Genetron® Performax™ LT, R407F

Thermodynamic Properties

Absolute Pressure (bar)	Bubble Temperature (°C)	Dew Temperature (°C)	Liquid Density (kg/m³)	Vapour Density (kg/m³)	Liquid Enthalpy (kJ/kg)	Vapour Density (kJ/kg)	Liquid Entropy (kJ/kg.K)	Vapour Entropy (kJ/kg.K)
0.50	-59.5	-52.9	1413.3	2.30	119.7	387.0	0.773	2.008
1.00	-46.3	-39.9	1373.3	4.41	137.1	394.5	0.852	1.973
1.013	**-46.06**	**-39.67**	**1372.5**	**4.46**	**137.5**	**394.7**	**0.854**	**1.972**
1.50	-37.7	-31.4	1346.3	6.47	148.7	399.3	0.902	1.954
2.00	-31.1	-25.0	1325.3	8.50	157.6	402.8	0.939	1.941
2.50	-25.7	-19.6	1307.6	10.52	165.0	405.6	0.969	1.931
3.00	-21.0	-15.1	1292.2	12.53	171.4	407.9	0.995	1.923
3.50	-16.9	-11.1	1278.4	14.53	177.0	409.9	1.017	1.917
4.00	-13.3	-7.49	1265.9	16.54	182.1	411.7	1.036	1.911
4.50	-10.0	-4.24	1254.3	18.55	186.8	413.2	1.054	1.906
5.00	-6.92	-1.25	1243.5	20.57	191.1	414.6	1.070	1.902
5.50	-4.10	1.51	1233.3	22.59	195.1	415.8	1.085	1.898
6.00	-1.46	4.09	1223.6	24.62	198.9	416.9	1.099	1.894
6.50	1.02	6.51	1214.4	26.67	202.5	418.0	1.112	1.891
7.00	3.36	8.80	1205.6	28.72	205.9	418.9	1.124	1.888
7.50	5.57	11.0	1197.2	30.78	209.1	419.8	1.136	1.885
8.00	7.68	13.0	1189.0	32.86	212.2	420.5	1.147	1.882
8.50	9.69	15.0	1181.1	34.95	215.2	421.3	1.157	1.879
9.00	11.6	16.9	1173.5	37.05	218.1	422.0	1.167	1.877
9.50	13.5	18.7	1166.0	39.17	220.8	422.6	1.176	1.875
10.0	15.2	20.4	1158.8	41.30	223.5	423.2	1.186	1.872
11.0	18.6	23.7	1144.8	45.62	228.6	424.2	1.203	1.868
12.0	21.7	26.7	1131.3	50.00	233.4	425.1	1.219	1.864
13.0	24.7	29.6	1118.3	54.46	238.0	425.9	1.234	1.860
14.0	27.5	32.3	1105.8	59.00	242.4	426.5	1.249	1.857
15.0	30.1	34.8	1093.5	63.62	246.6	427.1	1.262	1.853
16.0	32.6	37.3	1081.5	68.34	250.7	427.5	1.275	1.850
17.0	35.0	39.6	1069.8	73.15	254.6	427.9	1.288	1.846
18.0	37.3	41.8	1058.3	78.06	258.4	428.2	1.300	1.843
19.0	39.5	43.9	1046.9	83.08	262.0	428.4	1.311	1.840
20.0	41.7	45.9	1035.6	88.22	265.6	428.5	1.322	1.836
21.0	43.7	47.9	1024.5	93.48	269.1	428.6	1.333	1.833
22.0	45.7	49.8	1013.4	98.87	272.5	428.6	1.343	1.830
23.0	47.6	51.6	1002.4	104.40	275.9	428.5	1.354	1.827
24.0	49.4	53.4	991.4	110.08	279.2	428.4	1.363	1.823
25.0	51.2	55.1	980.4	115.92	282.4	428.2	1.373	1.820
26.0	53.0	56.7	969.4	121.93	285.6	427.9	1.383	1.817
27.0	54.7	58.3	958.4	128.14	288.7	427.6	1.392	1.813
28.0	56.3	59.9	947.2	134.54	291.8	427.2	1.401	1.810
29.0	57.9	61.4	936.0	141.17	294.9	426.7	1.410	1.806
30.0	59.5	62.9	924.7	148.04	297.9	426.2	1.419	1.803
31.0	61.0	64.3	913.2	155.17	300.9	425.6	1.428	1.799
32.0	62.5	65.7	901.5	162.59	303.9	424.9	1.436	1.795
33.0	63.9	67.0	889.5	170.33	306.9	424.2	1.445	1.791
34.0	65.4	68.4	877.3	178.44	309.9	423.3	1.453	1.787
35.0	66.7	69.6	864.7	186.95	313.0	422.4	1.462	1.782

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HARP INTERNATIONAL

Genetron® Performax™ LT (R407F)

Genetron® Performax™ LT, R407F, is a zero ozone depletion (ODP) hydrofluorocarbon (HFC) refrigerant blend. R407F is a ternary blend of R32, R125 and R134a (30%/30%/40%). It is widely used in new equipment that would have previously used HCFC R22 and HFC R404A .

APPLICATION

Genetron® Performax™ LT, R407F serves as a non-ozone depleting replacement for R22 in various commercial refrigeration applications, particularly in low temperature applications.

Since R407F is a close match to R22, it also serves as a retrofit fluid in applications where R22 is used. R407F is also the best performing lower global-warming-potential refrigerant for new supermarket installations with improved energy efficiency compared to other HFCs. It is a better alternative to R404A in both low and medium temperature supermarket applications since it has a higher capacity and efficiency than R404A.

PROPERTIES AND PERFORMANCE

R407F is designed to meet the needs of many types of new and existing refrigeration systems. R407F is a zeotropic HFC refrigerant blend, which is rated A1 by ASHRAE (lowest levels of toxicity and flammability), having zero Ozone Depletion Potential and a Global Warming Potential of 1825.

As a replacement for R404A, R407F is the ideal candidate having a similar refrigerating capacity across the range of low and medium evaporating temperature conditions and offers a distinct advantage with regard to the Coefficient of Performance (COP). The improved energy efficiency and reduced direct GWP help contribute to reduced running costs and a reduction in carbon the footprint in many application areas.

As a replacement for R22, R407F is a close match to R22's capacities and mass flow rates, with the mass flow rate required for each kilowatt of refrigeration within 5% of that required for R22. This makes it well suited as a retrofit for R22 in supermarket and food storage applications. Additionally, R407F is one of the more energy efficient R22 retrofit options available for refrigeration applications. Discharge temperatures of R407F are significantly lower than those seen with R22 though system pressures for R407F are slightly higher than R22, particularly in high ambient environments.

R407F is also the perfect solution for new refrigeration systems that would have previously used R22 offering zero ODP and a moderate direct GWP.

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LUBRICATION

POE lubricants must be used with R407F since it is not miscible with mineral or alkyl benzene lubricants. As with many HFC blends, retrofitting R407F will require a change to a polyester lubricant (POE) to ensure reliable oil return and circulation throughout the system. When retrofitting, a lubricant flushing procedure is necessary to reduce the original oil content below 5% of the new POE charge. For refrigeration systems using an oil separator, multiple oil flushes may not be required. New R407F equipment will be charged with the OEM recommended lubricant, ready to use with R407F.

CHARGING

Due to the zeotropic nature of R407F, it should be charged into the system as a liquid to prevent fractionation (changes in refrigerant composition due to vapour charging). In situations where vapour is normally charged into a system, a valve should be installed in the charging line to flash the liquid to vapour while charging.

RETROFITTING

R407F can be used to retrofit existing R22 and R404A systems in positive displacement, direct expansion refrigeration, and air conditioning equipment.

R407F retrofit procedures are straightforward and similar to those of other HCFC and HFC system retrofits. Pipework and expansion valves can be equivalent to those of R22 and are within the range of R404A systems operation. R407F should not be used in centrifugal chillers or equipment that uses a flooded evaporator due to its high temperature glide.

MATERIAL COMPATIBILITY

Whenever retrofitting air conditioning or refrigeration systems, compatibility of system materials must always be taken into consideration. Items such as elastomers, hoses, and filter-driers respond differently to different refrigerants and oils. For these reasons, before performing any refrigerant retrofit, Harp International recommends contacting the OEM for specific recommendations.

Genetron® PerformaxTM LT, R407F COMPARISON WITH R22 and R404A

Property	R407F	R22	R404A
Critical temperature	82.7°C	96.1°C	72.1°C
Critical pressure	47.5 bar	49.9 bar	37.3 bar
Molecular weight	82.0	86.5	97.6
Liquid density (saturation @ 20°C)	1139 kg/m^3	1210 kg/m^3	1067 kg/m^3
Dew point at 1 atm.	-39.7°C	-40.8°C	-45.5°C
Capacity [1]	11.9 kW	11.1 kW	11.0 kW
Mass flow per kW[1]	105%	100%	144%
Compressor discharge temperature[1]	88.8°C	99.4°C	65.7°C

1Based on calculated medium temperature refrigeration cycle.
Evaporator mid-point -15.0°C
5K useful superheat,
40.0°C condensing mid-point,
5K liquid sub-cooling,
65% compressor isentropic efficiency with fixed displacement of 20m3/hour.
No demand cooling applied.

R404A to R407F RETROFIT PROCEDURE

Whilst R407F is a good match for R404A, check OEM recommendations to ensure the existing systems design is suitable, including system capacities, relief valve sizing and equipment seal material compatibility.

Like R404A, R407F is a HFC refrigerant and a POE lubricant will be required. Whilst it is likely that the same lubricant may be suitable for use with both, R404A and R407F, check with the compressor manufacturer.

SYSTEM PREPARATION

- Record the system performance to obtain a baseline prior to retrofit, e.g. suction and discharge pressures, discharge temperature, temperatures in and out of the condenser and evaporator and the energy consumption if possible.
- Check the system service history for any on-going issues and to highlight any regular maintenance activities that may need to be undertaken.
- Remove the R404A from the system and record the system charge weight.
- Check and repair any existing leaks on the system.
- Check condition of compressor lubricant.
- Replace all seals on joints that have been opened and on the liquid receiver.
- Replace receiver float seal.
- Repair or replace old solenoid valves and ball valves to minimise leaks.
- Replace system filter drier.
- Evacuate the system to at least 1 mbar and perform a system strength pressure test with oxygen free Nitrogen in accordance with EN 378.
- If system fails the strength test repair any faults or replace any defective components and re-test.
- Perform a triple evacuation procedure, each time ensuring a vacuum of 1 mbar is pulled and held. Repair any leaks.
- Reset pressure controls for R407F. Pressure/temperature data is on Page 4 of this product information sheet.
- Charge the system with R407F. Typically the charge will be around 95% that of the original R404A charge weight.
- Note: If charging into the suction line on a running system the liquid from the cylinder must be vapourised before entering the system.

SYSTEM START UP

- Start the system and check for any leaks.
- Set the expansion valve settings. For calculating the sub-cooling use the R407F bubble point as the saturation temperature. For calculating the superheat use the R407F dew point as the saturation temperature.
- Monitor refrigerant and oil levels and adjust amounts as required.
- Record performance data and compare to that obtained for baseline performance.
- Label the system in accordance with the F-Gas Regulations and indicate all required information in the system log book.

R22 to R407F RETROFIT PROCEDURE

Before converting an R22 system to R407F, check OEM recommendations to ensure the existing systems design is suitable, system capacities, relief valve sizing and equipment seal material compatibility.

R407F is a HFC refrigerant and a POE lubricant will be required. Older R22 systems may contain a mineral or alkyl benzene based lubricant that is not compatible with HFCs like R407F. Check with the compressor manufacturer for any recommendations they may have.

SYSTEM PREPARATION

- Record the system performance to obtain a baseline prior to retrofit, e.g. suction and discharge pressures, discharge temperature, temperatures in and out of the condenser and evaporator and the energy consumption if possible.
- Check and repair any existing leaks on the system.
- If not a POE then remove the oil from the compressor sump, oil separators, oil float and suction line accumulators. Record amount removed.
- Replace all seals on joints that have been opened and on the liquid receiver.
- Replace drier.
- Add OEM recommended POE.
- Evacuate system and check for leaks.
- Re-charge with old refrigerant.
- Re-start system and check for leaks. Check oil levels.
- Run system for at least 24 hours.
- Check mineral oil concentration in the POE using a refractometer. Ensure residual mineral oil content is not more than 5%. Repeat oil change if necessary.
- Remove R22 from system.
- Install a HFC compatible filter drier.
- Replace receiver float seal.
- Repair or replace old solenoid valves and ball valves to minimise leaks.
- Evacuate the system to at least 1 mbar and perform a system strength pressure test with oxygen free Nitrogen in accordance with EN 378.
- If system fails the strength test repair any faults or replace any defective components and re-test.
- Perform a triple evacuation procedure, each time ensuring a vacuum of 1 mbar is pulled and held. Repair any leaks.
- Reset pressure controls for R407F. Pressure/temperature data is on Page 4 of this product information sheet.
- Liquid charge the system with R407F. Typically the charge will be around 95% that of the original R22 charge weight.
- Note: If charging into the suction line on a running system the liquid from the cylinder must be vapourised before entering the system.

SYSTEM START UP

- Start the system and check for any leaks.
- Set the expansion valve settings. For calculating the sub-cooling use the R407F bubble point as the saturation temperature. For calculating the superheat, use the R407F dew point as the saturation temperature.
- Monitor refrigerant and oil levels and adjust amounts as required.
- Record performance data and compare to that obtained for baseline performance.
- Label the system in accordance with the F-Gas Regulations and indicate all required information in the system log book.