Installation Operation Maintenance

Air Cooled Split System, 20-55 Ton Condensing Units Cooling Only, 50 Hz

RAUP 250, RAUP 300,
RAUP 400, RAUP 500, RAUP 600

To be used with the
manual of unit controller, UC2C/UC4C
Reference SS-SVX05A-E4

MUL-SVN05A-E4 (Jan 2012)

GENERAL INFORMATION

Foreword

These installation, operation and maintenance instructions are given as a guide to good practice in the installation, putting into service, operation and periodic maintenance by the Trane Product user. They do not contain full service procedures necessary for the continued successful operation of this equipment. The services of a qualified service technician should be employed through the medium of a maintenance contract with a reputable service company.

Warranty

Warranty is based on the general terms and conditions of The Trane Company. The warranty is void if the equipment is repaired or modified without the written approval of Trane, if the operating limits are exceeded or if the control system of 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.

Receiving / Handling

On arrival, inspect the unit before signing the delivery note. Specify any damage on the delivery note, and send a registered letter of protest to the last carrier of the goods **within 72 hours** of delivery. Notify the local Trane Sales Office at the same time. The unit should be totally inspected within 15 days of delivery.

If any concealed damage is discovered, stop unpacking the shipment. Take photos of the damaged material if possible. Notify the Carrier immediately by phone and registered mail. Notify the local Trane Sales office. Concealed damage must be reported within 15 days of delivery.

Contents

MODEL NOMENCLATURE

R	A	U	<u>P</u>	2	5	0	D	1	<u>C</u>	X	A	S	0	<u>F</u>
1	2	3	<u>4</u>	5	6	7	8	9	<u>10</u>	11	12	13	14	<u>15</u>

DIGIT 1,2,3 — Remote Condensing Unit / Air-Cooled / Up-flow

DIGIT 4 — Development Sequence

DIGIT 5,6,7 — Nominal Cooling Capacity, MBH

250 = 250	400 = 400	600 = 600
300 = 300	500 = 500	

DIGIT 8 — Electrical Rating / Utilization Range
D = 380-415V / 3 Phase / 50Hz

DIGIT 9 — Factory Mounted Control
1 = DOL Starter with Unitary Controller, UC-2C / UC-4C.
4 = DOL Starter with UC-2C / UC-4C C/W Low Ambient controls

DIGIT 10 — Minor Design Sequence
C = Modular RAUP design.

DIGIT 11 — Factory Installed Options
X = None
1 = Corrosion Resistant Fin

DIGIT 12 — Refrigerant Type
A = R22
B = R407C

DIGIT 13 — Operating Ambient
S = Standard Ambient Option
H = High Ambient Option

DIGIT 14 — Future Use

DIGIT 15 — Service Indicator
F = Introduction of 3Phase / 4Wire Starter System

General Data 20-55 Ton Condensing Unit

Table 1 - General Data 020-55 Ton Condensing Unit

		RAUP 250	RAUP 300	RAUP 400	RAUP 500	RAUP 600
Performances (1)						
Gross Cooling Capacity [R22] (1)	(kW)/(MBH)	73.9/253	90.3/308	113.9/389	147.9/505	180.5/617
Gross Cooling Capacity (R407C)	(kW)/(MBH)	70.2/240	85.8/293	108.2/370	140.5/480	171.5/589
Unit Capacity Steps (%)		100-50	100-50	100-75-50-25	100-75-50-25	100-75-50-25
Total Compressor Power Input (1)	(kW)	25.2	26.8	36.2	50.4	53.6
Utilization Range		400V +10% , 3 phase , 50Hz				
Sound Power Level	(dB(A)	87	89	89	90	92
Compressor						
Number		2	2	4	4	4
Type		Scroll				
Model		2x13T	2 x 15T	2x (10T+10T)	2 x (13T+13T)	2x (15T+15T)
Speeds Number		1				
Motors Number		1				
Motor RPM	(rpm)	2900				
Sump Heater (Optional) per compressor	(W)	65W - 240V	75W - 240V	65W - 240V	65W - 240V	75W - 240V
Liquid and Suction connection						
Suction Connection	brazed	2 1/8”	2 1/8”	1 5/8”x2	2 1/8”x2	2 1/8”x2
Liquid Connection	brazed	7/8”	7/8”	7/8”x2	7/8”x2	7/8”x2
Coil						
Type		Plate Fin				
Tube Size	(mm)	9.52				
Tube Type		Smooth				
Height	(mm)	1860	1860	1860	1860	1860
Lenght	(mm)	1782	1782	1782	1782	1782
Quantity		1	1	2	2	2
Face Area	(m2)	3.3	3.3	6.6	6.6	6.6
Rows		2+3	3	2	2+3	3
Fins Per Foot (fpf)		144	144	144	144	144
Fan						
Type / Drive Type		Propeller / Direct Drive				
Number		2	2	3	4	4
Diameter	(mm)/(in)	711/28				
Speeds Number		1				
Motors kW (2)		0.6/0.8				
Motor RPM	(rpm)	900				
Dimensions						
Height	(mm)	1911	1911	1911	1911	1911
Width	(mm)	1002	1002	1992	1992	1992
Length	(mm)	2264	2264	2264	2264	2264
Weight Uncrated	(kg)	583	593	990	1153	1177
Weight Crated	(kg)	603	613	1025	1188	1212
System Data						
Refrigerant Circuit		1	1	2	2	2
Refrigerant Charge (3)						
Approximate per circuit	(kg)	24.7	27.2	22.2	24.7	27.2
RAUP Only						
Minimum Outdoor Air Temperature for Mechanical Cooling						
Standard Ambient Operating Range [5]	(F)	59-109 F	59-109 F	59-109 F	59-109 F	59-109 F
	(C)	15-43 C	15-43 C	15-43 C	15-43 C	15-43 C

Notes

[1] At 7deg C SST and 35 deg C Ambient, 400V, Subcooling 8.3K, Superheat 11.1K

[2] Per Motor @ 400V

[3] Per Circuit

Installation

General Information

This manual cover the installation of the RAUP 250 & RAUP 300(single circuit), and RAUP 400, RAUP 500 & RAUP 600(dual circuits) air cooled condensing units. Installation procedures should be performed in the sequence that they appear in this manual. Do not destroy or remove the manual from the unit. The manual should remain weather-protected with the unit until all installation procedures are complete.

Note: *It is not the intention of this manual to cover all possible variations in the systems that may occur or to provide comprehensive information concerning every possible contingency that may be encountered during an installation. If additional information is required or if specific problem arise that are not fully discussed in this manual, contact your local sales office.*

Note: *"Warnings" and "Cautions" appear at appropriate places in this manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The Company assumes on liability for installations or servicing performed by unqualified personnel.*

Unit nameplate

The unit nameplate gives the full model reference. The power supply of unit is specified and must not vary by more that 5% of the specified voltage.

Machine room installation requirements

Foundation

A special base or foundation is not required when the floor is level and of sufficient strength to support the units weight.

Lifting of the unit

Four lifting lugs are provided at the base of each unit for crane lift. Attach cable slings to each lug (refer to **Figure1**) and install a spreader bar between the cable to protect the unit. Make sure that the lifting equipment is capable of handling the weight of the unit.

Clearances

Provide sufficient clearance around the unit for performance of service and maintenance. Caution unit operation is a function of the air temperature. Any recycling of the air fed out by he fans will increase the air intake temperature over the condense fins and result in a high temperature out. Make sure nothing prevents air flow to run through the unit coils. Refer to dimensional drawing recommended for detailed clearances, under Dimensional Data section.

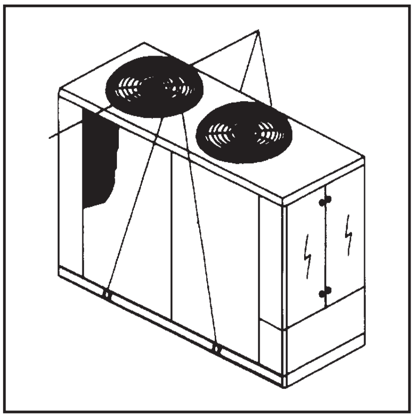
Special lifting and moving instruction

A specific lifting method is recommended as follows:

1. Four lifting points are built into the unit.
2. Slings and spreader bar to be provided by rigger and attached to the four lifting points.
3. Minimun rated lifting capacity (vertical) of each sling and spreader bar shall be no less than the tabulated unit shipping weight.
4. Caution: The unit must be lifting with the utmost care Avoid shock load by lifting slowly and evenly.

Figure 1

Lifting of the unit



Vibration Isolators (option)

Vibration isolators (rubber pads) are recommended and are to be placed under the unit feet.

Installation

Refrigerant circuit
One circuit on sizes 250 and 300, and two circuits on sizes 400, 500 and 600. Single circuit units will have two compressors manifolded. Both circuits of the four compressor units are manifolded. Refrigerant connections not connected are sealed and plugged.

Refrigerant pipe connections
Determination of the size of the pipe connections.

Liquid line
Size the liquid line on the basis of:
1. Full load operating conditions.
2. A pressure drop of 241 kPa maximum. (35 psig)
3. A liquid velocity not exceeding 3 m/s (to avoid hammer).

Suction line
Design the suction line to provide sufficient gas velocity in both horizontal and vertical runs to carry the compressor oil and ensure a uniform rate of return to the compressor. Size the compressor. Size the hot gas line on the basis of:
1. Producing gas velocity in horizontal runs at least 2.5 m/s at minimum operating conditions.
2. Producing gas velocity in vertical risers at least 5 m/s at minimum operating conditions.
3. Gas velocity should not exceed 20 m/s under maximum load conditions.
4. Maximum pressure drop in suction line should not exceed 20 kPa.

Pitch the horizontal run of suction line toward the evaporator.

Refrigerant line isolation
Isolate the refrigerant lines from the building to prevent normal vibration in the lines from the building structure. Also avoid bypassing the isolation system on the unit by attaching the refrigerant piping or electric conduit too rigidly.
Any unit vibration can travel along rigid pipes or conduits to the building.

Pressure and leak testing
When pressure and leak testing, these safety precautions must be adhered to:
1. Do not work in closed area where refrigerant may be leaking - a sufficient quantity of vapors may be present to cause personal injury. Provide adequate ventilation.
2. Do not use oxygen or ecetylene in place of regrigerant and dry nitrogen for leak testing- a violent explosion may result.
3. Always use a pressure regulator, valves and gauges to control drum and line pressures when pressure testing the system. Excessive pressures may cause line ruptures, equipment damage or an explosion resulting in personal injury.

Pressure test the liquid line, and suction line at pressures dictated by local codes.

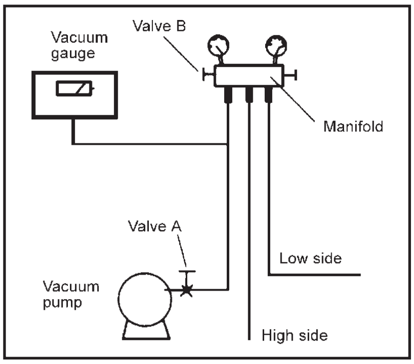
> **Caution:** Do not exceed the high pressure control setting plus 0.7 bar. Test pressures on liquid line and on suction line must comply with local and national codes.

Charge enough refrigerant into the system to raise the pressure to 1 bar. Using oil-pumped dry nitrogen, build the system pressure to 7 bar.
Check the piping and the evaporator unit for leaks with a leak detector. Be very thorough in this test, checking every possible point of leakage. If leaks are found during the testing, release the test pressure, break the connection and make a new joint. Retest to make sure the connection is solid.

Field evacuation
For field evacuation, use a rotary-style vacuum pump. Determine the pump size required for proper unit evacuation. When hooking a vacuum pump to a refrigeration system, <u>it is important to connect the pump to both the high and low side of the system.</u>

Follow the pump manufacturer's directions as to the proper methods of using the vacuum pump. The lines used to connect the pump to the system should be copper and of the largest diameter that can pratically be used. Using larger line sizes with minimum flow resistance can significantly reduce evacuation time. Rubber or synthetic hoses are not acceptable for unit evacuation because they have moisture absorbing characteristics which result in excessive rates of outgassing and pressure rise during standing vacuum test. This makes it impossible to determine if the unit has a leak.
A vacuum gauge should be installed in the common line ahead of the vacuum pump shutoff valve as shown in **Figure 2**. Close Valve B and open Valve A. After several minutes, the gauge reading will indicate the minimum blank-off pressure the pump is capable of pulling. Rotary pump should produce vacuum of less than 100 microns.
Open Valve B and evacuate the system to a pressure of 500 microns or less. Valve A must be closed when taking this reading. Once 500 microns or less is obtained, with Valve A closed, a time versus pressure rise over a 15 minute period is 200 microns. If pressure rise is greater than 200 microns but levels off to a contant value, excessive moisture is present. If the pressure steadily continues to rise, a leak is indicated.

Figure 2
Vacuum pump connection.



Installation

RAUP-C-E, Electrical Data (@ARI)

Model	Power supply	Compressors			Fan Motor @ 415V			UNIT MCA	Max Fuse Size & MCB
		RLA(ARI)	LRA	Qty.	KW	FLA	Qty.		
RAUP 250	380-415 V / 3Ph/50Hz	20.5	135	2	0.6	1.5	2	49	70
RAUP 300	380-415 V / 3Ph/50Hz	24.0	175	2	0.6	1.5	2	57	81
RAUP 400	380-415 V / 3Ph/50Hz	16.5	130	4	0.6	1.5	3	75	91
RAUP 500	380-415 V / 3Ph/50Hz	20.5	135	4	0.6	1.5	4	93	114
RAUP 600	380-415 V / 3Ph/50Hz	24.0	175	4	0.6	1.5	4	108	132

As per UL standard,
MCA = Minimum Circuit Ampacity,
MCA = 1.25 (LARGEST MOTOR AMP (RLA or FLA) + the SUM OF REMAINING MOTOR AMPS.
RLA (ARI) = Rated Load Amp at ARI Rating Point, (7.2C Evap / 54.4C Condensing)
WHEN, Compressor is Largest Load:
MAX FUSE SIZE & MCA = (2.25 * LARGEST COMPR. RLA) + SUM OF REMAINING COMPRESSOR RLA + FAN MOTOR FLA.
Note: The standard fuse or circuit breaker size selected must be equal to or less than the calculated value.
Also, the selected device rating must be greater than the minimum circuit ampacity.

Low Voltage Interconnecting Wiring
Install the zone sensor in the room/zone, and connect to the unitary controller (at RAUP) as shown in the unit wiring diagram. Use the recommended cable. The unitary controller can be enabled/disabled via the BIP1. Typically, this input is interfaced with AHU FAN STARTER INTERLOCK (DRY CONTACT)

Wiring diagrams are furnished with the units, but extra copies may be obtained from the local Trane sales office. The installing contractor is to provide and install fused disconnect switches and the wiring up to the unit control panel. Check all wiring connections and trace the circuits to make sure that they agree with the wiring diagrams.

Caution:
1. All wiring should comply with local and national codes. Type and location of disconnect switches should comply with local and national codes. Install disconnect switch near unit, within sight, for safety.
2. Use copper conductors only for installation wiring. Unit terminals are not designed to accept other type of wiring. The use of aluminium wire may cause galvanic corrosion and/or overheating at the connection points with resultant equipment failure.

Unit Start-Up
Preparation for start-up

Before starting the unit, use the following procedures to ensure that the unit is completely and properly installed and ready for start-up.

The installer must make sure that the following points are checked before the initial start-up.

1. Inspect all wiring connections. Connections should be clean and tight. Trace circuits to ensure that wiring agrees with wiring diagrams provided with the unit. Information in the title block of the wiring diagram should match the data that appears on the unit nameplate.
2. Close the unit power fused disconnect switch and the manual disconnect switch.
3. Check the unit supply voltage to ensure that the voltage is within the utilization range.
4. Check the compressor oil level.
5. Check with a phase-meter the direction of rotation of scroll Trane compressors or check the good operation of the discharge and suction pressures.
6. As the various motors of the system are started, check the direction of rotation and make sure that the driven equipment is operating satisfactorily.
7. Ensure sufficient cooling load available at day of start-up (minimum of 50% of design load).
Before making any electrical power

Installation

Preparation

Before putting the system into operation, perform these service and check-out procedures:

1. connections make sure that the insulation resistance of all power terminal to earth is in accordance with the international electrical codes. Measure the insulation of all electrical motors using a 500 V DC tester and refer to the manufacturer's specifications.

Warning:
No motor should be started if the insulation resistance is less than 2 mega ohms. Under no circumstances should any voltage be applied to a motor while it is under vacuum.

2. Check the unit supply voltage to ensure that the voltage is within the utilization range.

Caution:
Phase unbalance must not exceed 2%. Supply for all motors is to be within plus or minus 5% of the voltages specified on the compressor nameplate.

3. Place all refrigerant circuit valves in operating position.
4. Reset all controls equipped with a manual reset function.

Refrigerant charging

After the refrigeration pipework system has been pressure tested and evacuated, and meets the vacuum pressure requirements of paragraph <<Field evacuation>>, the refrigerant may be charged as follows. Be sure to follow the start-up procedure at the same as charging the refrigerant.

1. Loosely connect a cylinder of refrigerant to the 1/4" OD Charging Valve Located on the liquid line.
2. Open and close the valve on the refrigerant cylinder to purge the connection. Tighten the coupling nut.
3. Invert the refrigerant cylinder so that only liquid will enter the system.
4. Allow the compressor to continue running throughout the remainder of the charging operation. Do not allow the pressure to fall bellow 0.15 bar.

Caution:
Do not attempt to start the compressor by blocking the safety controls. Allow the condensing unit to function in a normal manner.

5. Allow the system to continue functioning for approximately 30 minutes. If during this period bubbles appear in the liquid line sight glass, add refrigerant.
6. Leak-test the refrigerant circuit.

Start-up procedure

1. During commisioning start the unit by turning the control circuit switch, (MCB) in the control panel.
   Make sure the AHU fan is operating and the status (via starter's dry contact) is reaches BIP 1 (enable/disable input point) of UC2C / UC4C
2. After the unit has started, allow in to operate for at least 15 minutes to stabilise operating pressures. Then check:
   - compressor oil level.
   - compressor and fan motor power consumption.
   - suction pressure.
   - discharge pressure.
   - liquid line sight glass.
   - superheat.
   - subcooling.

All readings and measurement should be logged.
Procedures are given below.

CAUTION

PHASE ROTATION IS CRITICAL

IF SUCTION PRESSURE DOES NOT FALL TO EXPECTED OPERTATING LEVEL WITHIN THIRTY (30) SECONDS AFTER COMPRESSOR IS STARTED, COMPRESSOR ROTATION MAY BE REVERSED.

TO REVERSE ROTATION, DISCONNECT ALL UNIT POWER AND REVERSE ANY TWO (2) INCOMING POWER LEAD WIRES AT THE UNIT HIGH VOLTAGE TERMINAL BLOCK. RECONNECT ALL UNIT POWER, RESTART UNIT, AND RE-CHECK SUCTION PRESSURE.

Installation

Oil level
Oil should be visible in the compressor, under full load, in the compressor oil level sight glass. The unit was charged with the proper amount of oil before shipping. Under normal operation, compressor oil is always expected to return to compressor oil sump, and no additional oil should be added. For oil level indication, refer to compressor oil sight glass, as per **Figure 3**. If oil is within sight glass visibility, oil quantity should be sufficient.t

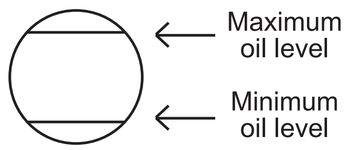
Refrigerant pressures
Observe operating pressures. if pressures are above or below normal see <<Trouble Analysis>> section. Normal operating pressures are in **Table 2.** A High & Low pressure settings are found in **Table 1**.

Liquid line sight glass (Optional)
The flow of refrigerant through the sight glass should be smooth and without bubbles. Bubbles indicate a refrigerant shortage and probably a leak, or a restriction in the liquid line.

Compressor Superheat
Normal Superheat is 6 to 8 deg C (11F-14F). Overfeeding of the evaporator results in high suction pressure, low superheat and possible liquid carryover, Inadequate or too high a superheat is remedied by adjusting stem on the thermostatic expansion valve (TEV). If this fails to correct the condition, then the valve cage or power element of the TEV may be defective and should be replaced.

Caution:
1. Excessive foaming indicates the presence of refrigerant in the oil and will result insuffcient compressor lubrication. Turn off the motor and investigate the cause.
2. An excess of the oil in the compressor can cause problems in the same way as a lack of oil. Before topping up, contact a qualified service technician.
   Use only Trane recommended oils.

Figure 3 - Compressor oil level



⚠ WARNING

1. Do NOT run the compressor on reverse rotation
2. Do NOT perform any pump down cycle with Scroll compressor
3. Do NOT run the compressor below the the setting of low pressure switch
4. Do NOT by pass any safety devices when operating the system.

Failure to observe any of the above will cause severe damage to the Scroll compressors.

Figure 3A
PIPING DETAILS OF REFRIGERANT COILS

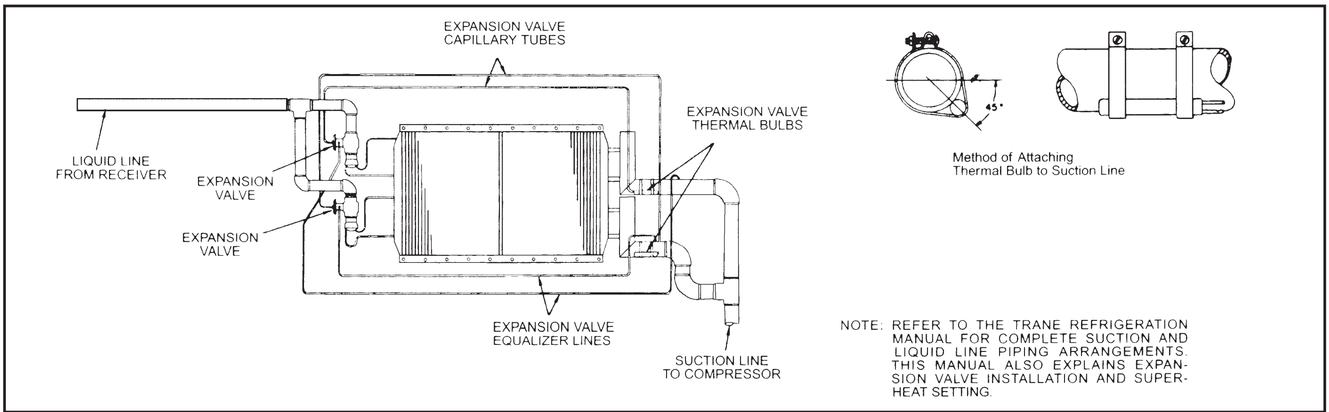


Figure 3B

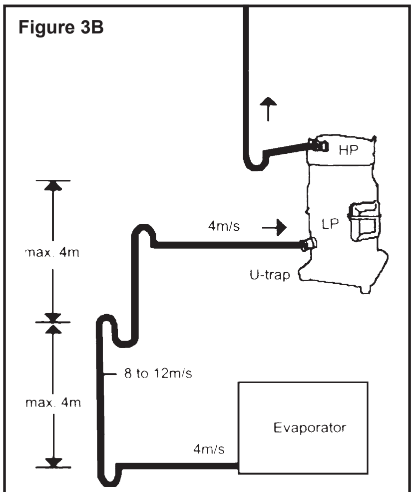


Figure 3C Manifolded Suction Headers

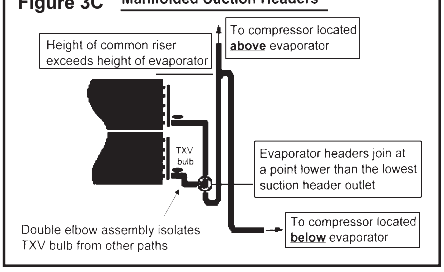


Table 2 - Normal operating conditions

Ambient	TEMPERATURE (C)		
	25	30	40
Discharge pressure (bar)	14-17	17-19	22-25
Suction pressure (bar)	4-6	4-6	4-6

Final checkout

Run the unit sequentially through its stages of cooling.
Once proper unit operation is confirmed, perform these final steps:
1. Inspect the unit for debris and/or misplaced tools and hardware.
2. If the unit is operated immediately, be sure all valves are in operating position.
3. Secure all panels including control panel in place.

Operation

Operating the unit
Unit operation unit intialized by turning the control circuit ON REFER CONTROLLER IOD.

Seasonal start-up procedure

1. Perform the applicable procedures outline under <<Annual Maintenance>> in the Maintenance Section.
2. Test the entire refrigerant system for leaks.
3. Close the system master disconnect switch
4. Start the system
5. Check the operation of all interlocked equipment.
6. Check oil level and operating pressures after the system has been in operation for 15 to 20 minutes.
7. Check discharge pressure against <<Normal operating conditions>>. If the pressure is above or below the normal level, stop the unit and correct the cause.
8. On Scrolls, compressor sightglass oil levels may be anywhere within the sightglass. Also 2 scrolls manifolded together will have different levels.

Maintenance

The folowing maintenance are given as an essential part of the required maintenance of this equipment. However the services of a qualified services technician are required to perform the periodic maintenance procedures as part of a regular maintenance contact. Perform all maintenance procedures at the scheduled intervals. This will prolong the life of the unit and reduce the possibility of costly equipment failure. Use an <<operator's log>> to record a weekly <<operator condition history>> for this machine. The operating log for this unit can be a valuable diagnostic tool for service personnel also, the operator, by noticing trends in the operating conditions can often foresee and prevent problem situations before they become serious. It may be required for inspection in the event of warranty claim.

Weekly maintenance

1. Check the compressor oil level. The oil should cover 1/2 of the sight glass when running at full load. Before oil is added allow the compressor to run continuously for 3-4 hours. Check the oil level every 30 minutes. If the level does not return to cover 1/2 of the sight glass contact a qualified service technician.
2. Trane approved compressor oil:
   R22-mineral (160p)
   R407C-POE (160SE)

Note:
The lubricating oils recogniesed by Trane have been subjected to extensive testing in laboratories and have been found to give the required satisfactory results for use with the compressors.
The use of any oil not conforming to Trane required standard is at the sole responsibility of the user and could result in warranty cancellation.

Maintenance

Caution:
1. Excessive foaming indicates the presence of refrigeration in the oil and will result in insufficient compressor lubrication. Turn off the motor and investigate the cause.
2. An excess of oil in the compressor can cause problems in the same way as a lack of oil. Before topping up, contact a qualified service technician.
   Use only Trane recommended oil.
3. The flow of refrigerant through the sight glass should be smooth and without bubbles. Bubbles indicate a refrigerant shortage and probably a leak, or a restriction in the liquid line. Contact a qualified service technician. Each sight glass is equipped with a moisture indicator. The colour of the indicator element changes with the amount of moisture in the refrigerant, but also as a function of tempreraturе. It should indicate <<dry>> refrigerant if it indicates <<wet>> run the unit for a minimum of 12 hours and check again. If it remains consistently in <<caution>> or <<wet>> zones, contact a qualified service technician.
4. Run the compressor(s) for a minimum of two (2) hours before taking the initial moisture level readings after a start-up. The moisture indicator element is moisture and temperature sensitive, so the system must be at normal operating temperatures to obtain correct moisture level readings.

3. Observe operating pressures. If pressures are above or below normal, see <<Trouble Analysis>> section. Normal Operating pressures are in **Table 2.**
4. Inspect entire system for any unusual conditions such as noisy compressor, loose access panels, leaky pipes of chattering contactors.
5. Note temperatures, pressures, date and time as well as any observation in a machine log book.

Annual maintenance

1. Remove corrosion from any surface and repaint. Check the condition of the gasket around the control panel door.
2. Perform all weekly maintenance procedures.

Maintenance inspections

If the unit does not perform properly during these inspections, consult the <<Trouble Analysis>> section for possible cause and recommended procedures. The following procedures should be carried out by a qualified service techinician as part of a maintenance contract.
The first and last visit will include the seasonal shut down and start-up procedures, when applicable as detailed on the section on <<operation>>. The visits should include the following proceduces:
- Inspect contacts of motor contactors.
- Check setting and function of each system control.
- Perform an oil analysis to determine the acidity of the compressor oil and record the results.

Warning / Caution:
The oil analysis procedure must be performed by a qualified service technician. Incorrect interpretation of analysis results can cause damage to the unit. The use of improper analysis procedures can cause hazardous condition that may result in injury to service personnel.
- Refrigerant leak test.
- Check motor winding insulation (once per year).

Other procedures may be necessary, depending on the age and usage of the equipment.

Note:
It is important that the equipment is regularly serviced by a qualified service technician, at least once per year / 1000 hours of operation, minimum frequency. Failure to respect this requirement may result in cancellation of Trane warranty and liability.

A maintenance visit by a qualified service technician is also recommended after the first 500 hours of operation after commissioning.

Table 2A
General interconnectiong line sizes

CONDENSING UNIT	LENGTH OF INTERCONNECTING LINES (FT) **																			
	0-20		21-40		41-60		61-80		81-100		101-120		121-140		141-160		161-180		181-200	
	LINE SIZE - O.D. (IN.)																			
	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT	LIQ	SUCT
RAUP 400	5/8	1 5/8	7/8	1 5/8	7/8	1 5/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8
RAUP 250, 500	7/8	1 5/8	7/8	1 5/8	7/8	2 1/8	7/8	2 1/8	7/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	—	—
RAUP 300, 600	7/8	1 5/8	7/8	2 5/8	7/8	2 1/8	7/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	—	—	—	—	—	—

** In shaded region, use 2 1/8 for all horizontal runs, and 1 5/8 for all vertical risers.
However, for correct and proper pipe sizing, it is recommended to size piping based on Trane recommended piping guide or use computer aided software where applicable

Compressor

Compressor Motor Winding Thermostat

Each motor winding thermostat is a pilot duty control designed to stop compressor operation if the motor windings become hot due to rapid cycling, loss of charge, abnormally low suction temperatures, or the compressor running backwards.

Compressor Manifold Piping

The compressor refrigerant piping manifold system was purposely designed to provide proper oil return to both compressors; therefore, **the original refrigerant manifolding system shuold not be modified in any way!**

If a compressor replacement is required, do not alter the compressor manifold piping; improper oil return and compressor failure could result. If a suction filter is required, install it a minimum of 18” upstream of the compressor manifold piping.
See Figure 4

Caution: Altering the original manifold piping may cause oil compressor failure.

The scroll compressors in the RAUP units do not unload. Instead, they are staged on and off for various steps of loading. **This sequence is critical and must not be changed!** Altering this sequence in any way could cause compresoor failure.

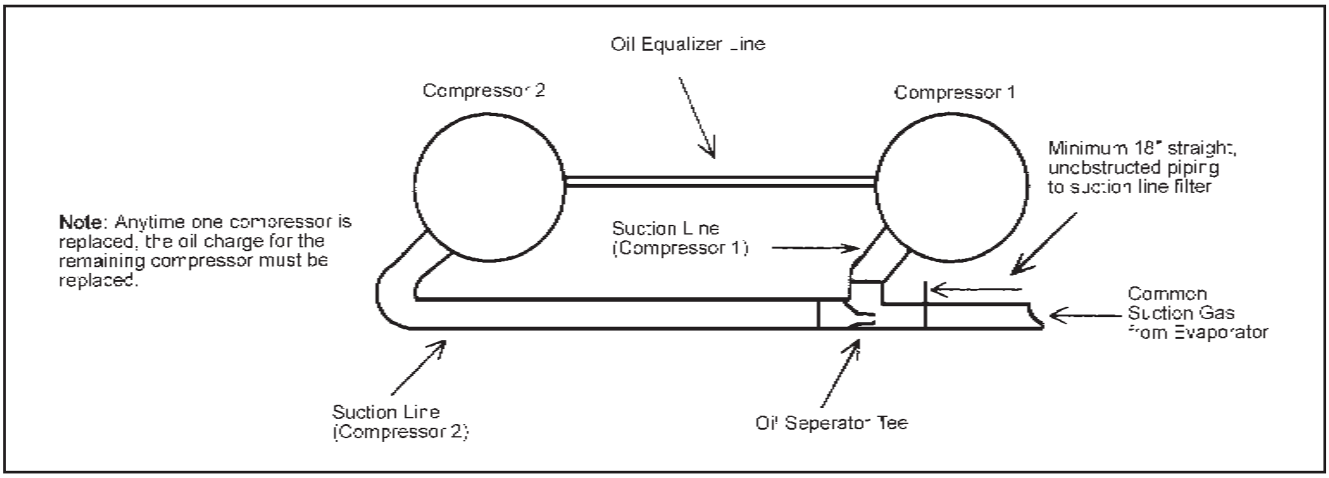
This sequence is of most importance because it maximizes lubrication and ensure proper oil return. Secondly, the design of the oil return with equalizer is critical. The lead compressor must always be in the lead in the sequence. Should it fail, it locks out the circuit immediately, saving the other compresoor.

Table 2B
Compresoor Sequencing

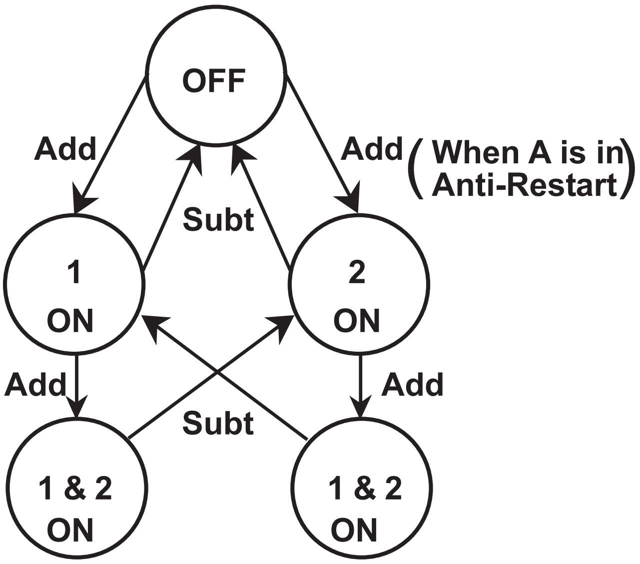
Unit Size	Control Step	Circuit 1 Comp. #		Circuit 2 Comp. #	
250/300	1 2	1 1, 2	(50%) (100%)		- -
400/500/600	1 2 3 4	1 1 1, 2 1, 2	(50%) (50%) (100%) (100%)	 3 3 3, 4	- (50%) (50%) (100%)

Note: 1, 2, 3 and 4 indicate which compressor in the unit is operating. (%) indicates the amount of the circuit in the operation during a given step. Refer to **dimensional data** for the location of the compressors 1, 2, 3 and 4 in the RAUP unit.

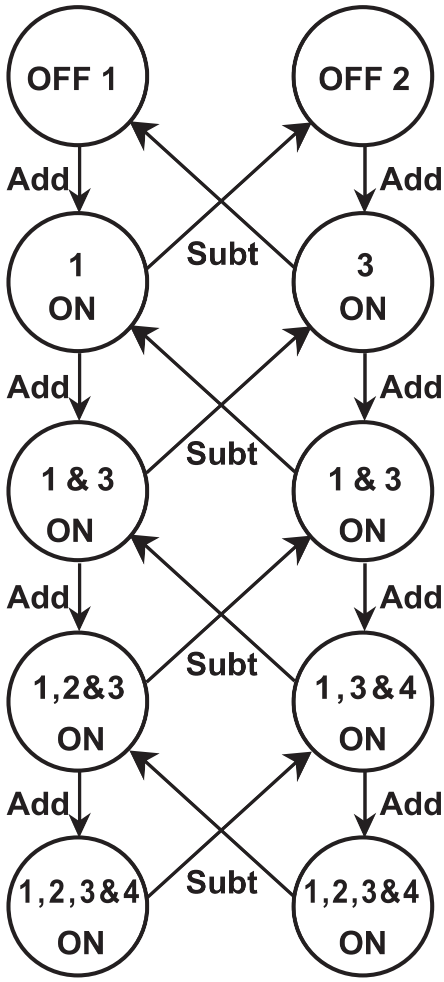
Figure 4 :
Location Requirements for Suction Line Filter Installation after Motor Burnout



Compressor Sequencing



UC 2C



UC 4C

Trouble Analysis

A. Compressor fails to starts

Problems and symptoms	Probable cause	Recommended action.
Full voltage at motor terminal but motor will not run.	Burned-out motor.	Repair or replace.
Inoperative motor starter.	Burned-out holding coil or broken contacts.	Repair or replace.
Open contacts of safety control of thermal overload.	Safety control of thermal overload relays has cut outs.	Call Trane Service.
Electric circuit test shows no current on line side of motor starter.	a) Power failure. b) Disconnect switch open.	Check for blown line fuse or broken leak. Determine why switch was opened.
Electric circuit test show current on line but not on motor side or fuse.	Fuse down. Replace fuse	Check load on motor.
Voltmeter does not read proper voltage.	Low voltage	Call power company.
Motor starter holding coil is not energized.	Open control circuit.	Locate open control and determine cause. See individual control.
Compresoor will not operate.	Frozen compressor due to locked or damaged mechanism	Replace Compressor.
Open contact on high pressure switch. Discharge pressure above cut-in setting.	Discharge pressure above cut-in setting of high pressure cut-out switch	See Complaint <<Discharge pressure too high.>>

B. Compressor stops

Problems and symptoms	Probable Cause	Recommended action
High pressure control has cut out.	See H.	See H.
Thermal overload relay has cut out.	a) voltage too low b)cooling load or condensing temperature too high	a) contact power company. b) see discharge pressure too high.
Winding thermostat has cut out.	Refrigerant shortage	

Trouble Analysis

C. Compressor shortcycles

Problems and symptoms	Probable cause	Recommended action
Suction pressure too low and frosting at driver.	Restricted liquid liner driver.	Replace driver core.
Motor starts and stops frequently	Faulty motor.	Replace compressor.

D. Compressor runs Continuously

Problems and symptoms	Probable cause	Recommended action
High temperature in conditioned space.	Excessively high cooling load	Check infiltration and insulation of conditioned space.
Bubbles in sight glass	a) Lack of refrigerant. b) Filter driver obstructed	a) Repair leak, add refrigerant. b) Replace driver core.

E. Compressor loses oil

Problems and symptoms	Probable cause	Recommended action
Oil level too low (sight glass).	Insufficient oil charge.	All oil.
Gradual drop of oil level.	Clogged filter drier	Replace.
Excessively cold suction. Noisy compressor	Liquid flooding back to compressor	Readjust superheat setting and verify correct bulb mounting.

F. Compressor is noisy

Problems and symptoms	Probable cause	Recommended action
Abnormally cold suction line: compressor knocks. Valve bulb attachment.	a) Liquid flood-back b) Expansion Valve stuck in open position.	a) Check superheat and expansion. b) Repair or replace
Compressor noisy	Incorrect direction of rotation	Inverse the direction of rotation

G. System short of capacity

Problems and symptoms.	Probable cause.	Recommended action
Expansion valve hissed.	Lack of refrigerant.	Add refrigerant.
High pressure drop across filter-drier.	Clogged filter-driver.	Clean or replace.
Superheat too high.	Superheat set too high.	Check superheat and adjust expansion valve
Superheat too high.	Excessive pressure drop in the thermal expansion valve.	Check superheat and reset thermal expansion valve

TRANE®

Trouble Analysis

H. Discharge pressure too high

Problems and symptoms	Probable cause	Recommended action
Too little or too warm condenser air. Restricted air flow.	Excessively warm air leaving condenser. Cuts out on high pressure control.	Clean coil, check fan and motor for proper operation.
Excessive discharge pressure.	Air or noncondensible gas in system.	Remove air or non condensibles.

J. Discharge pressure too high

Problems and symptoms	Probable cause	Recommended action
Bubbles in sight glass.	Lack of refrigerant.	Repair leak and charge.

K. Discharge pressure too high

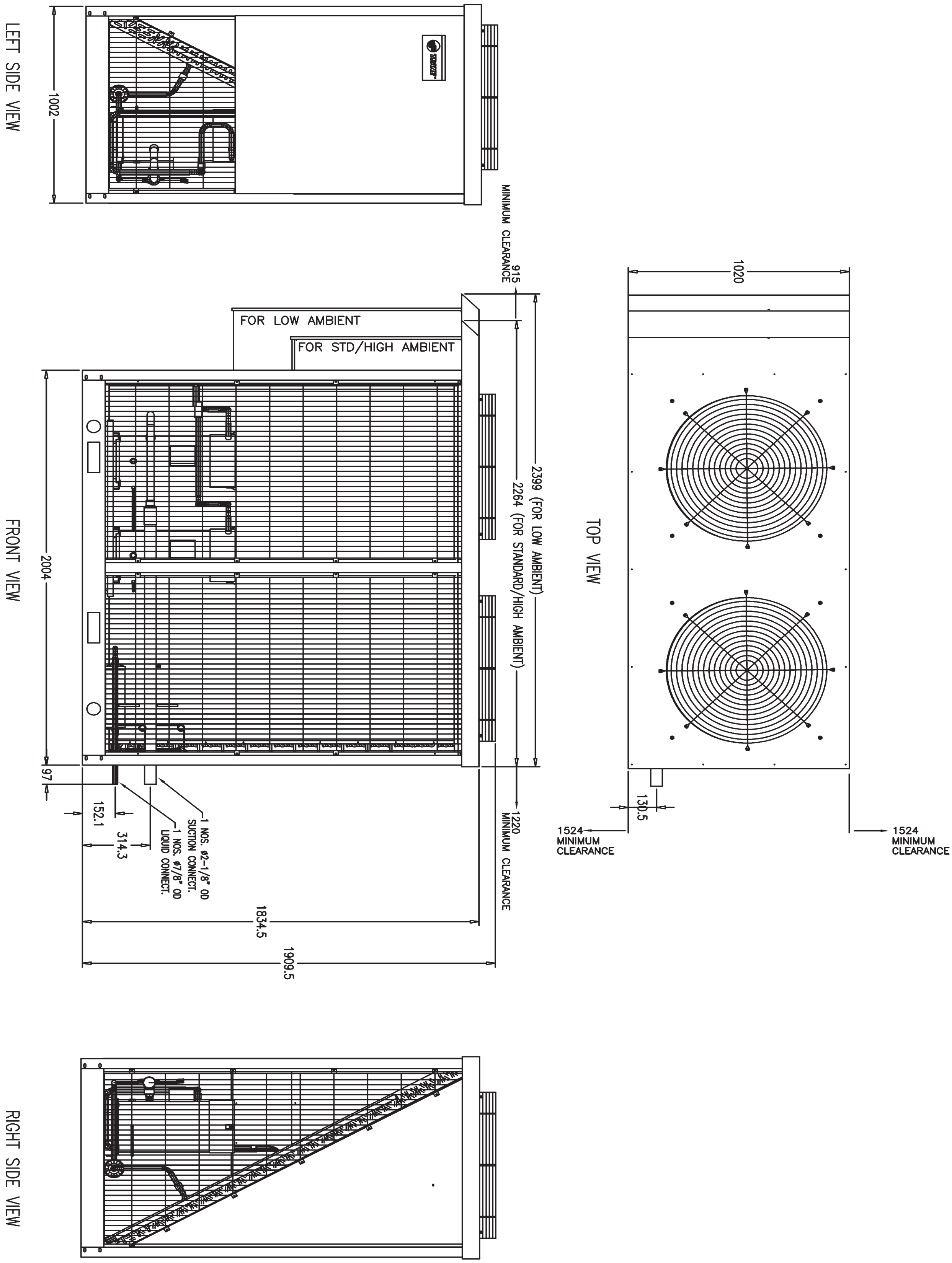
Problems and symptoms	Probable cause	Recommended action
Compressors run continuously.	Excessive load on evaporator	Check system.
Abnormally cold suction line; liquid flood-back to compressor.	a) Expansion valve opens too far. b) Expansion valve stuck in open position.	a) Adjust superheat and check bulb attachment. b) Repair or replace.

L. Discharge pressure too high

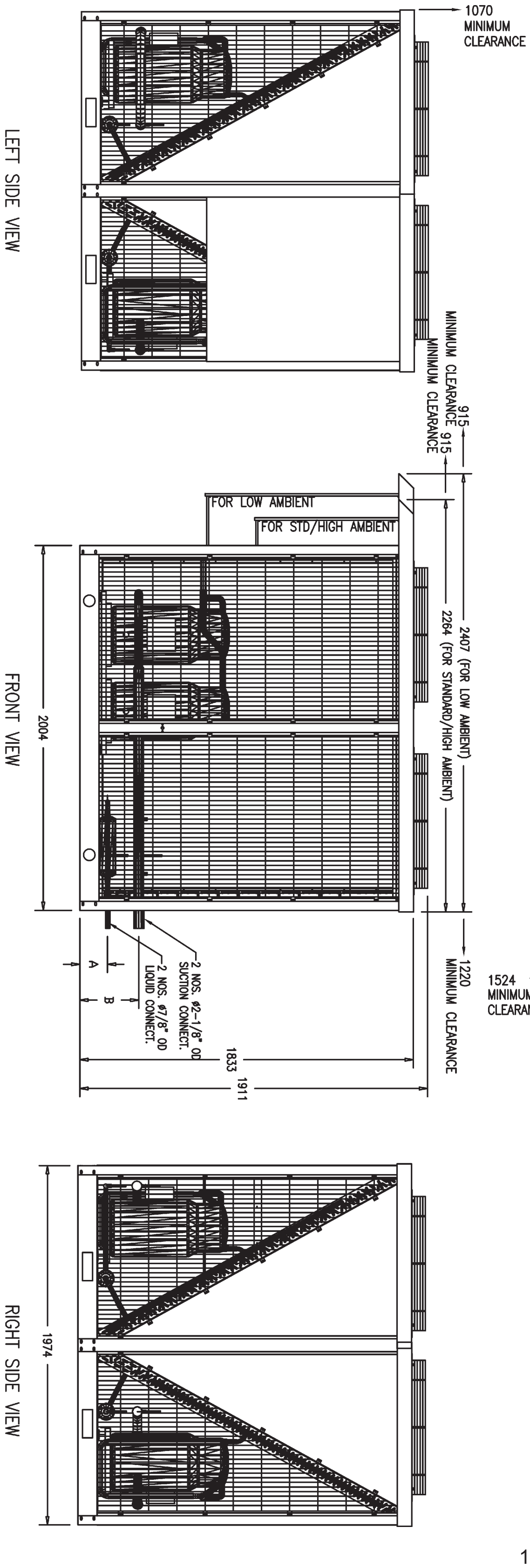
Problems and symptoms	Probable cause	Recommended action
Bubbles in sight glass.	Lack of refrigerant.	Repair leak, add refrigerant.
High pressure drop across filter-driver.	Clogged filter drier.	Replace.
No refrigerant flow through expansion valve.	Expansion valve power element has lost charge.	Replace valve power element.
Loss of capacity.	Obstructed expansion valve.	Clean or replace.
	Too much pressure drop in evaporator	Check external equaliser of expansion valve.

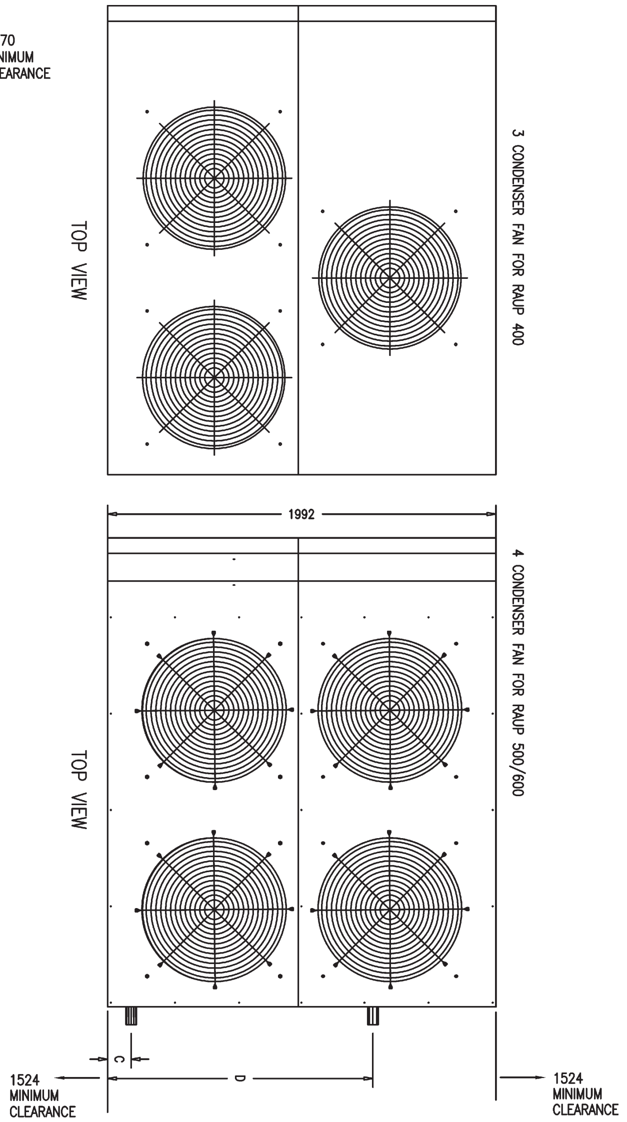
This is by no means a complete analysis of the scroll refrigeration system. Instead, its intention is to familiarize the operator with the operation of the scroll unit and provide the background necessary for him to recognize and accurately correct or report any developing problem.

Dimensional Data Air Cooled Condensing Unit RAUP 250/300



Dimensional Data Air Cooled Condensing Unit RAUP 400,500,600

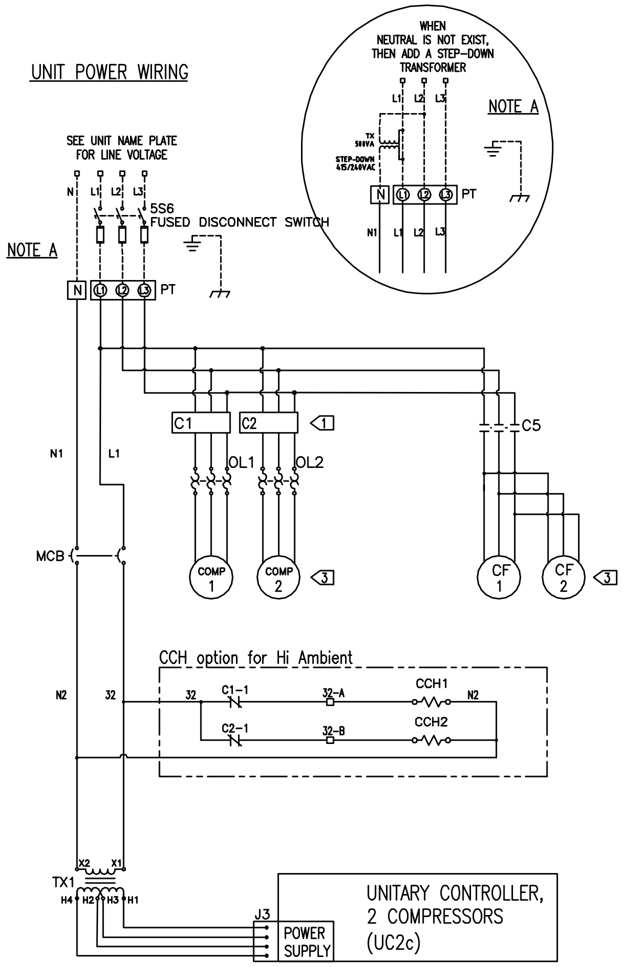




MODEL	DIMENSIONS			
	A	B	C	D
RAUP 400	151	315	98	1350
RAUP 500	151	314	121	1352
RAUP 600	153	324	121	1361

Wiring Diagam DOL Starter 3Phase/4Wire, (c/w UC2C)

RAUP 250/300



RAUP / Description	250	300
COMPRESSOR 1	SM161	SM185
COMPRESSOR 2	SM161	SM185
CDS MOTOR (kW)	0.6 x2	0.6 x2

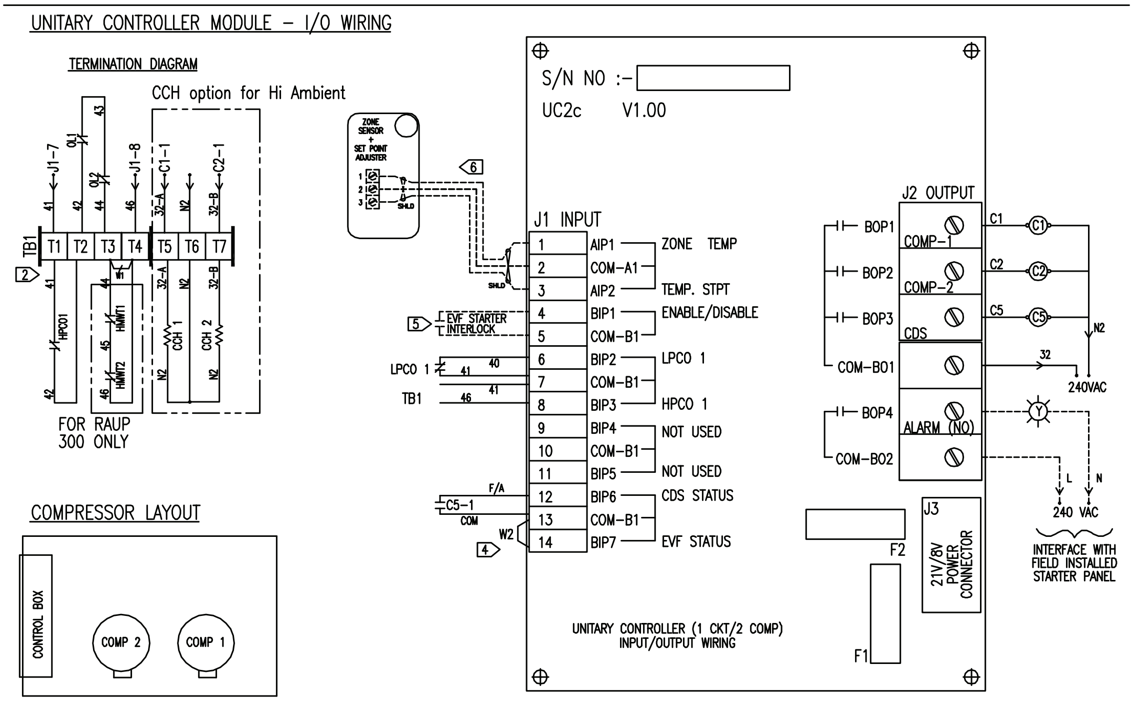
NOTES:

1. COMPRESSOR STARTER (OPTION 1: CONTACTOR; OPTION 2: SOFT STARTER)
2. REMOVE JUMPER W1 ON RAUP 300 FOR COMPRESSOR PROTECTION MODULE CONNECTION
3. COMPRESSOR SM161 ON RAUP 250 AND CF MOTORS ARE INTERNALLY PROTECTED.
4. REMOVE JUMPER W2, AND INSTALL EVAP FAN AIR FLOW SWITCH, IF AVAILABLE.
5. INSTALL EVAP FAN MOTOR STARTER, INTERLOCK (DRY CONTACT)
6. MUST BE 16–22 AWG, COPPER TWISTED PAIR SHIELDED CABLE. DO NOT RUN WITH HIGH VOLTAGE WIRE.

LEGEND

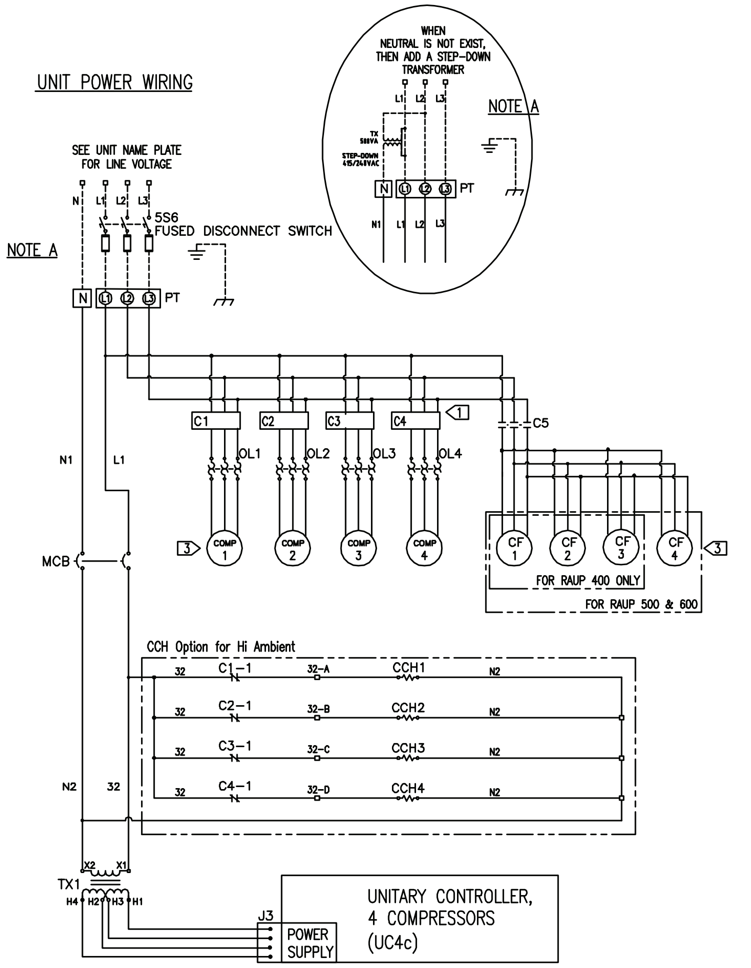
DEVICE DESIGNATION	DESCRIPTION
5S6	SWITCH, FUSED DISCONNECT
C1, C2	STARTER, COMPRESSOR #
C5	STARTER, CDS FAN MOTOR (CONTACTOR)
CCH 1, 2	CRANKCASE HEATER
CDS	CONDENSER
CF1, 2	CONDENSER FAN #
COMP1, 2	COMPRESSOR #
EVF	EVAPORATOR FAN
HMWT1, 2	HIGH MOTOR WINDING THERMOSTAT #
HPCO1	HIGH PRESSURE CUT-OUT #
LPCO1	LOW PRESSURE CUT-OUT #
MCB	CIRCUIT BREAKER, MAGNECTIC
OL1, 2	OVERLOAD #, (COMPRESSOR)
PT	POWER TERMINAL
TB1	TERMINAL BLOCK
TX1	TRANSFORMER, 380/415V : 240V
TX2	TRANSFORMER, 240V : 21/8V
UC2C	UNITARY CONTROLLER, 2 COMPRESSOR

————	SOLID LINE	PARTS AND WIRING IS DONE AT FACTORY
- - - - -	HIDDEN LINE	PARTS OR/AND WIRING ARE PROVIDED AND INSTALL AT FIELD



Wiring Diagam DOL Starter 3Phase/4Wire, (c/w UC4C)

RAUP 400-500/600

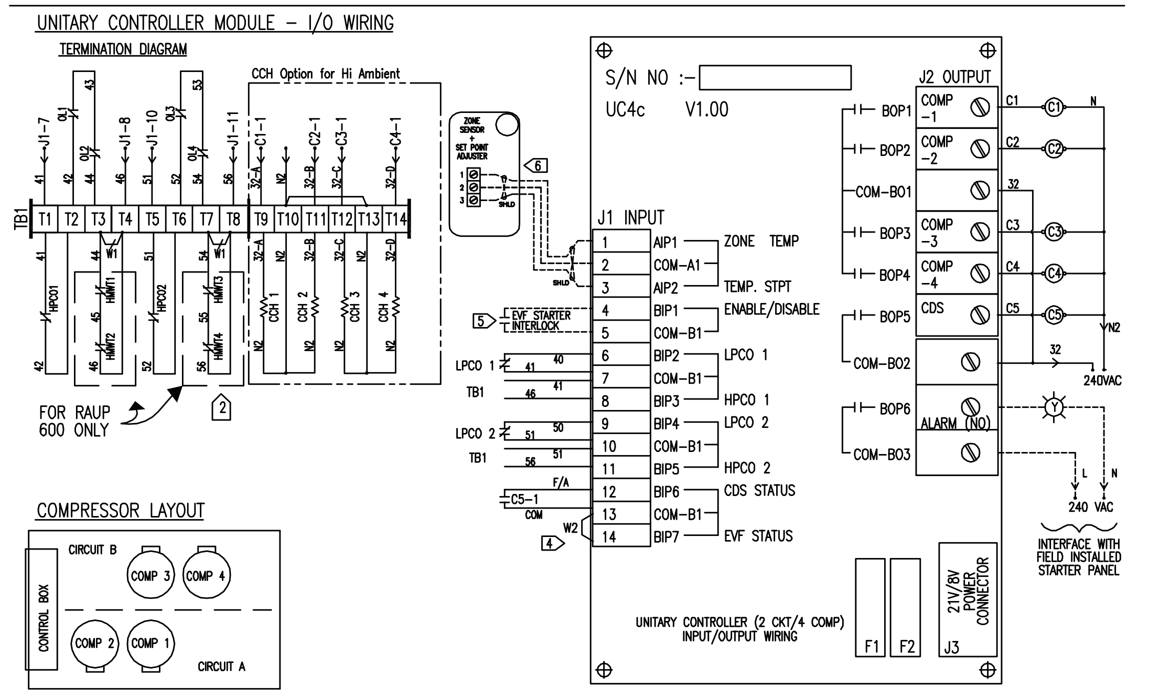


Description \ RAUP	400	500	600
COMPRESSOR 1&2	SM120	SM161	SM185
COMPRESSOR 3&4	SM120	SM161	SM185
CDS MOTOR (kW)	0.6 x3	0.6 x4	0.6 x4

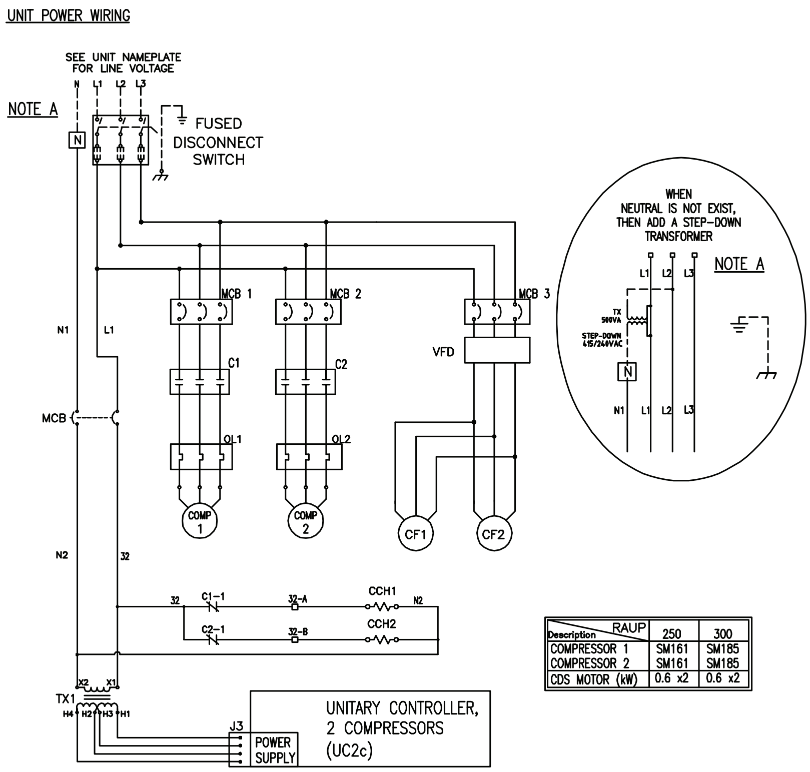
NOTES:

1. COMPRESSOR STARTER (OPTION 1: CONTACTOR; OPTION 2: SOFT STARTER)
2. REMOVE JUMPER W1 ON RAUP 300/600 FOR COMPRESSOR PROTECTION MODULE CONNECTION
3. COMPRESSOR SM120/161 ON RAUP 400/500 AND CF MOTOR ARE INTERNALLY PROTECTED.
4. REMOVE JUMPER W2, AND INSTALL EVAP FAN AIR FLOW SWITCH, IF AVAILABLE.
5. INSTALL EVAP FAN MOTOR STARTER, INTERLOCK (DRY CONTACT)
6. MUST BE 16–22 AWG, COPPER TWISTED PAIR SHIELDED CABLE. DO NOT RUN WITH HIGH VOLTAGE WIRE.

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	
5S6	SWITCH, FUSED DISCONNECT	
C1, C2, C3, C4	STARTER, COMPRESSOR #	
C5	STARTER, CDS FAN MOTOR (CONTACTOR)	
CCH 1, 2, 3, 4	CRANKCASE HEATER	
CDS	CONDENSER	
CF1, 2, 3, 4,	CONDENSER FAN #	
COMP1, 2, 3, 4	COMPRESSOR #	
EVF	EVAPORATOR FAN	
HMWT1, 2, 3, 4	HIGH MOTOR WINDING THERMOSTAT #	
HPCO1, 2	HIGH PRESSURE CUT-OUT #	
LPCO1, 2	LOW PRESSURE CUT-OUT #	
MCB	CIRCUIT BREAKER, MAGNECTIC	
OL1, 2, 3, 4	OVERLOAD # , (COMPRESSOR)	
PT	POWER TERMINAL	
TB1	TERMINAL BLOCK	
TX1	TRANSFORMER, 380/415V : 240V	
TX2	TRANSFORMER, 240V : 21/8V	
UC4C	UNITARY CONTROLLER, 4 COMPRESSOR	
________	SOLID LINE	PARTS AND WIRING IS DONE AT FACTORY
--------	HIDDEN LINE	PARTS OR/AND WIRING ARE PROVIDED AND INSTALL AT FIELD



Wiring Diagam DOL Starter
3Phase/4Wire (Head Pressure Control for Low Ambient c/w UC2C) RAUP 250/300



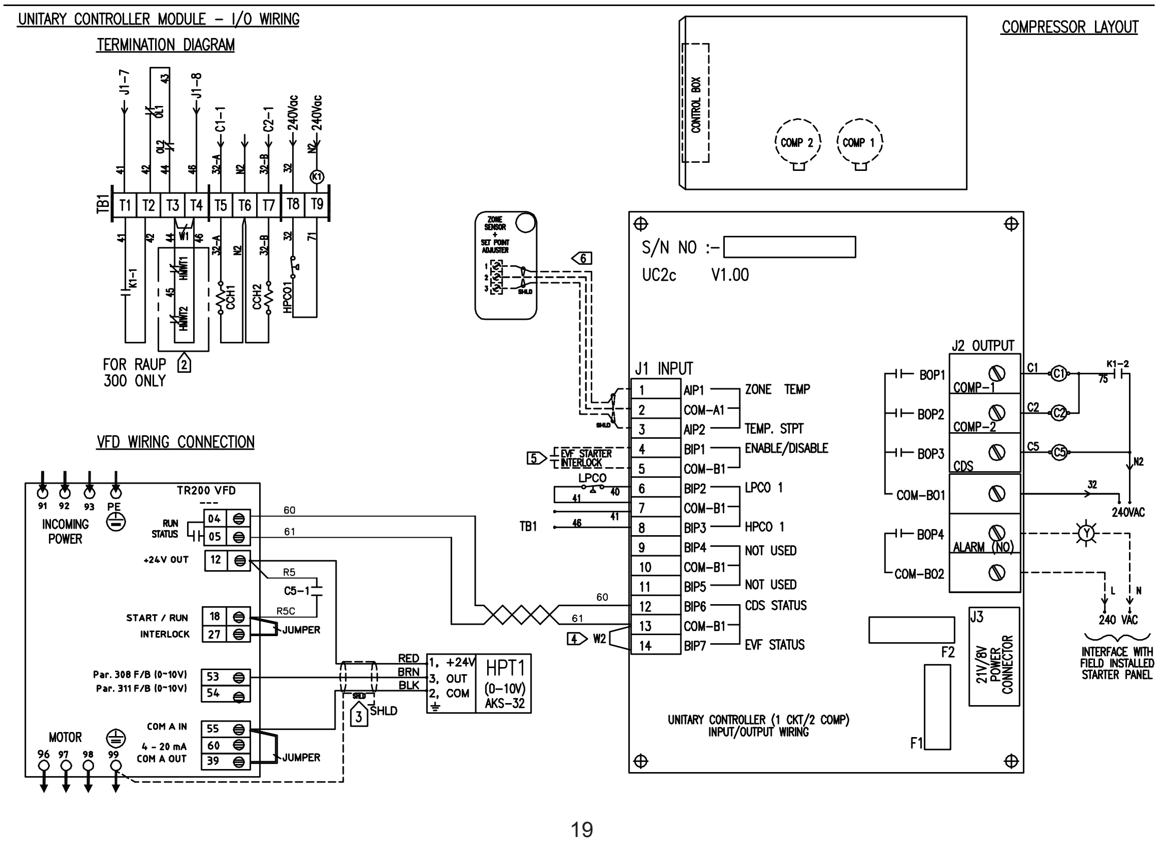
NOTES:

1. COMPRESSOR STARTER (OPTION 1: CONTACTOR; OPTION 2: SOFT STARTER)
2. REMOVE JUMPER W1 ON RAUP 300/600 FOR COMPRESSOR PROTECTION MODULE CONNECTION
3. COMPRESSOR SM120/161 ON RAUP 400/500 AND CF MOTOR ARE INTERNALLY PROTECTED.
4. REMOVE JUMPER W2, AND INSTALL EVAP FAN AIR FLOW SWITCH, IF AVAILABLE.
5. INSTALL EVAP FAN MOTOR STARTER, INTERLOCK (DRY CONTACT)
6. MUST BE 16-22 AWG, COPPER TWISTED PAIR SHIELDED CABLE. DO NOT RUN WITH HIGH VOLTAGE WIRE.

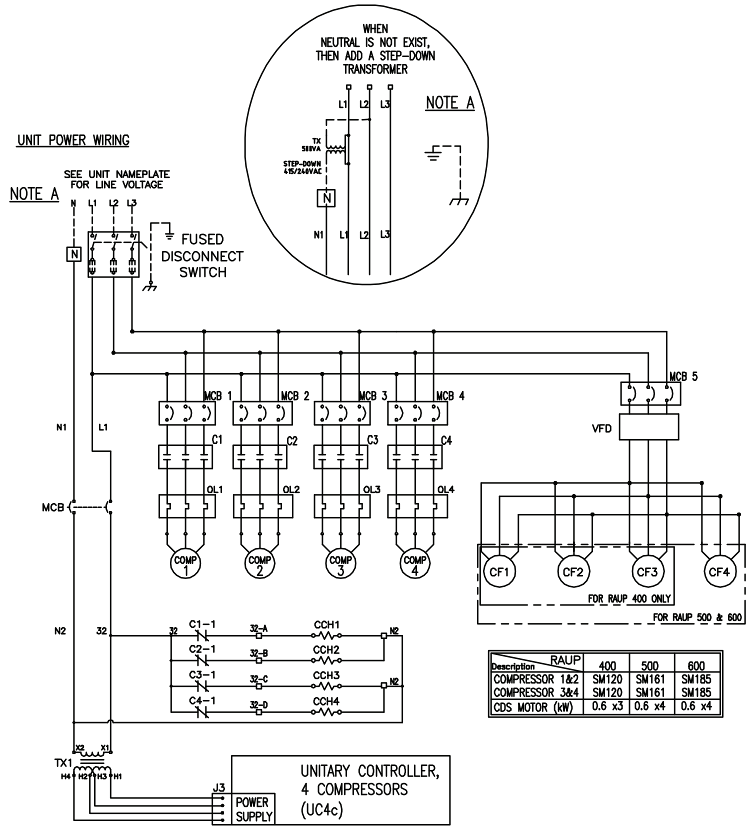
RAUP / Description	250	300
COMPRESSOR 1	SM161	SM185
COMPRESSOR 2	SM161	SM185
CDS MOTOR (kW)	0.6 x2	0.6 x2

LEGEND

DEVICE DESIGNATION	DESCRIPTION
C1, C2	STARTER, COMPRESSOR #
C5	CONTROL RELAY,CDS
CCH1, 2	COMPRESSOR CRANKCASE HEATER #
CDS	CONDENSER
CF1, 2	CONDENSER FAN #
COMP1, 2	COMPRESSOR #
EVF	EVAPORATOR FAN
HMWT1, 2	HIGH MOTOR WINDING THERMOSTAT #
HPCO1	HIGH PRESSURE CUT-OUT #
HPT	HIGH PRESSURE TRANSDUCER
K#	CONTROL RELAY, PRESSURE CUT-OUT
LPCO1	LOW PRESSURE CUT-OUT #
MCB	CIRCUIT BREAKER
OL1, 2	OVERLOAD # , (COMPRESSOR)
PT	POWER TERMINAL
TB1	TERMINAL BLOCK
TX1	TRANSFORMER, 380/415V : 240V
TX2	TRANSFORMER, 240V : 21/8V
VFD	VARIABLE FREQUENCY DRIVE
UC2C	UNITARY CONTROLLER, 2 COMPRESSOR



Wiring Diagam DOL Starter
3Phase/4Wire (Head Pressure Control for Low Ambient c/w UC4c) RAUP 400/500/600



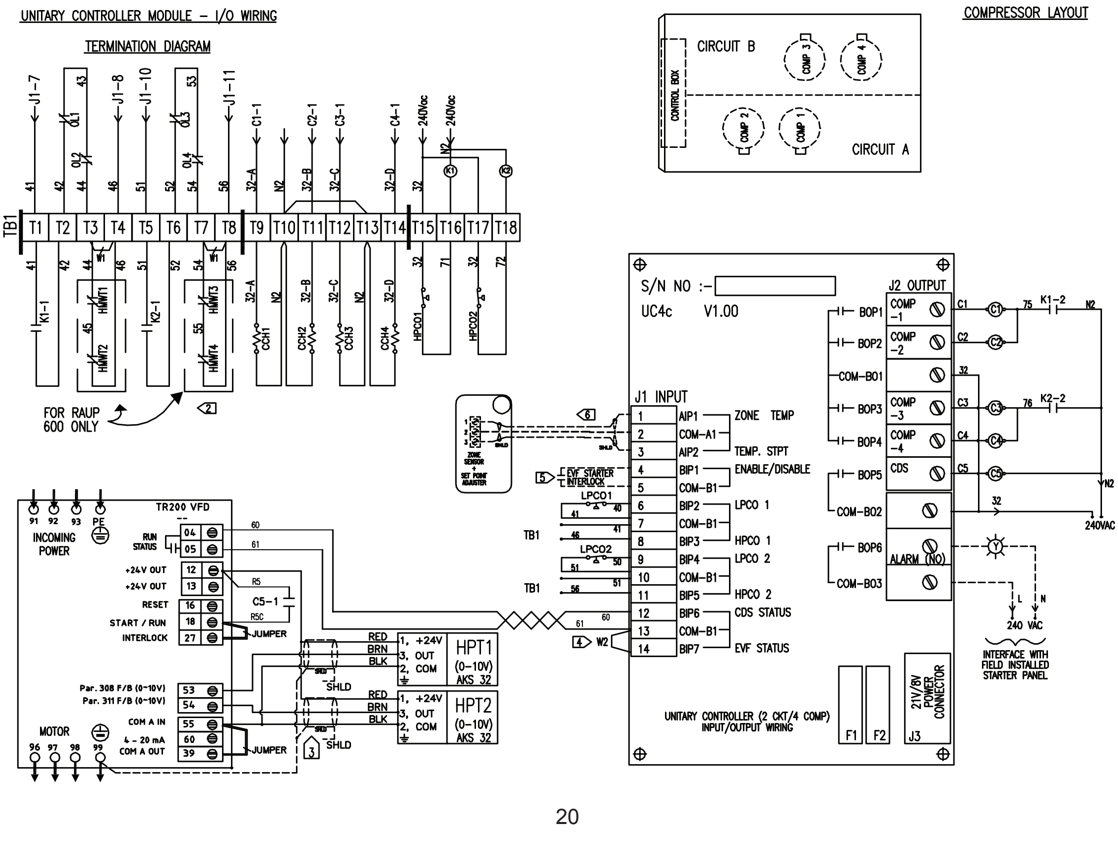
RAUP Description	400	500	600
COMPRESSOR 1&2	SM120	SM161	SM185
COMPRESSOR 3&4	SM120	SM161	SM185
CDS MOTOR (kW)	0.6 x3	0.6 x4	0.6 x4

NOTES:

1. COMPRESSOR STARTER (OPTION 1: CONTACTOR; OPTION 2: SOFT STARTER)
2. REMOVE JUMPER W1 ON RAUP 300/600 FOR COMPRESSOR PROTECTION MODULE CONNECTION
3. COMPRESSOR SM120/161 ON RAUP 400/500 AND CF MOTOR ARE INTERNALLY PROTECTED.
4. REMOVE JUMPER W2, AND INSTALL EVAP FAN AIR FLOW SWITCH, IF AVAILABLE.
5. INSTALL EVAP FAN MOTOR STARTER, INTERLOCK (DRY CONTACT)
6. MUST BE 16-22 AWG, COPPER TWISTED PAIR SHIELDED CABLE. DO NOT RUN WITH HIGH VOLTAGE WIRE.

LEGEND

DEVICE DESIGNATION	DESCRIPTION
C1, C2, C3, C4	STARTER, COMPRESSOR #
C5	CONTROL RELAY, CDS
CCH1, 2, 3, 4	COMPRESSOR CRANKCASE HEATER #
CDS	CONDENSER
CF1, 2, 3, 4	CONDENSER FAN #
COMP1, 2, 3, 4	COMPRESSOR #
EVF	EVAPORATOR FAN
HMWT1, 2, 3, 4	HIGH MOTOR WINDING THERMOSTAT #
HPCO1, 2	HIGH PRESSURE CUT-OUT #
HPT	HIGH PRESSURE TRANSDUCER
K#	CONTROL RELAY, PRESSURE CUT-OUT#
LPCO1, 2	LOW PRESSURE CUT-OUT #
MCB	CIRCUIT BREAKER
OL1, 2,3, 4	OVERLOAD # , (COMPRESSOR)
PT	POWER TERMINAL
TB1	TERMINAL BLOCK
TX1	TRANSFORMER, 380/415V : 240V
TX2	TRANSFORMER, 240V : 21/8V
VFD	VARIABLE FREQUENCY DRIVE
UC4C	UNITARY CONTROLLER, 4 COMPRESSOR



Installation Checklist

RAUP Trane Air Cooled Condensing Unit

This list must checked off by the installer to ensure correct installation before the unit start 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 (1 cm/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 handling installation works

Comments : ....

....

....

....

Signature : .... Name : ....

Order No : ....

Work site : ....

Please return to your Trance Service Agency

Commissioning Log Sheet

START-UP ENGINEER/TECHNICIAN NAME : ______________________
PROJECT NAME : ______________________
DEALER/CONTRACTOR : ______________________
SALES OFFICE LOCATION : ______________________
DATE COMMISSIONED : ______________________

1. Nameplate information

Model No: ______________ Serial No. ______________
Voltage: ______________ RLA: ______________

2. Compressor (S)

A. Voltage at Compressor Terminals

Comp. No. 1:	T1 ________	T2 ________	T3 ________
Comp. No. 2:	T1 ________	T2 ________	T3 ________
Comp. No. 3:	T1 ________	T2 ________	T3 ________
Comp. No. 4:	T1 ________	T2 ________	T3 ________
Voltage Imbalance:	Comp. "1" ________	Comp. "2" ________	
	Comp. "3" ________	Comp. "4" ________	

B. Amp Draw

Comp. No. 1:	T1 ________	T2 ________	T3 ________
Comp. No. 2:	T1 ________	T2 ________	T3 ________
Comp. No. 3:	T1 ________	T2 ________	T3 ________
Comp. No. 4:	T1 ________	T2 ________	T3 ________

3. Operating Conditions

A. Circuit "A"

Discharge Pressure. ________	Suction Pressure. ________
Liquid Line Pressure. ________	Suction Line Temp. ________
Liquid Line Temp. ________	SuperHeat. ________
Subcooling. ________	Evap. Entering Air Temp. (DB/WB) ________
Amblent Temp. ________	Evap. Discharge Air Temp. (DB/WB) ________

B. Circuit "B"

Discharge Pressure. ________	Suction Pressure. ________
Liquid Line Pressure. ________	Suction Line Temp. ________
Liquid Line Temp. ________	SuperHeat. ________
Subcooling. ________	Evap. Entering Air Temp. (DB/WB) ________
Amblent Temp. ________	Evap. Discharge Air Temp. (DB/WB) ________

4. Controls

A. All Fans Operating [ ] Yes
Properly? [ ] No Fan Inoperative

5. Refrigerant Piping

Evacuation Level ______________ System Charge ______________

Evaporator Piping Recommendation

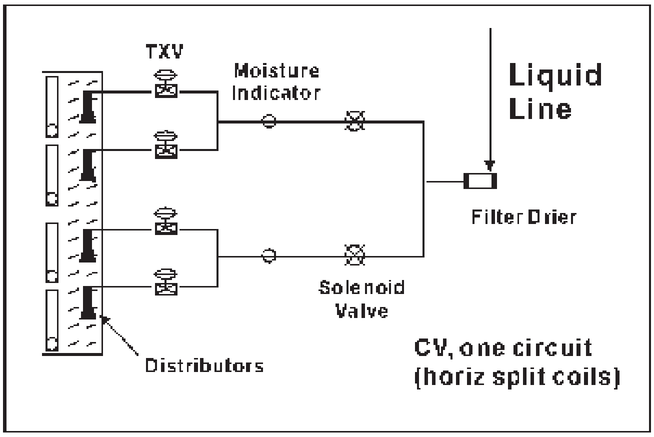


Figure 5A

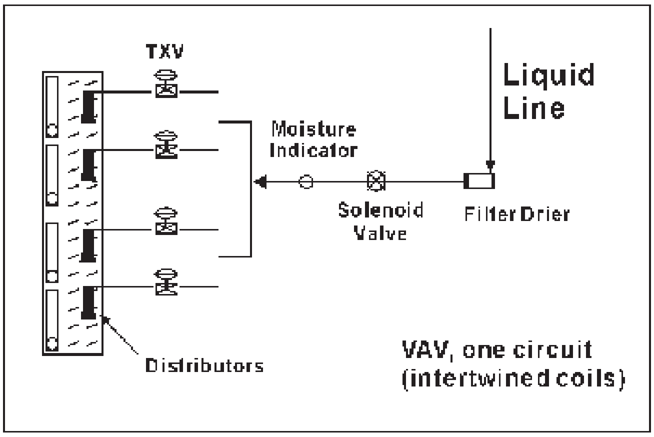


Figure 5B

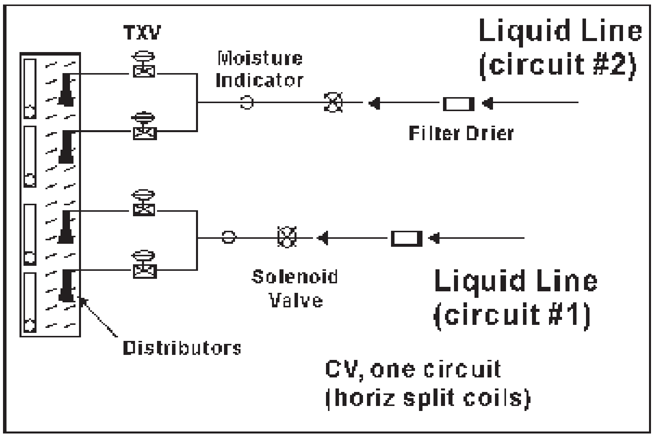


Figure 5C

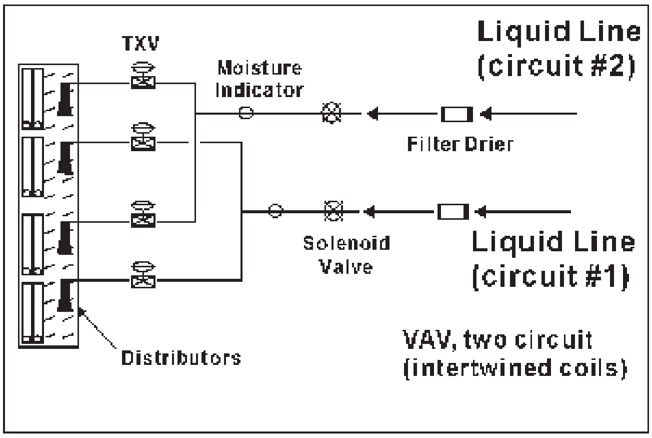


Figure 5D

Literature Order Number MUL-SVN05A-E4 (Jan 2012)

File Number

Supersedes MUL-SVN05A-E4 (June 2008)

Stocking Location Malaysia

Trane
www.trane.com

For more information, contact your local district office