DAIKIN ARKEMA
REFRIGERANTS ASIA LIMITED

R407H

REFRIGERANTS

R407H

Instructions for Use and Handling

The information contained herein is subject to change without notice, due to the refrigerants being under development. The information contained herein represents examples of actual measurement data, and examples of use herein do not guarantee that the products can be practically applicable for the example of use.

Instructions for Use and Handling of R407H

1 The legal situation

The European F-Gas regulation EU517/2014 foresees an accelerated phase down of the HFC consumption within the EU28. Especially high GWP refrigerants like R404A / R507 are under pressure. An early replacement in existing systems enables to meet the ambitious targets to lower the CO_2 weighted emissions down to 21% in 2030 compared to the 2015 baseline.

R407H* can be used as a Drop-In refrigerant in R404A / R507 systems. A Drop-In is the easiest way to convert a refrigeration system to another refrigerant. It is linked with minor changes and it usually uses the same oil type.

*ASHRAE registration application is under examination (as of September 2016). A1 class is expected.

2 When should R407H be used?

Drop-In and Retrofits have their advantages and disadvantages. The main criteria to base the decision upon are the technical conditions and costs directly and indirectly associated with the continued operation of the existing system. When these issues are solvable, a conversion to R407H should be done whenever an exchange of the R404A / R507 is needed. The following flow diagram should help with the decision.

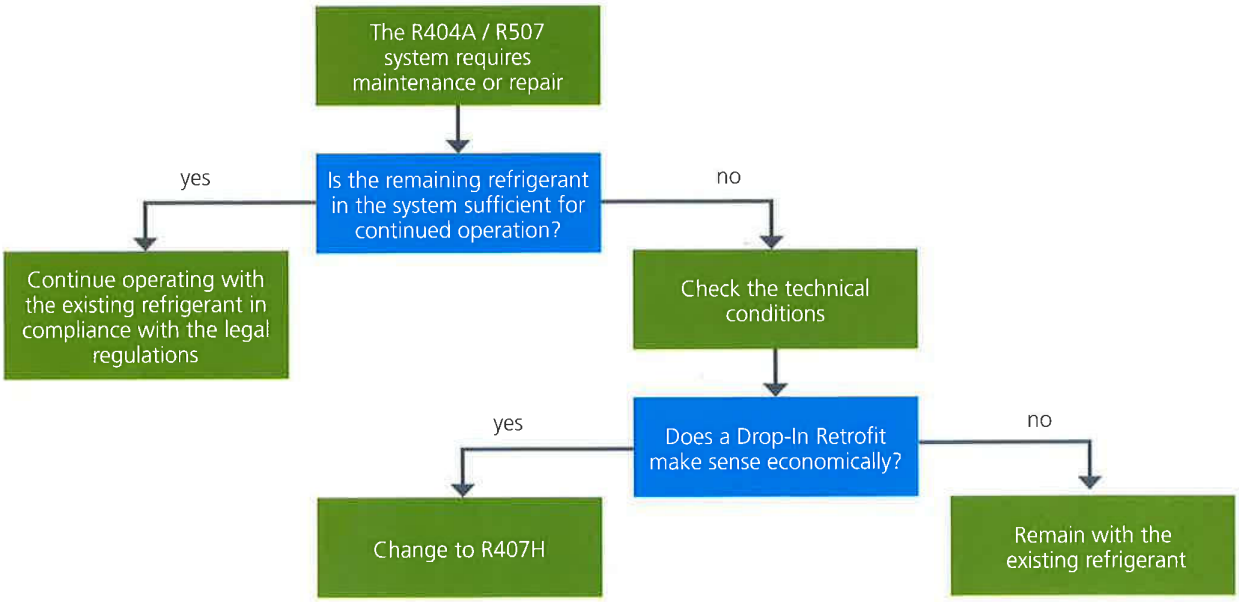


Fig. 1: Simplified diagram for the decision whether to retrofit or make drop-in of an R404A / R507 system

A cost estimate should decide whether the drop-in in the continuing operation with R404A / R507 is the optimal solution, and it should be based on a technical assessment of the system, its performance and condition. The subsequent running costs should also be included in the cost estimate.
With R407H, Daikin Chemical offers a drop-in refrigerant specially developed to replace R404A / R507. The main advantage of R407H compared to the use of retrofit refrigerants is the short conversion time, because it is often not necessary to change major parts of the system at the same time. Systems equipped with liquid injection or other measures to limit discharge temperatures are ideal for a conversion to R407H.

However, some systems cannot be converted to R407H. R407H has significantly higher discharge temperatures compared to R404A / R507. R404A / R507 systems with discharge temperature >80°C should not be converted to R407H.
In such cases, for converting to R407H it is necessary to take a measure like liquid injection to discharge temperatures.
Furthermore, R407H has zeotropic fluid characteristics. It is incompatible to systems equipped with a flooded evaporator. This might apply to some R507 systems.

3 Safety advice

The following general safety advice should be noted when using R407H:

- Wear personal protective equipment when working on refrigeration systems, including safety shoes, gloves and goggles.
- The vapors are heavier than air and may cause suffocation due to oxygen displacement.
- Care should be taken that the working environment is well ventilated at all times. Ensure that the oxygen concentration inside machine rooms does not fall below a safe limit.
- Prevent the decomposition of product vapor, e.g. on hot surfaces or through electrical arcing (welding operations).
- Do not smoke in areas where you could be exposed to refrigerants.
- Avoid overfilling gas cylinders when recovering refrigerants.
- Use electronic leakage detectors whenever possible.

4 Specific behavior of R407H in R404A / R507 systems

R407H is a mixture of R32 / R125 / R134a. It has been specially developed to enable a low-cost conversion alternatively to HFO-based drop-in refrigerants. In most cases, R407H can be used without major changes in R404A / R507 systems. However, a few points should be noted when using R407H:

4.1 Range of application of R407H

- R404A / R507 replacement refrigerant for MT with To >-10°C
- R404A / R507 replacement refrigerant for the low-temperature range with To >-40°C
- Refrigeration systems equipped with liquid injection
- Generally, R407H should not be used in systems with flooded evaporation, turbo compressors and R404A / R507 systems with discharge temperature >80°C.

4.2 Pressure and temperature glide

(see annex 7.4: R407H vapor table)
R407H has a normal boiling point (NBP) of -44°C. It has a slightly lower vapor pressure than R404A / R507. Due to its temperature / pressure behavior it can be used in existing R404A / R507 systems without problems. Generally however, the pressure resistance of existing systems should be thoroughly tested before using R407H. The temperature glide of R407H at the NBP is 7K.

4.3 Refrigeration performance and performance coefficient

The effective capacity of R407H can differ from that of R404A / R507. The efficiency (COP) is in most cases in the same range as that of R404A / R507.

4.4 Oil management

R407H is compatible with POE oils. However, it is absolutely necessary to check the oil return precisely after the conversion and during the running-in period.

4.5 Humidity

In refrigeration systems humidity should generally be avoided, regardless of the refrigerant or refrigerating machine oil selected. High levels of humidity in the refrigeration cycle may lead to the formation of ice at the expansion valve, to corrosion of metal surfaces and damage to the motor coils. When using POE oils, an additional danger is hydrolysis, i.e. chemical decomposition of the oil. Humidity can be avoided by adequately evacuating the refrigerating system. As always after maintenance and repair work, the vacuum should be lower than 10 mbar.

4.6 Filter dryers

R407H is compatible with the common HFC filter dryers used e.g. for R134a and R407C.

4.7 Compatibility with elastomers and plastics

R407H has the same compatibility with elastomers and plastics as R404A / R507. But even sealing materials suitable for use with both R407H and R404A / R507 are subject to ageing. Penetration by the old refrigerant can lead to embrittlement and swelling upon pressure reduction. Therefore, an exchange of the elastomer components (seals etc.) is generally recommended. Table 1 and Table 2 list sealing materials compatible with R407H.

	Neoprene	HNBR	NBR	EPDM
POE	+	o	+	+
MO	+	-	-	

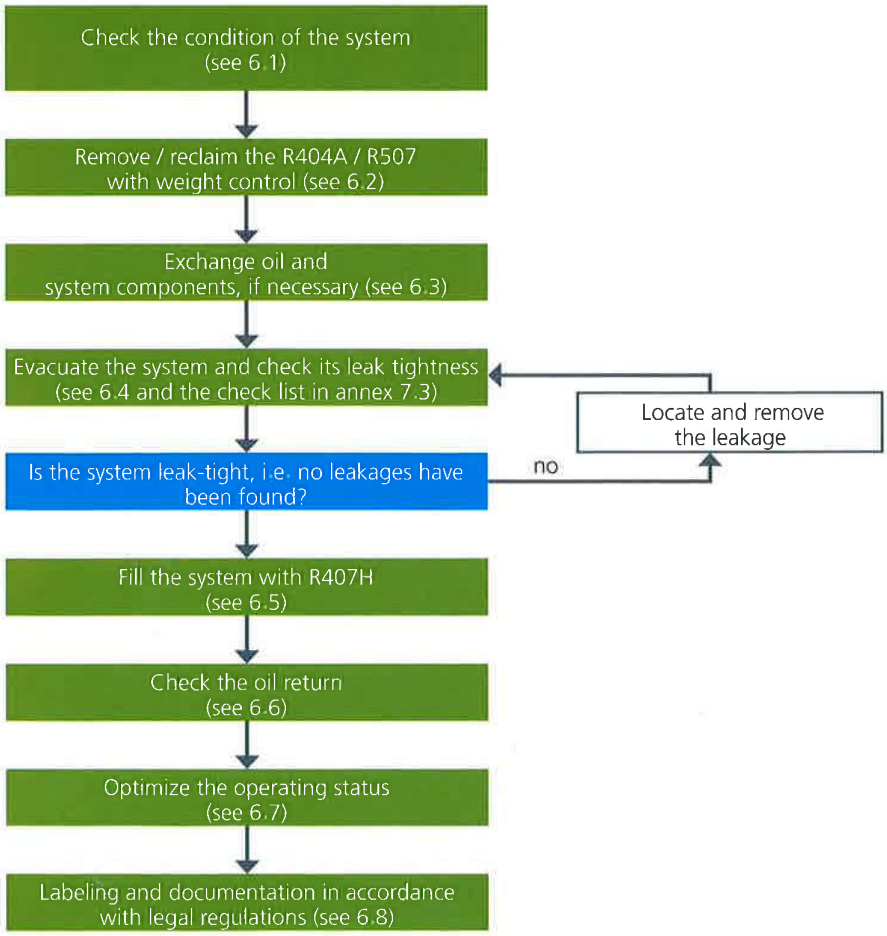
Table 1: The compatibility of elastomers with R407H and oils

	Polyester	Polyamide	Epoxy
POE	o	+	+
MO	o	+	+

Table 2: The compatibility of polymers with R407H and oils

Other types of elastomers and polymers can be tested for their compatibility with R407H on request. In such a case, please contact our technical service.

5 Flow diagram for the conversion to R407H



6 The conversion of R404A / R507 systems to R407H in detail

6.1 Inspecting and documenting the system condition

(see the check list in annex 7.2)

The conversion of a system from R404A / R507 to R407H begins with the inspection and documentation of the current system status. It should be the basis for the final decision whether to opt for a drop-in solution with R407H or for a continuing operation with R404A / R507.

The following points have to be settled:

- What overall impression does the system give? What would be the consequences of a system failure?
- Inspection of the logbook to detect any leakages
- Is the system suitable for the thermo-physical characteristics of R407H? Is it suitable for a zeotropic refrigerant (no flooded evaporators)? Are the existing discharge temperatures below 80°C (see 4.4)?
- Inspection of the suitability of the elastomer, plastic and sealing materials used for seals, O-rings, solenoid valves, etc.
- Performance measurements to detect any performance reserves in the system and to ascertain whether any performance reductions that may be caused by the exchange of the refrigerant can be compensated (see 4.3). The measurements of temperatures (e.g. at the condenser outlet) and pressures and their comparison with the R404A / R507 vapor table are necessary to ascertain whether or not R404A / R507 was used in the construction of the system. Furthermore, the vapor table (see annex 7.4) should be used to calculate from the measured pressure how high the expected pressure would be after filling the system with R407H and to compare it with the pressure resistance of the system.

6.2 Removal and recovery of the R404A / R507

The removal and reclaiming of the R404A / R507 from the system should be mandatory. The removed quantity of refrigerant must be filled into a suitable steel cylinder. The cylinder must be weighed during the reclaiming process to avoid overfilling. The specified bulk factors[1] must not be exceeded. The weight of the extracted R404A / R507 must be recorded in the system log book (see annex 7.3, or system log book). The vacuum should be relieved with dry nitrogen to prevent the penetration of humidity after removing the refrigerant from the system with suction.

6.3 Exchange of system components

The following system components must be exchanged or fitted:

- Filter dryer (HFC compatible)
- Elastomer materials, e.g. in O-rings, solenoid valves, shaft seals
- Nozzle sets at expansion valves, if necessary, or exchange of the expansion valve for a R407H type valve
- Exchange the refrigeration machine oil according to your compressor manufacturer's advise.

6.4 Evacuation and leak test

The system should be evacuated to a pressure below 10 mbar to remove any humidity from the system and to ensure that no air or nitrogen can impact the system's performance. When the system is evacuated, a vacuum pressure test must be carried out and documented (see check list). A pressure increase indicates that the system leaks; any leakage must be removed before filling the system with R407H.

6.5 Introducing R407H

R407H is a zeotropic refrigerant mixture. The same handling instructions apply to them that apply to e.g. R407C and R404A. It should go without saying that the usual safety measures are taken when filling a system, e.g. wearing of personal protective equipment.

R407H must be filled into a system from the liquid phase only. Care should be taken that while filling the system no liquid is taken in by the compressor.

As R404A / R507 and R407H have different densities, the quantities to be used are also different. Depending on the optimum filling level of a given system, and due to temperature variations, the optimum filling weight for R407H may differ in a range from 0 to -5% to the optimum weight of R404A / R507.

[1] Please check national transport regulations

- Filling quantity for systems with liquid receiver:
90% max. of the collector volume (see identification plate or operating instructions) as a liquid (for the conversion to mass see the vapor table in annex 7.4)
- Filling quantity for systems without liquid receiver:
Such systems should be filled in two steps. First, 90% of the R404A / R507 quantity removed (see 6.2) should be introduced. Then, the necessary remaining quantity of R407H should be added while the system status is being adjusted. The system must be allowed to reach a stable operating status after starting. Refrigerant should be added in the event of excessive overheating at the evaporator (see vapor pressure tables in the annex). Small quantities of liquid R407H are introduced into the system step-by-step until it reaches the specified operating parameters. Under no circumstances should the system be filled until the inspection glass shows no more bubbles, as this may lead to overfilling. Overfilling must be avoided under all circumstances, as this has a negative impact on refrigerating performance.
When the system has been filled completely, the total refrigerant quantity should be recorded in the logbook (see 7.3).

6.6 Checking the oil return

During the initial start-up phase the oil level at the compressor must be checked. If the oil level falls below the minimum (e.g. the lower level indicated at the inspection glass, or see the compressor manufacturer's specifications), add oil until the oil level reaches the mark. Under no circumstances should more oil be filled in before the oil return has stabilized.

6.7 Optimization of the operating status

When the system has been filled with refrigerant and has reached stable operating conditions, overheating must be adjusted with the help of the vapor table (see 7.4) in order to prevent liquid slugging. The point of reference should be the compressor intake (see vapor table).
Furthermore, all pressure controls, e.g. condenser pressure or suction pressure controls, should be adjusted to R407H with the help of the vapor table (see 7.4).

6.8 Labeling and documentation in accordance with legal requirements

In accordance with EU Directive EU517/2014, a system must be equipped with a system log book and marked with a label saying "Contains fluorinated greenhouse gases subject to the Kyoto protocol". The refrigerant used – R407H – must be clearly identified and the filling quantity must be specified in the area near the service connections. Furthermore, the refrigerating machine oil should always be identified.

7 Annex

7.1 Physical data[3]

		R404A	R507	R407H
Chemical Formula		CHF_2CF_3 / CH_3CF_3 / CH_2FCF_3	CHF_2CF_3 / CH_3CF_3	CH_2F_2 / CHF_2CF_3 / CH_2FCF_3
Molar Mass	kg/kmol	97.6	98.86	113.07
Boiling Point at 1.013 bar	°C	-46.2	-46.74	-44.7
Critical Temperature	°C	72.0	70.6	86.5
Critical Pressure	bar	37.29	37.1	48.5
liq. c_p [4]	kJ/(kgK)	1.542	1.539	1.585
vap. c_p [4]	kJ/(kgK)	1.221	1.225	1.176
Ratio c_p/c_v, vap.[4]		1.37	1.38	1.36
Spec. density, liq. [4]	kg/m³	1044	1048	1111
Spec. density, vap. [4]	kg/m³	65.27	68.89	41.86
Enthalpy of vaporization [4]	kJ/kg	140.26	136.45	199.02
Explosive limit in air[5]	% v/v	N/A	N/A	N/A

[3] Thermo-physical data calculated by Refprop 9.0
[4] sat. @ 25°C
[5] T = 25°C, p= 1.013bar

7.2 Check list – before the conversion

Check list for system conversion with R407H
System condition before the conversion

	Preparation before the conversion	Comments
☐	**Overall system impression** Is the refrigeration system in a reliable condition? Could a system failure cause major damage to products or to production processes?	
☐	**Inspection of the system log** Is it the logbook for this system? Has the system received regular maintenance? Has the system required frequent repairs? Are there any signs indicating problems with leak tightness?	
☐	**Oil management** Flooded evaporator (yes/no)? Collector in suction gas stream? Compressor location? Liquid collector with oil return system? Is the oil return system already critical before the conversion?	
☐	**Inspect the elastomers and other materials used for the construction of the system** Are the seals / O-rings / shaft seals / membranes inside the solenoid valves suitable for use with R407H?	
☐	**Pressure / temperature measurements / performance data (see admission pressure)** Does the pressure / temperature match R404A / R507? Overheating? Refrigerating performance / performance coefficient?	
☐	**Assessment of the convertibility to R407H** Does the information in hand suggest that the system is suitable for a conversion to R407H?	
☐	**Allocation of the necessary retrofitting components** e.g. filters / seals / expansion valve and any other materials	

7.3 Check list – during the conversion

Check list for system conversion with R407H
System status during the conversion

		Conversion operations	Comments
6.1	☐	**Pressure / temperature measurements** Identify the refrigerant used by comparing the measured pressure / temperature values (e.g. at the condenser outlet) with the wet-vapor table (see 7.4)	Pressure, bar _____ Temperature, °C _____ R404A / R507 used y/n ? _____
6.2	☐	**Removal of the refrigerant with suction** **Note:** use clearly labeled cylinders to store the reclaimed refrigerant only. Provide sufficient cylinder volume.	End pressure, bar _____ Weight after, kg _____ Weight before, kg _____ Net weight R404A / R507 _____
6.3	☐	**Exchange of system components** Including if necessary the exchange of the refrigeration machine oil	
6.4	☐	**Evacuation and leak test** End pressure after evacuation < 10 mbar	End pressure, mbar _____ after 1 hr., mbar _____ after 8 hrs., mbar _____ after 12 hrs., mbar _____
6.5	☐	**Filling with R407H** 90% of the reclaimed quantity of R404A / R507 remaining quantity depends on the system condition (see 6.5)	
6.6	☐	**Inspection of oil return**	Oil level ok _____ after 24 hrs. _____ after 1 week _____
6.7	☐	**Optimization of the operating status** Adjust overheating, adjust the pressure control, add POE oil if necessary to improve oil return	Overheating _____ Pressure check _____ Added POE, kg _____
6.8	☐	**Labeling** In accordance with EU517/2014	

7.4 Wet vapor table R404A / R507 / R407H*

	R404A				R507			R407H			
Temp.	p'	p''	Rho'	Rho''	p'	Rho'	Rho''	p'	p''	Rho'	Rho''
°C	bar	bar	kg/m³	kg/m³	bar	kg/m³	kg/m³	bar	bar	kg/m³	kg/m³
-50	0.84	0.81	1317.83	4.44	0.86	1326.91	4.81	0.77	0.53	1367.87	2.31
-49	0.89	0.85	1314.78	4.66	0.91	1323.82	5.04	0.81	0.56	1364.91	2.43
-48	0.93	0.90	1311.72	4.88	0.95	1320.71	5.27	0.86	0.59	1361.95	2.56
-47	0.98	0.94	1308.65	5.11	1.00	1317.60	5.52	0.90	0.62	1358.98	2.70
-46	1.02	0.99	1305.58	5.35	1.05	1314.48	5.78	0.95	0.66	1356.00	2.84
-45	1.07	1.04	1302.49	5.60	1.10	1311.36	6.04	0.99	0.69	1353.01	2.98
-44	1.13	1.09	1299.40	5.86	1.15	1308.22	6.31	1.04	0.73	1350.02	3.14
-43	1.18	1.14	1296.30	6.13	1.21	1305.07	6.60	1.09	0.77	1347.01	3.29
-42	1.24	1.19	1293.19	6.40	1.27	1301.91	6.89	1.15	0.81	1344.00	3.46
-41	1.29	1.25	1290.07	6.69	1.33	1298.75	7.20	1.20	0.85	1340.98	3.63
-40	1.35	1.31	1286.93	6.98	1.39	1295.57	7.51	1.26	0.90	1337.96	3.81
-39	1.41	1.37	1283.79	7.29	1.45	1292.38	7.83	1.32	0.94	1334.92	3.99
-38	1.48	1.43	1280.64	7.61	1.52	1289.18	8.17	1.38	0.99	1331.87	4.18
-37	1.55	1.50	1277.48	7.93	1.58	1285.97	8.52	1.44	1.04	1328.82	4.38
-36	1.61	1.57	1274.31	8.27	1.65	1282.75	8.87	1.51	1.09	1325.76	4.59
-35	1.69	1.64	1271.12	8.62	1.73	1279.52	9.24	1.58	1.15	1322.68	4.80
-34	1.76	1.71	1267.93	8.98	1.80	1276.27	9.63	1.65	1.20	1319.60	5.02
-33	1.83	1.78	1264.72	9.36	1.88	1273.01	10.02	1.72	1.26	1316.51	5.25
-32	1.91	1.86	1261.50	9.74	1.96	1269.74	10.43	1.80	1.32	1313.41	5.49
-31	1.99	1.94	1258.27	10.14	2.04	1266.46	10.85	1.87	1.39	1310.30	5.73
-30	2.08	2.02	1255.02	10.55	2.13	1263.17	11.28	1.96	1.45	1307.17	5.99
-29	2.16	2.11	1251.76	10.97	2.22	1259.86	11.73	2.04	1.52	1304.04	6.25
-28	2.25	2.20	1248.49	11.41	2.31	1256.53	12.19	2.13	1.59	1300.90	6.52
-27	2.35	2.29	1245.21	11.86	2.40	1253.20	12.66	2.21	1.66	1297.74	6.80
-26	2.44	2.38	1241.91	12.32	2.50	1249.84	13.15	2.31	1.74	1294.58	7.09
-25	2.54	2.48	1238.59	12.80	2.60	1246.48	13.66	2.40	1.81	1291.40	7.39
-24	2.64	2.57	1235.27	13.29	2.70	1243.09	14.17	2.50	1.89	1288.21	7.70
-23	2.74	2.68	1231.92	13.80	2.81	1239.70	14.71	2.60	1.98	1285.01	8.02
-22	2.85	2.78	1228.57	14.32	2.92	1236.28	15.26	2.70	2.06	1281.80	8.36
-21	2.96	2.89	1225.19	14.86	3.03	1232.85	15.83	2.81	2.15	1278.58	8.70
-20	3.07	3.00	1221.81	15.41	3.15	1229.41	16.41	2.92	2.24	1275.34	9.05

	R404A				R507			R407H			
Temp.	p'	p''	Rho'	Rho''	p'	Rho'	Rho''	p'	p''	Rho'	Rho''
°C	bar	bar	kg/m³	kg/m³	bar	kg/m³	kg/m³	bar	bar	kg/m³	kg/m³
-19	3.19	3.12	1218.40	15.98	3.26	1225.94	17.01	3.04	2.34	1272.09	9.41
-18	3.31	3.24	1214.98	16.57	3.39	1222.46	17.63	3.15	2.44	1268.83	9.79
-17	3.43	3.36	1211.54	17.17	3.51	1218.97	18.26	3.27	2.54	1265.55	10.18
-16	3.56	3.48	1208.08	17.79	3.64	1215.45	18.92	3.40	2.64	1262.26	10.58
-15	3.69	3.61	1204.61	18.43	3.77	1211.91	19.59	3.53	2.75	1258.96	10.99
-14	3.82	3.74	1201.11	19.09	3.91	1208.36	20.28	3.66	2.86	1255.64	11.41
-13	3.96	3.88	1197.60	19.76	4.05	1204.78	20.99	3.79	2.97	1252.31	11.85
-12	4.10	4.02	1194.07	20.46	4.20	1201.19	21.72	3.93	3.09	1248.97	12.30
-11	4.24	4.16	1190.52	21.17	4.34	1197.58	22.48	4.07	3.21	1245.60	12.77
-10	4.39	4.31	1186.95	21.90	4.50	1193.94	23.25	4.22	3.34	1242.23	13.24
-9	4.54	4.46	1183.36	22.66	4.65	1190.28	24.04	4.37	3.47	1238.84	13.74
-8	4.70	4.61	1179.74	23.44	4.81	1186.60	24.86	4.53	3.60	1235.43	14.24
-7	4.86	4.77	1176.11	24.23	4.98	1182.90	25.70	4.68	3.73	1232.00	14.76
-6	5.02	4.94	1172.45	25.05	5.14	1179.17	26.56	4.85	3.87	1228.56	15.30
-5	5.19	5.10	1168.77	25.90	5.32	1175.43	27.45	5.01	4.02	1225.10	15.85
-4	5.37	5.27	1165.07	26.76	5.49	1171.65	28.36	5.19	4.17	1221.63	16.42
-3	5.54	5.45	1161.34	27.65	5.67	1167.85	29.29	5.36	4.32	1218.13	17.01
-2	5.73	5.63	1157.59	28.56	5.86	1164.03	30.25	5.54	4.48	1214.62	17.61
-1	5.91	5.81	1153.82	29.50	6.05	1160.18	31.24	5.73	4.64	1211.09	18.23
0	6.10	6.00	1150.01	30.47	6.24	1156.30	32.25	5.92	4.80	1207.54	18.86
1	6.30	6.20	1146.18	31.46	6.44	1152.40	33.29	6.11	4.97	1203.98	19.51
2	6.50	6.40	1142.33	32.47	6.65	1148.46	34.36	6.31	5.15	1200.39	20.19
3	6.70	6.60	1138.44	33.52	6.86	1144.50	35.46	6.52	5.32	1196.78	20.88
4	6.91	6.81	1134.53	34.59	7.07	1140.51	36.59	6.72	5.51	1193.15	21.59
5	7.12	7.02	1130.59	35.69	7.29	1136.48	37.75	6.94	5.70	1189.50	22.32
6	7.34	7.24	1126.62	36.82	7.51	1132.43	38.93	7.16	5.89	1185.83	23.07
7	7.57	7.46	1122.61	37.99	7.74	1128.34	40.16	7.38	6.09	1182.13	23.84
8	7.80	7.69	1118.58	39.18	7.98	1124.22	41.41	7.61	6.29	1178.42	24.63
9	8.03	7.92	1114.51	40.40	8.22	1120.06	42.70	7.85	6.50	1174.68	25.44
10	8.27	8.16	1110.41	41.66	8.46	1115.87	44.03	8.09	6.72	1170.91	26.27

*based on Refprop 9.0

	R404A				R507			R407H			
Temp.	p'	p''	Rho'	Rho''	p'	Rho'	Rho''	p'	p''	Rho'	Rho''
°C	bar	bar	kg/m³	kg/m³	bar	kg/m³	kg/m³	bar	bar	kg/m³	kg/m³
11	8.52	8.40	1106.27	42.96	8.71	1111.64	45.39	8.33	6.93	1167.12	27.13
12	8.77	8.65	1102.10	44.29	8.97	1107.37	46.78	8.58	7.16	1163.31	28.01
13	9.02	8.90	1097.89	45.65	9.23	1103.07	48.22	8.84	7.39	1159.47	28.92
14	9.28	9.16	1093.64	47.05	9.49	1098.73	49.69	9.10	7.62	1155.61	29.85
15	9.55	9.43	1089.36	48.49	9.77	1094.34	51.21	9.37	7.87	1151.71	30.80
16	9.82	9.70	1085.03	49.97	10.04	1089.91	52.76	9.64	8.11	1147.79	31.78
17	10.10	9.98	1080.66	51.49	10.33	1085.44	54.36	9.92	8.37	1143.85	32.78
18	10.39	10.26	1076.25	53.05	10.62	1080.92	56.01	10.21	8.62	1139.87	33.82
19	10.68	10.55	1071.80	54.66	10.92	1076.36	57.70	10.50	8.89	1135.86	34.88
20	10.97	10.84	1067.30	56.31	11.22	1071.75	59.44	10.80	9.16	1131.83	35.96
21	11.27	11.15	1062.75	58.00	11.53	1067.08	61.22	11.11	9.44	1127.76	37.08
22	11.58	11.45	1058.15	59.74	11.84	1062.37	63.06	11.42	9.72	1123.66	38.23
23	11.90	11.77	1053.51	61.54	12.16	1057.60	64.95	11.73	10.01	1119.52	39.41
24	12.22	12.09	1048.81	63.38	12.49	1052.78	66.89	12.06	10.31	1115.36	40.62
25	12.55	12.41	1044.05	65.27	12.83	1047.90	68.89	12.39	10.61	1111.15	41.86
26	12.88	12.74	1039.24	67.22	13.17	1042.96	70.94	12.73	10.92	1106.91	43.14
27	13.22	13.08	1034.38	69.23	13.51	1037.96	73.06	13.07	11.24	1102.64	44.45
28	13.57	13.43	1029.45	71.29	13.87	1032.89	75.24	13.42	11.56	1098.33	45.79
29	13.92	13.78	1024.46	73.42	14.23	1027.76	77.48	13.78	11.89	1093.97	47.17
30	14.28	14.14	1019.41	75.61	14.60	1022.56	79.80	14.14	12.23	1089.58	48.59
31	14.65	14.51	1014.29	77.86	14.98	1017.29	82.18	14.52	12.57	1085.15	50.05
32	15.03	14.89	1009.09	80.18	15.36	1011.94	84.63	14.90	12.93	1080.67	51.55
33	15.41	15.27	1003.83	82.57	15.75	1006.52	87.16	15.28	13.28	1076.15	53.09
34	15.80	15.66	998.49	85.04	16.15	1001.01	89.77	15.68	13.65	1071.59	54.67
35	16.20	16.05	993.07	87.58	16.55	995.42	92.46	16.08	14.03	1066.98	56.29
36	16.60	16.45	987.57	90.20	16.97	989.73	95.24	16.49	14.41	1062.32	57.96
37	17.01	16.87	981.98	92.91	17.39	983.96	98.11	16.90	14.80	1057.61	59.68
38	17.43	17.28	976.30	95.70	17.81	978.09	101.08	17.33	15.20	1052.84	61.44
39	17.86	17.71	970.52	98.59	18.25	972.11	104.15	17.76	15.61	1048.03	63.26
40	18.29	18.15	964.65	101.57	18.70	966.03	107.32	18.20	16.02	1043.16	65.12

	R404A				R507			R407H			
Temp.	p'	p''	Rho'	Rho''	p'	Rho'	Rho''	p'	p''	Rho'	Rho''
°C	bar	bar	kg/m³	kg/m³	bar	kg/m³	kg/m³	bar	bar	kg/m³	kg/m³
41	18.74	18.59	958.67	104.65	19.15	959.83	110.60	18.65	16.44	1038.23	67.04
42	19.19	19.04	952.58	107.84	19.61	953.52	114.00	19.10	16.88	1033.25	69.01
43	19.65	19.50	946.38	111.15	20.08	947.07	117.52	19.57	17.32	1028.20	71.04
44	20.12	19.97	940.05	114.57	20.56	940.50	121.17	20.04	17.77	1023.09	73.13
45	20.59	20.44	933.59	118.12	21.04	933.78	124.97	20.52	18.22	1017.91	75.28
46	21.08	20.93	927.00	121.80	21.54	926.91	128.91	21.01	18.69	1012.67	77.50
47	21.57	21.42	920.26	125.62	22.04	919.88	133.00	21.51	19.17	1007.35	79.78
48	22.07	21.92	913.37	129.59	22.56	912.68	137.27	22.01	19.65	1001.96	82.13
49	22.59	22.44	906.31	133.73	23.08	905.29	141.72	22.53	20.15	996.49	84.56
50	23.11	22.96	899.07	138.04	23.61	897.71	146.36	23.05	20.65	990.95	87.06
51	23.64	23.49	891.65	142.53	24.15	889.91	151.21	23.59	21.17	985.31	89.63
52	24.18	24.03	884.02	147.22	24.70	881.88	156.29	24.13	21.69	979.59	92.30
53	24.72	24.58	876.17	152.13	25.27	873.61	161.62	24.68	22.23	973.78	95.04
54	25.28	25.14	868.07	157.28	25.84	865.05	167.21	25.24	22.77	967.86	97.88
55	25.85	25.71	859.72	162.68	26.42	856.20	173.11	25.81	23.33	961.85	100.81
56	26.43	26.29	851.09	168.36	27.01	847.02	179.34	26.39	23.89	955.73	103.84
57	27.02	26.88	842.13	174.35	27.61	837.46	185.93	26.98	24.47	949.49	106.98
58	27.62	27.48	832.83	180.69	28.23	827.50	192.94	27.58	25.06	943.14	110.23
59	28.23	28.09	823.14	187.41	28.85	817.06	200.42	28.19	25.66	936.66	113.59
60	28.85	28.71	813.01	194.57	29.49	806.09	208.43	28.80	26.27	930.04	117.08
61	29.48	29.34	802.38	202.22	30.13	794.50	217.06	29.43	26.89	923.28	120.70
62	30.12	29.99	791.18	210.43	30.79	782.18	226.43	30.07	27.52	916.36	124.46
63	30.78	30.65	779.31	219.32	31.46	768.99	236.67	30.72	28.17	909.29	128.37
64	31.45	31.32	766.64	228.99	32.15	754.73	247.99	31.38	28.83	902.03	132.44
65	32.13	32.00	753.01	239.62	32.85	739.11	260.67	32.05	29.50	894.59	136.68
66	32.82	32.70	738.18	251.43	33.56	721.72	275.14	32.73	30.18	886.94	141.10
67	33.52	33.41	721.80	264.78	34.28	701.83	292.12	33.42	30.88	879.07	145.72
68	34.24	34.14	703.33	280.19	35.03	678.14	312.90	34.12	31.59	870.96	150.55
69	34.98	34.88	681.82	298.59	35.78	647.65	340.43	34.83	32.31	862.58	155.62
70	35.72	35.64	655.33	321.83	36.56	599.65	385.06	35.56	33.05	853.92	160.94

R407H

Instructions for Use and Handling

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