DUPONT

Suva®
refrigerants

ART-22

Retrofit Guidelines for Suva HP62 in Stationary Equipment

Introduction

As production of R502 is reduced and ultimately phased out, environmentally acceptable replacement compounds are needed for use in existing R502 medium and low temperature refrigeration applications.

Suva HP62 is the DuPont registered trademark for a near-azeotropic blend of HFC-125/HFC-143a/HFC-134a with a corresponding composition of 44/52/4 weight percent.

Suva HP62 is a commercially available HFC (hydrofluorocarbon) refrigerant for retrofits in existing equipment and as the long term replacement for R502 in new equipment. For the lowest cost retrofit over the full temperature range of R502 applications, Suva HP80 and Suva HP81 (HCFC-based refrigerants) are also available. Refer to DuPont Technical Bulletins ART-9 (H-45947-2) for information on retrofitting with Suva HP80, or ART-15 (H-47763-1) for Suva HP81, or P-HP (H-47122-2) for more detailed information on uses and properties of all Suva HP refrigerants.

Using the retrofit guidelines summarized below, many R502 systems can be retrofitted for use with Suva HP62. This allows the existing equipment to continue to operate safely and efficiently even after R502 is no longer available.

Properties and Safety

Suva HP62 offers improved environmental properties versus R502, with zero Ozone Depletion Potential (ODP) and a significantly lower Halocarbon Global Warming Potential (HGWP). Refer to DuPont Technical Bulletin P-HP (H-47122-2) for more detailed information on properties and performance characteristics for Suva HP62. Refer to the Material Safety Data Sheet (MSDS) for safety information on the use of Suva HP62.

Table 1
Suva HP62 Physical Properties

Property	Units	Suva HP62	R502
Boiling Pt	°C	–46.5	–45.4
(1 atm)	°F	–51.6	–49.8
Vapor Pressure,	kPa	1255	1162
Sat'd Liquid at 25°C	psia	182.0	168
Liquid Density	kg/cu m	1048	1217
at 25°C	lb/cu ft	65.45	75.9
Density, Sat'd	kg/cu m	18.20	19.99
Vapor at –15°C	lb/cu ft	1.14	1.30
Ozone Depletion Potential as compared to R-12	R-12 = 1	0	0.23
Halocarbon Global Warming Potential as compared to R-11	R-11 = 1	0.94	3.75
Capacity as compared to R502*	R502 = 100%	100%	100%
Energy Eff. as compared to R502 (COP)*	R502 = 100%	90%	100%

*Conditions: –40°F evaporator/130°F condenser/65°F suction temperature

Lubricants

Lubricant selection is based on several factors, which can include lubricant return to the compressor, lubricity, and materials compatibility. Polyol ester lubricants are recommended for use in most HFC systems. There are many polyol ester lubricant manufacturers; to determine which lubricant is recommended for the refrigeration system, contact the compressor manufacturer, equipment manufacturer or a DuPont distributor.

Special care should be taken when handling polyol ester lubricants due to their tendency to absorb water. Contact with air should be minimized and the lubricant should be stored in a sealed container.

When retrofitting R502/mineral oil systems to Suva HP62/polyol ester lubricant, in order to achieve equivalent miscibility, the residual mineral oil should be around 5 wt. % or less of the total lubricant used in the system. Allowable residual mineral oil is highly dependent on system configuration and operating conditions. If the system shows signs of poor heat transfer in the evaporator or poor oil return to the compressor, it may be necessary to further reduce the residual mineral oil. A series of successive lubricant changes using polyol esters can normally reduce the mineral oil concentration to low levels. Lubricant manufacturers are presently developing field test methods for determining the wt. % mineral oil in polyol ester lubricant. Contact the lubricant manufacturer for the recommended test method.

System Modification

Suva HP62 provides similar energy efficiency and capacity to R502 with a lower discharge temperature and slightly higher discharge pressure. As a result, minimal system modifications are anticipated when retrofitting R502 systems with Suva HP62.

The chemical compatibility of plastics and elastomers should be considered before retrofitting to Suva HP62 and polyol ester. Testing shows that there will be no one family of elastomers or plastics that will work with all the alternative refrigerants. It is recommended that gaskets, shaft seals and o-rings be reviewed with the equipment manufacturer before retrofit. Also, see P-HP bulletin for elastomer information.

It is important to note that Suva HP62 was not designed for use in conjunction with other refrigerants (i.e., adding Suva HP62 to any other refrigerant can form mixtures which could cause system damage).

Selection of Refrigerant

Suva HP62 is an alternative refrigerant for all temperature R502 systems, making it suitable for use in such applications as:

- Food service
- Commercial refrigeration
- Transport refrigeration

For the entire temperature range of R502 refrigeration applications, HCFC-based alternative refrigerants for retrofits are also available. For semi-hermetic commercial applications such as supermarket display cases, medium or low temperature, Suva HP80 offers the lowest compressor discharge temperatures with good operating performance.

For hermetic, self-contained medium temperature applications such as ice machines, Suva HP81 may offer better operating characteristics with a moderate increase in compressor discharge temperature. To determine which alternative is right for the application, contact the compressor manufacturer, equipment manufacturer, or DuPont distributor.

Overview of Retrofit Process

Retrofit of an existing R502 system with Suva HP62 can be accomplished using service practices and equipment commonly used by trained mechanics or service contractors in the field.

The key steps involved in the retrofit are:

- Remove mineral oil from compressor and replace with selected polyol ester (POE) lubricant. Run system for 48 to 72 hours with R502 and determine residual mineral oil content. Perform additional lubricant changes if necessary.
- Recover R502 charge from the system.
- Replace filter/drier with new drier compatible with Suva HP62/POE.
- Charge system with Suva HP62.
- Start system and adjust charge and/or controls to achieve desired operation.

For the majority of systems, the compressor lubricant change, a filter/drier change and a possible adjustment to the superheat setting (in systems with expansion valves) will be the only system modifications required in a retrofit to Suva HP62. For systems which are still under warranty, we recommend contacting the equipment or compressor manufacturers prior to performing the retrofit. Some equipment or compressor warranties may be impacted by a change from the refrigerant or lubricant originally specified for the system or compressor.

Copeland Corporation approves the use of Suva HP80 and Suva HP62 in existing equipment, provided the following conditions are met:

- Retrofitting systems that employ compressors manufactured prior to 1973 is not recommended.
- You must follow Copeland retrofit guidelines, and use only Copeland-approved lubricants and other parts.
- Pressure safety controls may have to be reset, due to the higher operating pressures of the alternatives.
- Pressure relief devices MUST be added to the compressor crankcase set at a maximum of 375 psig on Discus 3D and 4D and all other semi-hermetic (non-Discus) models.

WARNING: It is possible that excess pressure build-up on models indicated could result in the compressor exploding unless the pressure relief valve specified has been properly installed on the originally built Copeland Compressor.

Equipment and Supplies Needed for Retrofit

- Safety Equipment (Gloves, Glasses)
- Manifold Gauges
- Thermocouples to read line temperatures
- Vacuum Pump
- Leak Detection Equipment
- Scale
- Recovery Unit (RRU 30 by Refrigerant Recovery Technologies, Inc. is recommended. See your local DuPont refrigerants distributor.)
- Recovery Cylinder
- Container for Recovered Lubricant
- Replacement Lubricant
- Replacement Refrigerant
- Replacement Filter/Drier
- Labels indicating the refrigerant and lubricant charged to the system

Retrofit Procedure

Summarized below is a more detailed discussion of the recommended procedures for retrofitting an R502 system to Suva.

1. **Baseline Data with 502.** For service contractors performing their initial retrofits with Suva HP62, it is recommended that system performance data be collected while 502 remains in the system. Check for correct refrigerant charge and operating conditions. The baseline of temperatures and pressures with the correct charge of 502 at various points in the system (evaporator, condenser, compressor suction and discharge, expansion device, etc.) will be useful when optimizing operation of the system with Suva HP62. A **System Data Sheet** is attached for recording this baseline data.
2. **Drain/Charge System Lubricant.** Where mineral oil is the existing lubricant in the system, it will have to be drained. This may require removing the compressor from the system, particularly with small hermetic compressors which have no oil drain. In this case, the lubricant can be drained from the suction line of the compressor. In most small systems, 90–95% of the lubricant can be removed from the compressor in this manner. Larger systems may require drainage from additional points in the system, particularly low spots around the evaporator, to remove the majority of the lubricant. 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. Compare to the compressor/system specifications to ensure that the majority of lubricant has been removed. Polyol ester lubricant is recommended for use with Suva HP62. In order to achieve equivalent miscibility to 502/mineral oil, the residual mineral oil should be about 5 wt. % or less of the total lubricant used in the system. In larger systems, the amount of residual mineral oil can be achieved by using a flushing technique. Three or more lubricant flushes may be required. Lubricant flushes involve:

   - Draining existing lubricant from the system, as described above.
   - Selecting a polyol ester lubricant with similar viscosity to the existing lubricant.
   - Charging an amount of polyol ester equal to the amount of lubricant removed.
   - Running the system with 502 for thorough mixing of polyol ester/existing lubricant (48 to 72 hours of operation may be required).

   Repeat these steps two more times. On the last flush 502 will be replaced with Suva HP62.
3. **Remove 502 Charge.** R502 should be removed from the system and collected in a recovery cylinder using a recovery device capable of pulling 10–20 in. Hg vacuum (34–67 kPa, 0.34–0.67 bar). If the correct 502 charge size

for the system is not known, weigh the amount of refrigerant removed, as the initial quantity of Suva HP62 charged in the system will be determined from this figure.

4. **Reinstall Compressor** (if removed from system in step 2). Use normal service practices.
5. **Replace Filter/Drier.** It is routine practice to replace the filter/drier following system maintenance. There are two types of filter/driers commonly used in 502 equipment:
   a. Loose fill driers, which contain only the molecular sieve desiccant.
   b. Solid core driers, in which the molecular sieve desiccant is dispersed within a solid core binder.

   The XH-7 or XH-9 molecular sieve desiccants manufactured by UOP, the MS 592 or MS 594 molecular sieves manufactured by Grace, or their equivalent is recommended for use in loose fill driers with Suva HP62. For solid core driers, consult the drier manufacturer for their recommended drier for use with Suva HP62. For example, in the United States Sporlan® and Alco® have solid core driers which show acceptable compatibility with Suva HP62.
6. **Reconnect System and Evacuate.** Use normal service practices. To remove air or other noncondensables in the system, evacuate the system to near full vacuum use (29.9 in., 500 microns, 0.14 kPa, 0.0014 bar).

   Leak Check System. Use normal service practices. If a leak detector is used consult the leak detector manufacturer for unit's sensitivity to Suva HP62. Reevacuate system following leak check if necessary.
7. **Charge System with Suva HP62.** Suva HP62 should be taken from liquid phase of the cylinder. Returnable cylinders of Suva HP62 are equipped with dip-tubes allowing liquid to be removed from the cylinders when the cylinder is in the upright position. 13.6 kg (30 lb) Dispose-a Can® cylinders are also equipped with dip-tubes. *Liquid and vapor charging positions are indicated by arrows on the cylinder or cylinder box.*

   Once the Suva HP62 is removed from the cylinder, it may be converted to vapor if desired for charging. Use a throttling valve and sight glass to ensure liquid does not enter the compressor. **It is not necessary to charge Suva HP62 liquid phase.**

   The refrigerant system will require less weight of Suva HP62 than 502. The optimum charge will vary depending on the operating conditions, size of the evaporator and condenser, size of the receiver (if present), and the length of pipe or tubing runs in the system. For most systems, the optimum charge will be 85–90% by weight of the original equipment manufacturer 502 charge.

   It is recommended that the system be initially charged with about 80% by weight of the correct 502 charge. Add the initial charge to the high pressure side of the system (compressor *not* running). When the system and cylinder pressures equilibrate, load the remainder of the refrigerant to the suction side of the system (compressor running). Liquid refrigerant should never enter the suction side of the compressor.
8. **Start Up System and Adjust Charge.** Start up the system, and let conditions stabilize. If the system is undercharged, add additional Suva HP62 in small amounts until the system conditions reach the desired levels. Refer to the Suva HP62 Pressure-Temperature chart (Table 2) to compare system suction pressure and evaporator temperature with the suction pressure and evaporator temperature for 502. Suva HP62 will have higher discharge pressures and lower discharge temperatures when compared to R502 operation. A typical increase in discharge pressure would be from 15 to 25 psi (103–172 kPa/1.03–1.72 bar); a typical decrease in discharge temperature would be from 0.50 to 10°C (0 to 18°F).

Note: Label Components and System. After retrofitting the system with Suva HP62, label the system components to identify the type of refrigerant (Suva HP62) and lubricant in the system, so that the proper refrigerant and lubricant will be used to service the equipment in the future. Suva refrigerant identification labels are available from DuPont.

Summary

With the phaseout of CFCs, existing refrigeration equipment will need to be replaced with new equipment or retrofitted with alternative refrigerants. Using the procedures described above, existing refrigeration 502 systems can be retrofitted for use with Suva HP62, allowing them to continue in service for the remainder of their useful life.

Attached is a **Retrofit Checklist** and **System Data Sheet** and pressure-temperature charts for Suva HP62 to assist you in the retrofit process.

Table 2
Pressure-Temperature Chart—Suva HP62 Saturation Properties
(Engineering and SI Units)

Engineering

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

SI

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

* Inches of Hg, vacuum

Checklist for Suva HP62 Retrofit

_____ Establish baseline performance with R502. (See data sheet for recommended data.)

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

_____ Drain lubricant charge from compressor (unless polyol ester lubricant is already in the system).*
- Remove 90–95% of lubricant from the system
- Measure amount of lubricant removed and record_____

_____ Charge polyol ester lubricant. Run system for 48–72 hours *minimum*.
- Recharge with amount equivalent to amount of mineral oil removed.

_____ Repeat lubricant drain and ester charging until mineral oil content is less than 5%.

_____ Remove R502 charge from system.
(Need 10–20 in. Hg vacuum [34–67 kPa, 0.34–0.67 bar] to remove charge.)

_____ Reinstall compressor (if removed).

_____ Replace filter drier with new drier approved for use with Suva HP62.
- Loose fill driers: use XH-7 or XH-9 desiccant or equivalent
- Solid core driers: check with drier manufacturer for recommendation

_____ Reconnect system and evacuate with vacuum pump. (Evacuate to full vacuum [29.9 in. Hg vacuum/0.14 kPa/0.0014 bar]).

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

_____ Charge system with Suva HP62.
- Initially charge 80% by weight of original equipment manufacturer specified R502 charge
- Amount of refrigerant charged: _____

_____ Start up equipment and adjust charge until desired operating conditions are achieved.
- If low in charge, add in increments of 2–3% of original R502 charge
- Amount of refrigerant charged: _____

Total Refrigerant Charged (add 9 and 10) _____

_____ Label components and system for type of refrigerant (Suva HP62) and lubricant (polyol ester).

_____ Conversion is complete!!

*R502 charge should only be removed if compressor must be taken out of system to drain oil, such as for small hermetics.

System Data Sheet

Type of System/Location: _____

Equipment Mfg.: _____ Compressor Mfg.: _____

Model No.: _____ Model No.: _____

Serial No.: _____ Serial No.: _____

R502 charge size: _____ Original Lubricant:

Type/mfg: _____

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/grams)				
Ambient Temp. (°F/°C)				
Relative Humidity				
Compressor:				
Suction T (°F/°C)				
Suction P (psig, psia/kPa, bar)				
Discharge T (°F/°C)				
Discharge P (psig, psia/kPa, bar)				
Box/Case T (°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 @ Superht. 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: _____