DUPONT

Suva®
refrigerants

ART-5

Retrofit Guidelines for Suva® MP39 and Suva® MP66

Introduction

Suva® MP39 and Suva® MP66 are commercially available mixtures of HCFC-22, HFC-152a, and HCFC-124 that have been developed to replace CFC-12 in medium- and low-temperature refrigeration applications. Suva® MP66 is also an excellent replacement for R-500. Using the retrofit guidelines summarized below, most CFC-12 and R-500 direct expansion systems using positive displacement compressors (reciprocating, rotary, screw, and scroll) can be easily and economically retrofitted to Suva® MP39 or Suva® MP66. This allows the existing equipment to continue to operate safely and efficiently for the remainder of its useful life.

Properties and Safety

The Suva® MP refrigerant blends offer better environmental properties than CFC-12 and R-500, with significantly lower ozone depletion potential (ODP) and global warming potential (GWP) (see **Table 1**). Like CFC-12 and R-500, Suva® MP39 and Suva® MP66 are nonflammable and have a low degree of toxicity. Refer to DuPont Technical Bulletin P-MP (H-45944-3) for more detailed information on the properties, uses, storage, and handling of Suva® MP39 and Suva® MP66. Refer to the product Material Safety Data Sheets (MSDSs) for more safety information.

Selection of Refrigerant

The Suva® MP blends are recommended replacements for CFC-12 and R-500 in direct expansion systems using positive displacement compressors. Suva® MP39 and Suva® MP66 are near-azeotropes; therefore, the vapor composition in the refrigerant cylinder is different from the liquid composition. This small composition difference will not affect performance in direct expansion systems; however, it may affect performance in systems with flooded evaporators. In general, the Suva® MP blends are not recommended for use in systems with flooded evaporators.

Suva® MP39 is the recommended alternative for most medium-temperature CFC-12 systems. Suva® MP39 has capacities and efficiencies comparable to those of CFC-12 in systems operating at evaporator temperatures of –23°C (–10°F) and above, making it suitable for use in such applications as reach-in and walk-in coolers, food and dairy display cases, beverage dispensers, beverage vending machines, and home refrigerators.

Suva® MP66 provides comparable capacity to CFC-12 in systems operating at evaporator temperatures below –23°C (–10°F), making it suitable for use in domestic and commercial freezers and some transport refrigeration equipment.

Suva® MP66 is also the recommended alternative for existing R-500 systems. With Suva® MP66, capacity, efficiency, discharge temperature, and discharge pressure will all be similar to that of R-500.

Lubricants

Lubricant selection is based upon 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 about any specific lubricant recommendations for your compressors. Other sources of lubricant information are the DuPont authorized distributor, lubricant manufacturers, and system manufacturers.

To maintain similar lubricant/refrigerant miscibility as CFC-12/mineral oil, use one quick lubricant change when retrofitting to Suva® MP39 or Suva® MP66. Both Suva® MP39 and Suva® MP66 are miscible with alkylbenzene lubricants, which are in use today with CFC-12 and R-500 in some refrigeration systems. Alkylbenzene lubricants have been used successfully in thousands of systems retrofitted with the Suva® MP blends and are compatible with materials of construction commonly used in CFC systems. In systems

Table 1
Suva® MP39 and Suva® MP66 Physical Properties

Property	Units	R-12	MP39	MP66	R-500
Boiling Point (1 atm)	°C (–°F)	–30 (–22)	–33 (–27)	–35 (–30)	–34 (–28)
Density, Saturated Liquid at 25°C (77°F)	kg/m³ lb/ft³	1311 81.8	1194 74.5	1193 74.5	1156 72.2
Density, Saturated Vapor at 25°C (77°F)	kg/m³ lb/ft³	37.2 2.32	29.0 1.81	30.7 1.92	36.8 2.29
Vapor Pressure, Saturated Liquid at 25°C (77°F)	kPa (abs) psia	651 94.5	773 112.1	819 118.8	768 111.5
Ozone Depletion Potential versus R-12	R-12 = 1	1.0	0.03	0.035	0.70
Halocarbon Global Warming Potential versus R-11	R-11 = 1	3.0	0.22	0.24	2.0
Capacity versus R-12*	R-12 = 100	100	108	116	—
MP66 versus R-500**	R-500 = 100	—	—	100	100
Efficiency versus R-12*	R-12 = 100	100	101	101	—
MP66 versus R-500**	R-500 = 100	—	—	100	100

* Conditions: –23.3°C (–10°F) Evaporator/54.4°C (130°F) Condenser/Superheat to 32.2°C (90°F)/Subcool to 32.2°C (90°F)
** Conditions: 1.7°C (35°F) Evaporator/54.4°C (130°F) Condenser/Superheat to 26.7°C (80°F)/Subcool to 51.6°C (125°F)

already charged with the alkylbenzene lubricant, no lubricant change is needed when retrofitting with Suva® MP39 or Suva® MP66.

Oil return to the compressor is required for proper lubrication. Field experience has shown that Suva® MP39 works successfully with mineral oil in many hermetic systems where oil return is not a concern, such as reach-in coolers, display cases, and beverage dispensers. Systems may have poor oil return if the evaporator is distant from the compressor, the evaporator is below the compressor, or there are low line velocities. In such systems, the best way to protect the compressor is to make one oil change. Knowledgeable contractors are in the best position to determine if oil return might be a problem.

Filter Drier

Change the filter drier during the retrofit. This is routine practice following system maintenance. There are three types of filter driers commonly used in CFC-12 or R-500 equipment:

- Solid-core driers, in which the molecular sieve desiccant is dispersed within a solid-core binder.
- Loose-filled driers, which contain only the molecular sieve desiccant.
- Compacted-bead driers, which also contain only the molecular sieve desiccant, but the desiccant is compacted in the drier by mechanical pressure, usually a spring.

For solid-core driers, consult the drier manufacturer for the recommended drier to use with the Suva® MP blends. Most existing models of solid-core driers, such as the Sporlan® Catch All® or Alco® ADK, are compatible with the Suva® MP blends.

The XH-9 molecular sieve desiccant (manufactured by UOP) or equivalent (such as MS 594 from Grace) is recommended for use in loose-filled driers with the Suva® MP blends.

Compacted bead driers may use either the XH-9 or XH-6 desiccant or equivalent. Consult the drier manufacturer for recommendation.

System Modification

The compositions of Suva® MP39 and Suva® MP66 have been selected to provide performance comparable to CFC-12 or R-500 for specific applications in terms of both capacity and energy efficiency. As a result, minimal system modifications are anticipated when retrofitting CFC-12 or R-500 systems with Suva® MP39 or Suva® MP66. Review hose and gasket materials for compatibility with the Suva® MP blends. In general, elastomers and plastics recommended for use with HCFC-22 are suitable for use with the Suva® MP blends with either mineral oil or alkylbenzene lubricants. Consult the equipment manufacturer for specific hose and gasket recommendations.

Retrofits of CFC-12 or R-500 systems with other alternative refrigerants, such as HCFC-22 or HFC-134a, may require more extensive modifications to the existing equipment (compressor replacement, etc.). For some systems, this cost may be prohibitive. Suva® MP39 and Suva® MP66 provide the service contractor and equipment owner with a cost-effective way to retrofit an existing CFC-12 or R-500 system.

NOTE: Suva® MP39 and Suva® MP66 were not designed for use with other refrigerants or additives that have not been clearly specified by DuPont. Mixing CFC-12 or R-500 with a Suva® MP refrigerant may have an adverse impact on system performance; therefore, topping off an existing CFC-12 or R-500 charge with Suva® MP39 or Suva® MP66 is not recommended.

Overview of Retrofit Process

Retrofit of an existing CFC-12 or R-500 system with Suva® MP39 or Suva® MP66 can be accomplished with service practices and service equipment commonly used by trained mechanics or service contractors in the field. The key steps involved in the retrofit are:

1. Evacuate CFC-12 or R-500 charge from system.
2. Remove mineral oil from compressor and replace with alkylbenzene lubricant (AB is the recommended lubricant), except as noted for MP39 in small hermetic systems.
3. Replace filter drier with new drier compatible with the Suva® MP refrigerant blends.
4. Charge system with Suva® MP39 or Suva® MP66.
5. Start system and adjust charge or controls to achieve desired operation.

For the majority of systems, the compressor lubricant change, the filter drier change, and, in systems with expansion valves, a possible adjustment to the superheat setting will be the only system modifications required in a retrofit to Suva® MP39 or Suva® MP66. For systems that are still under warranty, contact the equipment or compressor manufacturers prior to performing the retrofit concerning warranty terms.

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 (See your local Authorized DuPont Distributor.)
- Recovery cylinder
- Container for recovered lubricant
- Replacement lubricant
- Refrigerant cylinder with Suva® MP39 or Suva® MP66
- Replacement filter drier
- Labels indicating the refrigerant and lubricant charged to the system

Retrofit Procedure

Prior to the retrofit, review the Material Safety Data Sheets for safety information on the use of Suva® MP39 or Suva® MP66:

1. **Establish Baseline Data with CFC-12 or R-500.** For service contractors performing their initial retrofits with Suva® MP refrigerant blends, it is recommended that system performance data be collected while CFC-12 or R-500 is in the system. This baseline data of temperatures and pressures at various points in the system (evaporator, condenser, compressor suction and discharge, expansion device, etc.) at normal operating conditions can be useful when optimizing operation of the system with the Suva® MP39 or Suva® MP66. A System Data Sheet is included on page 11 for recording this baseline data.
2. **Remove CFC-12 or R-500 Charge.** CFC-12 or R-500 should be removed from the system and collected in a recovery cylinder using a recovery device capable of pulling 10–15 in Hg vacuum (50–67 kPa, 0.50–0.67 bar [abs)]). If the recommended CFC-12 or R-500 charge size for the system is not known, weigh the amount of refrigerant removed, if possible. The initial quantity of Suva® MP39 or Suva® MP66 charged in the system can be determined from this amount.
3. **Drain Lubricant from Compressor (if a lubricant change is required).** *One quick oil change is all that is normally required to ensure that adequate mineral oil has been removed from the system.* Consult compressor manufacturer for specific lubricant recommendations. In many systems where mineral oil is the existing lubricant, the lubricant may have to be changed to alkylbenzene. This may require removing the compressor from the system. For small hermetic compressors that have no oil drain, the lubricant can usually be removed from the compressor by using an oil pump or by draining through 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 amount of lubricant removed from the compressor.

   Oil return to the compressor is required for proper lubrication. Field experience has shown that Suva® MP39 works successfully with mineral oil in many hermetic systems where oil return is not a concern, such as reach-in coolers, display cases, and beverage dispensers. Systems may have poor oil return if the evaporator is distant from the compressor, the evaporator is below the compressor, or there are low line velocities. In such systems, the best way to

protect the compressor is to make one oil change. Knowledgeable contractors are in the best position to determine if oil return might be a problem.

If poor system performance is noted on start-up, an additional lubricant change may be required (DuPont experience is that this occurs in <1% of retrofits). Record the amount of lubricant removed on the Retrofit Checklist (p. 10), because this information will be needed in the next step.

4. **Charge Compressor with the Recommended Lubricant.** In most cases, this will be alkylbenzene. Charge the compressor with the same volume of lubricant as the volume of mineral oil lubricant removed in step 3. Use a viscosity of alkylbenzene (or recommended lubricant) similar to that of the mineral oil used in the system or the viscosity recommended for that compressor model (150 SUS or 32 cSt is typical for medium-temperature CFC-12 systems). Check with the compressor manufacturer for specific lubricant recommendations.

   Reinstall Compressor (if removed from system in step 3). Use normal service practices.

5. **Replace Filter Drier.** It is routine practice to replace the filter drier following system maintenance. Replacement driers are available that are compatible with Suva® MP39 and Suva® MP66.

   For loose-filled driers, the XH-9 molecular sieve desiccant (manufactured by UOP) or equivalent (such as MS 594 from Grace) is recommended for use with the Suva® MP blends. Compacted-bead driers may use either the XH-9 or XH-6 desiccant or equivalent.

   For solid-core driers, consult the drier manufacturer for the recommended drier to use with Suva® MP blends. Most existing models of solid-core driers, such as the Sporlan® Catch All® or Alco® ADK, are compatible with Suva® MP blends.

6. **Reconnect System and Evacuate.** Use normal service practices. To remove air or other non-condensibles in the system, evacuate the system to a deep vacuum of 29.9 in Hg vacuum (500 µm/0.14 kPa, 0.0014 bar [abs]).

   Leak Check System. Use normal service practices. Reevacuate system after leak check.

7. **Charge System with Suva® MP39 or Suva® MP66.** Suva® MP39 and Suva® MP66 are near-azeotropic blends; therefore, the vapor composition in the refrigerant cylinder is different from the liquid composition. To ensure that the proper blend composition is charged in the system, it is important that *liquid only* be removed from the cylinder. Cylinders of both Suva® MP39 and Suva® MP66 are equipped with dip tubes, allowing liquid to be removed from the cylinder in the upright position. The proper position is indicated by arrows on the cylinder and cylinder box. Once removed from the cylinder, the Suva® MP blends can be charged to the system as vapor as long as all of the liquid removed from the cylinder is transferred to the system.

   Retrofits of CFC-12 Equipment: The refrigeration system will require a *smaller* charge size with Suva® MP39 or Suva® MP66 than with CFC-12. The optimum charge will vary depending on the operating conditions, size of the evaporator and condenser, size of receiver (if present), and length of pipe or tubing runs in the system. For most systems, the optimum charge will be 75–90% by weight of the original CFC-12 charge. The system should be initially charged with 70–75% by weight of the original CFC-12 charge (ex.: if original CFC-12 charge was 10 oz, initially charge 7–7.5 oz of Suva® MP39 or Suva® MP66; similarly, if original CFC-12 charge was 300 g, initially charge 210–220 g of Suva® MP39 or Suva® MP66).

   Retrofits of R-500 Equipment: The refrigeration system will require a slightly *larger* charge with Suva® MP66 than with R-500. For most systems, the optimum charge will be about 105% by weight of the original R-500 charge. The system should be initially charged with 95–100% by weight of the original R-500 charge.

   Add the initial charge to the high-pressure side of the system until the system and cylinder pressure equilibrate. Position the refrigerant filling connections to the low-pressure side of the system, start the compressor, and load the remainder of the refrigerant to the suction line of the system. Because liquid must be removed from the refrigerant cylinder, it is important to charge the refrigerant slowly into the suction line to allow it to flash before it enters the system, in order to avoid damage to the compressor from liquid refrigerant entering the suction side of the compressor. A throttling device may also be used to cause the refrigerant to flash before entering the system.

8. **Adjust Charge.** Let conditions stabilize. If the system is undercharged, add additional Suva® MP39 or Suva® MP66 in small amounts (still removing liquid from the charging cylinder) until desired operating conditions are achieved.

   When the system is stabilized, compressor suction pressures for the Suva® MP blends should be within about 1 psi (7 kPa, 0.07 bar) of normal system operation with CFC-12 for most medium temperature applications. Compressor discharge pressures will typically be about 10–20 psi (70–140 kPa, 0.7–1.4 bar) higher than normal system operation with CFC-12. For Suva® MP66 retrofits of R-500 equipment, compressor discharge pressures will be about 5 psi (34 kPa, 0.34 bar) higher and compressor suction pressures about 3 psi (18 kPa, 0.18 bar) lower than with R-500.

The Suva® MP blends are more sensitive to charge size than CFC-15 is; therefore, system peformance will change more quickly if the system is overcharged (or undercharged) with the Suva® MP blends. See the section "How to Determine Suction Pressure, Super Heat, and Subcool" below for additional information on optimizing system performance.

NOTE: System charge should be determined by measuring operating conditions (discharge and suction pressures, suction line temperature, compressor amps, superheat, etc.). Attempting to charge until the sight glass is clear may result in overcharging the refrigerant.

NOTE: Label Components and System. After retrofitting the system with one of the Suva® MP blends, label the system components to identify the type of refrigerant (Suva® MP39 or Suva® MP66) and lubricant in the system, so that the proper refrigerant and lubricant will be used to service the equipment in the future. Identification labels are available at your DuPont authorized distributor.

Summary

Using the procedures described above, existing CFC-12 and R-500 refrigeration systems can be retrofitted for use with Suva® MP39 or Suva® MP66, allowing them to continue in service for the remainder of their useful life.

The Retrofit Checklist, System Data Sheet, and pressure–temperature charts for Suva® MP39 and Suva® MP66 (starting on p. 6) will assist you in the retrofit process.

Pressure/Temperature Relationship of Suva® MP Blends

Temperature Glide

Temperature glide occurs in both the evaporator and the condenser. In the evaporator, assuming constant pressure, the refrigerant blend begins to boil at one temperature and completes boiling at a higher temperature. The difference in these boiling temperatures is called temperature glide. This also occurs in the condenser, except that the temperature decreases as the refrigerant vapor condenses. The temperature glide for the Suva® MP blends will be in the 4–5°C (8–10°F) range.

NOTE: The average evaporator temperature will be the same, and the cooling performance will be the same or better compared to R-12 or R-500 operation.

How to Read the Tables

Tables 2a and 2b show the pressure/temperature relationship of Suva® MP39 compared with CFC-12; **Tables 3a and 3b** show the pressure/temperature relationship of Suva® MP66 compared with CFC-12 and R-500. As you can see, there are three temperatures 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 in the 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 or condenser will perform like it is operating at this constant temperature. Based on the suction or condenser pressure, use this average temperature to compare coil temperatures (i.e., evaporator or condenser temperatures) with CFC-12 or R-500. For Suva® MP39 and Suva® MP66, the Average Evaporator Temperature is approximately 2°C (4°F) *lower* than the Saturated Vapor Temperature; the Average Condenser Temperature is approximately 2°C (4°F) *higher* than the Saturated Liquid Temperature.

How to Determine Suction Pressure, Superheat, and Subcool

Suction Pressure

1. Determine the expected evaporator temperature using the CFC-12 or R-500 column (baseline data).
2. Find the same expected evaporator temperature in the "Average Coil Temperature" column for Suva® MP39 or Suva® MP66, and note the corresponding pressure for this temperature. This is the suction pressure at which the system should operate. (See definition of Average Coil Temperature in previous section for relationship of Saturated Liquid and Saturated Vapor of Suva® MP39 and Suva® MP66 with Average Coil Temperature.)

Superheat

Using the "Saturated Vapor Temperature" column for Suva® MP39 or Suva® MP66, the amount of vapor superheat is calculated in the same manner as for CFC-12 and R-500.

Subcool

Using the "Saturated Liquid Temperature" column for Suva® MP39 or Suva® MP66, the amount of liquid subcool is calculated in the same manner as for CFC-12 and R-500.

Pressure-Temperature Chart
Suva® MP39 (psi/°F)

Pressure psi	R-12 Sat. Temp. (°F)	Suva® MP39 Sat. Liquid Temp. (°F)	Suva® MP39 Sat. Vapor Temp. (°F)	Suva® MP39 Avg. Coil Temp. (°F)
20*	–63	–67	–55	–60
15*	–49	–53	–42	–47
10*	–38	–43	–32	–37
5*	–29	–35	–23	–28
0	–22	–27	–16	–21
2	–16	–22	–11	–15
4	–11	–17	–6	–10
6	–7	–13	–2	–6
8	–2	–9	2	–2
10	2	–5	6	2
12	5	–2	9	5
14	9	2	13	9
16	12	5	16	12
18	15	8	19	15
20	18	11	21	17
22	21	14	24	20
24	24	16	27	23
26	27	19	29	25
28	29	21	32	28
30	32	24	34	30
32	34	26	36	32
34	37	28	38	34
36	39	30	40	36
38	41	32	42	38
40	43	34	44	40
42	45	36	46	42
44	47	38	48	44
46	49	40	50	46
48	51	42	52	48
50	53	44	54	50
55	58	48	58	54
60	62	52	62	58
65	66	56	66	62
70	70	59	69	65
75	74	63	73	69
80	77	66	76	71
85	81	69	79	74
90	84	73	82	78
95	87	76	85	81
100	90	78	88	83
105	93	81	90	86
110	96	84	93	89
115	99	87	96	92
120	102	89	98	94
125	104	92	101	97

Pressure psi	R-12 Sat. Temp. (°F)	Suva® MP39 Sat. Liquid Temp. (°F)	Suva® MP39 Sat. Vapor Temp. (°F)	Suva® MP39 Avg. Coil Temp. (°F)
130	107	94	103	99
135	109	96	105	101
140	112	99	107	103
145	114	101	110	106
150	117	103	112	108
155	119	105	114	110
160	121	108	116	112
165	123	110	118	114
170	125	112	120	116
175	128	114	122	118
180	130	116	124	120
185	132	117	126	122
190	134	119	127	123
195	136	121	129	125
200	138	123	131	128
205	139	125	133	129
210	141	126	134	130
215	143	128	136	132
220	145	130	138	134
225	147	131	139	135
230	148	133	141	137
235	150	135	142	139
240	152	136	144	140
245	154	138	145	142
250	155	139	147	143
255	157	141	148	145
260	158	142	150	146
265	160	144	151	148
270	162	145	153	149
275	163	147	154	151
280	165	148	155	152
285	166	150	157	154
290	168	151	158	155
295	169	152	159	156
300	170	154	161	158
310	173	156	163	160
320	176	159	166	163
330	179	162	168	165
340	182	164	170	167
350	184	167	173	170
360	187	169	175	172
370	189	171	177	174
380	192	174	180	177
390	194	176	182	179
400	196	178	184	181

* Inches Mercury Below One Atmosphere

Table 2b
Pressure–Temperature Chart
Suva® MP39 (kPa/°C)

Pressure kPa (abs)	R-12 Sat. Temp. (°C)	Suva® MP39 Sat. Liquid Temp. (°C)	Suva® MP39 Sat. Vapor Temp. (°C)	Suva® MP39 Avg. Coil Temp. (°C)
20	–62.0	–64.0	–57.5	–60.0
40	–49.5	–52.0	–45.5	–48.0
60	–41.5	–44.0	–37.5	–40.0
80	–35.0	–38.0	–32.0	–34.5
100	–30.0	–33.5	–27.0	–29.5
110	–28.0	–31.0	–25.0	–27.5
120	–25.5	–29.0	–23.0	–25.5
130	–24.0	–27.0	–21.0	–23.5
140	–22.0	–25.5	–19.5	–22.0
150	–20.0	–24.0	–17.5	–20.0
160	–18.5	–22.0	–16.0	–18.5
170	–17.0	–20.5	–14.5	–17.0
180	–15.5	–19.5	–13.0	–15.5
190	–14.0	–18.0	–12.0	–14.5
200	–12.5	–16.5	–10.5	–13.0
210	–11.0	–15.5	–9.5	–12.0
220	–10.0	–14.0	–8.0	–10.5
230	–8.5	–13.0	–7.0	–9.5
240	–7.5	–11.5	–6.0	–8.0
250	–6.0	–10.5	–4.5	–7.0
260	–5.0	–9.5	–3.5	–6.0
270	–4.0	–8.5	–2.5	–5.0
280	–3.0	–7.5	–1.5	–4.0
290	–2.0	–6.5	–0.5	–3.0
300	–1.0	–5.5	0.5	–2.0
310	0.0	–4.5	1.5	–1.0
320	1.0	–3.5	2.0	0.0
330	2.0	–2.5	3.0	1.0
340	3.0	–2.0	4.0	1.5
350	4.0	–1.0	4.5	2.5
375	6.0	1.0	7.0	4.5
400	8.0	3.0	8.5	6.5
425	10.0	5.0	10.5	8.5
450	12.0	7.0	12.5	10.5
475	14.0	8.5	14.0	12.0
500	15.5	10.0	15.5	13.5
525	17.5	11.5	17.0	15.0
550	19.0	13.0	18.5	16.5
575	20.5	14.5	20.0	18.0
600	22.0	16.0	21.5	19.5
625	23.5	17.5	23.0	21.0
650	25.0	19.0	24.0	22.0
675	26.5	20.0	25.5	23.5
700	27.5	21.5	26.5	24.5
725	29.0	22.5	28.0	26.0

Pressure kPa (abs)	R-12 Sat. Temp. (°C)	Suva® MP39 Sat. Liquid Temp. (°C)	Suva® MP39 Sat. Vapor Temp. (°C)	Suva® MP39 Avg. Coil Temp. (°C)
750	30.5	24.0	29.0	26.5
775	31.5	25.0	30.0	27.5
800	33.0	26.5	31.5	29.0
825	34.0	27.5	32.5	30.0
850	35.0	28.5	33.5	31.0
900	37.5	30.5	35.5	33.0
950	39.5	32.5	37.5	35.0
1000	41.5	34.5	39.5	37.0
1050	43.5	36.5	41.5	39.0
1100	45.5	38.5	43.0	40.5
1150	47.5	40.0	45.0	42.5
1200	49.5	42.0	46.5	44.0
1250	51.0	43.5	48.0	45.5
1300	53.0	45.0	49.5	47.0
1350	54.5	46.5	51.0	48.5
1400	56.0	48.0	52.5	50.0
1450	57.5	49.5	54.0	51.5
1500	59.0	51.0	55.5	53.0
1550	60.5	52.5	57.0	54.5
1600	62.0	54.0	58.0	56.0
1650	63.5	55.0	59.5	57.0
1700	65.0	56.5	60.5	58.5
1750	66.5	58.0	62.0	60.0
1800	68.0	59.0	63.0	61.0
1850	69.0	60.5	64.5	62.5
1900	70.5	61.5	65.5	63.5
1950	71.5	62.5	66.5	64.5
2000	73.0	64.0	68.0	66.0
2050	74.0	65.0	69.0	67.0
2100	75.5	66.0	70.0	68.0
2150	76.5	67.0	71.0	69.0
2200	77.5	68.5	72.0	70.5
2250	79.0	69.5	73.0	71.5
2300	80.0	70.5	74.0	72.5
2350	81.0	71.5	75.0	73.5
2400	82.0	72.5	76.0	74.5
2450	83.0	73.5	77.0	75.5
2500	84.0	74.5	78.0	76.5
2600	86.5	76.5	80.0	78.5
2700	88.5	78.5	81.5	80.0
2800	90.0	80.0	83.5	82.0
2900	92.0	82.0	85.0	83.5
3000	94.0	83.5	86.5	85.0
3100	96.0	85.5	88.0	87.0
3200	97.5	87.0	90.0	88.5

Table 3a
Pressure–Temperature Chart
Suva® MP66 (psi/°F)

Pressure psi	R-12 Sat. Temp. (°F)	R-500 Sat. Temp. (°F)	Suva® MP66 Sat. Liquid Temp. (°F)	Suva® MP66 Sat. Vapor Temp. (°F)	Suva® MP66 Avg. Coil Temp. (°F)
20*	–63	–69	–70	–59	–64
15*	–49	–55	–56	–45	–50
10*	–38	–44	–46	–35	–40
5*	–29	–36	–37	–27	–31
0	–22	–28	–30	–20	–24
2	–16	–23	–25	–14	–18
4	–11	–18	–20	–10	–14
6	–7	–14	–16	–6	–10
8	–2	–10	–12	–2	–6
10	2	–6	–8	2	–2
12	5	–2	–5	6	2
14	9	1	–1	9	5
16	12	4	2	12	8
18	15	7	5	15	11
20	18	10	8	18	14
22	21	13	10	20	16
24	24	16	13	23	19
26	27	18	15	25	21
28	29	21	18	28	24
30	32	23	20	30	26
32	34	26	22	32	28
34	37	28	25	34	30
36	39	30	27	37	33
38	41	32	29	39	35
40	43	34	31	41	37
42	45	36	33	42	38
44	47	38	35	44	40
46	49	40	37	46	42
48	51	42	38	48	44
50	53	44	40	50	46
55	58	48	44	54	50
60	62	52	48	58	54
65	66	56	52	61	57
70	70	60	56	65	61
75	74	63	59	68	64
80	77	67	63	72	68
85	81	70	66	75	71
90	84	73	69	78	74
95	87	76	72	81	77
100	90	79	75	83	79
105	93	82	77	86	81
110	96	84	80	89	84
115	99	87	83	91	87
120	102	90	85	94	89
125	104	92	88	96	92

Pressure psi	R-12 Sat. Temp. (°F)	R-500 Sat. Temp. (°F)	Suva® MP66 Sat. Liquid Temp. (°F)	Suva® MP66 Sat. Vapor Temp. (°F)	Suva® MP66 Avg. Coil Temp. (°F)
130	107	95	90	99	94
135	109	97	93	101	97
140	112	99	95	103	99
145	114	102	97	105	101
150	117	104	99	107	103
155	119	106	101	109	105
160	121	108	103	111	107
165	123	110	106	113	110
170	125	112	108	115	112
175	128	114	109	117	113
180	130	116	111	119	115
185	132	118	113	121	117
190	134	120	115	123	119
195	136	122	117	125	121
200	138	124	119	126	123
205	139	126	121	128	125
210	141	128	122	130	126
215	143	129	124	131	128
220	145	131	126	133	130
225	147	133	127	135	131
230	148	134	129	136	133
235	150	136	130	138	134
240	152	138	132	139	136
245	154	139	134	141	138
250	155	141	135	142	139
255	157	142	137	144	141
260	158	144	138	145	142
265	160	145	140	146	143
270	162	147	141	148	145
275	163	148	142	149	146
280	165	150	144	151	148
285	166	151	145	152	149
290	168	153	147	153	150
295	169	154	148	155	152
300	170	155	149	156	153
310	173	158	152	158	155
320	176	161	155	161	158
330	179	163	157	163	160
340	182	166	160	166	163
350	184	168	162	168	165
360	187	171	164	170	167
370	189	173	167	172	170
380	192	176	169	175	172
390	194	178	171	177	174
400	196	180	174	179	177

* Inches Mercury Below One Atmosphere

Table 3b
Pressure–Temperature Chart
Suva® MP66 (kPa/°C)

Pressure kPa (abs)	R-12 Sat. Temp. (°C)	R-500 Sat. Temp. (°C)	Suva® MP66 Sat. Liquid Temp. (°C)	Suva® MP66 Sat. Vapor Temp. (°C)	Suva® MP66 Avg. Coil Temp. (°C)
20	–62.0	–65.0	–65.5	–59.0	–62.0
40	–49.5	–53.0	–53.5	–47.0	–50.0
60	–41.5	–45.0	–45.5	–39.5	–42.0
80	–35.0	–39.0	–39.5	–33.5	–36.0
100	–30.0	–33.0	–35.0	–29.0	–31.5
110	–28.0	–31.5	–32.5	–27.0	–29.5
120	–25.5	–29.5	–30.5	–25.0	–27.5
130	–24.0	–27.5	–29.0	–23.0	–25.5
140	–22.0	–26.0	–27.0	–21.5	–24.0
150	–20.0	–24.0	–25.5	–19.5	–22.0
160	–18.5	–22.5	–24.0	–18.0	–20.5
170	–17.0	–21.0	–22.5	–16.5	–19.0
180	–15.5	–19.5	–21.0	–15.0	–17.5
190	–14.0	–18.0	–19.5	–14.0	–16.5
200	–12.5	–17.0	–18.5	–12.5	–15.0
210	–11.0	–15.5	–17.0	–11.5	–14.0
220	–10.0	–14.5	–16.0	–10.0	–12.5
230	–8.5	–13.0	–14.5	–9.0	–11.5
240	–7.5	–12.0	–13.5	–8.0	–10.5
250	–6.0	–11.0	–12.5	–7.0	–9.5
260	–5.0	–9.5	–11.5	–5.5	–8.0
270	–4.0	–8.5	–10.5	–4.5	–7.0
280	–3.0	–7.5	–9.5	–3.5	–6.0
290	–2.0	–6.5	–8.5	–2.5	–5.0
300	–1.0	–5.5	–7.5	–2.0	–4.5
310	0.0	–4.5	–6.5	–1.0	–3.5
320	1.0	–3.5	–5.5	0.0	–2.5
330	2.0	–3.0	–4.5	1.0	–1.5
340	3.0	–2.0	–3.5	1.5	–0.5
350	4.0	–1.0	–3.0	2.5	0.0
375	6.0	1.0	–1.0	4.5	2.0
400	8.0	3.0	1.0	6.5	4.0
425	10.0	5.0	3.0	8.5	6.0
450	12.0	6.5	5.0	10.0	8.0
475	14.0	8.5	6.5	11.5	9.5
500	15.5	10.0	8.0	13.5	11.0
525	17.5	11.5	9.5	15.0	12.5
550	19.0	13.5	11.0	16.5	14.0
575	20.5	15.0	12.5	18.0	15.5
600	22.0	16.0	14.0	19.0	17.0
625	23.5	17.5	15.5	20.5	18.5
650	25.0	19.0	17.0	22.0	20.0
675	26.5	20.5	18.0	23.0	21.0
700	27.5	21.5	19.5	24.5	22.5
725	29.0	23.0	20.5	25.5	23.5
750	30.5	24.0	22.0	26.5	24.5
775	31.5	25.5	23.0	28.0	25.5
800	33.0	26.5	24.0	29.0	26.5
825	34.0	27.5	25.5	30.0	27.5
850	35.0	28.5	26.5	31.0	28.5
900	37.5	31.0	28.5	33.0	30.5
950	39.5	33.0	30.5	35.0	32.5
1000	41.5	35.0	32.5	37.0	34.5
1050	43.5	37.0	34.5	39.0	36.5
1100	45.5	39.0	36.0	40.5	38.0
1150	47.5	40.5	38.0	42.5	40.0
1200	49.5	42.5	39.5	44.0	41.5
1250	51.0	44.0	41.0	45.5	43.0
1300	53.0	45.5	43.0	47.0	45.0
1350	54.5	47.0	44.5	48.5	46.5
1400	56.0	48.5	46.0	50.0	48.0
1450	57.5	50.0	47.5	51.5	49.5
1500	59.0	51.5	49.0	53.0	51.0
1550	60.5	53.0	50.0	54.5	52.0
1600	62.0	54.5	51.5	55.5	53.5
1650	63.5	56.0	53.0	57.0	55.0
1700	65.0	57.0	54.0	58.0	56.0
1750	66.5	58.5	55.5	59.5	57.5
1800	68.0	60.0	56.5	60.5	58.5
1850	69.0	61.0	58.0	62.0	60.0
1900	70.5	62.5	59.0	63.0	61.0
1950	71.5	63.5	60.5	64.0	62.5
2000	73.0	64.5	61.5	65.0	63.5
2050	74.0	66.0	62.5	66.5	64.5
2100	75.5	67.0	63.5	67.5	65.5
2150	76.5	68.0	65.0	68.5	67.0
2200	77.5	69.0	66.0	69.5	68.0
2250	79.0	70.5	67.0	70.5	69.0
2300	80.0	71.5	68.0	71.5	70.0
2350	81.0	72.5	69.0	72.5	71.0
2400	82.0	73.5	70.0	73.5	72.0
2450	83.0	74.5	71.0	74.5	73.0
2500	84.0	75.5	72.0	75.5	74.0
2600	86.5	77.5	74.0	77.0	75.5
2700	88.5	79.5	76.0	79.0	77.5
2800	90.0	81.0	77.5	80.5	79.0
2900	92.0	83.0	79.5	82.5	81.0
3000	94.0	84.5	81.0	84.0	82.5
3100	96.0	86.5	83.0	85.5	84.5
3200	97.5	88.0	84.5	87.0	86.0

Checklist for Suva® MP39 or Suva® MP66 Retrofit

_____ 1. Establish baseline performance with CFC-12 or R-500.

_____ 2. Remove CFC-12 or R-500 charge from system.
(Need 10–15 in Hg vacuum [50–67 kPa, 0.50–0.67 bar] to remove charge.)
- Use recovery cylinder *(do not vent to atmosphere).*
- Weigh amount removed (if possible): _____

_____ 3. Drain lubricant charge from compressor (where required).
- Measure amount of lubricant removed and record: _____

_____ 4. Charge approved lubricant (alkylbenzene in most cases).
- Recharge with same amount removed in *Step 3.*
- Reinstall compressor (if removed).

_____ 5. Replace filter drier with new drier approved for use with Suva® MP blends.
- Loose-fill driers: use XH-9 desiccant or equivalent.
- Compacted-bead driers: use XH-9 or XH-6 desiccant or equivalent.
- Solid-core driers: check with drier manufacturer for recommendation.

_____ 6. Reconnect system and evacuate with vacuum pump. Evacuate to full vacuum (29.9 in Hg vacuum[500 µm/0.14 kPa, 0.0014 bar]).
- Leak check system. (Reevacuate system following leak check.)

_____ 7. Charge system with Suva® MP39 or Suva® MP66>
- Remove *liquid only* from cylinder.
- Initial charge 70–75% by weight of original CFC-12 charge, or 100% by weight of original R-500 charge.
- Amount of refrigerant charged: _____

_____ 8. Adjust charge until desired operating conditions are achieved.
- Remove *liquid only* from cylinder.
- If charge is low, add in increments of 3–5% of original CFC-12 or R-500 charge.
- Amount of refrigerant charged: _____

Total Refrigerant Charged (add 7 and 8)_____

- Label components and system for type of refrigerant (Suva® MP39/Suva® MP66) and lubricant (alkylbenzene).

Retrofit is complete!!

System Data Sheet

Type of System/Location: _____

Equipment Mfg.: _____
Model No.: _____
Serial No.: _____
CFC-12/R-500 charge size: _____

Compressor Mfg.: _____
Model No.: _____
Serial No.: _____
Lubricant type: _____
Charge size: _____

Drier Mfg.: _____
Model No.: _____

Drier type (check one):
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/Fixture 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 at 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: _____