2	–36	–45	78	46	35
4	–32	–41	80	48	36
6	–28	–37	82	49	37
8	–24	–33	84	50	38
10	–20	–30	86	51	40
12	–17	–26	88	52	41
14	–14	–23	90	54	43
16	–11	–20	92	55	44
18	–8	–18	94	56	45
20	–5	–15	96	57	46
22	–2	–12	98	58	47
24	0	–10	100	59	48
26	2	–7	105	62	51
28	5	–5	110	64	53
30	7	–3	120	69	58
32	9	–1	125	72	60
34	11	2	130	74	63
36	13	3	135	76	65
38	15	5	140	78	67
40	17	7	145	81	69
42	19	9	150	83	71
44	21	11	175	93	81
46	23	12	200	101	89
48	24	14	250	117	104
50	26	16	300	131	118
52	28	17	350	143	129
54	29	19	400	154	140
56	31	20			

*inHg, vacuum

SI Units

Pressure, kPa	R-22 Sat. Temp, °C	HP62 Sat. Temp, °C	Pressure kPa	R-22 Sat. Temp, °C	HP62 Sat. Temp, °C
25	–67	–71	1450	38	31
50	–55	–59	1500	39	32
75	–47	–52	1550	40	34
100	–41	–46	1600	42	35
125	–36	–41	1650	43	36
150	–32	–37	1700	44	37
175	–28	–34	1750	46	38
200	–25	–30	1800	47	40
225	–22	–28	1900	49	42
250	–20	–25	2000	51	44
275	–17	–22	2100	53	46
300	–15	–20	2200	56	48
325	–12	–18	2300	58	50
350	–10	–16	2400	59	52
375	–8	–14	2500	61	54
400	–7	–12	2600	63	56
425	–5	–10	2700	65	57
450	–3	–9	2800	67	59
475	–1	–7	2900	68	61
500	0	–6			
550	3	–3			
600	6	0			
650	8	2			
700	11	5			
750	13	7			
800	15	9			
850	18	11			
900	20	13			
950	22	15			
1000	23	17			
1050	25	19			
1100	27	20			
1150	29	22			
1200	30	24			
1250	32	25			
1300	33	27			
1350	35	28			
1400	36	30			

Table 5
Pressure/Temperature Chart
Suva® 507/R-22 Saturation Properties

English Units

Pressure, psi	R-22 Sat. Temp, °F	507 Sat. Temp, °F	Pressure psi	R-22 Sat. Temp, °F	507 Sat. Temp, °F
25*	–100	–110	58	32	19
20*	–80	–90	60	34	21
15*	–66	–77	62	35	22
10*	–56	–67	64	37	24
5*	–48	–61	66	38	25
4*	–47	–59	68	40	26
3*	–45	–58	70	41	28
2*	–44	–57	72	42	29
1*	–43	–56	74	44	30
0	–41	–54	76	45	32
2	–36	–48	78	46	33
4	–32	–44	80	48	34
6	–28	–39	82	49	35
8	–24	–36	84	50	37
10	–20	–32	86	51	38
12	–17	–29	88	52	39
14	–14	–26	90	54	40
16	–11	–23	92	55	41
18	–8	–20	94	56	42
20	–5	–17	96	57	43
22	–2	–15	98	58	44
24	0	–12	100	59	46
26	2	–10	105	62	48
28	5	–8	110	64	51
30	7	–6	120	69	55
32	9	–3	125	72	58
34	11	–1	130	74	60
36	13	1	135	76	62
38	15	3	140	78	64
40	17	4	145	81	66
42	19	6	150	83	69
44	21	8	175	93	78
46	23	10	200	101	87
48	24	11	250	117	102
50	26	13	300	131	115
52	28	15	350	143	127
54	29	16	400	154	137
56	31	18			

*inHg, vacuum

SI Units

Pressure, kPa	R-22 Sat. Temp, °C	507 Sat. Temp, °C	Pressure kPa	R-22 Sat. Temp, °C	507 Sat. Temp, °C
25	–67	–72	1000	23	16
50	–55	–61	1050	25	17
75	–47	–53	1100	27	19
100	–41	–47	1150	29	21
125	–36	–43	1200	30	22
150	–32	–39	1250	32	24
175	–28	–35	1300	33	25
200	–25	–32	1350	35	27
225	–22	–29	1400	36	28
250	–20	–26	1450	38	30
275	–17	–24	1500	39	31
300	–15	–22	1550	40	32
325	–12	–19	1600	42	34
350	–10	–17	1650	43	35
375	–8	–15	1700	44	36
400	–7	–14	1750	46	37
425	–5	–12	1800	47	38
450	–3	–10	1900	49	41
475	–1	–9	2000	51	43
500	0	–7	2100	53	45
550	3	–4	2200	56	47
600	6	–2	2300	58	49
650	8	1	2400	59	51
700	11	4	2500	61	53
750	13	6	2600	63	54
800	15	8	2700	65	56
850	18	10	2800	67	58
900	20	12	2900	68	59
950	22	14			

Table 6
Suva® 134a (R-134a) Physical Properties

Physical Property	Unit	Suva® 134a (R-134a)	R-12
Boiling Point at 1 atm	°F	–14.9	–21.6
	°C	–26.1	–29.8
Vapor Pressure	psia	96.61	94.51
Sat'd Liquid at 77°F (25°C)	kPa	666.1	651.6
Liquid Density	lb/ft^3	75.28	81.84
at 77°F (25°C)	kg/m^3	1,206	1,311
Density	lb/ft^3	2.02	2.32
Sat'd Vapor at 77°F (25°C)	kg/m^3	32.4	37.2
Ozone-Depletion Potential Compared with CFC-12	CFC-12 = 1	0	1
Global Warming Potential Compared with CO_2	CO_2 = 1	1300	8500

Table 7
Suva® HP62 (R-404A) and Suva® 507 (R-507) Physical Properties

Physical Property	Unit	Suva® HP62 (R-404A)	Suva® 507 (R-507)	R-502	R-22
Boiling Point at 1 atm	°F	–51.6	–52.1	–49.8	–41.4
	°C	–46.5	–46.7	–45.4	–40.8
Vapor Pressure	psia	182	187	168	151
Sat'd Liquid at 77°F (25°C)	kPa	1,255	1,287	1,162	1,041
Liquid Density	lb/ft^3	65.45	65.5	75.9	74.5
at 77°F (25°C)	kg/m^3	1,048	1,049	1,217	1193
Density	lb/ft^3	4.0	4.3	4.2	2.8
Sat'd Vapor at 77°F (25°C)	kg/m^3	64.1	68.9	67.3	44.9
Ozone-Depletion Potential Compared with R-12	R-12 = 1	0	0	0.23	0.05
Global Warming Potential Compared with CO_2	CO_2 = 1	3260	3300	5494	1700

Table 8
Compositions of Suva® Refrigerants

Compositions, wt%	HFC-125	HFC-143a	HFC-134a
Suva® HP62 (R-404A)	44	52	4
Suva® 507 (R-507)	50	50	
Suva® 134a (R-134a)			100

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