

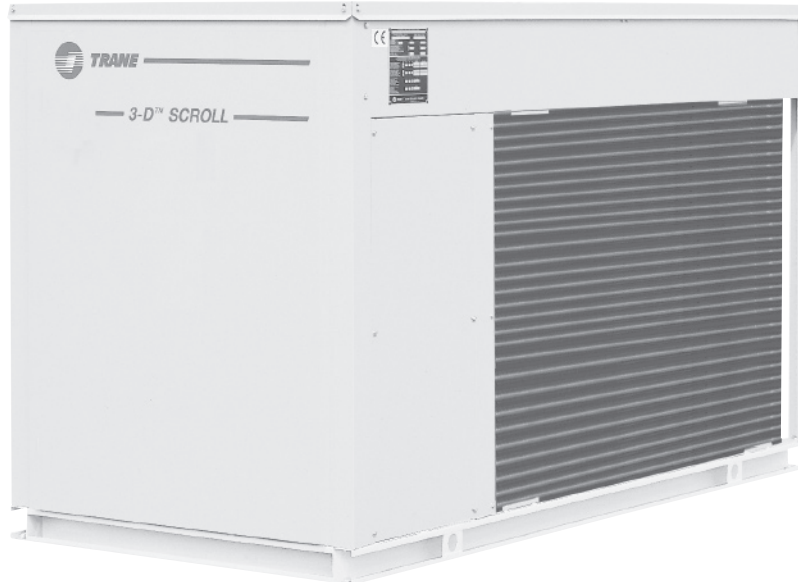


Installation Operation Maintenance

RAUL

Air Cooled Condensing Unit

**Sizes 190 – 260 – 300 – 350 – 400
450 – 500 – 600 – 700 – 800**



**To be used
with the CH530 control
module manual**

RAU-SVX01F-E4

General information

Foreword

These instructions are given as a guide to good practice in the installation, start-up, operation, and maintenance by the user, of Trane RAUL. They do not contain full service procedures necessary for the continued successful operation of this equipment. The services of a qualified technician should be employed through the medium of a maintenance contract with a reputable service company. Read this manual thoroughly before unit start-up.

Units are assembled, pressure tested, dehydrated, charged and run tested before shipment.

Warnings and cautions

Warnings and Cautions appear at appropriate sections throughout this manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The constructor assumes no liability for installations or servicing performed by unqualified personnel.

WARNING! : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION! : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices or for equipment or property-damage-only accidents.

Safety recommendations

To avoid death, injury, equipment or property damage, the following recommendations should be observed during maintenance and service visits:

1. The maximum allowable pressures for system leak testing on low and high pressure side are given in the chapter «Installation». Always provide a pressure regulator.
2. Disconnect the main power supply before any servicing on the unit.
3. Service work on the refrigeration system and the electrical system should be carried out only by qualified and experienced personnel.

Reception

On arrival, inspect the unit before signing the delivery note.

Reception in France only:

In case of visible damage: The consignee (or the site representative) must specify any damage on the delivery note, legibly sign and date the delivery note, and the truck driver must countersign it. The consignee (or the site representative) must notify Trane Epinal Operations - Claims team and send a copy of the delivery note. The customer (or the site representative) should send a registered letter to the last carrier within 3 days of delivery. Note: for deliveries in France, even concealed damage must be looked for at delivery and immediately treated as visible damage.

Reception in all countries except France:

In case of concealed damage: The consignee (or the site representative) must send a registered letter to the last carrier within 7 days of delivery, claiming for the described damage. A copy of this letter must be sent to Trane Epinal Operations - Claims team.

Warranty

Warranty is based on the general terms and conditions of the manufacturer. The warranty is void if the equipment is repaired or modified without the written approval of the manufacturer, if the operating limits are exceeded or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance or failure to comply with the manufacturer's instructions or recommendations is not covered by the warranty obligation. If the user does not conform to the rules of this manual, it may entail cancellation of warranty and liabilities by the manufacturer.

Contents

Refrigerant

The refrigerant provided by the manufacturer meets all the requirements of our units. When using recycled or reprocessed refrigerant, it is advisable to ensure its quality is equivalent to that of a new refrigerant. For this, it is necessary to have a precise analysis made by a specialized laboratory. If this condition is not respected, the manufacturer warranty could be cancelled.

Environmental Protection / Compliance with F-Gas regulation

This equipment contains a fluorinated gas covered by the Kyoto Protocol [or an ozone depleting substance covered by Montreal Protocol]. The type and quantity of refrigerant per circuit is indicated on the product nameplate. The Global Warming Potential of the refrigerant implemented in Trane Air Conditioning and Refrigeration Equipment is presented in the table by type of refrigerant.

Refrigerant type	GWP (1) value
R134a	1 300
R407C	1 653

The operator (contractor or end user) must check local environmental regulations impacting installation, operation and disposal of the equipment; in particular need to recover environmentally harmful substances (refrigerant, oil, antifreeze agents, etc.) Do not vent into the atmosphere any refrigerant. The handling of refrigerant shall be fulfilled by a qualified service engineer.

(1) GWP = global warming potential

Maintenance contract

It is strongly recommended that you sign a maintenance contract with your local Service Agency. This contract provides regular maintenance of your installation by a specialist in our equipment. Regular maintenance ensures that any malfunction is detected and corrected in good time and minimizes the possibility that serious damage will occur. Finally, regular maintenance ensures the maximum operating life of your equipment. We would remind you that failure to respect these installation and maintenance instructions may result in immediate cancellation of the warranty.

Training

To assist you in obtaining the best use of it and maintaining it in perfect operating condition over a long period of time, the manufacturer has at your disposal a refrigeration and air conditioning service school. The principal aim of this is to give operators and technicians a better knowledge of the equipment they are using, or that is under their charge. Emphasis is particularly given to the importance of periodic checks on the unit operating parameters as well as on preventive maintenance, which reduces the cost of owning the unit by avoiding serious and costly breakdown.

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Installation

For minimum clearance, consult the certified submittals, which are available on request from your Trane Sales Office.

Unit nameplate

The unit nameplate gives the complete model reference numbers. The unit power rating is shown, and power supplies should not deviate by more than 5 % from the rated power. Compressor motor amperage is shown in box I.MAX. The customer's electrical installation must be able to withstand this current.

Installation instructions

Foundations

No special foundations are required, provided the supporting surface is flat and level, and can withstand the weight or the unit.

Anti-vibration rubber pads

They are supplied as standard with the machine, and should be placed between the supporting floor and the unit to attenuate vibrations.

- 4 pads for the sizes 190 to 300
- 6 pads for the sizes 350 to 800
- Trane does not allow the installation of spring isolators.

Clearance

Respect recommended clearance around the unit to allow maintenance operation to take place without obstruction and recommended clearance around condenser.

CAUTION! Unit operation depends on the air temperature. Any recycling of the air fed out by the fans will increase the air intake temperature over the condenser fins and can result in high pressure cut-out. In this case the standard operating conditions are modified. Operation of the unit may be affected by an increase in air temperature on the condenser. When the units are positioned in a windy area, avoid all the risks of air-cooled recycling.

See submittals

Handling

Note:

The plates welded at the end of the bases must not be used for handling.

Figure 1 - Handling

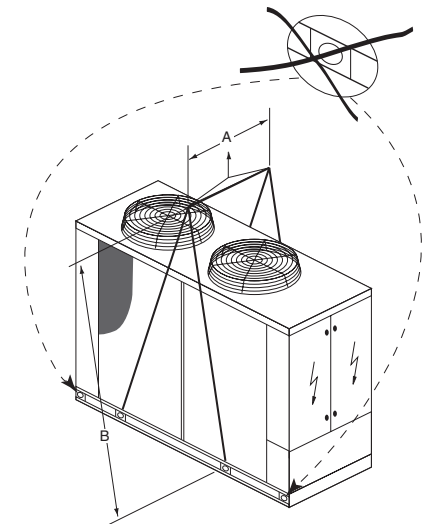


Table 1 - Dimensions of recommended slings and swing-bar:

	190	260	300	350	400	450	500	600	700	800
A (mm)	1500	1500	1500	1500	1500	1500	2400	2400	2300	2300
B (mm)	1800	1800	1800	1800	1800	1800	1800	1800	2200	2200
Weight - crated (kg)	555	625	691	869	959	985	1123	1251	1695	1754

Installation

Refrigerant lines

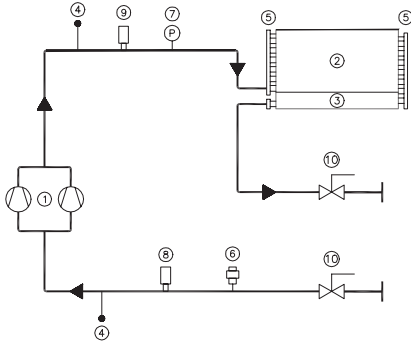


Figure 2 - Refrigerant flow chart

- 1 = Compressor
- 2 = Condenser coil
- 3 = Subcooler coil
- 4 = Schraeder valve
- 5 = Coil header
- 6 = Relief valve
- 7 = High pressure switch
- 8 = Low pressure transducer
- 9 = High pressure transducer
- 10 = Stop valve

Calculating and fixing the capacity of refrigerant lines is necessary to assure the oil return to the compressor, avoid refrigerant phase changes and limit pressure drop.

Liquid lines

Calculate capacity of liquid line, as per the following criteria.

1. Maximum load operating conditions.
2. To avoid any evaporation risk:
 - Consider the vertical risers
 - Maximum pressure drop must not exceed 1 to 2°C
3. Liquid circulation speed in a 0.5 to 2m/s range.

Discharge lines

Discharge lines should be calculated to obtain the gas displacement speed in horizontal and vertical lines required to drive compressor oil. Determine diameter of discharge lines as per the following criteria.

1. Speed above 2.5 m/s horizontally. (Consider minimum speed at minimum load)
2. Speed above 5.0 m/s vertically (Vertical risers, consider speed at minimum load)
3. Maximum speed 20 m/s.
4. Horizontal pipe run must be pitched of 1cm/m in the same direction as the refrigerant circulation
5. An oil trap is necessary for vertical risers greater than 3m. For major elevations add an intermediate oil trap every 5m.
6. Maximum pressure drop between 20 to 50 kPa
7. Install a filter drier adapted to refrigerant capacity.

Insulation of refrigerant lines

Insulate refrigerant lines from building itself to avoid transmission to building structure of vibrations normally caused by pipework. Also avoid bypassing the unit's damping system by fixing the refrigerant lines or the electrical ducts very rigidly. Vibrations may propagate into building structure through rigidly fixed refrigerant lines.

Pressure tests. Leak detection

During operations, take the following precaution:

1. Neither oxygen nor acetylene should be used instead of refrigerant and nitrogen to detect leaks, otherwise a violent explosion may occur.
2. Always use valves and manometers to check the test pressure in system. Excessive pressure may either cause pipes to rupture, damage unit, or cause an explosion, causing possible physical injury.

Carry out liquid line and hot gas line pressure tests in accordance with current standards.

The test pressures applied to the liquid line and the hot gas suction line must comply with the country's standards.

Caution: Do not go more than 0.7 bar above the high pressure switch setpoint.

Installation

Introduce enough refrigerant into circuit in order to obtain a pressure of 85 to 100 kPa. Search for possible leaks using detector. This operation should be carried out with great care throughout the system.

If leaks are detected, pump down the refrigerant, and repair defective component. Repeat test process, to check that the repair can withstand rated pressure.

Refrigerant charge (all split system types)

Units ship with a nitrogen holding charge and isolating valves.

After system pressure and vacuum testing, fill up unit with refrigerant. The refrigerant complement will be charged according to the diameter and the length of the refrigerant piping work up to obtain the correct superheat and subcooling temperatures.

Oil charge

The oil quantity necessary for the split system has also to be adjusted according to the diameter and the length of the refrigerant piping work.

Important note: These operations have to be performed by a specialist according to the rules of the art. The results have to be written on a start up record by the Trane engineer or the client's specialist who has performed this start up. The quantity of refrigerant and oil added are at the client's charges.

Installation

Table 3 - R407C General data

		RAU 190 R407C	RAU 260 R407C	RAU 300 R407C	RAU 350 R407C	RAU 400 R407C	RAU 450 R407C	RAU 500 R407C	RAU 600 R407C	RAU 700 R407C	RAU 800 R407C
Performances (1)											
Gross cooling capacity (1)	(kW)	54.8	66.6	81.1	95.3	108.3	118.8	133.0	162.0	194.7	218.8
Power input in cooling (1)	(kW)	16.7	23.6	28.2	31.0	36.1	43.2	48.7	57.9	61.8	74.6
Main Power supply		400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Sound Power Level (5)	(dB(A))	88	90	91	91	92	93	93	94	98	98
Units											
Amps											
Nominal (4)	(A)	41.3	50.1	59.0	70.3	79.1	88.0	99.3	117.0	150.4	168.1
Start-up Amps	(A)	144	199	207	219	228	236	248	265	299	316
Max supply cable size	(mm ²)	35	35	35	50	50	95	95	95	150	150
Compressor											
Number		2	2	2	3	3	3	4	4	6	6
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Model		10T+10T	10T+15T	2x15T	10+10T-15T	10T+15T-15T	15T15T+15T-15T	2x(10T+15T)	2x(10T+15T)	2x(10T+15T)	2x(10T+15T)
Number of speeds		1	1	1	1	1	1	1	1	1	1
Number of motors	C1 / C2	2	2	2	2 / 1	2 / 1	2 / 1	2 / 2	2 / 2	3 / 3	3 / 3
Rated Amps (2)(4)	(A)	17.7	17.7 / 26.6	26.6	17.7 / 26.6	17.7 / 26.6	26.6	17.7 / 26.6	26.6	17.7 / 26.6	17.7 / 26.6
Locked rotor Amps (2)	(A)	120	120 / 175	175	120 / 175	120 / 175	175	120 / 175	175	120 / 175	120 / 175
Motor RPM	(rpm)	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
Sump Heater (2)	(W)	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V
Liquid and Suction connection											
Suction connection		brazed	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	2»1/8	2»1/8
Liquid connection		brazed	7/8»	7/8»	7/8»	7/8»	7/8»	7/8»	7/8»	1»1/8	1»1/8
Coil											
Type		Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin
Tube size	(mm)	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52
Tube type		Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Height	(mm)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
Length	(mm)	2743	2743	2743	3455	4115	4115	5486	5486	5486	5486
Face Area	(m ²)	3.34	3.34	3.34	4.21	5.02	5.02	6.69	6.69	6.69	6.69
Rows	#	2	2	3	3	3	3	2	3	3	3
Fins per foot (fpf)	#	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0
Fan											
Type		Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller
Number		2	2	2	3	3	3	4	4	6	6
Diameter	(mm)	962	962	962	962	962	962	962	962	962	962
Drive type		Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct
Number of speeds		1	1	1	1	1	1	1	1	1	1
Air flow	(m ³ /h)	27000	27000	25300	35900	37900	37900	54000	50700	89100	89100
Number of motors		2	2	2	3	3	3	4	4	6	6
Motor HP (2)	(kW)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1.72	1.72
Rated Amps (2)	(A)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	3.26	3.26
Locked rotor Amps (2)	(A)	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	15.5	15.5
Motor RPM	(rpm)	705	705	705	705	705	705	705	705	930	930
Dimensions											
Height	(mm)	1582	1582	1582	1582	1582	1582	1584	1584	1598	1598
Length	(mm)	2061	2061	2061	2921	2921	2921	2225	2225	3090	3090
Width	(mm)	995	995	995	995	995	995	1865	1865	1948	1948
Weight uncrated	(kg)	514	584	650	810	900	926	1040	1168	1575	1634
Weight crated	(kg)	555	625	691	869	959	985	1123	1251	1695	1754
System Data											
Refrigerant circuit		1	1	1	2	2	2	2	2	2	2
System Data											
Refrigerant circuit		1	1	1	2	2	2	2	2	2	2
Refrigerant Charge (3)											
Circuit A & B	(kg)	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system

(1) at 7°C SST and 35°C ambient

(2) per motor

(3) per circuit

(4) 5°C sat suction temp. - 60°C sat discharge temp.

(5) In accordance with ISO 3746

Installation

Table 4 - R134a General data

		RAU 190 R134a	RAU 260 R134a	RAU 300 R134a	RAU 350 R134a	RAU 400 R134a	RAU 450 R134a	RAU 500 R134a	RAU 600 R134a	RAU 700 R134a	RAU 800 R134a
Performances (1)											
Gross cooling capacity (1)	(kW)	43.8	53.2	63.9	75.4	85.1	93.6	106.3	127.9	153.8	172.7
Power input in cooling (1)	(kW)	12.1	15.8	18.5	21.3	24.3	27.7	31.5	37.0	47.1	53.9
Main Power supply		400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Sound Power Level (5)	(dB(A))	86	87	89	89	90	90	90	92	98	98
Units											
Amps											
Nominal (4)	(A)	31.2	38.2	45.2	53.3	60.3	67.3	75.4	89.4	116.4	130.4
Start-up Amps	(A)	139	194	201	209	216	223	231	245	272	286
Max supply cable size	(mm²)	35	35	35	50	50	95	95	95	150	150
Compressor											
Number		2	2	2	3	3	3	4	4	6	6
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Model		10T+10T	10T+15T	2x15T	10+10T - 15T	10T+15T - 15T	15T+15T - 15T	2x(10T+15T)	2 x (15T+15T)	2x(10T+10T+15T)	2x(10T+15T+15T)
Number of speeds		1	1	1	1	1	1	1	1	1	1
Number of motors	C1 / C2	2	2	2	2 / 1	2 / 1	2 / 1	2 / 2	2 / 2	3 / 3	3 / 3
Rated Amps (2)(4)	(A)	12.7	12.7 / 19.7	19.7	12.7 / 19.7	12.7 / 19.7	19.7	12.7 / 19.7	19.7	12.7 / 19.7	12.7 / 19.7
Locked rotor Amps (2)	(A)	120	120 / 175	175	120 / 175	120 / 175	175	120 / 175	175	120 / 175	120 / 175
Motor RPM	(rpm)	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
Sump Heater (2)	(W)	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V	50W - 400V
Liquid and Suction connection											
Suction connection		brazed	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	1»5/8	2»1/8	2»1/8
Liquid connection		brazed	7/8»	7/8»	7/8»	7/8»	7/8»	7/8»	7/8»	1»1/8	1»1/8
Coil											
Type		Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin	Plate Fin
Tube size	(mm)	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52
Tube type		Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Height	(mm)	1219	1219	1219	1219	1219	1219	1219	1219	1219	1219
Length	(mm)	2743	2743	2743	3455	4115	4115	5486	5486	5486	5486
Face Area	(m²)	3.34	3.34	3.34	4.21	5.02	5.02	6.69	6.69	6.69	6.69
Rows	#	2	2	3	3	3	3	2	3	3	3
Fins per foot (fpf)	#	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0
Fan											
Type		Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller
Number		2	2	2	3	3	3	4	4	6	6
Diameter	(mm)	962	962	962	962	962	962	962	962	962	962
Drive type		Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct
Number of speeds		1	1	1	1	1	1	1	1	1	1
Air flow	(m³/h)	27000	27000	25300	35900	37900	37900	54000	50700	89100	89100
Number of motors		2	2	2	3	3	3	4	4	6	6
Motor HP (2)	(kW)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1.88	1.88
Rated Amps (2)	(A)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	4.2	4.2
Locked rotor Amps (2)	(A)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	14.7	14.7
Motor RPM	(rpm)	680	680	680	680	680	680	680	680	915	915
Dimensions											
Height	(mm)	1582	1582	1582	1582	1582	1582	1584	1584	1598	1598
Length	(mm)	2061	2061	2061	2921	2921	2921	2225	2225	3090	3090
Width	(mm)	995	995	995	995	995	995	1865	1865	1948	1948
Weight uncrated	(kg)	514	584	650	810	900	926	1040	1168	1575	1634
Weight crated	(kg)	555	625	691	869	959	985	1123	1251	1695	1754
System Data											
Refrigerant circuit		1	1	1	2	2	2	2	2	2	2
Refrigerant Charge (3)											
Circuit A & B	(kg)	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system	Split system

(1) at 7°C SST and 35°C ambient

(2) per motor

(3) per circuit

(4) 5°C sat suction temp. - 60°C sat discharge temp.

(5) In accordance with ISO 3746

Installation

Electrical connections

CAUTION!

1. The greatest care should be taken when cutting through passages and installing electric wiring. Under no circumstances should chips of metal or cuttings of copper or isolating material fall into the starter panel or electric components. Relays, contactors, terminals and control wiring should be covered and protected before power supplies are connected.
2. Install power supply cabling as shown in wiring diagram. Adequate cable gland should be chosen, ensuring no foreign bodies enter the electrical housing or components.
3. Cabling must comply with standards in force. The type and location of fuses must also comply with standards. As a safety measure, fuses should be visibly installed, close to the unit.
4. Only copper wiring should be used. Using aluminium wires can produce galvanic corrosion and possibly lead to superheat and failure of connection points.

As standard, Trane provides the single power supply which includes the transformer. Warranty reserves will be formulated if a transformer, not supplied by Trane, is installed inside the electric panel.

Temperature sensor

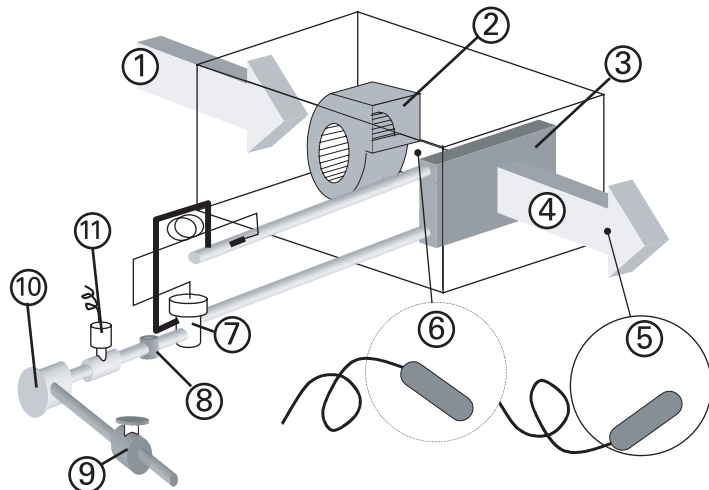
Two temperature sensors are provided, in the control panel of the unit. They have to be fitted on site in order to measure the air inlet and outlet temperature downstream to the DX coil (evaporator). Refer to supplied wiring diagram for connection of sensors.

To place the sensor into the airflow, the technician will have to cut the cable between the electronic case and the sensing element, and then reconnect both elements with a twisted pair cable with a maximum distance of 300m.

Hot gas-bypass control (option)

The hot gas bypass option only provides a relay contact needed to initiate hot gas bypass on the evaporator. All the refrigerant piping modifications are not done in the factory and have to be done on the jobsite. An additional refrigerant line and solenoid valve must be added on site (not provided) between the discharge line and the suction line on Circuit 1. When the solenoid valve is activated, refrigerant vapor will flow from the discharge line to the suction line. This refrigerant vapor satisfies the compressor mass flow requirement, but because no phase change has occurred, this flow does not contribute to unit capacity. The amount of capacity shed by the hot gas bypass line depends upon the size of the line (restriction) and the pressure difference between the discharge line and the suction line. Closing the solenoid valve in the hot gas bypass line deactivates hot gas bypass.

Figure 3



- 1 = Air intake
- 2 = Fan
- 3 = Evaporating coil
- 4 = Air supply
- 5 = Evaporator leaving air temperature sensor

- 6 = Evaporator entering air temperature sensor
- 7 = Thermostatic expansion valve
- 8 = Sight glass
- 9 = Manual shut-off valve
- 10 = Filter dryer
- 11 = Liquid solenoid valve

Installation

Functional description

The hot gas bypass solenoid valve will be controlled by a normally open (NO) relay output. Energizing the solenoid will open the valve.

Freeze avoidance or evaporator limit will also operate while in the hot gas-bypass mode. Shutdown of the unit when in hot gas-bypass due to evaporator limit will not result in any diagnostics and the unit will restart normally when there is a need to run.

Total time spent in hot gas bypass mode will be recorded and available to the user.

Design details

The following rules will be applied to hot gas bypass operation, if hot gas bypass is installed and enabled.

1. Hot gas bypass will be opened when the circuit is running with compressors at the minimum (first) capacity step and the control algorithm requires a further reduction in capacity.
2. Hot gas bypass will be closed at circuit startup.
3. Hot gas bypass will be closed when it is already open, but additional capacity is required.
4. Hot gas bypass will be closed and the circuit shut down if the unit has been running with hot gas-bypass for more than the hot gas-bypass time limit.
5. Hot gas bypass will be closed and the compressor shut down if the saturated suction temperature for Circuit 1 gets below the Low Refrigerant Temperature Cutout + 0.5°C.

Capacity control modes

RAUL units support air temperature control and external capacity control (optional), which are described below. At least one of these options must be configured.

Air temperature control (standard)

Units with an evaporator leaving air temperature sensor is capable of air temperature control. Air temperature control is used on RAUL units if the external capacity control feature is not selected.

Air temperature control will require an active air temperature setpoint, based on a front panel air temperature setpoint, an external air temperature setpoint, a BAS air temperature setpoint, and a local schedule air temperature setpoint. These settings are displayed on DynaView and TechView similarly to the existing chilled water setpoint values.

The capacity control method is identical to that used for chilled water control, with setting changes being used to adjust the control appropriately.

External capacity control (option)

Optional replace air temperature control

External capacity control be a configurable option for RAUL units. The configuration options are as follows:

- Not Installed
- 2 Low Voltage Binary Inputs (2 capacity steps)
- 3 Low Voltage Binary Inputs (3 capacity steps)
- 4 Low Voltage Binary Inputs (4 capacity steps)

When in external capacity control mode, the unit is in AUTO command mode, and there is no need to run, «waiting for need to run» submode is displayed.

Communication failure with any of the external capacity control hardware inputs will cause a shutdown of the unit if the external capacity control feature is configured and enabled.

External capacity control overrides any other capacity control mode except manual control mode if enabled.

General start-up

Start-up Preparation

Carry out all operations on check list and that the unit is correctly installed and ready to operate.

The installer must check all the following points before calling in the Trane Servicing Department to put the equipment into service:

- Check position of unit.
- Check unit is level.
- Check type and position of rubber pads.
- Check clearance required for maintenance access (See submittals).
- Check clearance around condenser (See Submittals).
- Check Filter(s) dryer are present.
- Insure that thermostatic expansion valve(s) are well positioned.
- Insure that air discharge temperature sensors are well positioned.
- Insure that the isolation resistance of all power supply terminals to ground complies with standards and regulations in force.
- Check that unit voltage and frequency supplied match rated input voltage and frequency.
- Check that all electrical connections are clean and sound.
- Check that main power supply switch is sound.
- On start-up of each motor in the system, check the direction of rotation and operation of all the components they drive.
- Check that there is sufficient demand for cooling on the day of start-up (around 50% of nominal load).

Start-up

Follow the instructions below to correctly start-up the unit.

Installation and unit inspection:

- Ensure that all the operations above (start-up preparation), are followed.

Follow the instruction stuck inside the electrical cabinet:

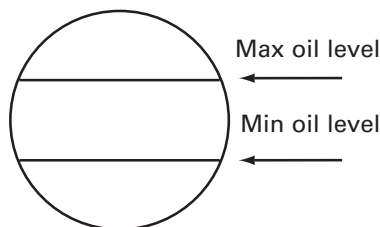
- Unscrew the screws securing the isolators located under the rails supporting the compressor.
- Put the plexiglass supplied by Trane in front of the power terminal.
- Ensure all refrigerant valves are in service positions.
- Ensure that the unit is not damaged.
- Check fixing of capillary tubes (protection from vibration and from wear) and ensure that they are not damaged.
- Reset all manually set control devices.
- Check refrigerating circuits tightness.

Checking and setting:

Compressors:

- Check oil level at rest. The level should reach at least halfway up indicator located on housing. See fig. 4 for correct level.

Figure 4 - Compressor oil level



- Check fixing of capillary tubes (protection from vibration and from wear) and insure that they are not damaged.
- Reset all manually set control devices.
- Check refrigerating circuits tightness.
- Check oil acidity.
- Check electrical terminals tightening of the motors and in the control panel.
- Check the isolation of the motors using a 500V DC megohmmeter which meets manufacturer's specifications (minimum value 2 megohms).
- Check the direction of the rotation using phasemeter.

Electrical power wiring:

- Check all the electrical terminals tightening.
- Set-up compressors overload relays.
- Set-up fan-motors overload relays.

Electrical control wiring:

- Check all the electrical terminals tightening.
- Check all the pressostats.
- Check and set-up the control module.
- Test and start-up without the electrical power.

Condenser:

- Check setting of the safety pressure valve.
- Check direction of the rotation of fans.
- Check the isolation of the motors using a 500V DC megohmmeter which meets manufacturer's specifications (minimum value 2 megohms).

General start-up

Operating parameters statement:

- Switch on main power supply switch.
- Start-up the unit by pushing auto on the control module screen.
- After unit start up, leave in operation for at least 15 minutes, to insure pressures are stabilized.

Then check:

- voltage.
- compressors and fan-motors currents.
- suction temperature and pressure.
- ambient air temperature.
- blowing air temperature.
- discharge pressure and temperature.
- liquid refrigerant temperature and pressure.
- operating parameters:
- superheat: difference between suction temperature and dew point temperature. Normal superheat must be within 5°C and 10°C.
- sub-cooling: difference between liquid temperature and bubble point temperature. Normal sub-cooling on standard unit with R134a should be 5 to 10°C, and 2 to 5°C with 407c.
- difference between dew point temperature in high pressure and condenser air inlet temperature. Normal value on standard unit with R134a and all the fans operating should be 15 to 18°C. With 407C, it should be 20 to 23°C.

Final check:

When the unit is operating correctly:

- Check that the unit is clean and clear of any debris, tools, etc...
- All valves are in operating position.
- Close control and starter panel doors and check panels fixation.

Caution

- For the warranty to apply, any start-up carried out directly by the customer must be recorded in a detailed report, which must be sent as soon as possible to the nearest Trane office.
- Do not start-up a motor whose insulation resistance is less than 2 megohms.
- Phase imbalance should not be greater than 2%.
- The voltage supplied to motors should be within 5% of the rated voltage on the compressor nameplate.
- Excessive emulsion of the oil in the compressor shows that refrigerant is present in the oil and the result will be that compressor is not lubricated enough. Shut down compressor and consult Trane technician.
- Excess oil in compressor can damage the compressor. Before adding oil, consult Trane technician. Use only Trane products recommended.
- The compressors must operate in a single direction of rotation. If refrigerant high pressure remains stable in the 30 seconds after compressor start-up, immediately shut down unit and check the direction of rotation using phasemeter.

Operation

Control System

The control is through the CH530 control module.

Unit operations

- Start-up the unit by pushing «auto» on the control module screen.

Week end shutdown

- If the unit needs to be shut down for a short period of time, push the «stop» button of the module.
- If the unit is shut down for a longer period, see under "Seasonal shutdown", below.
- Insure that all safeties are taken to protect the compressor against refrigerant migration.
- **Do not put the general and control disconnect switches to off.**

Seasonal shutdown

- If the unit needs to be shut down for a short period of time, push the «stop» button of the module.
- Carry out leak test.
- Carry out oil analysis
- Record operating pressures, temperatures, amperages and voltage.
- Check operation of machines/ compare conditions of operation against original commissioning data.
- Push the «stop» button of the module.
- Insure that all safeties are taken to protect the compressor against refrigerant migration.
- Fill out the visit log sheet and review with the operator.
- **Do not put the general and control disconnect switches to off.**

Seasonal start-up

- Check operational set points and performance.
- Calibrate controls.
- Check operation of all safety devices.
- Inspect contacts & tighten terminals.
- Megger the motor compressor windings.
- Record operating pressures, temperatures, amperages and voltage.
- Carry out leak test.
- Check configuration of unit control module.
- Change the oil as required based upon results of the oil analysis made during seasonal shutdown
- Check operation of machines/ compare conditions of operation against original commissioning data.
- Fill out the visit log sheet and review with the operator

Maintenance

The following maintenance instructions are part of maintenance operations required for this equipment. A qualified technician is needed for regular maintenance as part of a regular maintenance contract.

Carry out all operations as required by schedule. This will insure long unit service life and reduce the possibility of serious and costly breakdown.

Keep service records up to date, showing monthly information on unit operations.

These records can be of great help to maintenance personnel diagnostics. Similarly, if machine operator keeps a log of changes in unit operating conditions, problems can be identified and solutions found before more serious problems arise.

Inspection visit after the first 500 hours of operation from unit start up

- Carry out oil analysis.
- Carry out leak test.
- Inspect contacts and tighten terminals.
- Record operating pressures, temperatures, amperages and voltage.
- Check operation of machines/ compare conditions of operation against original commissioning data.
- Fill out inspection visit log sheet and review with the operator.

Monthly preventive visit

- Carry out leak test.
- Oil test of acidity.
- Inspect contacts and tighten terminals.
- Record operating pressures, temperatures, amperages and voltage.
- Check operation of machines/ compare conditions of operation against original commissioning data.
- Fill out visit log sheet and review with the operator.

Annual preventive visit

- Check operational set points and performance.
- Calibrate controls.
- Check operation of all safety devices.
- Inspect contacts & tighten terminals.
- Megger the motor compressor windings.
- Record operating pressures, temperatures, amperages and voltage.
- Carry out leak test.
- Check configuration of unit control module.
- Carry out oil analysis
- Change the oil as required based upon results of the oil analysis
- Check operation of machines/ compare conditions of operation against original commissioning data.
- Fill out the annual start up visit log sheet and review with the operator.

Caution

- Please refer to specific Trane documentation on oil, available from your nearest Trane office. Oils recommended by Trane have been exhaustively tested in Trane laboratories to the specific requirement of Trane unit and hence the user's requirements. Any use of oils not meeting specifications recommended by Trane is the responsibility of the user only, who thereby is liable to warranty loss.
- Oil analysis and oil test acidity must be carried out by a qualified technician. Poor interpretation of results may cause unit operating problems. Also, oil analysis must follow the correct procedures, to avoid accidental injury to maintenance personnel.
- If the condensers are dirty, clean them with a brush. If the coils are too dirty, consult a cleaning professional. Never use water to clean condenser coils.
- Contact Trane for information on maintenance contracts.

Warning

- Switch off unit main power supply before to any intervention. Failure to follow this safety instruction can lead to accident death of the maintenance personnel and may also destroy equipment.
- Never use steam or hot water above 55°C to clean condenser coils. The resulting increasing pressure could cause refrigerant loss.



INSTALLATION CHECKLIST

RAUL Trane Air Cooled Condensing Unit

This list must be checked off by the installer to ensure correct installation before the unit starts up.

Unit acceptance

- Check for damage, if any, on transportation
- Check for equipment shipped against delivery slip
- Check lifting system

Unit positioning

- Remove packaging
- Check position of unit
- Check unit is level
- Check clearance around condenser
- Check clearance required for maintenance access
- Check position of rubber pads

Refrigerant circuit

- Check filter dryer and sight glass presence
- Check oil traps presence on discharge line (if there vertical risers>3m)
- Check pitch for horizontal lines (1cm/m)
- Check refrigerant presence

Electrical equipment

- Check direction of rotation of compressors and fan motors
- Check installation and rating of mains power switch/fuse
- Check that electrical connections comply with specification
- Check that electrical connections match information on manufacturer's identification plate
- Check electrical connections and connections to mains power switch

General

- Check available cooling charge (50% of rated installation load)
- Check with other trades handling installation works

Comments:

.....

.....

.....

Signature: Name

Order N°

Work site:

Please return to your local Trane Service Office.

Troubleshooting guide

These are simple diagnostic hints. If there is a breakdown, the Trane Service office should be contacted for confirmation and assistance.

Problems symptoms	Problem cause	Action recommended
A) The compressor does not start up		
Compressor terminals are live but motor does not start	Motor burned out.	Replace compressor
Contacting motor not operational.	Coil burned out or broken contacts.	Repair or replace.
No current ahead of motor contactor.	a) Power cut. b) Main power supply switched off.	Check fuses and connection. See why system tripped. If system is operational, switch on main power supply.
Current ahead of fuse, but not on contactor side.	Fuse blown.	Check motor insulation. Replace fuse.
Low voltage reading on voltmeter.	Voltage too low.	Contact power Supply Utility.
Starter coil not excited.	Regulation circuit open.	Locate regulation device which has tripped out and see why. See instructions concerning this device. Replace compressor.
Compressor does not run. Compressor motor "groans". High pressure switch tripped to contacts open on high pressure. Discharge pressure too high.	Compressor sticking (damaged or sticking components). Discharge pressure too high	See instructions for "discharge pressure high".
B) Compressor stops		
High pressure switch tripped.		
Over current thermal relay tripped.	Discharge pressure too high.	See instructions for "discharge pressure high".
	a) Voltage too low. b) Cooling demand too high, or condensing temperature too high.	a) Contact Power Supply Utility. b) See instruction "discharge pressure too high".
Motor temperature thermostat tripped. Anti-freeze security tripped.	Not enough cooling fluid.	Repair leak. Add refrigerant.
C) Compressor stops just after its start		
Suction pressure too low. Filter drier iced up.	Filter drier clogged.	Replace filter drier.

Problems symptoms	Problem cause	Action recommended
D) The compressor keeps running without stopping		
Temperature too high in areas requiring air-conditioning.	Excess load on cooling system.	Check thermal insulation and air-tightness of areas requiring air-conditioning.
E) Loss of oil in compressor		
Oil level too low in indicator.	Not enough oil.	Contact Trane office before to order oil
Gradual fall in oil level. Suction line too cold. Compressor noisy	Filter drier clogged. Liquid flows back to compressor.	Replace filter drier. Adjust superheat and check bulb fixing of the expansion valve.
F) Compressor noisy		
Compressor knocks.	Components broken in compressor.	Change compressor.
Suction line abnormally cold.	a) Uneven liquid flow. b) Expansion valve locked in open position.	a) Check superheat setting and fixing of expansion valve bulb. b) Repair or replace.
G) Insufficient cooling capacity		
Thermostatic expansion valve "whistles".	Not enough refrigerant.	Check refrigerant circuit tightness and add refrigerant.
Excess pressure drops through filter drier.	Drier filter clogged.	Replace.
Excessive superheat.	Superheat not properly adjusted.	Check adjustment of superheat and adjust thermostatic expansion valve.
H) Discharge pressure too high		
Condenser abnormally hot.	Presence of uncondensable liquids in system, or excess refrigerant.	Purge uncondensable fluids and drain off excess refrigerant.
Condenser air output too hot.	Reduced air flow. Air intake temperature higher than specified for unit.	Clean battery. Check operation of motor fans.

Problems symptoms	Problem cause	Action recommended
I) Suction pressure too high		
Compressor operates continuously.	Excess cooling demand on evaporator.	Check system.
Suction duct abnormally cold.	a) Expansion valve too far open.	a) Check for superheat and check that expansion valve bulb is secure.
Refrigerant flows back to compressor.	b) Expansion valve locked in open position.	b) Replace.
J) Suction pressure too low		
Excessive pressure drop through filter drier. Refrigerant does not flow through thermostatic expansion valve	Drier filter clogged. Expansion valve bulb has lost its refrigerant.	Replace the deshydrator. Replace the bulb.
Loss of power.	Expansion valve obstructed.	Replace.
Superheat too low.	Excessive pressure drops through evaporator.	Check adjustment of superheat and adjust thermostatic expansion valve.

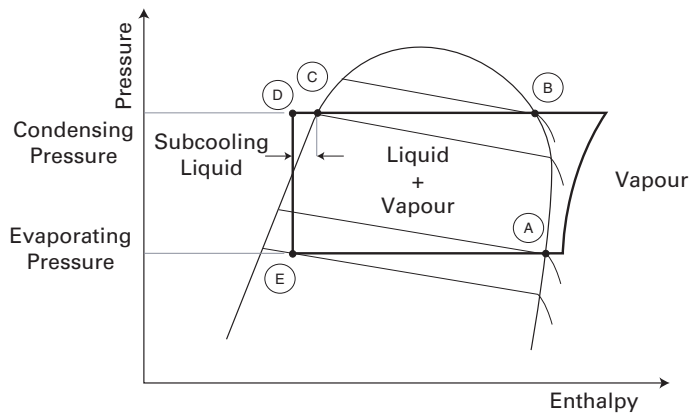
Note:

The above is not a comprehensive analysis of the Scroll compressor refrigeration system. The aim is to give operators simple instructions on basic unit processes so that they have the technical knowledge to identify and bring defective operations to the notice of qualified technicians.

Performance Data

Performance data is given for Ambient air temperature versus Dew temperature at evaporating pressure. Refer to point A on Figure 4.

Figure 4



- Ⓐ Dew Temperature at Evaporating Pressure
 - Ⓑ Dew Temperature at Condensing Pressure
 - Ⓒ Bubble Temperature at Condensing Pressure
 - Ⓓ Liquid Temperature at Condensing Pressure
 - Ⓔ Inlet Temperature at Evaporating Pressure
- Subcooling = Ⓒ - Ⓓ

Table 5- Dew point and Bubble temperature versus pressure for R407C

Absolute Pressure (bar)	Dew Temp. (°C)	Bubble Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)	Bubble Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)	Bubble Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)	Bubble Temp. (°C)
0.2	-65.0	-72.5	2.7	-14.4	-20.9	6.0	7.8	1.7	27.0	62.8	58.8
0.3	-58.7	-66.1	2.8	-13.4	-20.0	6.5	10.2	4.2	28.0	64.4	60.5
0.4	-54.0	-61.3	2.9	-12.5	-19.1	7.0	12.6	6.6	29.0	65.9	62.1
0.5	-50.1	-57.3	3.0	-11.7	-18.2	7.5	14.8	8.9	30.0	67.4	63.7
0.6	-46.8	-54.0	3.1	-10.8	-17.3	8.0	16.8	11.0	31.0	68.8	65.3
0.7	-43.9	-51.0	3.2	-10.0	-16.5	8.5	18.8	13.0	32.0	70.2	66.8
0.8	-41.3	-48.4	3.3	-9.2	-15.6	9.0	20.7	15.0	33.0	71.6	68.3
0.9	-39.0	-46.1	3.4	-8.4	-14.8	9.5	22.6	16.9	34.0	72.9	69.7
1.0	-36.9	-43.9	3.5	-7.6	-14.0	10.0	24.3	18.7	35.0	74.2	71.1
1.1	-34.9	-41.9	3.6	-6.8	-13.3	11.0	27.6	22.1	36.0	75.5	72.5
1.2	-33.1	-40.0	3.7	-6.1	-12.5	12.0	30.7	25.3	37.0	76.7	73.9
1.3	-31.4	-38.3	3.8	-5.4	-11.8	13.0	33.6	28.3	38.0	77.9	75.2
1.4	-29.8	-36.7	3.9	-4.7	-11.0	14.0	36.4	31.1	39.0	79.1	76.5
1.5	-28.3	-35.1	4.0	-4.0	-10.3	15.0	39.0	33.8	40.0	80.2	77.8
1.6	-26.8	-33.7	4.1	-3.3	-9.6	16.0	41.4	36.4	41.0	81.3	79.1
1.7	-25.5	-32.3	4.2	-2.6	-8.9	17.0	43.8	38.8	42.0	82.4	80.3
1.8	-24.1	-30.9	4.3	-2.0	-8.3	18.0	46.0	41.2	43.0	83.4	81.5
1.9	-22.9	-29.6	4.4	-1.3	-7.6	19.0	48.2	43.4	44.0	84.3	82.7
2.0	-21.7	-28.4	4.5	-0.7	-7.0	20.0	50.2	45.6	45.0	85.2	83.9
2.1	-20.5	-27.2	4.6	0.0	-6.3	21.0	52.2	47.7	46.0	86.2	85.1
2.2	-19.4	-26.1	4.7	0.6	-5.7	22.0	54.2	49.7	47.0	87.1	86.2
2.3	-18.3	-25.0	4.8	1.2	-5.1	23.0	56.0	51.6	48.0	88.1	87.3
2.4	-17.3	-23.9	4.9	1.8	-4.5	24.0	57.8	53.5	49.0	89.1	88.4
2.5	-16.3	-22.9	5.0	2.4	-3.9	25.0	59.5	55.3	50.0	90.0	89.5
2.6	-15.3	-21.9	5.5	5.2	-1.0	26.0	61.2	57.1			

Table 6 - Dew point temperature versus pressure for R134a

Absolute Pressure (bar)	Dew Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)	Absolute Pressure (bar)	Dew Temp. (°C)
0,2	-56,4	2,7	-2,2	6,0	21,6	27,0	81,2
0,3	-49,7	2,8	-1,2	6,5	24,2	28,0	82,9
0,4	-44,6	2,9	-0,3	7,0	26,7	29,0	84,6
0,5	-40,5	3,0	0,7	7,5	29,1	30,0	86,2
0,6	-36,9	3,1	1,6	8,0	31,3	31,0	87,8
0,7	-33,9	3,2	2,5	8,5	33,5	32,0	89,3
0,8	-31,1	3,3	3,3	9,0	35,5	33,0	90,8
0,9	-28,6	3,4	4,2	9,5	37,5	34,0	92,3
1,0	-26,4	3,5	5,0	10,0	39,4	35,0	93,7
1,1	-24,3	3,6	5,8	11,0	43,0	36,0	95,1
1,2	-22,3	3,7	6,6	12,0	46,3	37,0	96,5
1,3	-20,5	3,8	7,4	13,0	49,5	38,0	97,8
1,4	-18,8	3,9	8,2	14,0	52,4	39,0	99,1
1,5	-17,1	4,0	8,9	15,0	55,2	40,0	100,3
1,6	-15,6	4,1	9,7	16,0	57,9	41,0	101,6
1,7	-14,1	4,2	10,4	17,0	60,5	42,0	102,8
1,8	-12,7	4,3	11,1	18,0	62,9	43,0	103,9
1,9	-11,4	4,4	11,8	19,0	65,2	44,0	105,0
2,0	-10,1	4,5	12,5	20,0	67,5	45,0	106,0
2,1	-8,8	4,6	13,1	21,0	69,6	46,0	107,1
2,2	-7,6	4,7	13,8	22,0	71,7	47,0	108,2
2,3	-6,5	4,8	14,5	23,0	73,7	48,0	109,2
2,4	-5,4	4,9	15,1	24,0	75,7	49,0	110,3
2,5	-4,3	5,0	15,7	25,0	77,6	50,0	111,4
2,6	-3,2	5,5	18,8	26,0	79,4		



Notes

Notes



Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

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