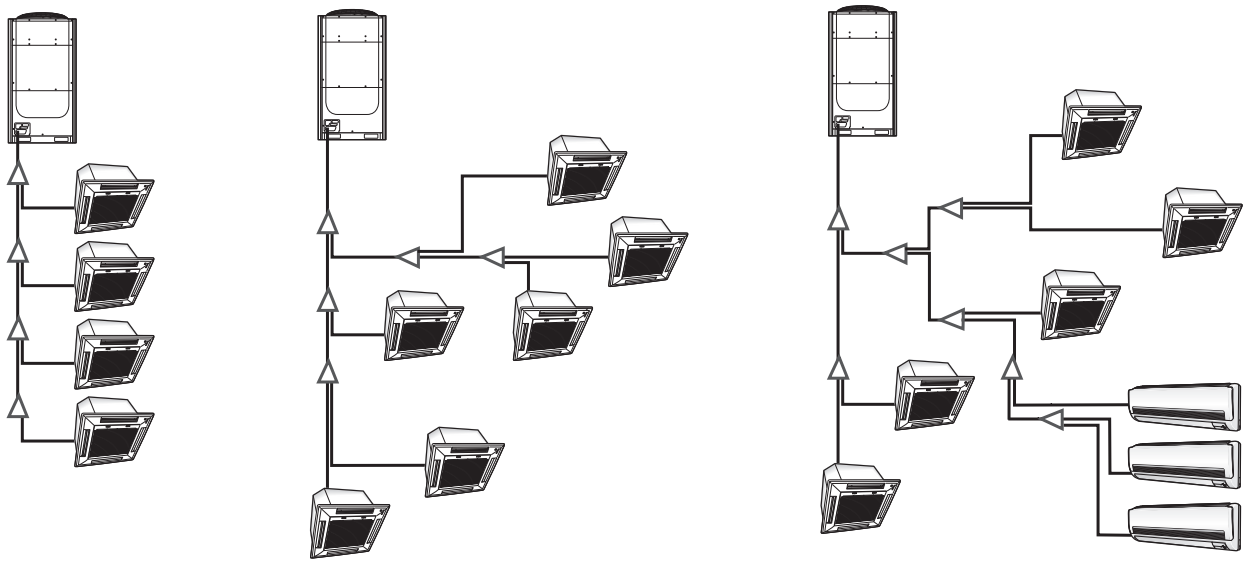
Training Manual

VRF 2-day Installer Training



⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

August 2016

VRF-TRG004B-EN

TRANE

VRF 2-day Installer Training

- Introduction / What is Trane VRF?
- Certification Checklist:
  - Piping
  - MCUs & EEVs
  - ODUs, WCUs & IDUs
  - Addressing
  - Controllers
- Troubleshooting
- Startup, Commissioning, Warranty
- Evaluation for Certification

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment & Knowledge

2016

Ingersoll Rand.

Ver-10

Welcome:

TRANE

Welcome to our 2-day Installer Training for Trane VRF.

Thank you for taking time out of your busy schedules to travel for this training. The investment you and your company is making is **greatly appreciated**.

Presenters:

Support Team: Jim Lawrence, Paul Solberg

You! (Tent Cards & Sign-up sheets)

Intro-2

Introduction:

Purpose: this training is to qualify you to properly install a new Trane VRF system and receive the qualified warranty.

Process: You will work through a 99-step check list and learn how to use the Technician Utility Tool. You will also learn to Configure, Address and Troubleshoot so that you will be comfortable Starting Up & Commissioning our VRF system.

Payoff: When you pass the open book 37-question final exam with >80%, you will be certified to install a Trane VRF system and qualify it for the qualified Trane warranty.

Intro-3

Introduction:

Facilities:

- Bathrooms
- Which door(s) not to leave through (alarms)
- Fire
- Other Emergencies
- Smoking Area
- Snacks & Drinks
- Lunch

Misc:

- Badges – keep them with you until the last afternoon. Turn them in after the final evaluation.
- Computers – we'll show you where to get the software

Intro-4

Introduction:

Questions

We'll start off taking questions as they come up.

But not at break!

Parking Lot as needed.

Use your Manual

Follow along, not everything we say is in the manual…..**take notes**, etc…

Table of Contents:

VRF Installer Training Manual

Introduction:

2-day VRF Installer Training
2015 Schedule

		Min	Starts	Ends	
Day-1	Welcome, Introduction & Baseline Exam	120	8:00 AM	10:00 AM	Day-1
	Break	10	10:00 AM	10:10 AM	
	Part-1: Refrigerant, Water & Drain Piping	70	10:10 AM	11:20 AM	
	Break	10	11:20 AM	11:30 AM	
	Part-2: MCU & EEV	30	11:30 AM	12:00 PM	
	Lunch	30	12:00 PM	12:30 PM	
	Part-2: MCU & EEV	30	12:30 PM	1:00 PM	
	Part-3: ODUs, WCUs & IDUs; Walk-through	75	1:00 PM	2:15 PM	
	Break	10	2:15 PM	2:25 PM	
	Part-4: Addressing	45	2:25 PM	3:10 PM	
	Break	10	3:10 PM	3:20 PM	
	Part-5: Controllers	60	3:20 PM	4:20 PM	
	Break	10	4:20 PM	4:30 PM	
	Part-5: Controllers	60	4:30 PM	5:30 PM	

		Min	Starts	Ends	
Day-2	Quiz-1 Open Book & Review	100	8:00 AM	9:40 AM	Day-2
	Break	10	9:40 AM	9:50 AM	
	Part-5: Controllers	60	9:50 AM	10:50 AM	
	Break	10	10:50 AM	11:00 AM	
	Part-5: Controllers	60	11:00 AM	12:00 PM	
	Lunch	30	12:00 PM	12:30 PM	
	Part-6: Troubleshooting Error Codes	45	12:30 PM	1:15 PM	
	Part-7: Startup, Commissioning & Warranty	15	1:15 PM	1:30 PM	
	Break	10	1:30 PM	1:40 PM	
	Part-8: ASHRAE-15 Application	60	1:40 PM	2:40 PM	
	Break	10	2:40 PM	2:50 PM	
	Parking Lot Questions, Final Review, Q&A	30	2:50 PM	3:20 PM	
	Evaluation & Questionares	100	3:20 PM	5:00 PM	

Intro-7

Baseline Assessment:

20-Questions, Closed Book, 10-minutes

Put your name at the top of the paper.

Please don't discuss this with anyone.

When you are finished, please bring your paper up front and take a short break.

Intro-8

What is Trane VRF?

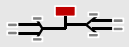
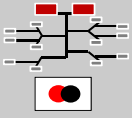
Big Picture Concepts

1. What is Trane VRF?
2. VRF HP vs. HR Cycles
3. VRF Schematics:
   - Clg Only, Mainly Clg, Htg Only, Mainly Htg
4. VRF Applications:
   - HP vs. HR with respect to Diversity
   - Diversity vs. Combination Ratio
5. Big Picture on Controls

Show VRF Overview Video

1. What is Trane VRF?

Refrigerant-Based Ductless Systems

		Cooling Capacity	Max Line length	Max circuit length	
		T	Ft	Ft	Configuration
VRF	Mini •Can match up to 9 indoor units •Can't be combined into larger capacities	3-4.5	500	1000	
	ODU: •Can be combined up to 64 indoor units •Heat pump and simultaneous heating and cooling (heat recovery)	6, 8, 10, 12, 14, 16 comb 48	656	3280	

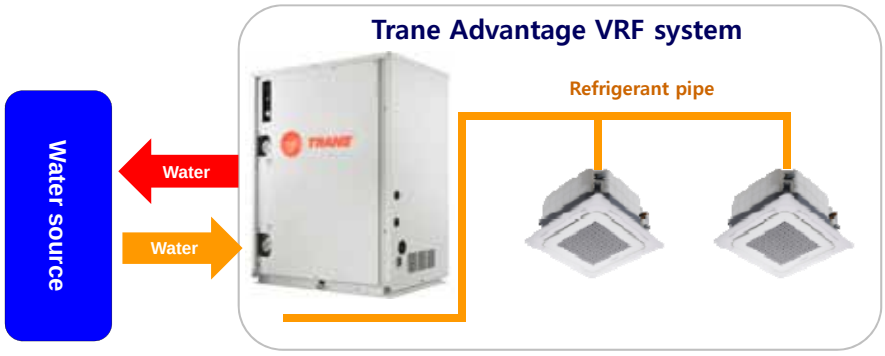
WCUs come in **6, 8, 10 & 16** ton sizes for a max capacity of **48**-tons.
Air cooled come in 6,8,10,12,14,16 ton sizes for a max of 48 tons

Cooling/heating capacity → building size → zoning → simultaneous heat/cool

1. What is Trane VRF?

◆ What is a Water Cooled Unit (WCU)?

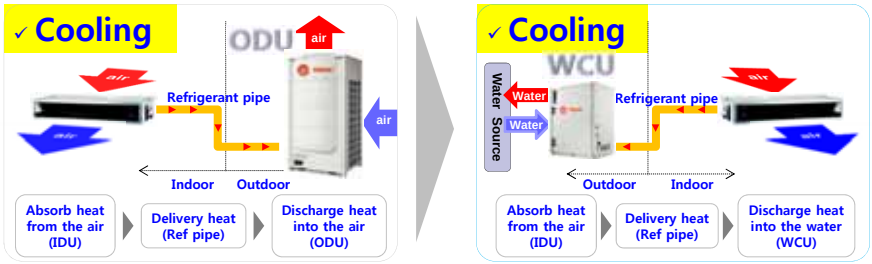
A WCU is essentially an ODU that uses water instead of air as a heat source or heat sink.



Intro-11

1. What is Trane VRF?

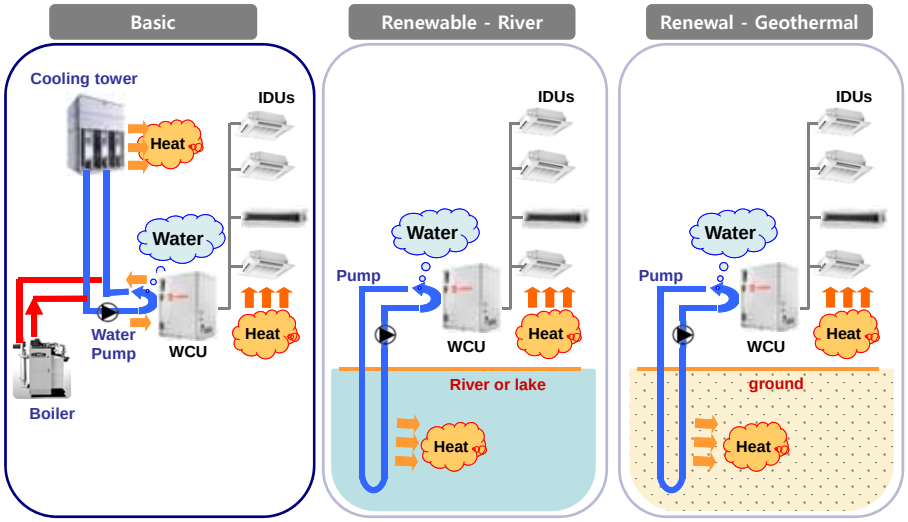
◆ How do ODU – WCU units operate in Clg & Htg modes?



Intro-12

1. What is Trane VRF?

◆ Various applications



Intro-13

1. What is Trane VRF?

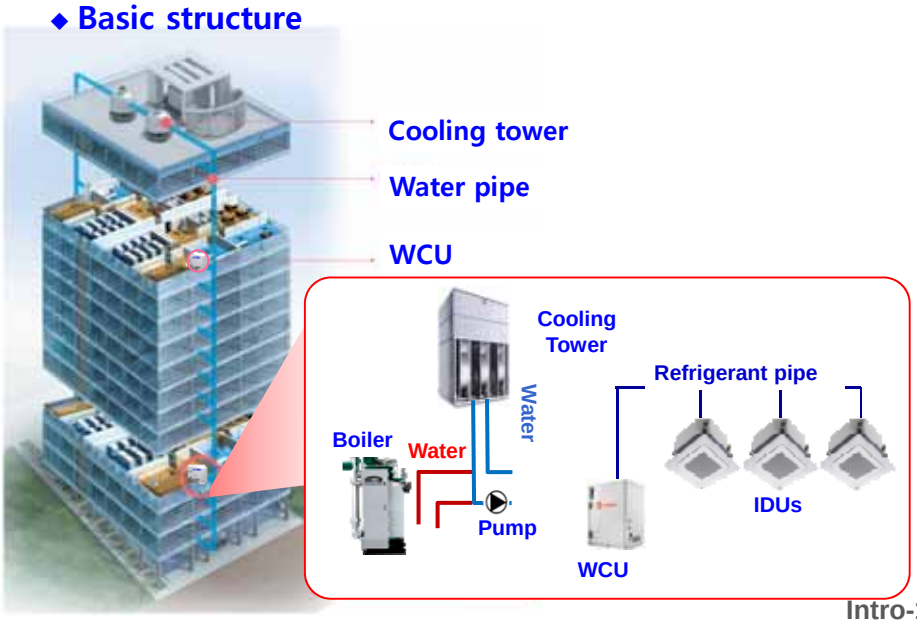
◆ System comparison: ODU vs. WCU

	ODU	WCU
System	ODU + IDU	WCU + IDU & Cooling tower / Boiler
Additional system	Refrigerant Pipe	Refrigerant Pipe, Pump, Water Pipe
Heat Source/Sink	Air	Water
Condensing Part	Motor + Fan + Fin & tube Heat Exchanger	Plate Heat Exchanger
Operation Temperature	Air Temp for Cooling : 23~118 deg F Air Temp for Heating : -4~75 deg F	Water Temp for Cooling : 50~113 deg F Water Temp for Heating : 50~113 deg F
Feature	✓ Simple system - only ODU ✓ Easy installation ✓ Long Ref piping up to 722-ft ✓ Largest capacity up to 36-tons ✓ Easy maintenance	✓ Additional system required (cooling tower…) ✓ No defrost operation for heating ✓ No capacity drop by ambient temperature ✓ No limitation for water piping ✓ No louver in machine room ✓ Low noise - No fan, concealed cabinet ✓ Largest capacity up to 48-tons

Intro-14

1. What is Trane VRF?

◆ **Basic structure**



Intro-15

1. What is Trane VRF?

Advantages of VRF

1. Energy efficiency
2. Comfortable & Quiet
3. Small footprint
4. Scalable capacity
5. Ductless
6. Easy to design
7. Water Cooled Units (WCU)

Intro-16

1. What is Trane VRF?

Challenges of VRF

1. High installed cost
2. Requires a separate ventilation system
3. Lots of refrigerant piping/connections
4. Distributed maintenance
5. Limited air cleaning capability
6. ASHRAE-15 compliance is difficult
7. Difficult to re-configure spaces

Intro-17

1. What is Trane VRF?

◆ **WCU Target market**

✓ **Tall or wide multi story buildings**
- No water pipe length limitation
- Deal with the part-load, no headwinds affects

✓ **Building renewal**
- Reuse the existing water pipe and heat source (cooling tower & boiler)
- High efficiency, no exterior change, low noise

✓ **Government office**
- Mandatory use of renewable energy as certain ratio (district water, underground water, sea water, solar energy etc. exist)

✓ **Luxury resident building**
- Low noise, no defrost in heating, Individual control

✓ **Others**
- The amount of refrigerant in the building is limited
- A building where current chiller system it not enough for cooling or heating

Intro-18

1. What is Trane VRF?

Trane VRF Portfolio

Outdoor Units (ODU)

- Single or dual inverter compressors
- Vapor injection system
- Plate heat exchanger (intercooler)
- Single modules can be combined up to 48 tons
- Maximum number of connectable indoor units is 25 (single module) and up to 64 (triple module)

NOMINAL TONS	POWER	BASIC MODULES						COMBINED MODULES
		6	8	10	12	14	16	14~48
HEAT PUMP	208~230/60/3							
	460/60/3							
HEAT	208~230/60/3							

Full line of units – voltages, capacities and application

Intro-19

1. What is Trane VRF?

Trane VRF Portfolio

Mini Outdoor Units

- Available in 3, 4 and 5 ton nominal capacities
- 208~230/60/1
- Heat pump
- Twin rotary compressor
- Connectable indoor units (up to 6 for 3-ton, 8 for 4-ton & 9 for 5-ton)

NOMINAL TONS	POWER	BASIC MODULES		
		3	4	5
HEAT PUMP	208~230/60/1			

Mini VRF completes the outdoor line up for smaller capacity applications

Intro-20

1. What is Trane VRF?

◆ **WCU sizes**

6, 8 or 10 ton

16 ton

Up to 48-tons

Multiple Modules

(Up to 3 on 1 system)

* HP and HR is selected by option setting

Intro-21

1. What is Trane VRF?

◆ **Maximum # of IDUs per WCU or ODU**

WCU Tonnage	Max # IDU's		ODU Tonnage	Max # IDU's
6 tons	14		6 tons	12
8 tons	18		8 tons	16
10 tons	22		10 tons	20
12 tons	29		12 tons	25
14 tons	32		14 tons	29
16 tons	36		16 tons	33
18 tons	40		18 tons	37
20 tons	44		20 tons	41
22 tons	47		22 tons	45
24 tons	51		24 tons	49
26 tons	55		26 tons	54
28 tons	58		28 tons	58
30 tons	62		30 tons	62
32-48 tons	64		32-36 tons	64

IDUs

4-Way Cassette

4-Way Mini Cassette

1-Way Cassette

HSP

MSP

Slim Duct

High Wall

Ceiling

AHU Kit

* Minimum capacity of the IDU is 7.5-mbh

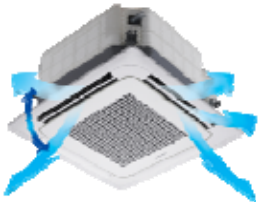
Intro-22

1. What is Trane VRF?

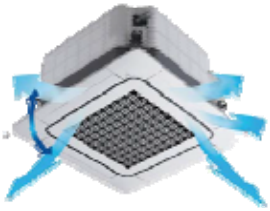
CASSETTE INDOOR UNITS

- **Strong airflow, yet quiet operation**
- **Stylish panel designs**
- **Light weight for easy installation**
- **Internal drain pump with check valve**
- **Limited fresh air intake**
- **Individual blade control (4-way cassettes)**

1-Way Cassette Model
7.5~12 MBh



Mini 4-Way Cassette Model
(22 5/8" x 22 5/8" body)
9.5~20 MBh



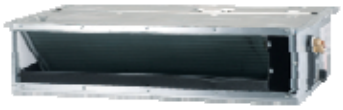
4-Way Cassette Model
(33" x 33" body)
9~48 MBh

Intro-23

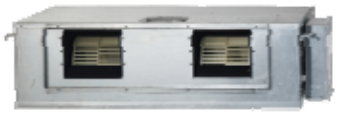
1. What is Trane VRF?

CONCEALED INDOOR UNITS

- **Three ranges of static pressure to meet every application requirement**
- **Compact designs make installation simple**
- **Larger units can be ducted to supply multiple spaces**
- **Easy to clean filters**



Slim duct
7.5~48 MBh
0.16-0.24" ESP



Mid static pressure duct
18~48 MBh
.04-.8" ESP

High static pressure duct
36~96 MBh
0.4-1.0" ESP

Comprehensive line up of indoor VRF solutions to meet all application requirements

Intro-24

1. What is Trane VRF?

OTHER INDOOR UNITS

- Easy to clean filters
- Wireless remote control
- Clean, crisp design

High wall unit
7.5~24 MBh

Ceiling suspended unit
18~24 MBh

Intro-25

1. What is Trane VRF?

Trane VRF Indoor Unit Portfolio

Available Trane VRF Indoor Units

	Nominal MBH														
	7.5	9.0	12	15	18	20	24	27	30	36	42	48	60	72	96
1-Way	✸	✸	✸												
Mini 4-way		✸	✸		✸	✸									
4-way		✸			✸		✸		✸	✸			✸		
Slim Duct	✸	✸	✸	✸	✸		✸	✸	✸	✸			✸		
Mid Static	✸	✸	✸	✸	✸	✸	✸	✸	✸	✸			✸		
High Static												✸	✸	✸	✸
High Wall	✸	✸	✸		✸	✸	✸								
Floor/ Ceiling					✸		✸								
Convertible AHU							✸		✸	✸	✸	✸	✸		

Comprehensive line up of indoor VRF solutions to meet all application requirements

Intro-26

1. What is Trane VRF?

Trane VRF ODU–WCU Model Numbers

4	T	V	R	0	1	2	0	B	3	0	0	N	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Digit 4: Functional Type Outdoor Unit
- H = Heat Pump
- P = Water Cooled
- R = Heat Recovery

Digit 6, 7, 8: Nominal capacity (MBH)
- 072 = 6-ton
- 096 = 8-ton
- 120 = 10-ton
- 144 = 12-ton
- 168 = 14-ton
- 192 = 16-ton

Digit 10: Electric power supply characteristics
- 1 = 208-230/60/1 (mini)
- 3 = 208-230/60/3
- 4 = 460/60/3

Intro-27

1. What is Trane VRF?

Trane VRF Indoor Unit Model Numbers

4	T	V	D	0	0	1	8	A	1	0	0	N	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Digit 4: Configuration Type
- **B** = Mini 4-Way Cassette
- **C** = 4-Way Cassette
- **D** = MSP Duct Type (Mid Pressure)
- **E** = 1-Way Cassette
- **L** = Slim Duct Type (Low Pressure)
- **A** = HSP Duct Type (High Pressure)
- **X** = Ceiling
- **W** = High Wall
- **M** = Convertible Air Handler

Digit 6, 7, 8: Nominal capacity (MBH)
- 006 = 1/2-ton (non avail currently)
- 007 = 5/8-ton
- 009 = 3/4-ton
- 012 = 1-ton
- 018 = 1.5-tons
- 020 = 1.67-ton
- 024 = 2-tons
- 027 = 2.25 tons
- 030 = 2.5-tons
- 036 = 3-tons
- 042 = 3.5 tons
- 048 = 4-tons
- 077 = 6.5-tons
- 096 = 8-tons

Intro-28

1. What is Trane VRF?

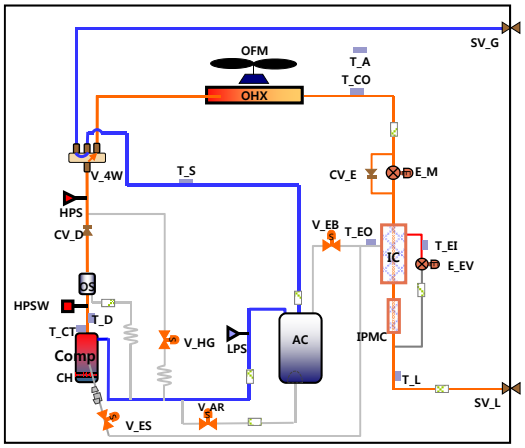
Value Proposition: Installers

- Simplified piping
- Easy wiring
- Lightweight indoor units
- Advanced diagnostics
- Auto-commissioning

Intro-29

2. Trane Advantage HP Cycle

■ **ODU: 6-ton (208 – 230V, 460V)**



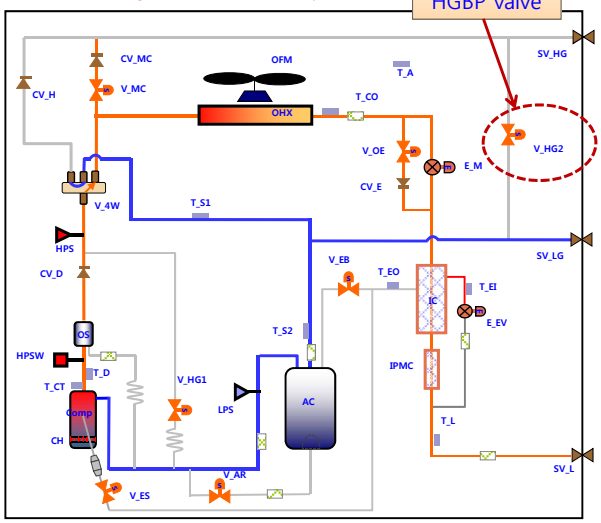
	Name
Comp	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Intro-30

2. Trane Advantage HR Cycle

ODU: 6-ton (208 – 230V, 460V)

HR has extra HGBP valve



	Name
Comp	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_MC	Main Cooling Valve
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG1	Hot Gas Bypass Valve 1
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
V_OE	Outdoor EEV Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_H	HR Check valve
CV_MC	Main Cooling Check Valve
T_D	Discharge Temp. Sensor
T_S1	Suction Temp. Sensor 1
T_S2	Suction Temp. Sensor 2
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_HG	High Gas Pipe Service Valve
SV_LG	Low Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

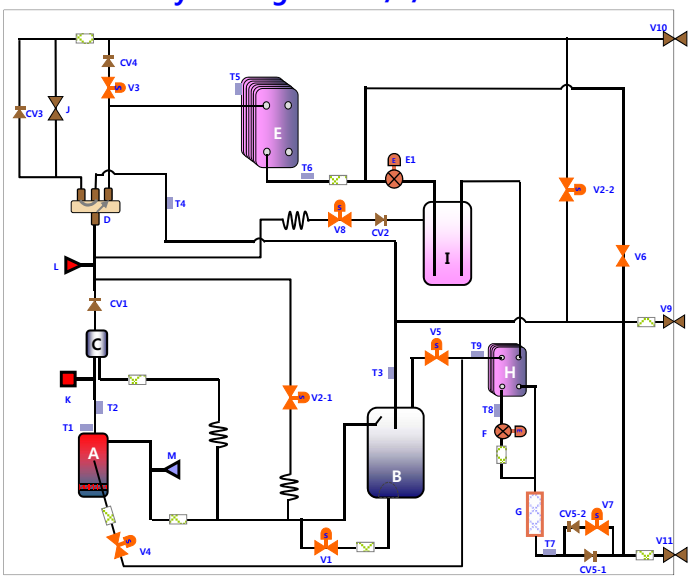
HR has 3 refrigerant piping connections at ODU.

Which gas line is new?

Intro-31

2. Trane Advantage WCU Cycle

◆ **WCU Cycle diagram – 6/8/10 ton**

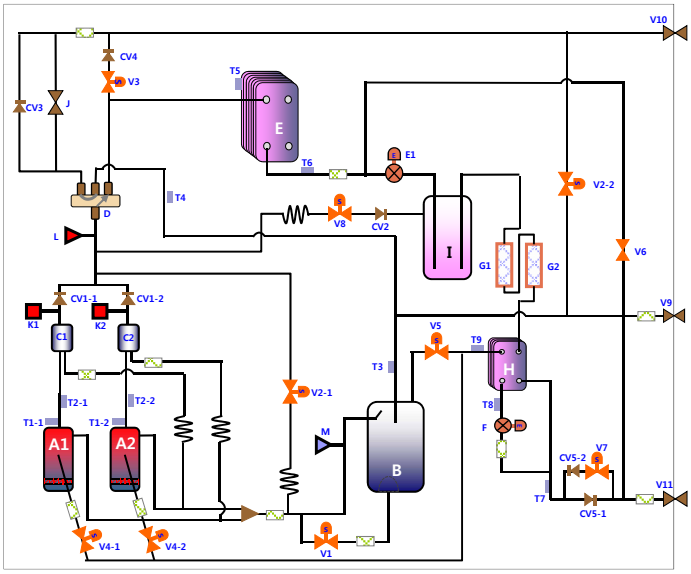


	Name
A	INV COMP
B	ACCUM
C	O/S
D	4WAY V/V
E	PLATE HEAT EXCHANGER
E1	MAIN EEV
F	EVI EEV
G	IPM COOLER
H	SUB COOLER
I	RECEIVER
J	HEAT PUMP V/V
K	HIGH PRE. S/W
L	HIGH PRE. SENSOR
M	LOW PRE. SENSOR
V1	ACCUM RETRUN V/V
V2-1, V2-2	HOT GAS BYPASS VV
V3	MAIN COOLING V/V
V4	EVI V/V
V5	EVI B/P V/V
V6	DPR V/V
V7	LIQUID TUBE V/V
V8	HOT GAS CHARGING V/V
V9	LOW PRE. GAS SERVICE V/V
V10	HIGH PRE. GAS SERVICE V/V
V11	LIQUID SERVICE V/V
CV1	DISC. CHECK V/V
CV2	HRV CHECK V/V
CV3	HR CHECK V/V
CV4	MAIN COOL CHECK V/V
CV5-1, CV5-2	LIQUID TUBE CHECK V/V
T1	COMP TOP SENSOR
T2	DISC. SENSOR
T3	SUC. SENSOR 2
T4	SUC. SENSOR 1
T5	WATER SENSOR
T6	COND OUT SENSOR
T7	LIQUID TUBE SENSOR
T8	SC IN SENSOR
T9	SC OUT SENSOR

Intro-32

2. Trane Advantage WCU Cycle

◆ **WCU Cycle diagram – 16-ton**



	Name
A1, A2	INV COMP
B	ACCUM
C1, C2	O/S
D	4WAY V/V
E	PLATE HEAT EXCHANGER
E1	MAIN EEV
F	EVI EEV
G1, G2	IPM COOLER
H	SUB COOLER
I	RECEIVER
J	HEAT PUMP V/V
K1, K2	HIGH PRE. S/W
L	HIGH PRE. SENSOR
M	LOW PRE. SENSOR
V1	ACCUM RETRUN V/V
V2-1, V2-2	HOT GAS BYPASS VV
V3	MAIN COOLING V/V
V4-1, V4-2	EVI V/V
V5	EVI B/P V/V
V6	DPR V/V
V7	LIQUID TUBE V/V
V8	HOT GAS CHARGING V/V
V9	LOW PRE. GAS SERVICE V/V
V10	HIGH PRE. GAS SERVICE V/V
V11	LIQUID SERVICE V/V
CV1-1, CV-2	DISC. CHECK V/V
CV2	HRV CHECK V/V
CV3	HR CHECK V/V
CV4	MAIN COOL CHECK V/V
CV5-1, CV5-2	LIQUID TUBE CHECK V/V
T1-1, T1-2	COMP TOP SENSOR
T2-1, T2-2	DISC. SENSOR
T3	SUC. SENSOR 2
T4	SUC. SENSOR 1
T5	WATER SENSOR
T6	COND OUT SENSOR
T7	LIQUID TUBE SENSOR
T8	SC IN SENSOR
T9	SC OUT SENSOR

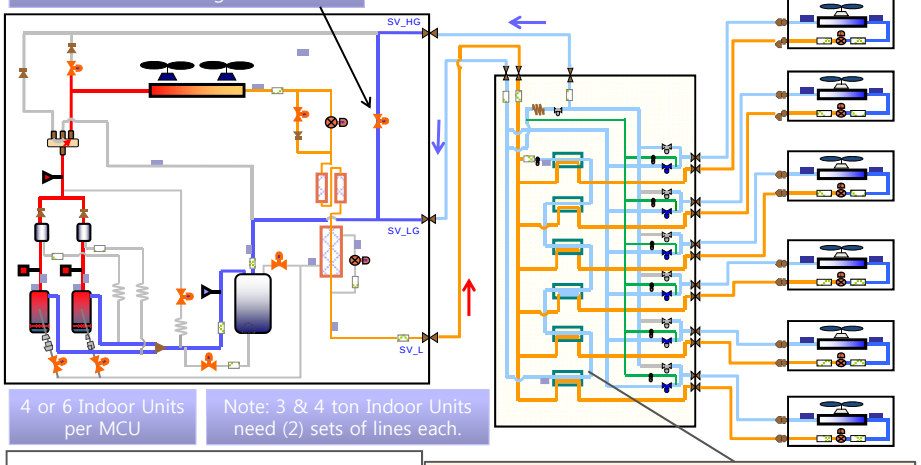
Intro-33

4. Refrigerant Flow HR: Cooling-Only

HGBP-2 equalizes pressure between gas return lines & allows both gas lines to return suction gas from MCU's.

Note: 3-in & 2-out of MCU

All Cooling



4 or 6 Indoor Units per MCU

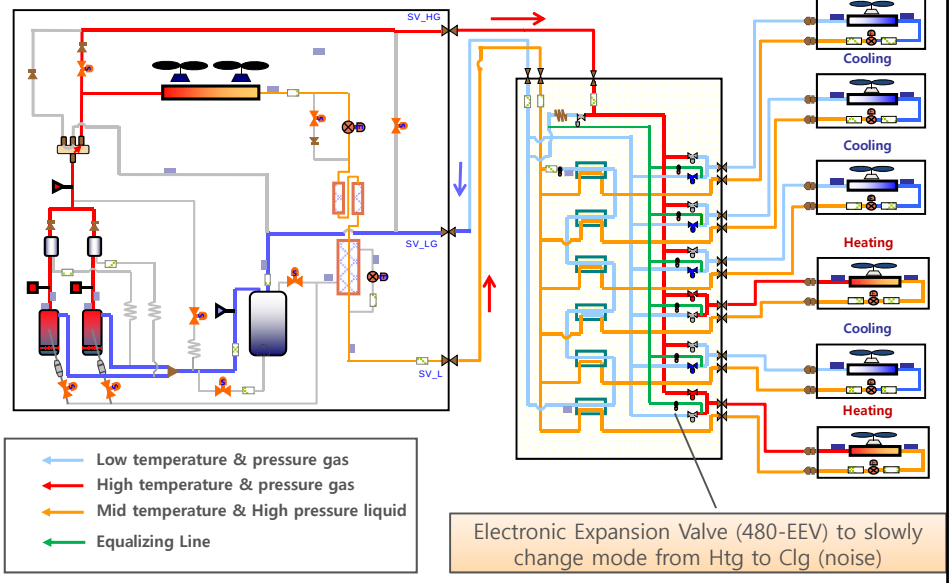
Note: 3 & 4 ton Indoor Units need (2) sets of lines each.

Low temperature & pressure gas
High temperature & pressure gas
Mid temperature & High pressure liquid

MCU's Sub-Cooling allows for greater distance and reduces sound as EEV can open more.

Intro-34

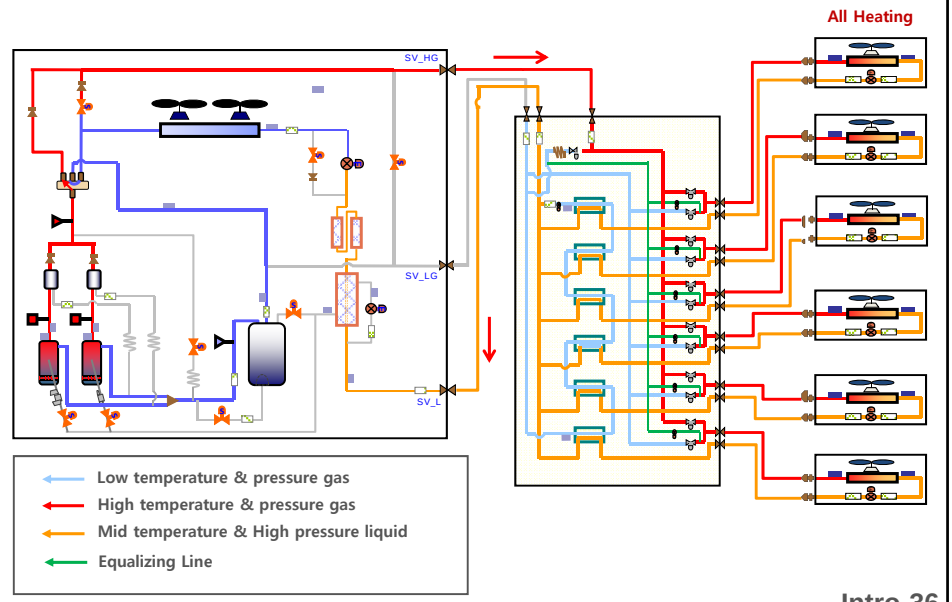
4. Refrigerant Flow HR: Mainly Cooling



Electronic Expansion Valve (480-EEV) to slowly change mode from Htg to Clg (noise)

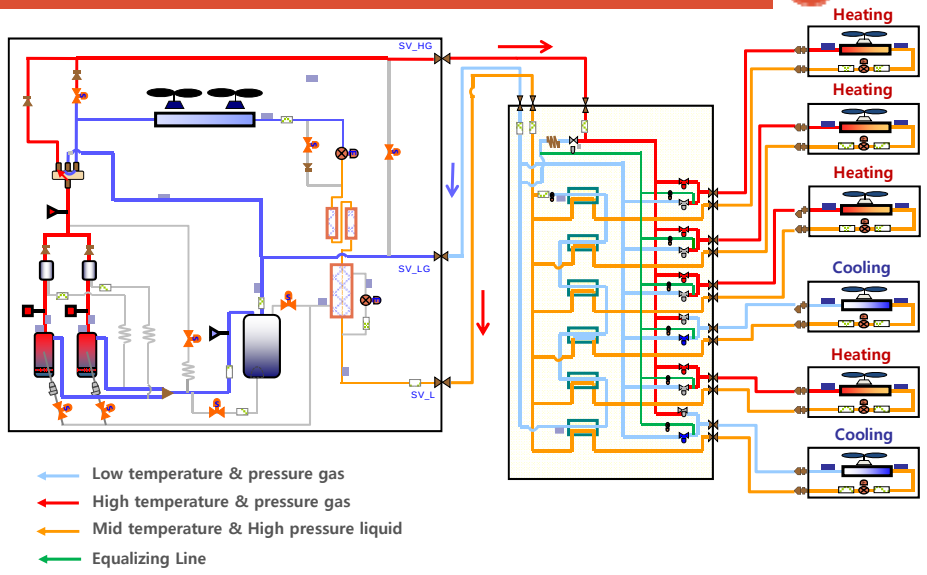
Intro-35

4. Refrigerant Flow HR: Heating Only



Intro-36

4. Refrigerant Flow HR: Mainly Heating

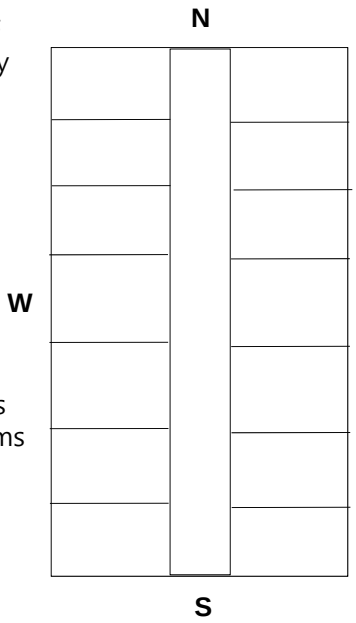


Intro-37

6. VRF & Diversity:

Heat Pump VRF systems can only heat or cool at any given time.

Ideal applications for **HP** are systems with very little diversity. Whole system on one side of the building.



If your application requires you to heat some zones while cooling other zones, you'll need to use a **Heat Recovery** VRF system to do both simultaneously.

Don't forget **Internal** vs. **External** Diversity

Ideal applications for **HR** are systems with maximum diversity. System having zones on both sides of building (E & W).

Intro-38

6. Diversity vs. Combination Ratio

If an application has a Load Diversity of .8 or 80%, you could put 1/.8 worth of IDU's capacity with respect to the ODU's capacity.

So you could put 12.5 tons worth of IDU's on a 10-ton ODU.

We call this a Combination Ratio of 125%.

Trane VRF's Combination Ratio has an acceptable range of 50% - 130%.

6. Diversity vs. Combination Ratio

Inversely if you had an application where you wanted to install 5-tons of IDU's capacity with a 10-ton ODU, this would equal a Combination Ratio of 50% (the lower limit).

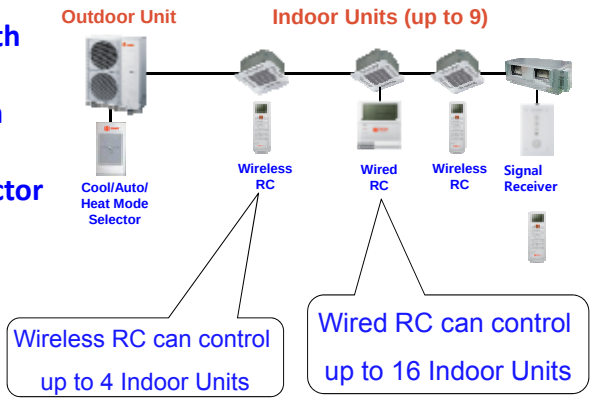
Why might you want to do something like this?

8. Big Picture on Controls:

Advantage VRF (Mini)

Small/Simple Building Controls Example

- **Single schedule from 1 Wired Remote – with up to 16 Indoor Units scheduled – Wired on F3/F4**
- **Cool/Auto/Heat Selector Switch (Heat Pump)**
- **On-Off and setpoint control for individual units at Remote Controller**

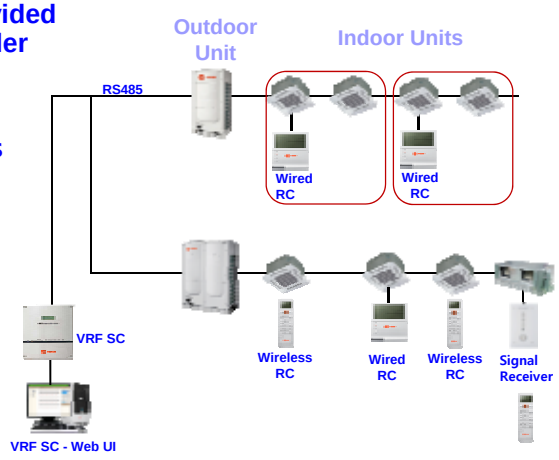


Intro-41

8. Big Picture on Controls:

Multiple System – Building Controls Example

- **Web user interface provided by VRF System Controller (VRF SC)**
- **Up to 256 Indoor Units**
- **Up to 80 Outdoor Units**
- **VRF SC can provide building-level control:**
  - **Scheduling**
  - **Unit grouping**
  - **Setpoint limits**
  - **Security/login**
  - **Alarming**
- **Wired in to R1/R2**

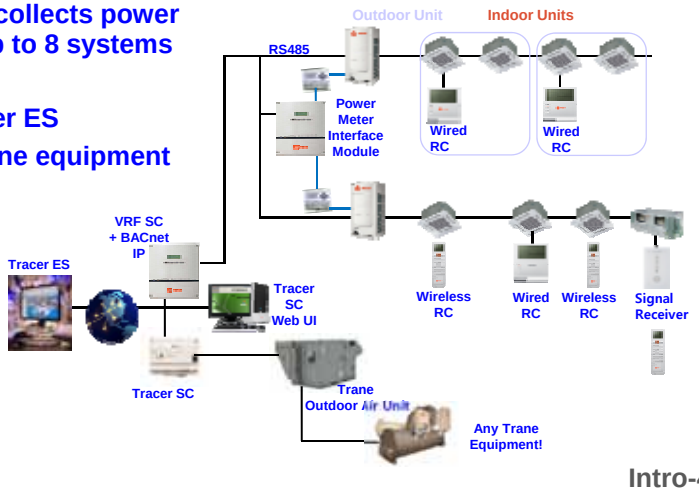


Intro-42

8. Big Picture on Controls:

Multi – Building Controls Example including Tracer SC & Tracer ES

- **Power Meter Interface Module (PIM) collects power usage from up to 8 systems**
- **Tracer SC**
- **Optional Tracer ES**
- **Allows for Trane equipment coordination with VRF**



Intro-43

TRANE

VRF 2-day Installers Training

Welcome/Introduction, Baseline Assessment & What is Trane VRF?

Now, that we have finished the Introduction, let's jump into the first part:

Refrigerant, Water & Drain Piping

100+ Years of Performance, Innovation, Commitment & Knowledge

Ingersoll Rand

TRANE

VRF 2-day Installer Training

Part-1: Refrigerant, Water & Drain Piping

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand.

Five "Must Have" items for a successful install

TRANE

1. Expectations Set Before Job Starts!
2. Clean Installation!
3. VRF Select Report!
4. Populated Component Location Sheet!
5. The Right Tools (Technician Utility Tool (TUT), R410 Rated, Pressure Rated, Vacuum Rated, etc.)!

Refrigerant, Water & Drain Piping
Step-1:

Obtain the latest VRF Select Report from the Trane Account Manager responsible for this project.

- Equipment List
- Piping diagram
- Wiring diagram
- Etc…

See Appendix-4 for a copy of the Clarksville VRF System Report

Refrigerant, Water & Drain Piping
Step-2:

All refrigerant pipe used must be ACR, clean & capped (to avoid moisture and debris).

It must also be nitrogen purged during the entire braze process.

No soft solder allowed.

Refrigerant, Water & Drain Piping
Step-2:

➢ **Drawing review**

Compare the actual site with the drawing and check interferences and the requirements for each pipe diameter size/length/quantity ahead of time.

Outer diameter	Minimum thickness	Temper grade
1/4	0.7	C1220T-O
3/8	0.7	
1/2	0.8	
5/8	1.0	
3/4	0.9	C1220T-1/2H Or C1220T-H
7/8	0.9	
1	1.0	
1-1/8	1.1	
1-1/4	1.1	
1-3/8	1.35	
1-1/2	1.6	
2-1/8	2.0	

<Temper grade and minimum thickness of the refrigerant pipe>

➢ **Pipe Cutting**

Cutting

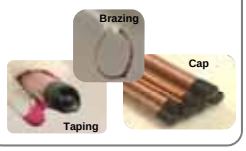
- Use a Copper Cutter

De-Burring

- Removing burr

Covering

- Block the end of pipe to prevent foreign substance entering

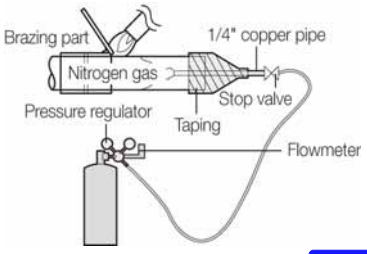


Brazing required to store pipe more than 1 month on site

Refrigerant, Water & Drain Piping
Step-2:

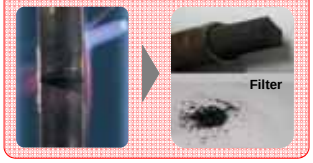
➢ **Brazing**

- To prevent oxide while brazing, must flow nitrogen to displace any oxygen in the piping.
  * Oxide will form inside the pipe. It can cause the damage of the compressor, valves etc.
  * Adjust the flow rate of Nitrogen gas with a pressure regulator to maintain **1.76 ft^3/hr.**

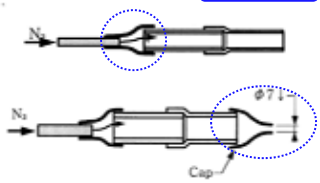


OK

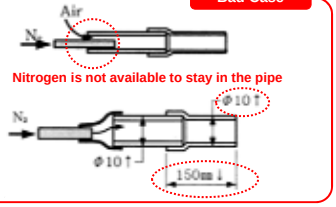
Without Nitrogen Flow



Good Case



Bad Case



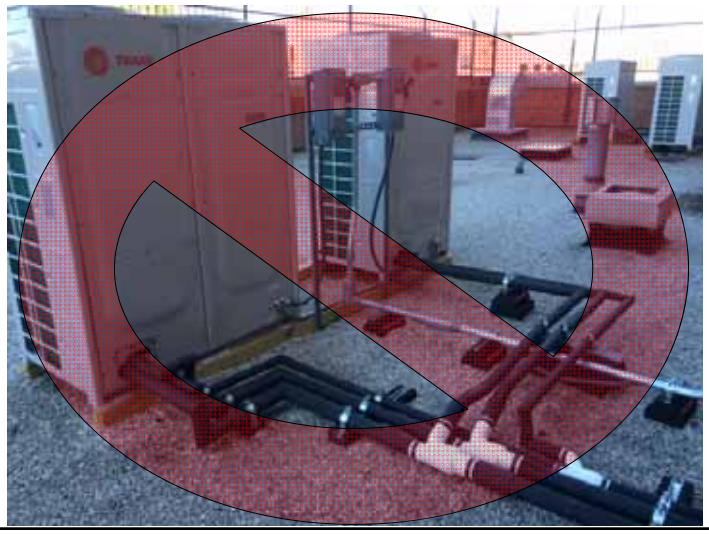
Refrigerant, Water & Drain Piping

Step-2:

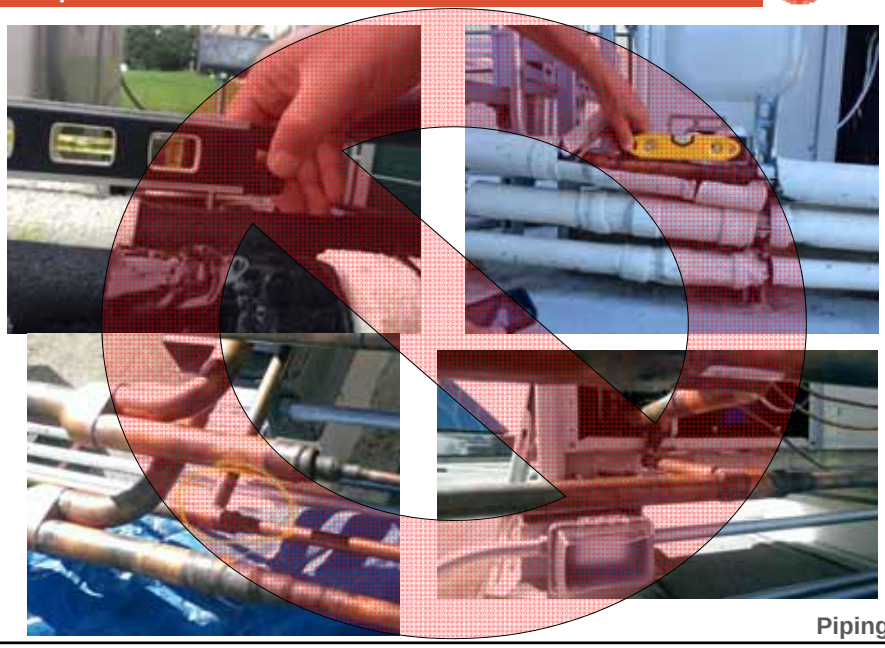
Refrigerant, Water & Drain Piping

Step-3:

Outdoor joints are installed level,
not pointing up or down (multi module systems only).



Refrigerant, Water & Drain Piping
Step-3:



Piping - 9

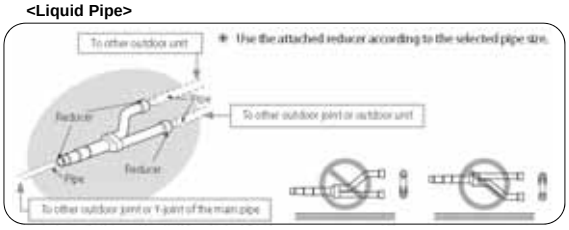
Refrigerant, Water & Drain Piping
Step-3:

➢ **Branch Pipe Installation for Outdoor units**

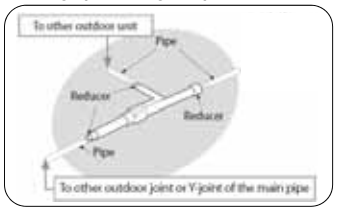
Use the attached reducer properly according to the selected pipe size.

*** Branch pipe for Gas pipe and Liquid pipe have different shape**

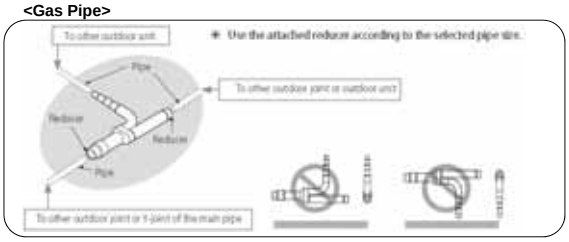
<Liquid Pipe>



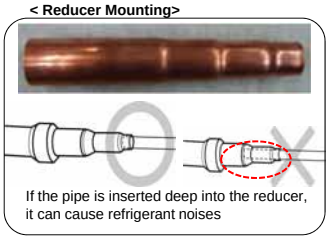
<high pressure gas Pipe>



<Gas Pipe>



< Reducer Mounting>



If the pipe is inserted deep into the reducer, it can cause refrigerant noises

Piping - 10

Refrigerant, Water & Drain Piping
Step-3:

In order to create clearance that will allow for proper installation of the outdoor y-joints on a multi-module system…….the outdoor units will have to be raised a minimum of 8 inches.

Piping - 11

Refrigerant, Water & Drain Piping
Step-3:

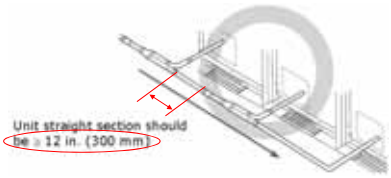
Piping - 12

Refrigerant, Water & Drain Piping
Step-3:

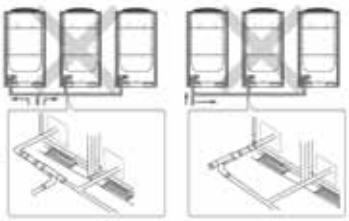
Piping - 13

Refrigerant, Water & Drain Piping
Step-3:

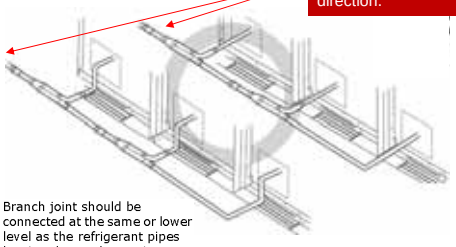
- **Installation of ODUs - Refrigerant piping**



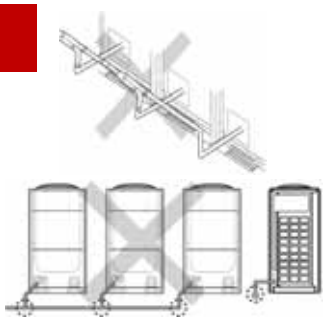
* Refrigerant pipes must be connected in parallel with the unit



36" straight pipe after the last ODU y-joint before changing direction.



Branch joint should be connected at the same or lower level as the refrigerant pipes leaving the outdoor unit.



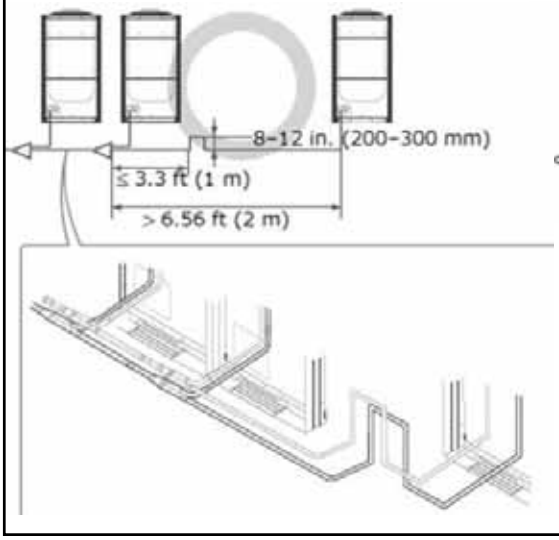
Piping - 14

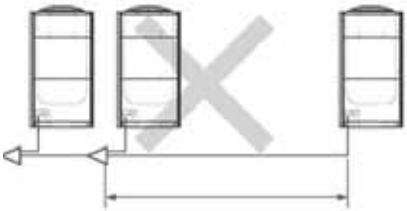
Refrigerant, Water & Drain Piping
Step-3:

Outdoor joints are installed in the correct direction (multi module systems only).

Refrigerant, Water & Drain Piping
Step-3:

If the piping length between the ODU and the branch joint exceeds 6.56ft, install a 10” inverted trap in each line.





Note: A trap is of equal length on all three sides. The same size trap must be installed on all lines. Mismatched “traps” are not allowed.

Piping - 16

Refrigerant, Water & Drain Piping

Step-3:

Piping - 17

Refrigerant, Water & Drain Piping

Step-3:

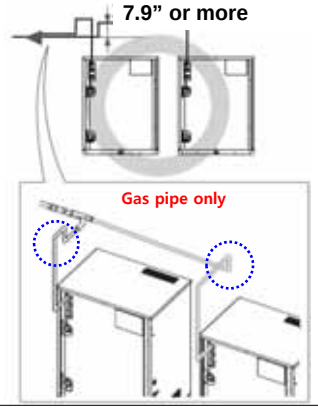
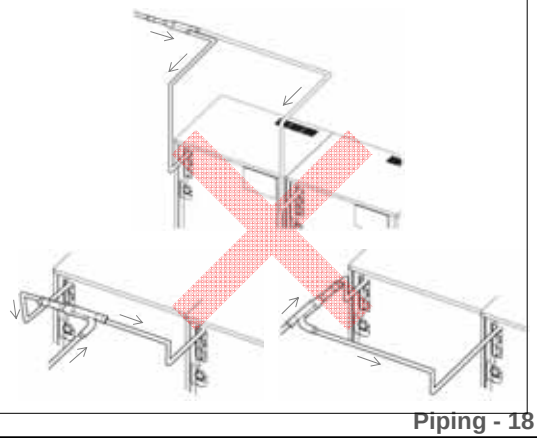
- **Refrigerant piping - WCU**

  Use Y-joint provided (Do not use T-joint)

  - ✓ **Between WCUs**

When refrigerant pipe leaves the WCU unit and turns up, you must install a trap in the gas pipe only.

→ This is to prevent oil from staying in the pipe of stopped WCU in cooling

Correct installation	Incorrect installation
	

Piping - 18

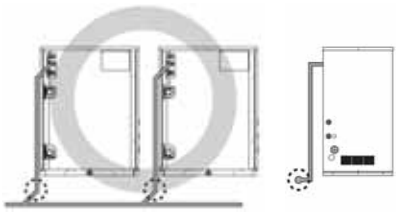
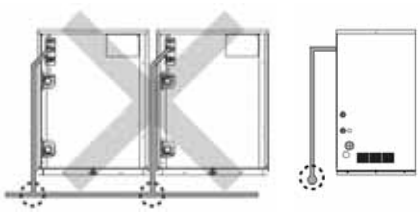
Refrigerant, Water & Drain Piping
Step-3:

◆ Refrigerant piping - WCU

Use Y-joint provided (Do not use T-joint)

✓ **Between WCUs**

Branch joint between WCUs must be installed horizontally and parallel to the unit.

Correct installation	Incorrect installation
	

Piping - 19

Refrigerant, Water & Drain Piping
Step-3:

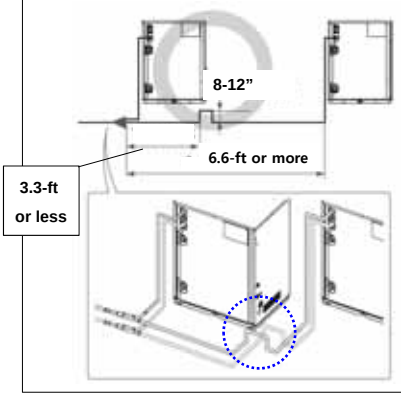
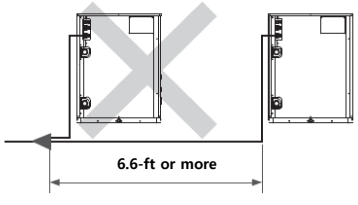
◆ Refrigerant piping - WCU

Use Y-joint provided (Do not use T-joint)

✓ **Between WCUs**

When the piping length between WCU and the branch joint exceeds 6.6-ft, install a vertical trap as show in the figure.

→ to prevent oil staying in the pipe of stopped WCU

Correct installation	Incorrect installation
	

Note: A trap is of equal length on all three sides. The same size trap must be installed on all lines. Mismatched “traps” are not allowed.

Piping - 20

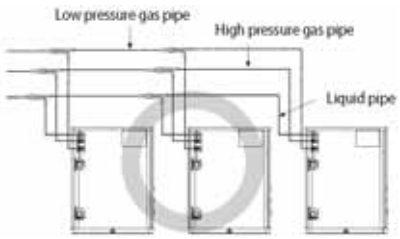
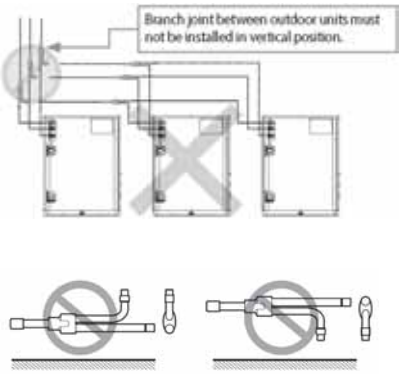
Refrigerant, Water & Drain Piping
Step-3:

- **Refrigerant piping - WCU**

Use Y-joint provided (Do not use T-joint)

✓ **Between WCUs**

Branch joint between WCUs must not be installed in vertical position.

Correct installation	Incorrect installation
* Trap is missed here to emphasize the direction of branch joint 	

Piping - 21

Refrigerant, Water & Drain Piping
Steps 4 & 14:

Step-4: Indoor refrigerant Y-joints are installed level +/- 15° in either direction.

Y-joints are selected/installed based on downstream capacity.

Step-14: There is a minimum 19.5" between a radius and the inlet of the Y-joint.

It is also 19.5” leaving the Y-joint before going into a radius.

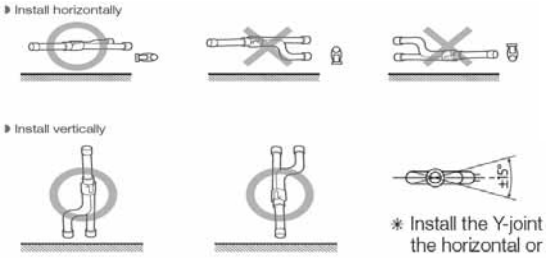
Piping - 22

Refrigerant, Water & Drain Piping

Step-4:

➢ **Branch Pipe Installation for Indoor Units**

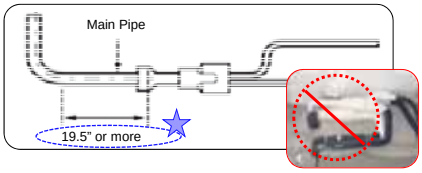
- When installing the branch pipe, pay attention to the following cautionary items

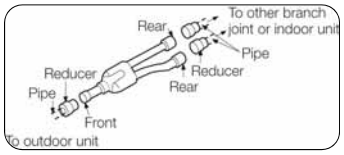


✳ Install the Y-joint within ±15° on the horizontal or on the vertical.

Sample Picture

*** Note: Keep a minimum distance of 19.5" or more from a radius entering or leaving a Y-joint.**





Incorrect installation of Y-joint & header joint cause poor oil and refrigerant distribution between IDUs. It may decrease the system's performance or cause compressor failure.

Refrigerant, Water & Drain Piping

Step-4:

Refrigerant, Water & Drain Piping
Steps 5&6: Distribution Headers

Can only be used with a Heat Pump VRF system.
Only use if you don't have enough space for Y-joints.

5. Distribution header fittings are installed level within +/- 10° / 15° in either direction.
(vertical installation is not allowed)

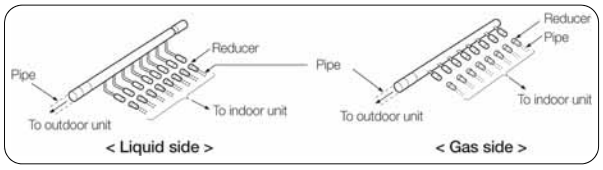
6. Unused distribution header ports are brazed shut & insulated. Unused ports should start closest to the inlet of the header. After that, largest capacity first starting at the inlet.

Field supplied braze caps or pinch braze acceptable.

Refrigerant, Water & Drain Piping
Steps 5&6: Distribution Headers

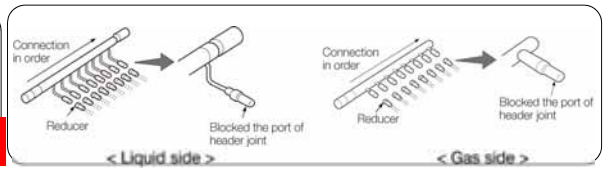
➢ **Header Pipe Installation for Indoor Units**

Select the reducer fitted on the diameter of the pipe

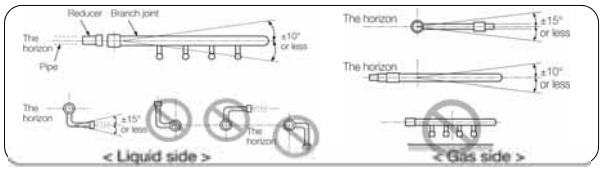


Braze ends of the pipes with caps which are not occupied

Connect the largest indoor unit capacity first starting at the inlet



Install the header joint horizontally.



Incorrect installation of Y-joint & Header Joint cause poor oil and refrigerant distribution between IDU's. It may decrease the system's performance or cause compressor failure.

Refrigerant, Water & Drain Piping
Step 7:

Refrigerant pipes are insulated with 1/2" wall minimum insulation.
(3/4" minimum on refrigerant pipes 1- 1/2" and larger)

Verify local, state and national codes.

Refrigerant, Water & Drain Piping
Step 7:

➢ **Insulation work for pipe**

1) You must check if there is a leak before completing all the installation process.

2) Insulate the gas pipe, hp gas and liquid pipe by referring to the thickness of insulator for each pipe size. The standard condition is 86°F, less than humidity 85%. (If the condition is in high humidity, use one grade thicker)

3) Use EPDM insulation which meets the following condition.

Pipe	Pipe Size(in)	Insulator(Cooling, Heating)		Remark
		Standard [86˚F,85%]	High Humidity [86˚F,over 85%]	
		EPDM, NBR		
Liquid	1/4-3/8	3/8"	½"	Heat resisting temperatures Over 120℃
	1/2 - 2	½"	¾"	
Gas	1/4	½"	¾"	
	3/8 - 1	¾"	1"	
	1-1/8 – 1-3/4		1-1/4"	
	2	1"	1-1/2"	

<EPDM SPEC>		
Item	Unit	Standard
Density	g/cm³	0.048-0.096
Dimension change route by heat	%	Below -5
Water absorption rate	g/cm³	Below 0.005
Thermal conductivity	Kcal/m·h·℃	Below 0.037
Moisture transpiration factor	ng/(m²·s·Pa)	Below 15
Moisture transpiration grade	g/(m²·24h)	Below 15
Formaldehyde dispersion	mg/L	There should be none
Oxygen rate	%	Over 25

Refrigerant, Water & Drain Piping
Step 8:

All refrigerant pipe insulation joints are sealed with appropriate adhesives and/or tape (be sure to mark joints).

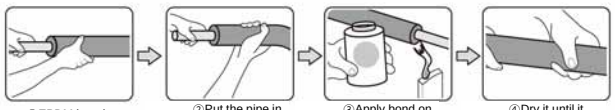
Verify local, state and national codes.

Refrigerant, Water & Drain Piping
Step 8:

➢ **Insulation work for pipe**

- All the refrigerant pipe & Drainpipe should be insulated to prevent dewing on the pipe.

Case 1



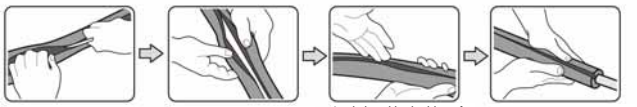
①EPDM length should be longer then pipe length. Do not extend EPDM by force

②Put the pipe in EPDM insulation carefully so that the pipe will not get damaged with EPDM.

③Apply bond on both side of cut surface. Make sure to use the correct type of bond for EPDM

④Dry it until it becomes thick, sticky and does not get detached.

Case 2



Use the original uncut insulation material.

Only in special case is the vertical cutting of the insulation allowed.

Apply bond both sides of the surface of EPDM and press them together for long lasting bonding.

Dry it until it becomes thick and sticky.

Case 3

Bring face to face the each end of EPDM on fitting connection part.

Make fitting cover to fit the EPDM insulation. Fitting cover should be overlapped with insulation min 1inch(2.5m).

Bond the both cutting sides of fitting cover.

Refrigerant, Water & Drain Piping
Step 8:

➢ **Insulation work for Branch pipe**

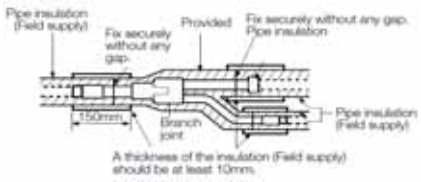
1) Attach the insulation provided with a branch joint

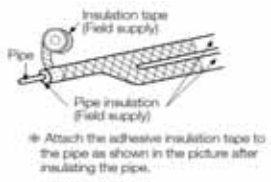
Not Plenum Rated

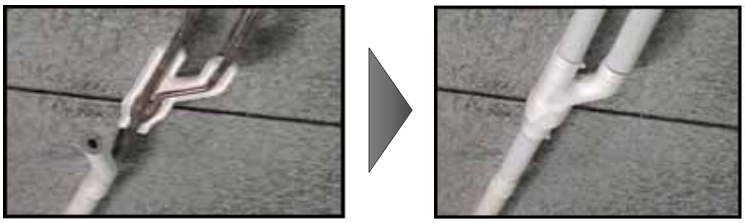
2) Wrap the connected part with an insulation (field provided) of a thickness of at least ½".

3) Use an insulation that should be able to handle the interior temperature over **248 F**.

4) Wrap the branch joint with an insulation of a thickness of at least ½".



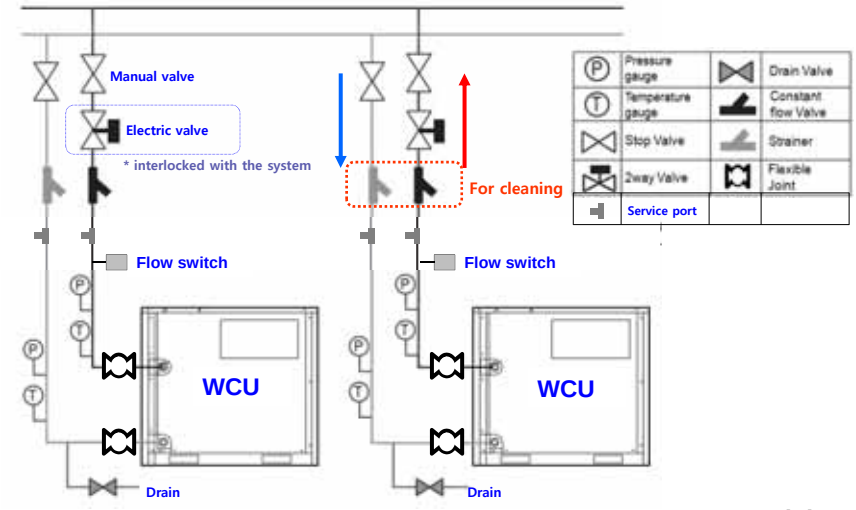




Refrigerant, Water & Drain Piping
Step 8:

◆ **Water system - Water pipe installation example**

- **Product will not operate if flow switch is not installed.**
- **Connect wye strainer in a downward configuration to prevent trapping air**



Refrigerant, Water & Drain Piping
Step 8:

◆ Water system - Flow Switch (Mandatory)

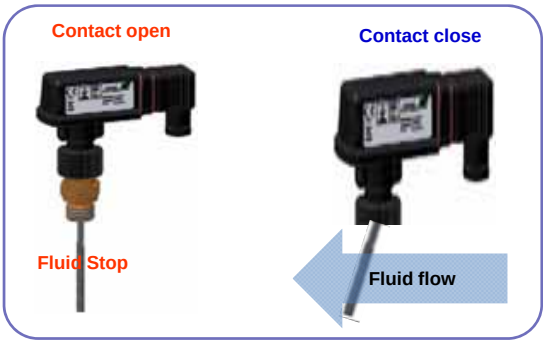
✓ Purpose: To check for water circulation
* Contact will be closed when flow rate is same or more than required flow rate

✓ Selection: Switch must work when flow rate is same or higher than minimum for the system

Installation

Insert Type

Connect Type



Refrigerant, Water & Drain Piping
Step 8:

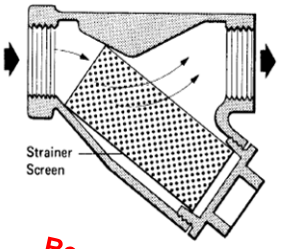
◆ Water system – Strainer (Mandatory)

✓ Purpose: to filter the water and protect plate heat exchanger against dirt and debris.

✓Installation: Install strainer 50mesh or more for each water inlet of WCU.

* IOM

Fluid	Pressure	Mesh size	Material(strainer/mesh)
Water	284-psi	50 Mesh or more	AISI316 / SUS304

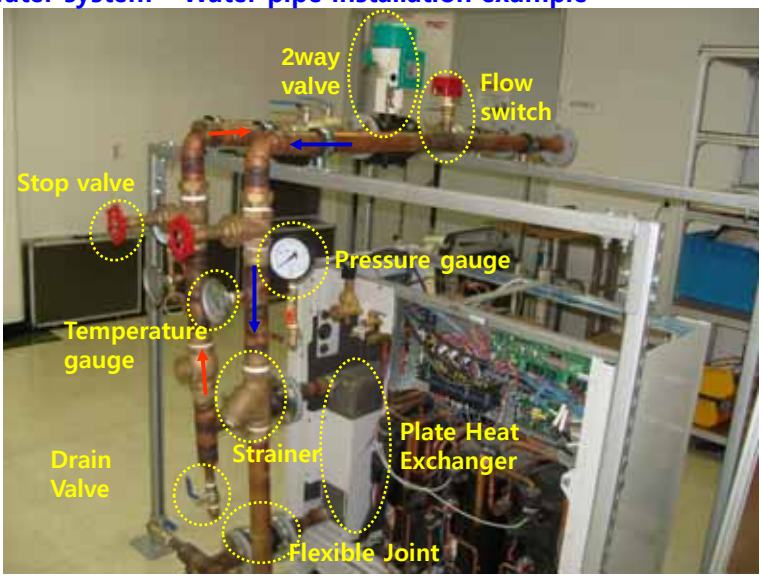


Recommended

Type	Mesh Type	Punching Type	**Mixed Type**
Feature			
type	Wire	Punching in plate	Wire Type(inner) + Punching Type(outer)
Feature	Filtration area: large Stiffness : bad	Filtration area: small Stiffness: good	Filtration area: large Stiffness: good
Recommendation	△	△	O

Refrigerant, Water & Drain Piping
Step 8:

◆ Water system - Water pipe installation example



Piping - 35

Refrigerant, Water & Drain Piping
Step 8:

◆ Setting - Option

Optional item	Input unit	SEG1	SEG2	SEG3	SEG4	Function of the option	Remarks
Setting long piping condition (Setting is unnecessary if high-head condition is set.)	Main	0	9	0	0	Disable (Factory default)	
				0	1	Long piping level 1	When equivalent length of farthest indoor unit from the outdoor unit is between 100~170 m
				0	2	Long piping level 2	When equivalent length of farthest indoor unit from the outdoor unit is over 170 m
Energy saving setting	Main	1	0	0	0	Disable (Factory default)	Energy saving mode triggers when the room temperature reaches desired temperature while operating in heating mode.
				0	1	Enable	
Disable	-	1	1	This function is not applicable for this model			
Expand operational temperature range for cooling	Main	1	2	0	0	Disable	
				0	1	Enable	
Channel address	Main	1	3	A	U	Automatic setting (Factory default)	Address for classifying the product from upper level controller (DMS, S-NET 3, etc)
				0~15		Manual setting for channel 0~15	
Disable	-	1	4	This function is not applicable for this model			
Circulation water flow control	Individual	1	5	0	0	Disable (Factory default)	When variable flow control valve is applied
				0	1	7-10 V	
				0	2	5-10 V	
				0	3	3-10 V	

Piping - 36

Refrigerant, Water & Drain Piping
Step 9:

All condensate drain pipes are installed, insulated & supported every 3 – 5 feet.

Verify local, state and national codes.

Refrigerant, Water & Drain Piping
Step 9:

➢ **Mounting the Drainpipes**

- Mount a horizontal pipe in the hanger.(Hanger distance should be **5ft or less** otherwise there could be sagging)
- Perform **1/100 or more slope** works on the horizontal pipe in the direction of the vertical drop pipe


➢ **Connecting the Drainpipe**

- Use a T-joint to make connections between the horizontal pipe(main pipe) & branch pipe(sub pipe)
  (T-joint should be faced upward)
- Wait 1~2mins till the PVC pipe are fixed (Do not bond Below -23F, it can cause damage or delay of fixing time)


PVC glue on the pipe


PVC glue on the T-joint


Combine

Refrigerant, Water & Drain Piping
Step 9:

➢ **Drainpipe Cutting & Insulation**

- Cut the drainpipe as its dimension and size are shown in the diagram (Use a special cutter for the PVC pipes)


Mark the length


Cutting


PVC Pipe Cutter

- Insulate the drainpipe that is cut (The drainpipe insulation materials should be **non-flammable**)

✓ **Recommendation**

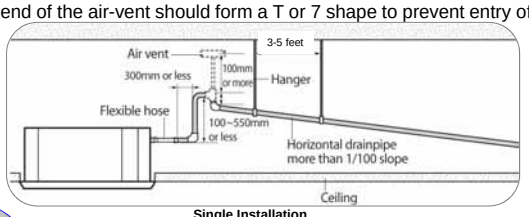
1. Insulation thickness is **5~10T or more**
2. Select the desirable insulation thickness according to the humidity/temperature of the ceiling.

Refrigerant, Water & Drain Piping
Step 9:

➢ **Branch pipe (sub pipe) work**

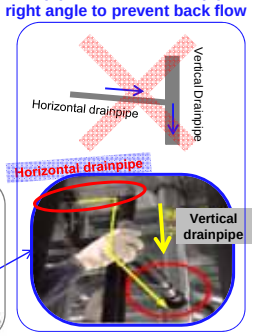
1) Indoor unit **with drain pump**

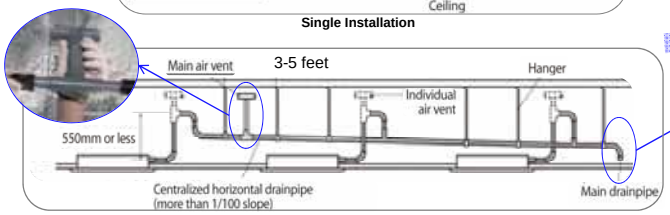
- The pipe coming from the indoor unit should have a trap to prevent vapor lock
- The min height is **3.93 inches** from the pump outlet **OR** the max height is **29 inches** from the bottom of the indoor unit to the top of the drainpipe (vent not included).
- Install an air vent at max height to prevent a back flow caused by pressure in the drainpipe.
- The end of the air-vent should form a T or 7 shape to prevent entry of dust or foreign substances.



Single Installation

Do not connect Horizontal drainpipe to Vertical drainpipe at right angle to prevent back flow





Multi Installation

Refrigerant, Water & Drain Piping
Step 9:

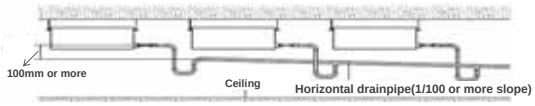
➢ **Branch pipe (sub pipe) work**

1) Indoor unit **without drain pump**

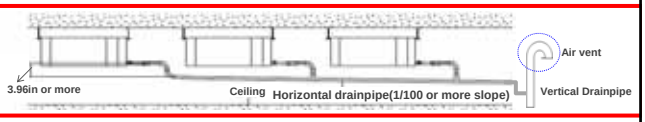
- Form a P or U-trap on the pipe to prevent a back flow.
- Install an air-vent on the top of vertical drainpipe. It should be located higher than the drainpipe height
- Do not install the Air-Vent between Indoor unit & U-trap

Single Installation

Multi Installation



Low Static Duct (Slim Duct) units only.
Blow Through blower design.
Other ducted units are Draw Through.



Refrigerant, Water & Drain Piping
Step 10:

All refrigerant fittings are insulated with supplied polystyrene insulation & taped/sealed to prevent condensation.

Refrigerant, Water & Drain Piping
Step 10:

Sample of Good Installation

Sample of Bad Installation

Piping - 43

Refrigerant, Water & Drain Piping
Step 10:

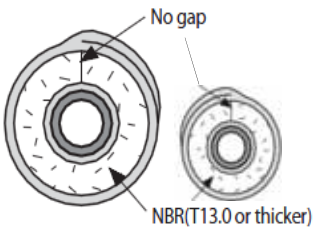
➢ Insulation

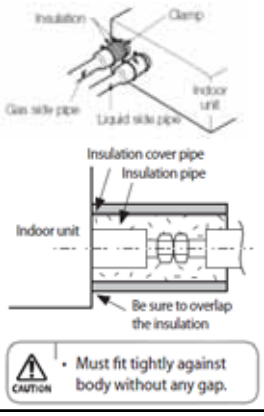
3. Insulation

- Once you have checked that there are no leaks in the system, you can insulate the piping and hose.

- To avoid condensation problems, place ½" or thicker Acrylonitrile Butadiene Rubber separately to Gas & Liquid pipe.

- Wind insulating tape around the pipes and drain hose avoiding to compress the insulation too much.

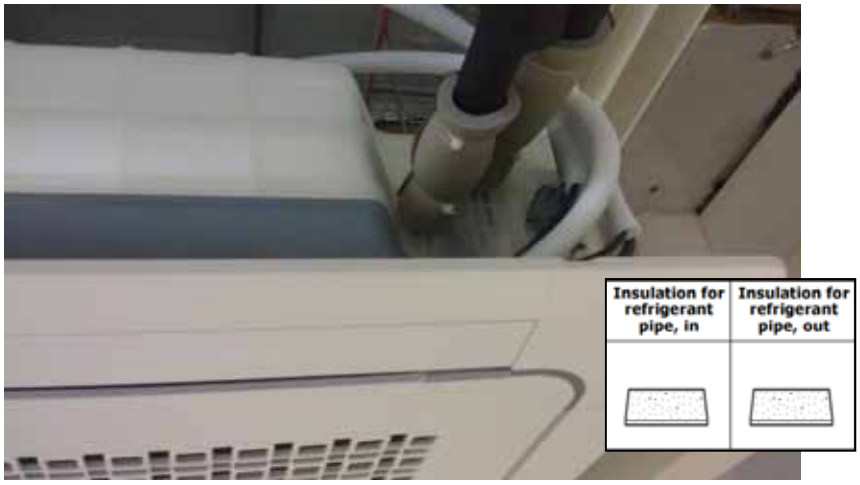




Piping - 44

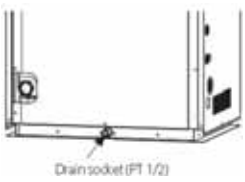
Refrigerant, Water & Drain Piping
Step 10:

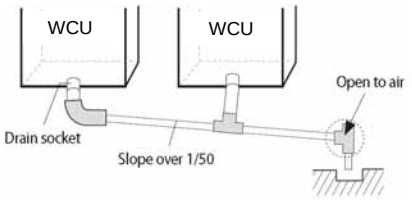
Piping Insulation



Refrigerant, Water & Drain Piping
Step 10:

- **WCU - Drain pipe**





1. Attach the drain pipe to the drain socket (PT1/2) located on the bottom of the product.
2. Do not install trap and ensure the slope of the drain pipe is more than 1/50.
3. Insulate the drain pipe and drain plug with insulation over ½" thick.
4. If you have installed a heater to prevent drain pipe from freezing, install safety equipment for the heating device.

Refrigerant, Water & Drain Piping
Step 11:

All refrigerant pipes are to be supported between 3 – 5 feet.

Verify local, state and national codes.

Refrigerant, Water & Drain Piping
Step 11:

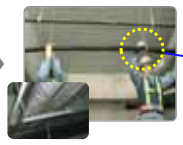
➢ Mounting

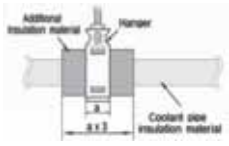
1) Installing the hanger bolt(or ladder tray)
   ½ in or less : 5ft or less
   5/8 in or more : 6.5ft or less
   *** If the bolt distance is over 5-6.5ft pipe might sag because of it's weight**



2) Insulating the pipe (Refer to Insulation work)
   - Keep the tape or cap end of each side

3) Hanging the pipe
   - Hang the pipe on the hanger or saddle support
   - Insert Insulation pad between pipe & hanger to prevent insulation being pressed



*** Reference**
- Branch pipe (Y-Joint): Install a hanger within **18"** before and after the branch pipe


Refrigerant, Water & Drain Piping
Step 11:

Support

- **Cautions when hanging pipe or support**
  - **To prevent deformation of refrigerant pipe, proper support is necessary.**

Saddle support or hanger can applied

Additional piece of Insulation (prevent from insulation damage)

Recommended support distance is 3.-5ft

Support both sides of Y-joint and header.

Refrigerant, Water & Drain Piping
Step 11:

Sample of Good Installation

Sample of Bad Installation

Refrigerant, Water & Drain Piping
Step 11:

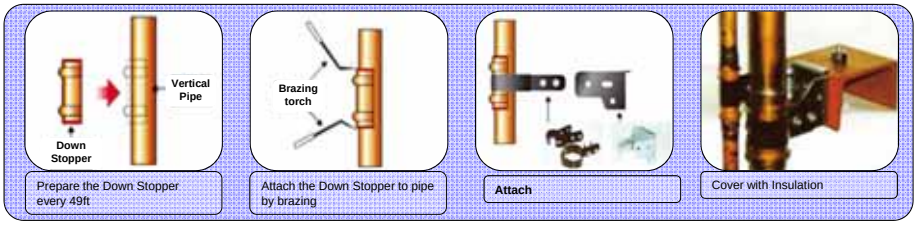
➢ Vertical Piping Support

- Because of pipe weight there could be warped or sagging of the pipe.
To prevent these problem Vertical pipe must be fixed with U shape Bolt (Circular band) & Down Stopper.

1. Fix the Vertical Pipe with U shape bolt or Circular band for each floor
2. If the pipe length is over 49ft in vertical fix with Down Stopper every 49ft additionally

Pipe Length	Mounting Interval	Remarks
Below 49ft	Brace pipe every 16.5ft if below 49ft in height	If there is a pit, fix a pipe at each floor
Over 49ft	If above 49ft in height, Install a Down Stopper every 3 floors or every 49ft	Also, pipe must be braced every 16.5ft

*** How to Fix with Down Stopper**



Refrigerant, Water & Drain Piping
Step 12:

Refrigerant Y-joints are supported on both sides within 18 inches of the braze.

Refrigerant, Water & Drain Piping
Step 12:

Support

- **Caution when hanging pipe or support**
  - **To prevent deformation of refrigerant pipe, proper support is necessary.**

Support both sides of Y-joint & header.

Refrigerant, Water & Drain Piping
Step 13:

Refrigerant charge has been verified to be the appropriate amount in each system per applicable ASHRAE 15 standard.

Refrigerant, Water & Drain Piping
Steps 14-16:

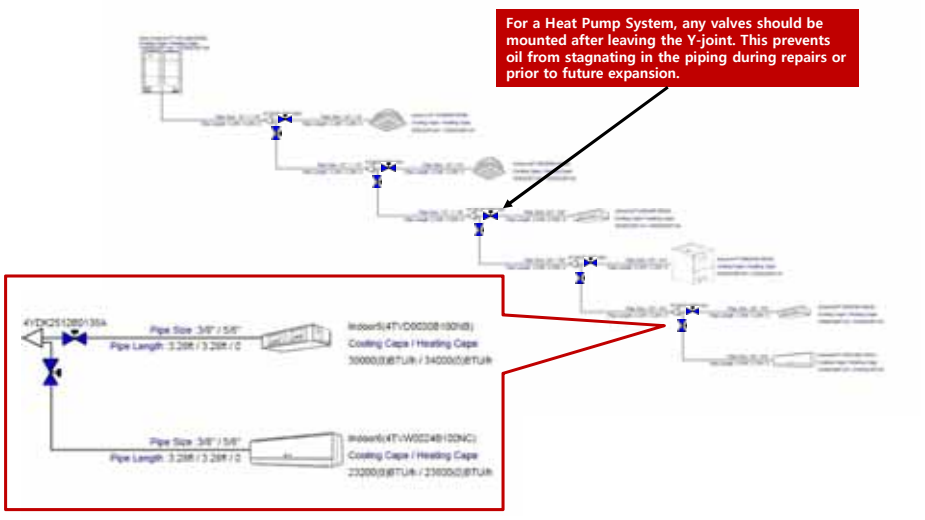
Step 14: There is a minimum 19.5" between a radius and the inlet or outlet of the Y-joint. .

Step 15: There is a minimum 36" between Y-joints.

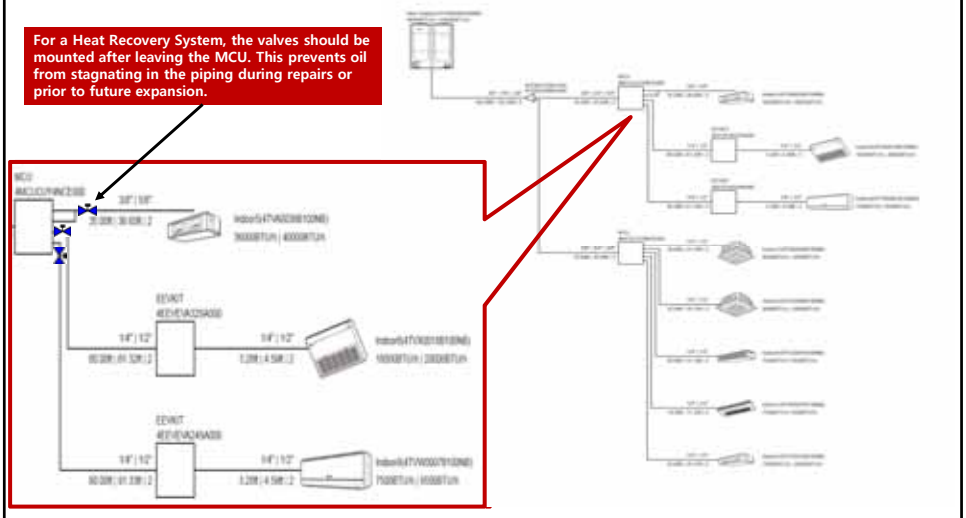
Step-16: All isolation valves (when used) are installed in the appropriate direction, verified to be fully open & insulated.

Isolation valves with service ports are recommended.
Install so the service port is towards the IDU's or MCU(s).

Refrigerant, Water & Drain Piping
Steps 15-16:



Refrigerant, Water & Drain Piping
Steps 15-16:



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Refrigerant, Water & Drain Piping
Steps 17:

Step-17: Refrigerant pipe system has been pressure tested per Trane recommendation.

Piping - 58

Refrigerant Leak Testing

1. **Use tools rated for R410A.**
2. **Do not remove the Schrader core from the service valves.**
3. **Use dry nitrogen gas when doing a leak test.**
4. **Pressure system to 72 psi for 5 minutes.**
5. **Pressure system to 220 psi for 5 more minutes.**
6. **Pressure system to 590 psi for 24 hours, pictures before and after. If leaks are detected, repair as necessary and re-test.**
7. **Bring back down to 145 psi and leave until ready to begin vacuum. If the pressure drops for any other reason other than verifiable temperature fluctuations, check for leaks.**

TIP - Pressure check each day's work to prevent an emergency at final testing!

Refrigerant Leak Testing

Useful to Install Pressure Gauge

For Commissioning Report - need before & after photos showing system held pressure 590-psi for 24-hours.

Refrigerant, Water & Drain Piping
Step 18:

Vacuum process was performed on the refrigerant pipe system per Trane recommendation.

Triple evacuation method is utilized.

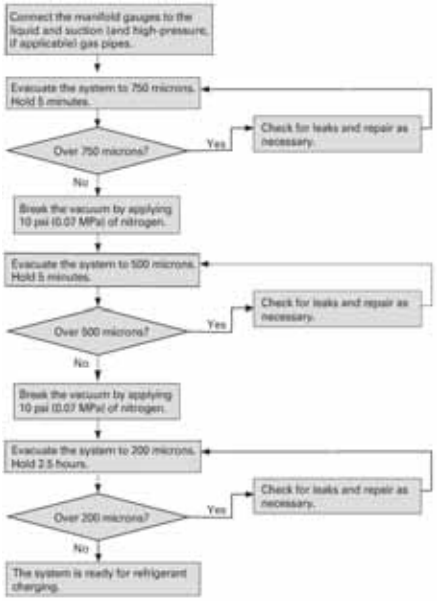
1. 750 microns
2. 500 microns
3. Then finally to 200 microns and hold for 2.5-hours.

Refrigerant, Water & Drain Piping
Step 18:

Vacuum drying the system

1. Use vacuum rated hoses.
2. Check valve on pump.
3. Connect a hose to the liquid/gas/high pressure gas pipes and make the vacuum with a vacuum pump.
4. Triple evacuation to 200 microns
   - ❑ Evacuate to 750, 500 and finally 200 microns
   - ❑ Hold for 15minutes, 15 minutes and 2.5 hours respectively
   - ❑ Rise of no more than 200 microns in 15 minutes
   - ❑ Take pictures of gauges before and after at 200 microns only.

   If left overnight -
   - ❑ Rise to no higher than 750 microns after 12 hrs
5. Keep the vacuum until gauge pressure reaches the value in the table. (hold for minimum 2.5 hours at 200 microns)
6. After achieving the necessary vacuum, check if the gauge pressure has changed.
7. If no change is found, then the system is ready for the refrigerant charging phase.



Refrigerant, Water & Drain Piping
Step 18:

MCU & EEV valves ship in the open position.
Once powered you have to use the K1 button.

Table 34. Setting operations with button K1

Number of times button K1 is pressed	Operation	4-digit display
1 (hold for 5 seconds)	Auto Commissioning Mode	K - K- Blank - Blank
1	Refrigerant charging in heating mode	K - 1 - Blank - Blank
2	Test operation in heating mode	K - 2 - Blank - Blank
3	Pump out in heating mode (Outdoor unit address 1)	K - 3 - Blank - 1
4	Pump out in heating mode (Outdoor unit address 2)	K - 3 - Blank - 2
5	Pump out in heating mode (Outdoor unit address 3)	K - 3 - Blank - 3
6	**Not Used in North America**	**N/A**
7	Vacuuming (Outdoor unit address 1)	K - 4 - Blank - 1
8	Vacuuming (Outdoor unit address 2)	K - 4 - Blank - 2
9	Vacuuming (Outdoor unit address 3)	K - 4 - Blank - 3
10	**Not Used in North America**	**N/A**
11	Vacuuming (All)	K - 4- Blank - A
12	End operation	—

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Refrigerant, Water & Drain Piping
Step 19:

Calculating Refrigerant Amount

- Manual calculation per the IOM.

OR

- Provide line size and length to the sales person for updated VRF Select Report with updated line lengths and additional refrigerant amounts.

OR

- Download VRF Select and update locally.

But remember - An 'As-Built' VRF Selection Report is required for warranty

Piping - 64

Refrigerant, Water & Drain Piping
Step 20:

Additional refrigerant is to be weighed in with an accurate digital scale before releasing factory charge.

- Press K2 once to initiate refrigerant charging in the Cooling mode.
- Press K1 once for refrigerant charging in the Heating mode.

Length & Diameter of each liquid refrigerant pipe must be recorded to accurately calculate additional refrigerant.

Piping - 65

Refrigerant, Water & Drain Piping
Steps 21-22:

Step-21: When charging is complete make sure condensing unit service valves are open with valve covers reinstalled & tightened.

Step-22: Refrigerant piping was installed as the engineering plans described. Any changes are reported to the account manager for updating the “as built” VRF Select Report.

Pipe layout, diameter & equipment must match precisely.

Piping - 66

Refrigerant, Water & Drain Piping
Step 22:

ODU

Make sure piping limitations are not exceeded.

Distance from first Y-joint to the farthest IDU must not exceed 149-ft

REFRIGERANT PIPING LIMITATIONS (See Notes)			
Maximum Allowable Pipe Length	Outdoor Unit to Indoor Unit	Actual (Equivalent) Length	656 (722) feet and less
		Total Piping Length	3,281 feet and less
	Between Outdoor Units (Module Installation)	Actual (Equivalent) Length	33 (43) feet and less
	Between MCU and its farthest IDU	Actual Length	147-feet
Maximum Allowable Piping Height Difference	Outdoor Unit Located Above Indoor Unit		361 Feet
	Outdoor Unit Located Below Indoor Unit		131 Feet
	Between Indoor Units	Heat Pump	164 Feet
		Heat Recovery	49 Feet
	Between Mode Control Units (Heat Recovery)		49 Feet
1. For job specific piping guidelines and limitations, use VRF Select.			
2. For applications where the outdoor unit is more than 164-ft above the furthest indoor unit, special installation conditions apply.			
3. For more information, refer to the Installation, Operation and Maintenance Manual or contact your local Trane sales office.			
4. An Inverted Trap is required when one ODU module is located more than 7-ft from another ODU.			

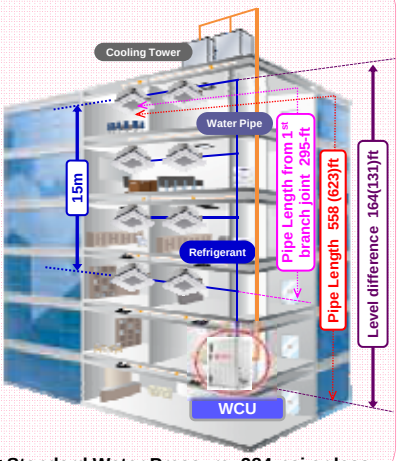
Refrigerant, Water & Drain Piping
Step 22:

◆ WCU Piping Limitations

✓ **WCU Piping Limitations:**

- o **Total Pipe length : 984-ft**
- o **Max pipe length : 558-ft (equivalent 623-ft)**
- o **Max level difference (WCU~IDU)**
  - o **164-ft when WCU is highest**
  - o **131-ft when WCU is lowest**
- o **Max level difference (IDU~IDU): 49-ft**
- o **Max pipe length from 1st branch joint : 295-ft**

preliminary



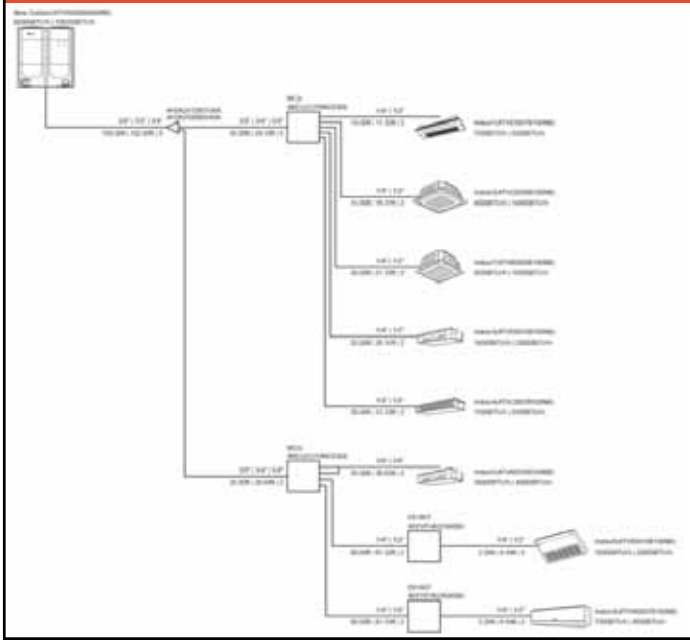
※ **Standard Water Pressure: 284-psi or less**

Refrigerant, Water & Drain Piping
Step 23:

If not done yet, final refrigerant pipe line lengths must be turned over to the Trane Salesperson of record for final selection program layout.

Most accurate layout from VRF Select is used for warranty.

Refrigerant, Water & Drain Piping
Step 23:

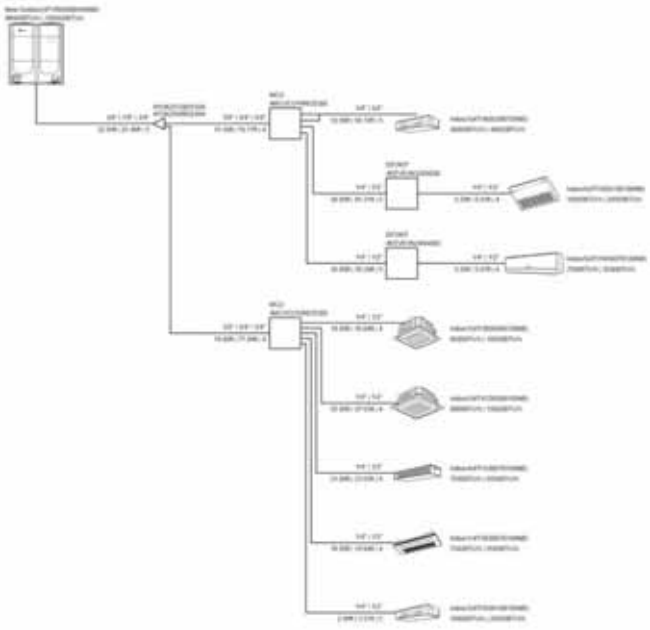


The system configuration may be different from the actual installation conditions, refer to the installation manual.

Initial layout of the Clarksville display units

Refrigerant, Water & Drain Piping

Step 23:



The system configuration may be different from the actual installation conditions, refer to the installation manual.

Final layout of the Clarksville display units

TRANE

VRF 2-day Installer Training

Part-1: Refrigerant, Water & Drain Piping

Now, that you have finished the Refrigerant, Water & Drain Piping steps, it's time to move on to the MCU & EEV Kits…

100+ Years of Performance, Innovation, Commitment and Knowledge

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VRF 2-day Installer Training

Part-2: MCU & EEV Kits

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

MCU & EEV Kits

Step-25:

MCU(s) are installed in an unoccupied area to minimize the noise from mixed heating and cooling operation.

If not, precautions may have to be taken to minimize such noise.

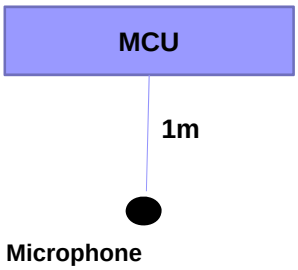
MCU & EEV Kits
Step-25:

MCU Noise Level

STEADY STATE SOUND PRESSURE LEVEL (dBA)	PEAK SOUND PRESSURE LEVEL (dBA)
32	48

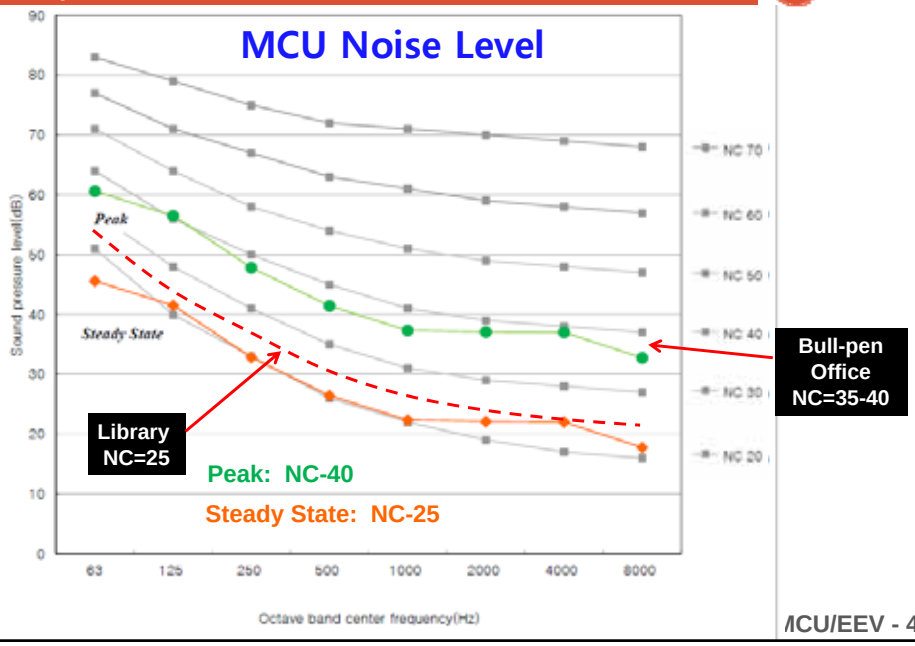
*Measured in an anechoic chamber

*Measurement Location



MCU/EEV - 3

MCU & EEV Kits
Step-25:



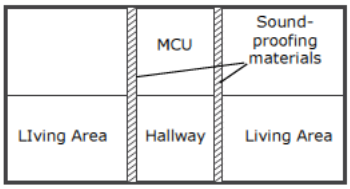
MCU/EEV - 4

MCU & EEV Kits
Step-25:

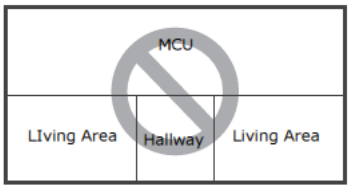
Mode Control Unit (MCU)

Figure-7

- MCU's have the possibility of generating a "bubbling" noise while in simultaneous heating and cooling operation or during low ambient operation. In order to mitigate this, precautions need to be taken to reduce this transfer of noise to occupied spaces by either isolating the MCU from the space using the layout of the building (interior walls, closets, hallways, etc.) or with the use of soundproofing materials.



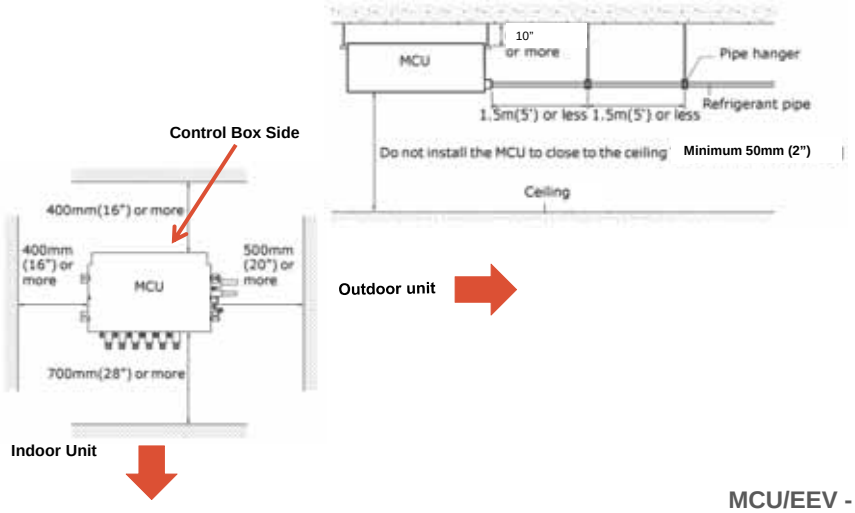
Reduced risk of noise transfer by utilizing interior walls to isolate MCU from occupied spaces.



Increased risk of noise transfer from MCU to occupied spaces because of the free flow of sound between occupied spaces.

MCU & EEV Kits
Step-25:

Mode Control Unit (MCU)



MCU & EEV Kits
Steps 26-28:

Step-26: Make sure MCU's are installed level.

Step-27: Make sure EEV kits are installed level.

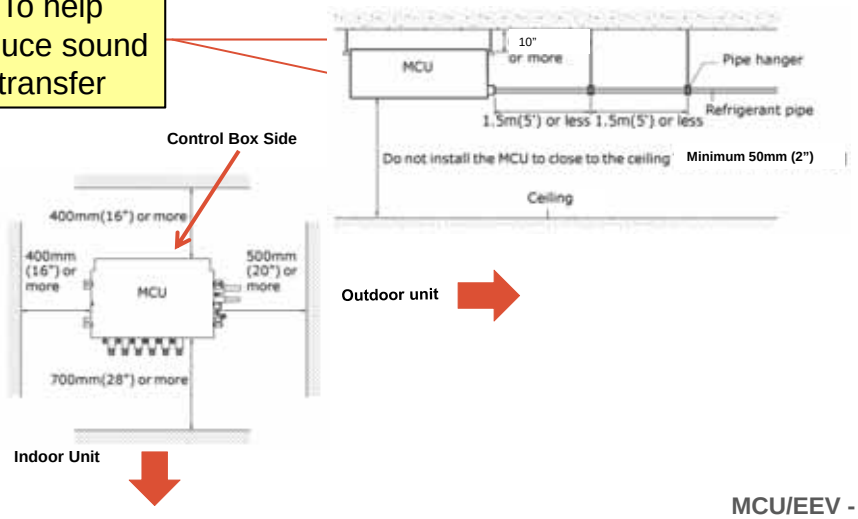
Step-28: For the purpose of servicing the MCU, the space between the top of the MCU(s) and the structure/obstructions above it should meet minimum clearances.
(refer to the Trane IOM)

Trane recommends 10" minimum.
Leave more space if possible to make future service easier.

MCU & EEV Kits
Step 28:

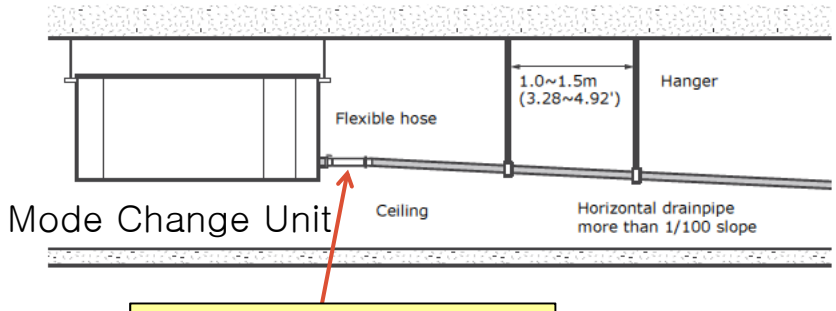
Mode Control Unit (MCU)

To help reduce sound transfer



MCU & EEV Kits
Step 29:

MCU drain pipe is connected and insulated.



Accessory Drain Hose Stub gravity drain only, can drain to central point for pumping.

MCU/EEV - 9

MCU & EEV Kits
Steps 30-31:

Step-30: MCU liquid, suction, and high pressure gas for incoming refrigerant pipes are connected to the corresponding ports and torqued to specification.

See MCU installation manual training materials.
Cut flare connection & braze won't void warranty.

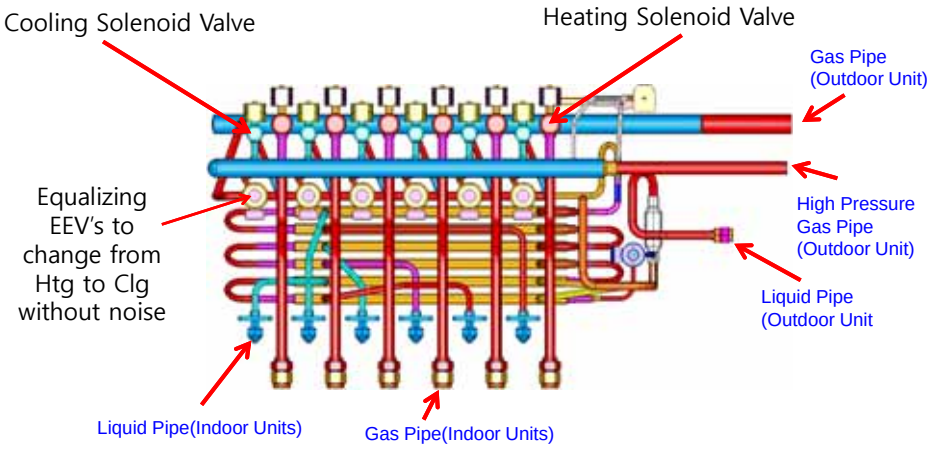
Step-31: Indoor units have been connected to the outlet side of the MCU(s) and torqued to factory specification. (liquid and gas)

MCU/EEV - 10

MCU & EEV Kits
Steps 30-31:

Figure-8

Mode Control Unit (MCU)



MCU & EEV Kits
Steps 30-31:

➢ **Connecting the Refrigerant Pipe to IDUs**

1. Purging the unit

MCU does not come nitrogen charged.

- Indoor unit is supplied with a pre-charge of nitrogen gas. (insert gas)

- Purge the nitrogen gas before connect the refrigerant pipe

2. Connect the refrigerant pipe

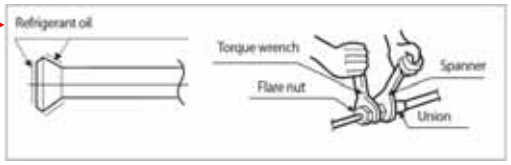
- A smaller one for the liquid refrigerant

- A larger one for the gas refrigerant

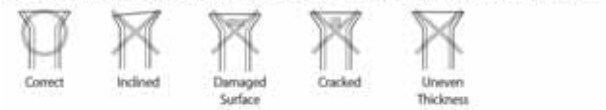
- The inside of copper pipe must be clean & has no dust

Be sure to only use PVE oil – **Nu-Calgon 4319-24**

Pipe Diameter (OD)	Torque (ft. / lbs.)
1 / 4"	10.46 - 12.6
3 / 8"	24.02 - 29.4
1 / 2"	36.43 - 44.4
5 / 8"	45.45 - 55.5



Check if you flared the pipe correctly. There are some examples of incorrectly flared pipes below.



MCU & EEV Kits
Step 32:

The sum of connected indoor units to each MCU must not exceed its capacity:

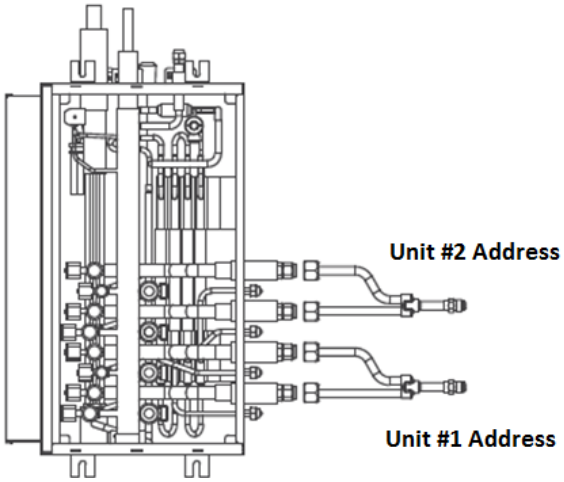
- 120,000 Btu/h for the 4 port
- 180,000 Btu/h for the 6 port
- 192,000 Btu/h for the dedicated 2 port

You must use two ports (2 liquid & 2 gas) to feed a 36-48MBh IDU regardless of the MCU model number. If using a 72MBh or 96MBh HSP ducted unit you must use the dedicated 2 port MCU & feed each unit with 2 liquid & 2 gas ports.

MCU & EEV Kits
Step 32:

MCU Capacity

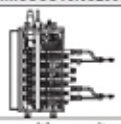
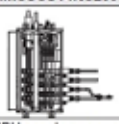
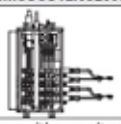
Example – Two large capacity ducted indoor units (36-96 MBH) connected to a 4MCUCUY2NCE000 dedicated 2-port MCU box.



MCU & EEV Kits

Step 32:

	Model Number	Units	Unit Dimensions LxWxH(inches)	Unit Weight (lbs)	Shipping Dimensions LxWxH(inches)	Shipping Weight (lbs)
MCU-KIT	4MCUCUY6NCE000	Up to 6 indoor units	32.67X7.87X18.5	59.52	38.30X9.84X21.84	70.55
	4MCUCUY4NCE000	Up to 4 indoor units		52.91		63.93
	4MCUCUY2NCE000	Up to 2 indoor units - HSP 36 - 96MBH)				

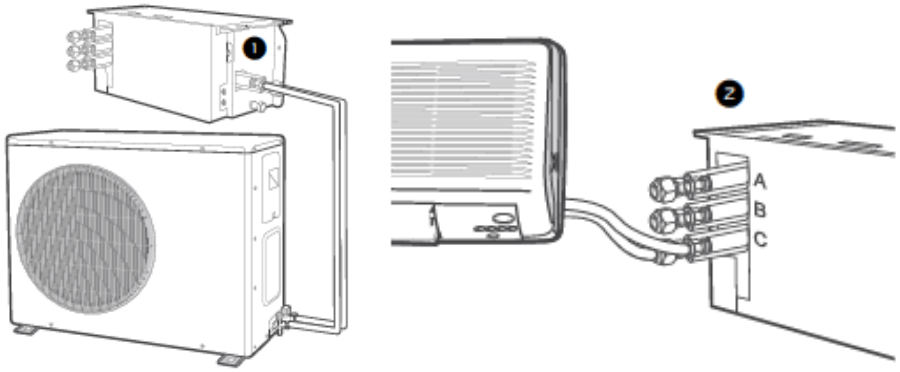
Model	4MCUCUY6NCE000	4MCUCUY4NCE000	4MCUCUY2NCE000
Example installing			
Installing indoor units	The indoor unit's capacity which is under 48MBH, can be connected in the MCU. Do not connect the indoor unit's capacity exceeds 48MBH. Single capacity range under 36MBH - Connect the liquid, gas pipe of indoor unit to each single port in MCU. Single capacity range between 36 MBH to 48MBH - Join two ports in the MCU with offered Y-connector(liquid, gas), then connect to indoor unit as above. * Reference of continuous cooling. In case of continuous cooling at -15°C(5°F) ambient condition, join two ports in the MCU with offered Y-connector, then connect to indoor unit even though unit's capacity is less than 36MBH. Option switch and key function needs to be set. Detail information refer the page 73 to 74.		The indoor unit's capacity which is greater than or equal to 36MBH, can be connected in the MCU. Do not connect the indoor unit's capacity not exceeding 36MBH. Single capacity range between 36MBH to 96MBH. - Join two ports in the MCU with offered Y-connector(liquid, gas), then connect to indoor unit as above.

MCU/EEV - 15

MCU & EEV Kits

Step 33:

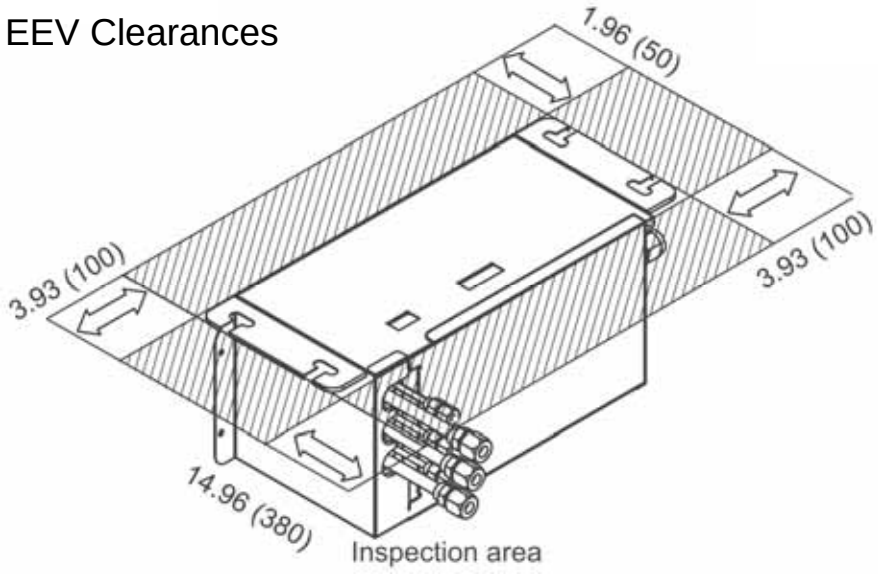
Multi-port EEV kit liquid and suction incoming refrigerant pipes are connected to their corresponding ports.



MCU/EEV - 16

MCU & EEV Kits
Step 33:

EEV Clearances



MCU/EEV - 17

MCU & EEV Kits
Step 34:

The sum of connected indoor units to each EEV kit does not exceed design specifications.

MCU/EEV - 18

MCU & EEV Kits
Step 34:

Electronic Expansion Valve Kit

Model	Port-A (MBH)	Port-B (MBH)	Port-C (MBH)
4EEVEVA24SA000	< 15.5		
4EEVEVA32SA000	> 17		
4EEVXDA24K1320	7 – 15.5	17 - 31	
4EEVXDA24K2000	7 – 15.5	7 – 15.5	
4EEVXDA24K2320	7 – 15.5	7 – 15.5	17 – 31
4EEVXDA24K3000	7 – 15.5	7 – 15.5	7 – 15.5
4EEVXDA32K2000	17 - 31	17 - 31	
4EEVXDA32K2240	17 - 31	17 - 31	7 – 15.5
4EEVXDA32K3000	17 – 31	17 – 31	17 – 31

MCU & EEV Kits
Step 34:

Electronic Expansion Valve Kit

Single port EEV Kit



Single Port EEV can be used on HP or HR
Single Port EEV: 12-Vdc (plugs into IDU's control board)

Input filter for 1-port EEV goes on the inlet Liquid Line

MCU & EEV Kits
Step 34:

Electronic Expansion Valve Kit

2 and 3 port EEV Kit

2/3 port EEV kits for HP only (can't be used for HR)

2/3 Port EEV: 208/230-Vac

MCU & EEV Kits
Steps 35-37:

Step-35: All 208/230 VAC supply voltage to the MCU & EEV(s) has been connected by a licensed electrician.

Verify local, state and national codes.

Step-36: Each MCU and 2/3-Port EEV has a service disconnect nearby per NEC installed by a licensed electrician.

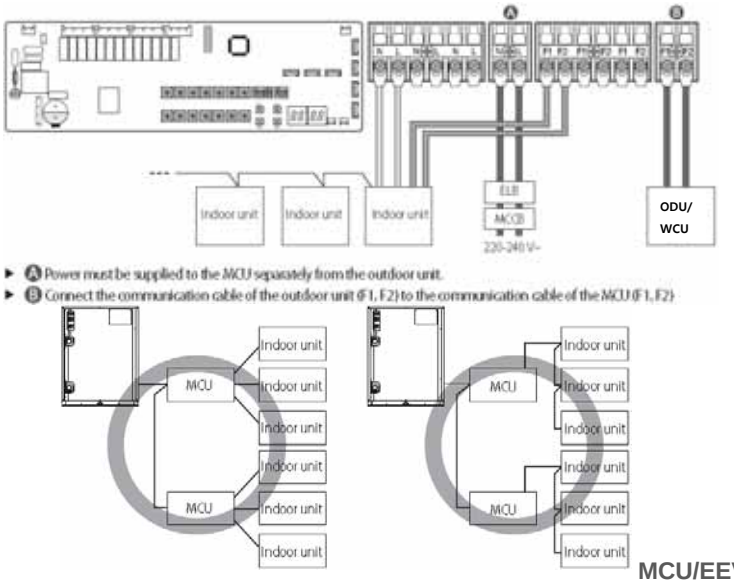
Verify local, state and national codes.

Step-37: Unused MCU and EEV outlet ports are sealed against leaks & insulated to prevent condensation.

MCU & EEV Kits

◆ **ODU/WCU Wiring to MCU**

✓ **MCU**



MCU/EEV - 23

TRANE

VRF 2-day Installer Training

Part-2: MCU & EEV Kits

Now, that you have finished the MCU & EEV Kits steps, it's time to move on to the ODUs, WCUs & IDUs…

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand

VRF 2-day Installer Training

Part-3: ODUs, WCUs & IDUs

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

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ODUs, WCUs & IDUs:
Checklist for Installation

◆ **Check list for installation**

Installation work	ODU / WCU	• Have you checked the external surface and the inside of the ODU? • Is there any possibility of short-circuit caused by the heat of an ODU? • Is the place well-ventilated and ensures space for service? • Is the outdoor unit fixed securely to withstand any external force?
	IDU	• Have you checked the external surface and the inside of the IDU? • Is there enough space for service? • Have you checked if the center of the IDU is installed horizontally?
Refrigerant pipe work		• Have you selected correct pipes? • Are the liquid and gas valves open? • Is the total number of connected IDUs within the allowable range? • Are the length and the height difference between the refrigerant pipes within the allowable range? • Are the branch joints properly installed? • Did you check the connection of liquid and gas pipes? • Have you selected correct insulator for pipes and insulated them correctly? • Did you insulate the pipes and connection part correctly? • Is the quantity of the additional refrigerant correctly weighed in? (You must record the amount of additional refrigerant on the service record paper placed inside of the ODU/WCU.)

ODUs, WCUs & IDUs:
Checklist for Installation

◆ **Check list for installation**

Refrigerant pipe work	• Have you checked if the drain pipes of the IDU and ODU/WCU are connected together? • Have you completed the drain test? • Is the drain pipe properly insulated?
Electrical wiring work	• Are the power cable and communication cable tightened firmly on the terminal board within the range of rated tightening torque? • Have you checked for cross-connection of the power and communication cables? • Have you performed the grounding to the ODU/WCU? • Did you make sure to use 2-conductor cable (not multi-conductor cable) for the communication cable? • Is the length of the wire within allowed range? • Is the wiring route correct?
Setting address	• Did you set the address of the IDU and ODU/WCU properly? • Did you set the address of the IDU and ODU/WCU properly? (When using multiple remote controllers)
Option	• If there is a possibility of the ODU/WCU unit vibrating, check whether the anti-vibration frame is correctly installed.

ODUs, WCUs & IDUs:
Step-40:

Outdoor unit(s) not placed too close to nearby walls or obstructions.

- 6-12 ton (72-144MBh): Trane recommends 12” between units for the purpose of cleaning.
- 3-5 ton (36MBh–53MBh): Trane recommends 36” from front and right side to meet NEC.

Refer to the Trane IOM for required installation clearances.

ODUs, WCUs & IDUs:
Step-40:

Clearances

Choose an installation location based on the following considerations:

•**Install the Outdoor Unit:**

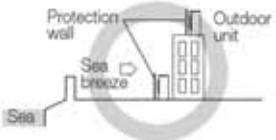
- o On a supporting structure that can bear the weight of the ODU. The supporting structure can be a base on the ground, on a waterproof roof, or in a pit.
- o With sufficient clearances around the unit for service and repairs.
- o On a flat surface that does not collect water.
- o In a well ventilated location.
- o Away from strong wind.
- o Above direct exposure to snow.
- o Where there is no risk of flammable gas leakage.
- o Where there is no exposure to salt, machine oil, sulfide gas, or corrosive environmental conditions.
- o Away from direct sea breeze.

ODUs, WCUs & IDUs:
Step-40:

➢ **Drawing review for ODUs:**

- Install the outdoor unit in a place (such as near buildings etc.) where it can be prevented from sea breeze which can damage the outdoor unit.

- If you cannot avoid installing the outdoor unit by the seashore, construct a protection wall around to block the sea breeze.



▶ Protection wall should be constructed with a solid material such as concrete to block the sea breeze and the height and the width of the wall should be 1.5 times larger than the size of the outdoor unit. Also, secure over **27"** between the protection wall and the outdoor unit for exhausted air to ventilate.

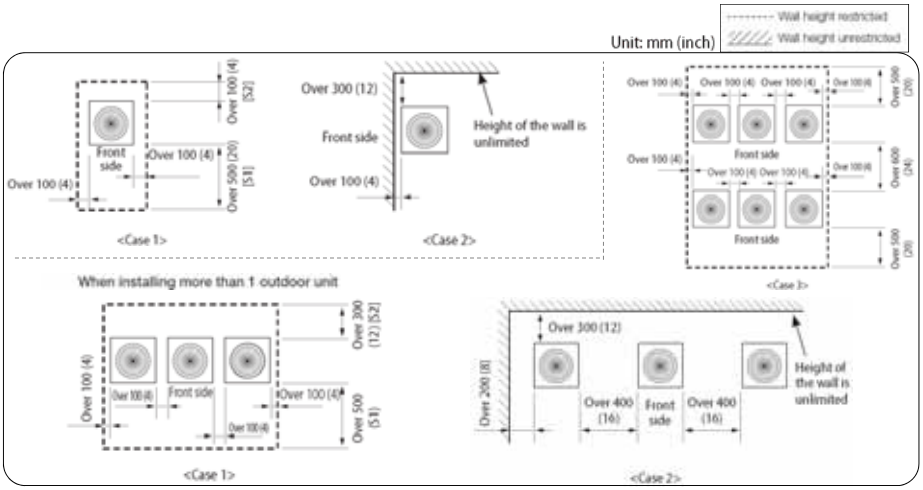
- Install the outdoor unit in a place where water can drain smoothly.

✣ If you cannot find a place satisfying above conditions, please contact manufacturer. Make sure to clean the sea water and the dust on the outdoor unit heat exchanger.

ODUs, WCUs & IDUs:
Step-40:

➢ **SPACE REQUIREMENTS for ODUs:**

- Below is minimum installation space based on operating condition of outdoor temperature of 95°F.
(If operating condition of outdoor temperature is higher than 95°F, try to have more space)



ODUs, WCUs & IDUs:
Step-40:

➢ **Drawing review**

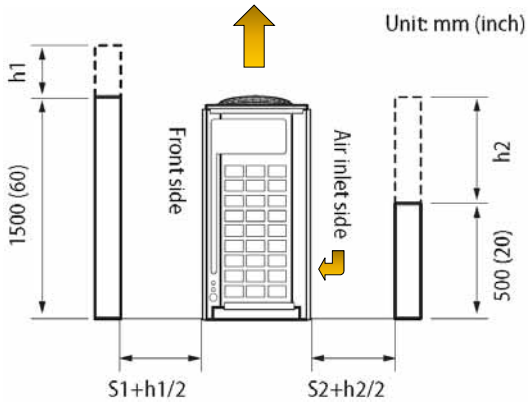
In case of 'Case 1' and 'Case 3'

• The height of the wall should be 60in or less in the front side.

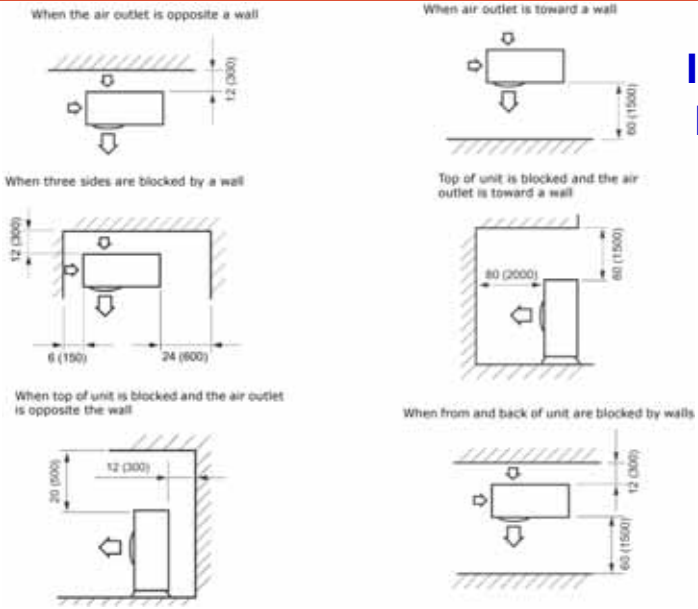
• The height of the wall should be 20in or less in the air inlet side.

• The height of the wall is unlimited on the sides.

• If the height of the wall exceeds the above value, the additional height (h1)/2, (h2)/2 should be added to the service space (S1), (S2) individually.

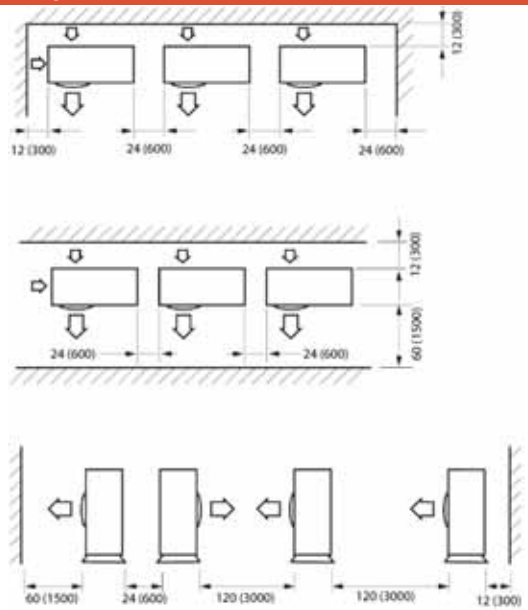


ODUs, WCUs & IDUs:
Step-40:



Individual Mini VRF Units

ODUs, WCUs & IDUs:
Step-40:



Multiple Module Mini VRF Units

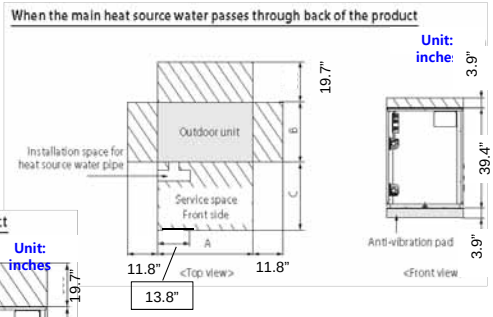
ODUs, WCUs & IDUs:
Step-40:

◆ **Design WCU system - installation space**

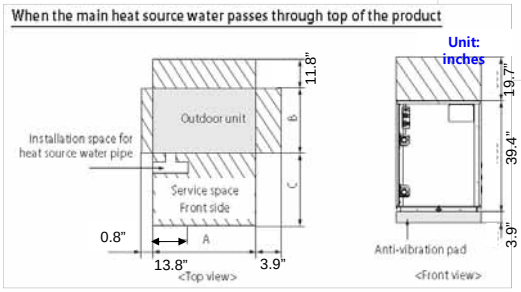
✓ **Space requirement for installation**

Model	A	B	C
4TVP072/096/120✳✳	30.3”	21.5”	23.6”
4TVP192✳✳	43.3”	21.5”	23.6”

When the main heat source water passes through back of the product



When the main heat source water passes through top of the product



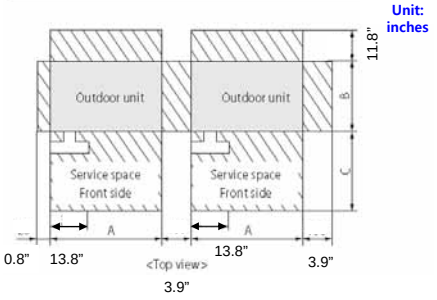
If the WCU needs to be installed close to the walls, prevent vibration from being transferred to the walls with cushioning materials, etc.

ODUs, WCUs & IDUs:
Step-40:

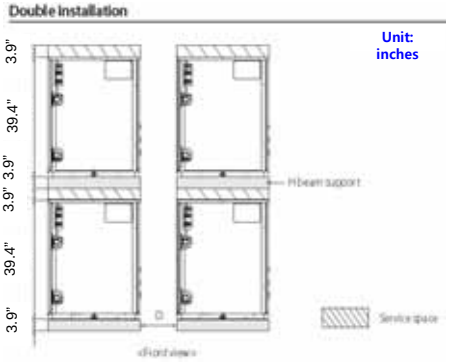
◆ **Design WCU system - installation space**

✓ **Space requirement for installation**

Module or continuous installation



Double installation



If the WCU needs to be installed close to the walls, prevent vibration from being transferred to the walls with cushioning materials, etc.

Model	A	B	C
4TVP072/096/120✳✳	30.3”	21.5”	23.6”
4TVP192✳✳	43.3”	21.5”	23.6”

ODUs, WCUs & IDUs:
Step-40:

◆ Installation

✓ WCU should be installed indoors only.

✓ The water pressure of the water pipe system connected to WCU must remain under 284-psi.

✓ Strainer and flow switch must be installed within 3-6 ft from the WCU. (Strainer must be installed on entrance side.)
- When strainer is not installed, sand, dust or rust debris may cause product breakage.
- Make sure to install a flow switch that works at minimum discharge. When optimal discharge level is not reached, heat exchanger within the WCU may break.

✓ If you stop the product for a long time (or in night time), water pipe circuit may freeze in winter. To prevent freezing …
- Drain remaining water in the water pipe
- Operate water pump continuously during outdoor unit operation, 1~5 mins before the operation and 1~5 mins after operation stops
- Install self-regulating heat cable on the water pipes

✓ When inlet water temperature is lower than 50-deg F, appropriate anti-freeze must be used according to the temperature.
(Set the WCU option switches K21 and K22 according to the usage temperature.)
- When lowest inlet water temperature is 23-deg F, freezing point of anti-freeze must be lower than 17-deg F
- When lowest inlet water temperature is 14-deg F, freezing point of anti-freeze must be lower than 5-deg F

✓ Install auto air vent valve at a point where air may remain within the pipe (such as vertical water pipe). If the air within the pipe is not vented, it may cause performance decrease or corrosion on the product or pipes.

ODUs, WCUs & IDUs:
Step-41:

Outdoor unit(s) discharge air is unobstructed and/or properly ducted.

Refer to the Trane IOM for installation clearances.

ODUs, WCUs & IDUs:
Step-41:

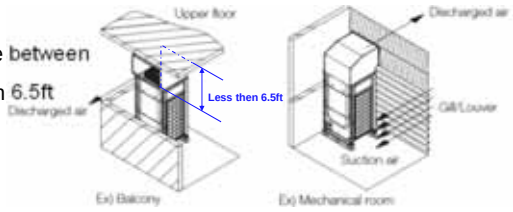
➢ **Install the outdoor unit**

2. Installing Duct (field supply) - Install Duct when it is required

- Discharge Duct

Install a discharge duct when space between the air-outlet & obstacle is less then 6.5ft

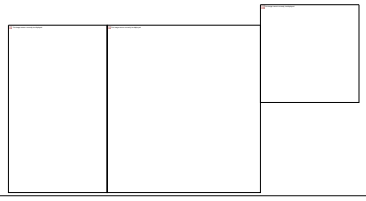
*** E.S.P for Duct is max 0.32" wg**



- Wind/Snow prevention duct

Install wind/snow prevention duct in abnormally harsh environments such as snowy or windy areas

The frame/foundation should be higher than expected snowfall



ODUs, WCUs & IDUs:
Step-41:

JW

➢ **Install the outdoor unit**

3. Louver Installation

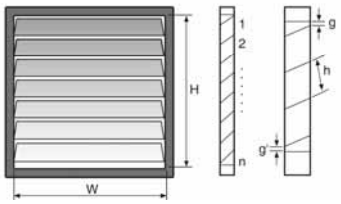
- Opening rate: 80% and more.

- Louver angle (Blade Slope): 20° and less.

- Louver shape: Don't use drainable blade type.

- Air velocity of inlet side: 394-fpm or less

$$\text{Openingh Rate} = \frac{\text{Louver Free Area}}{\text{Net Opening Size}} = \frac{W \times ((h \times n) + g + g')}{W \times H} \times 100$$

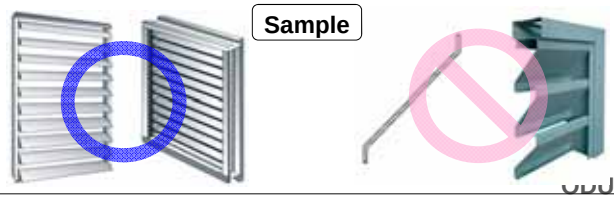


Area = CFM / Face Velocity

Lookup ODU-Fan cfm in VRF Select;
For 8-ton HR 208/230 => 9,180-cfm

Area = 9,180-cfm / 394-fpm = 23.3 ft^2

Sample



ODUs, WCUs & IDUs:
Step-42:

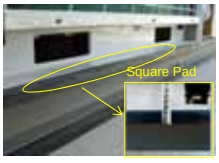
ODUs & WCUs properly secured to structure/stand.

Per Local, State or National codes

ODUs, WCUs & IDUs:
Step-42:

- **Install the outdoor unit**

Sample of Good Installation

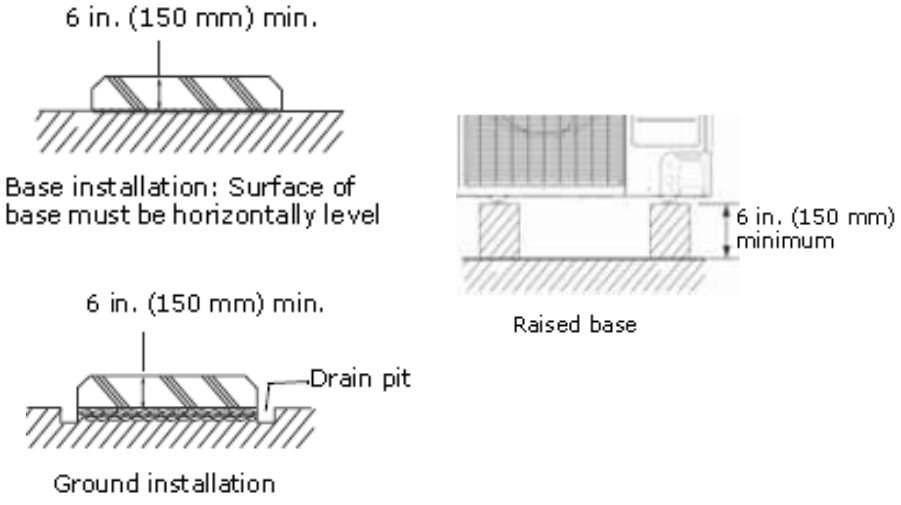


Sample of Bad Installation

ODUs, WCUs & IDUs:
Step-42:

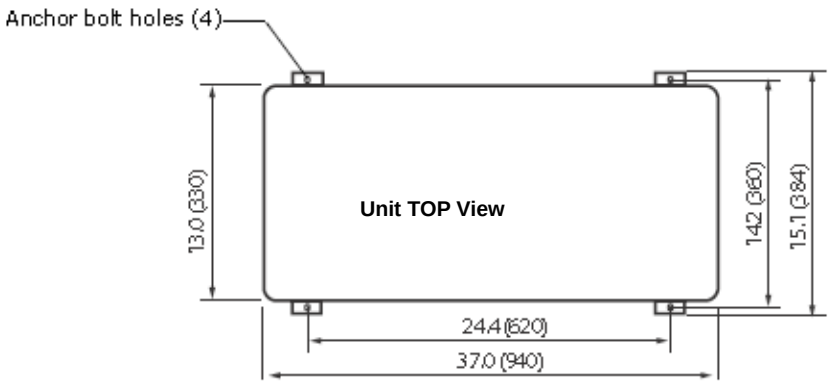
ODUs, WCUs & IDUs:
Step-42:

- **Mini VRF Mounting (3-5 ton; sizes 036–053)**



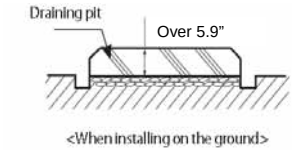
ODUs, WCUs & IDUs:
Step-42:

- **Mini VRF Mounting (3-5 ton; sizes 036-053)**

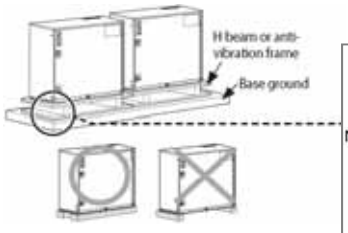


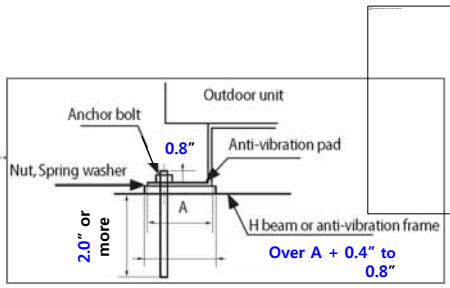
ODUs, WCUs & IDUs:
Step-42:

- **WCU Base ground construction**



<When installing on the ground>





* Product can be distorted because of its weight and vibration can be enlarged

ODUs, WCUs & IDUs:
Steps 43-44:

Step-43: Outdoor unit(s) properly drained.

Per IOM

Step-44: Outdoor unit(s) piping complete.

Per Trane recommendations

Per Local, State or National codes

ODUs, WCUs & IDUs:
Steps 43-44:

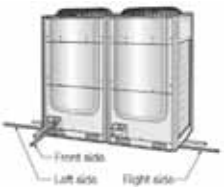
➢ **Refrigerant piping for ODUs:**

1. Remove the cover from unit.

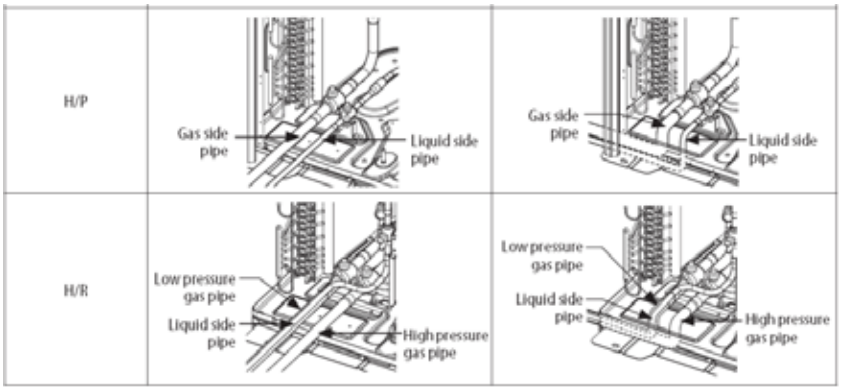
2. Separate the knock-out hole to use.

If the hole is open, small animals such as squirrels and rats may get into the unit through the hole and the unit may be damaged.

3. Fix the pipe cover of bottom side & fix the pipe cover of upper side thereafter.



Free piping & wiring directions

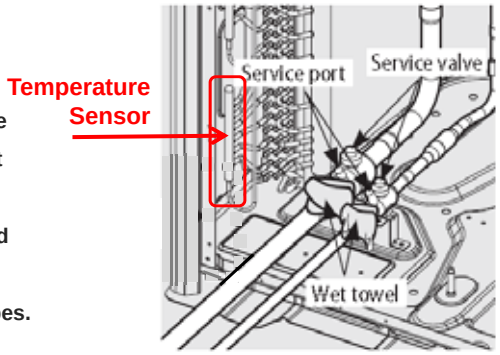


ODUs, WCUs & IDUs:
Steps 43-44:

➢ **Refrigerant piping for ODUs:**

Caution for connecting the pipe

- **When connecting the pipe to the unit, the unit may get damaged by a welding fire and a flame. Use a flame proofing cloth to protect the unit from a welding fire or flame.**
- **Ambient air temperature sensor for detecting outside temperature is located on the left side of the welding part. Make sure not to damage the temperature sensor when welding it.**
- **The O-ring and Teflon packing inside service valve may get damaged by a welding fire. Wrap the bottom side of the service valve with a wet cloth and weld it as shown above.**
- **The connecting pipes of liquid side and gas side should not contact each other. Vibration may cause a damage to the pipes.**



ODUs, WCUs & IDUs:
Steps 45-47:

Step-45: All piping is insulated and supported.

Step-46: Correct supply voltage to the outdoor unit(s) has been connected by a licensed electrician.

Step-47: Outdoor unit(s) are properly grounded per NEC.

Per Trane recommendations

Per Local, State or National codes

ODUs, WCUs & IDUs:
Step 48:

All outdoor unit(s) have proper overcurrent protection and service disconnects per NEC.

- IDU is powered separately from ODU
- Each ODU/WCU is powered separately

if a module installation

Verify overcurrent protection meets condensing unit data plate specifications.

ODUs, WCUs & IDUs:
Step 49:

All communication wires (F1/F2, OF1/OF2) have been connected (between ODU/WCU's).

ODUs, WCUs & IDUs:
Step 49:

What communications wire should be used?

Communication wire type is important

Wire requirements include:

- 18 AWG (minimum) communications wire
- Stranded shielded twisted pair
- Recommendation is to use Tracer Comm4/BACnet MSTP "purple" wire
- Use the same wire type for all VRF 2-wire links:
  - OF1/OF2, F1/F2, R1/R2, F3/F4
- Windy City Wire sells this Trane Communications Cable also suitable for VRF Systems (# 052003-S)

ODUs, WCUs & IDUs:
Step 49:

What communications wire should be used?

FEATURING SMARTWIRE GLIDE TECHNOLOGY

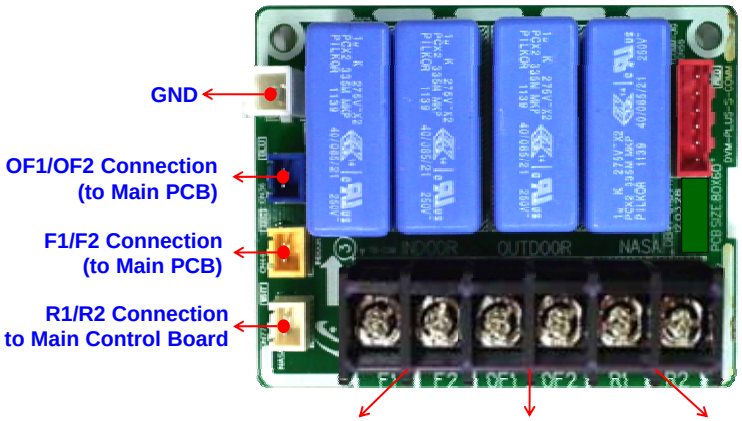
Note: See individual cable specs for detailed product descriptions for each part number.

Conductor: Tinned Copper Temperature Rating: See Spec			NEC Reference: Art. 800 Jacket: Low-Smoke PVC		Insulation: FEP Color Code: Chart #2
Part Number	**AWG**	**Cond**	**Jacket**	**Stripe**	**Notes**
052003-S	18	2	Violet	None	Trane Comm 3/4; BACnet
0520033-S	18	2	Yellow	None	Trane Comm 3/4; BACnet
0520034-S	18	2	Orange	None	Trane Comm 3/4; BACnet
0520036-S	18	2	Green	None	Trane Comm 3/4; BACnet

ODUs, WCUs & IDUs:
Step 49:

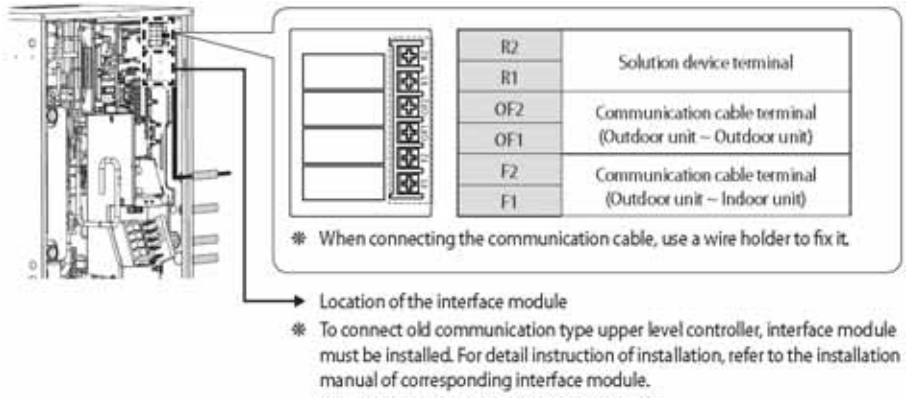
ODU/WCU - Communication Board

Communications Link Wiring



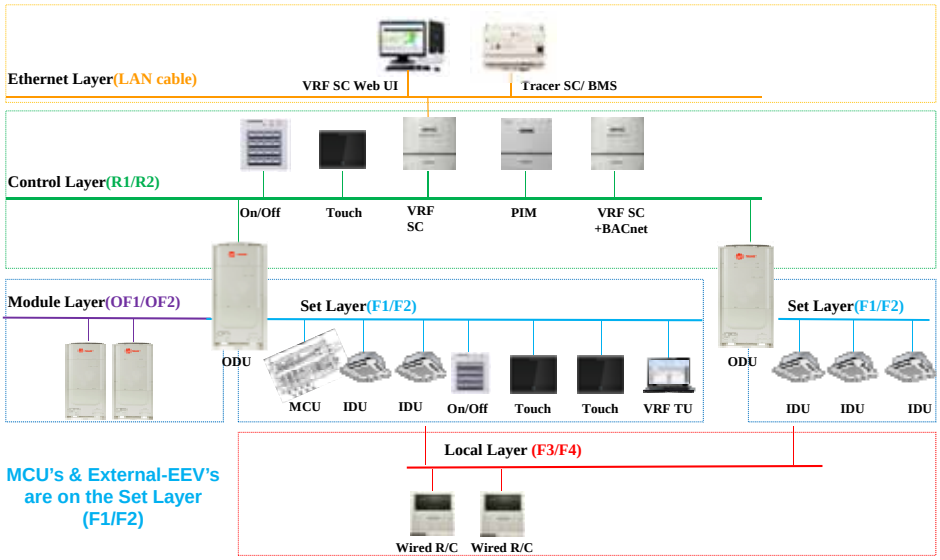
ODUs, WCUs & IDUs:
Step 49:

- **WCU Wiring**
  - ✓ **Communication Cable connection**



ODUs, WCUs & IDUs:
Step 49:

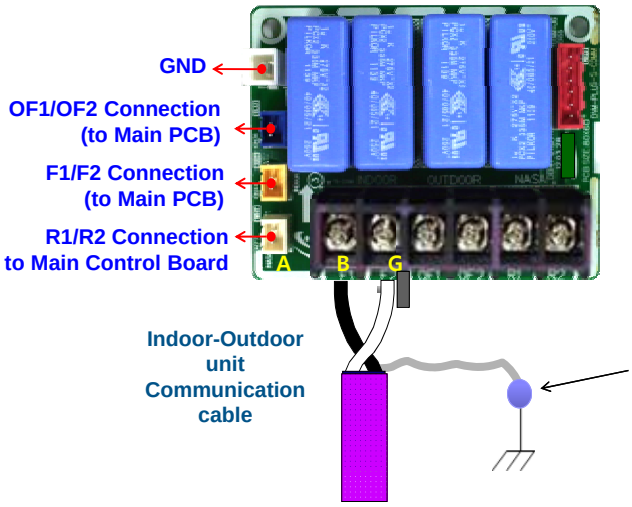
Installation Wiring Across a VRF System - System Diagram



ODUs, WCUs & IDUs:
Step 50:

Shielded communication cable shielding wire is grounded at the outdoor unit on a separate terminal than the main service ground connection.

ODUs, WCUs & IDUs:
Step 50:



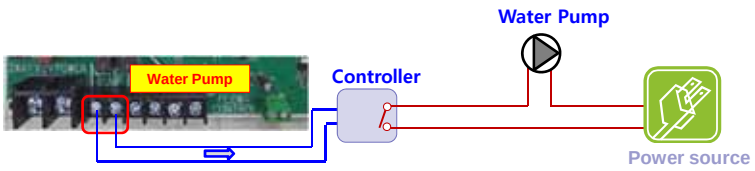
Maintain Polarity IAW Best Practices

- Ground shield at ODU/WCU end of link ONLY
- **Do not connect at main service ground terminal**

ODUs, WCUs & IDUs:
Step 52:

◆ **Water system - Wiring**

✓ ***Pump out***
- Signal Output: Dry contact
- To interlock pump operation with WCU system



Remote controller	Contact signal	Water pump	Remark
On	➡ Close (30sec after controller on) ➡	Pump on	Delay for water pump "on"
Off	➡ Open(30sec after controller off) ➡	Pump stop	Delay for PHE

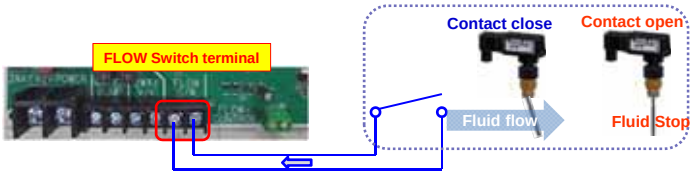
* PHE : Plate heat exchanger

ODUs, WCUs & IDUs:
Step 52:

◆ Water system - Wiring

✓ *Flow switch (Mandatory)*

- Signal Input: Dry contact from flow switch
- Product will not operate if flow switch is not installed.
- If Flow switch is not detected E435 will occur (Flow switch Error)



Water flow rate	Contact signal	Set working
Above setpoint	Close	System working normally
Below setpoint	Open	System stop & Error (E435)

ODUs, WCUs & IDUs:
Step 53:

All indoor units are securely suspended/hung with appropriate hardware.

Per Trane recommendations

Per Local, State or National codes

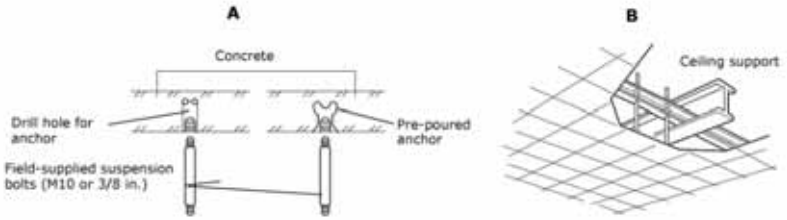
ODUs, WCUs & IDUs:
Step 53:

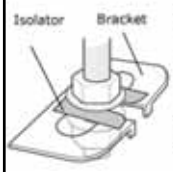
To mount the unit:

1. Place the template on the spot where the unit is to be installed and mark the holes.

   Note: *The template may shrink or stretch slightly due to heat or humidity. Before drilling holes, verify proper dimensions between the marks. Refer to "Installing the Front Panel" for final finishing clearances.*

2. Determine the appropriate type of suspension bolts and anchors according to the ceiling type. Insert bolt anchors into existing ceiling supports (A) or construct a suitable support (B).





3. Install suspension bolts at all four locations.
4. Screw two nuts to each suspension bolt, leaving space between the nuts for hanging the unit.

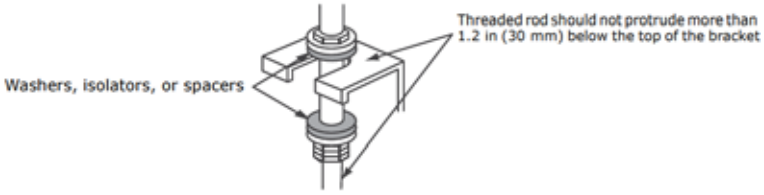
   Note: *If the suspension bolts are longer than 59 in. [1.5 m]) or vibrations are a concern, place isolators on the brackets to absorb vibrations.*

5. Hang the unit by its support brackets between the two nuts.
6. If pad stoppers or isolators are used to absorb vibrations, place them on the brackets.

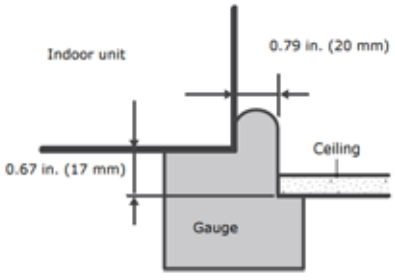
ODU/WCU/IDU - 39

ODUs, WCUs & IDUs:
Step 53:

7. Tighten the nuts to suspend the unit following the guidelines in the figure below.



8. Maintain proper spacing between the unit and the ceiling; refer to the following figure.



9. Adjust the level of the unit with a leveler.

ODU/WCU/IDU - 40

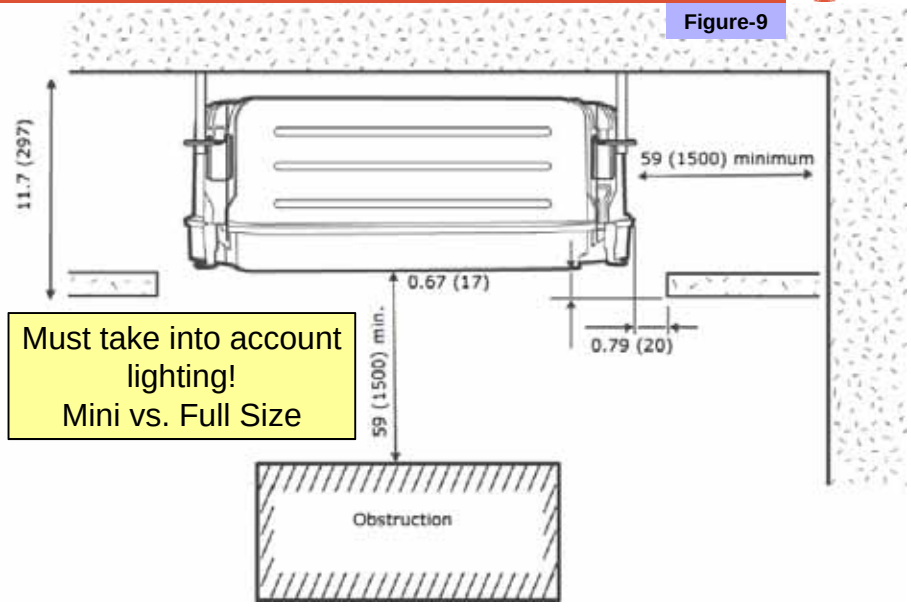
ODUs, WCUs & IDUs:
Step 54:

4-way and Mini 4-way cassette units are 59" minimum from nearby walls and obstructions on all sides.

Minimum 10-feet between installed 4-way and mini 4-way cassettes.

ODUs, WCUs & IDUs:
Step 54:

Figure-9

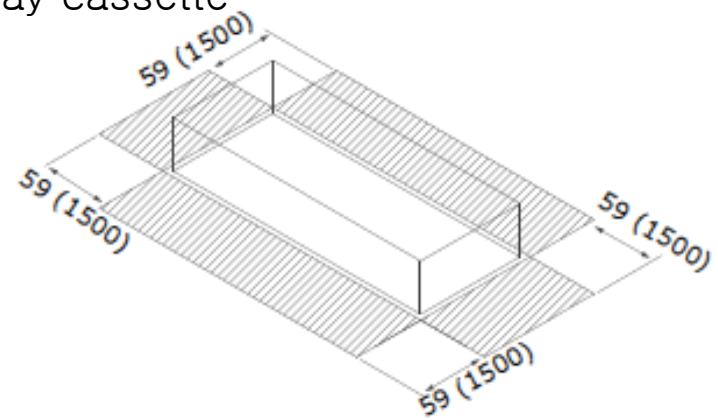


Must take into account lighting!
Mini vs. Full Size

ODUs, WCUs & IDUs:
Step 55:

1-way a cassette units are 59" minimum from nearby walls and obstructions.
(on all sides excluding return air side of unit)

1-way cassette



U/IDU - 43

ODUs, WCUs & IDUs:
Step 56:

Convertible units must have sufficient space in front of them.

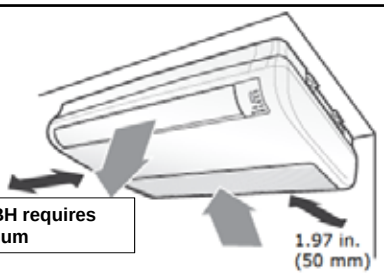
Obstructions to the side of the unit are as follows:

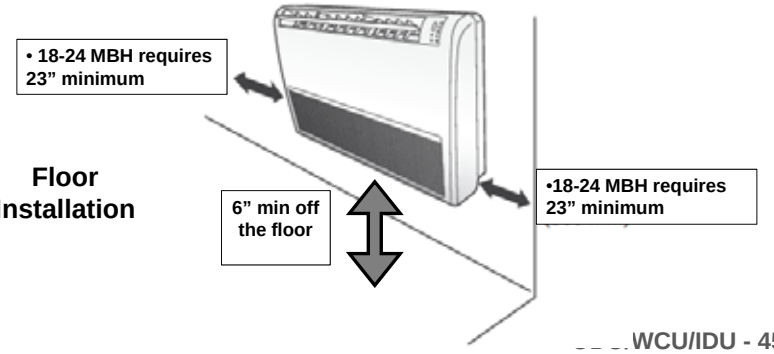
•18-24 MBH requires 23” minimum

ODU/WCU/IDU - 44

ODUs, WCUs & IDUs:
Step-56:

Ceiling Installation





ODUs, WCUs & IDUs:
Steps 57-59:

Step-57: Wall mounted (High Wall) ideally should be 6-ft minimum from the ground – but must be at least 1-ft from the ceiling.

Step-58: All condensate drain pipes are sized properly, installed and insulated.

Per Local, State or National codes

Step-59: All condensate drain pipes are supported per local and state requirements.

Trane recommends every 3-5 feet.

ODUs, WCUs & IDUs:
Step 60:

Condensate lines from units with Trane condensate pumps (cassette units, optional pumps for ducted units) tap into the top of main drain (not in side or bottom).

Figure 10

ODUs, WCUs & IDUs:
Steps 61-62:

Step-61: P-traps from ducted units are primed before operation.

On applicable units

Step-62: All flare connections are torqued to factory specification.

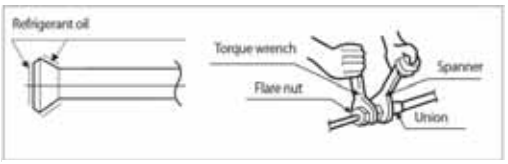
ODUs, WCUs & IDUs:
Steps 61-62:

➢ **Connecting the Refrigerant Pipe**

Figure-11

1. Purging the unit
- **Indoor unit is supplied with a pre-charge of nitrogen gas. (insert gas)**
- **Purge the nitrogen gas before connect the refrigerant pipe**

2. Connect the refrigerant pipe
- **A smaller one for the liquid refrigerant**
- **A larger one for the gas refrigerant**
- **The inside of copper pipe must be clean & has no dust**
- **Apply a light coat of refrigerant oil to the face of the flare before**



Pipe Diameter (OD)	Torque (ft. / lbs.)
1 / 4"	10.46 - 12.6
3 / 8"	24.02 - 29.4
1 / 2"	36.43 - 44.4
5 / 8"	45.45 - 55.5

Check if you flared the pipe correctly. There are some examples of incorrectly flared pipes below.

ODUs, WCUs & IDUs:
Steps 63-64:

Step-63: All refrigerant pipe insulation is installed and sealed.

Per Trane recommendations

Per Local, State or National codes

Step-64: All refrigerant pipe and fittings are insulated, sealed, and supported.

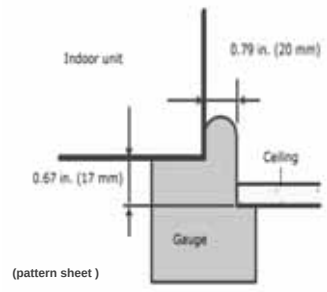
Per Trane recommendations

Per Local, State or National codes

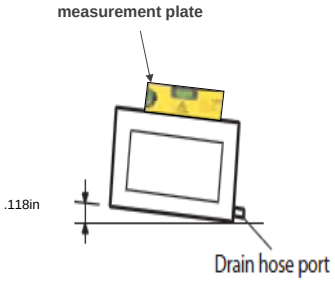
ODUs, WCUs & IDUs:
Step 65:

All indoor units are installed level.

Sample



Cassette Type



Duct Type

ODUs, WCUs & IDUs:
Step 66:

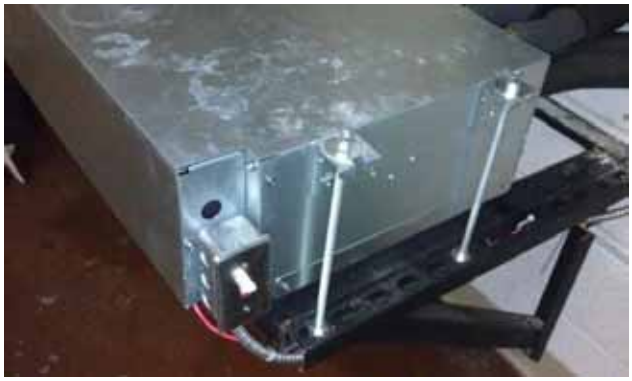
All 208/230VAC supply voltage to the indoor unit has been connected by a licensed electrician per NEC.

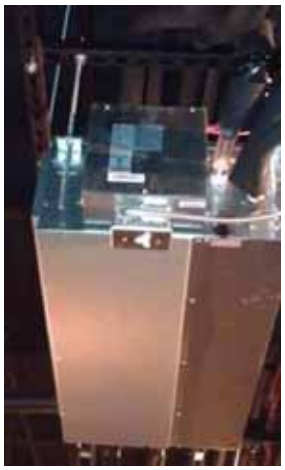
Per Local, State or National codes

ODUs, WCUs & IDUs:
Step 67:

Each indoor unit has a service disconnect nearby per NEC, installed by a licensed electrician.

Per Local, State or National codes





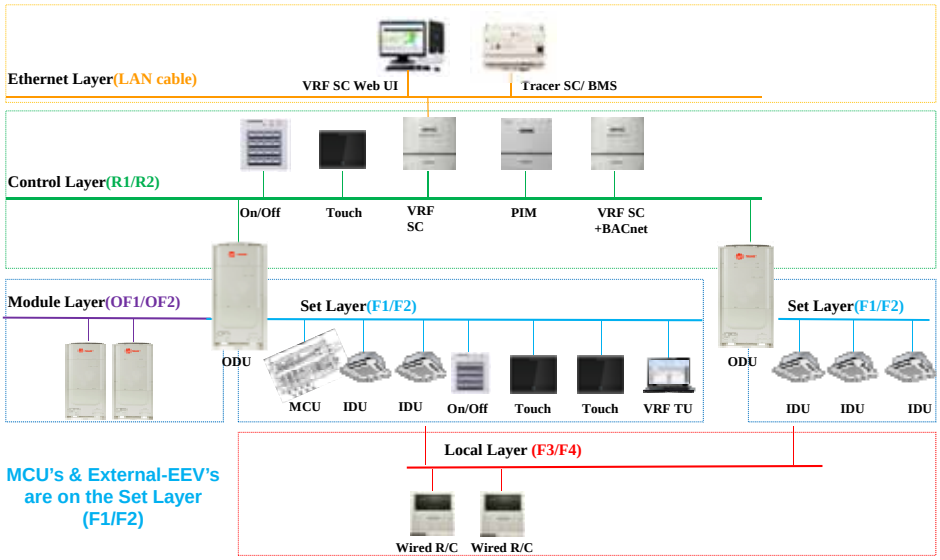
ODUs, WCUs & IDUs:
Steps 68-69:

Step-68: All communication cable (F1/F2, F3/F4) wire is 18 AWG, twisted shielded cable. (see Step-10 for more information)

Step-69: All communication wires (F1/F2) have been connected.

ODUs, WCUs & IDUs:
Steps 68-69:

Installation Wiring Across a VRF System - System Diagram



ODUs, WCUs & IDUs:
Step 70:

All wired controllers F3/F4 communication connections are connected to indoor unit(s).

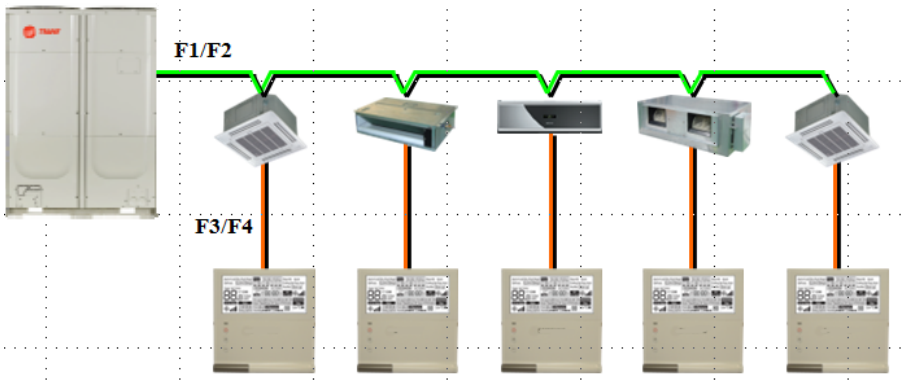
Maximum 16 indoor units with wired controller (maximum 4 with wireless)

Communications Wiring

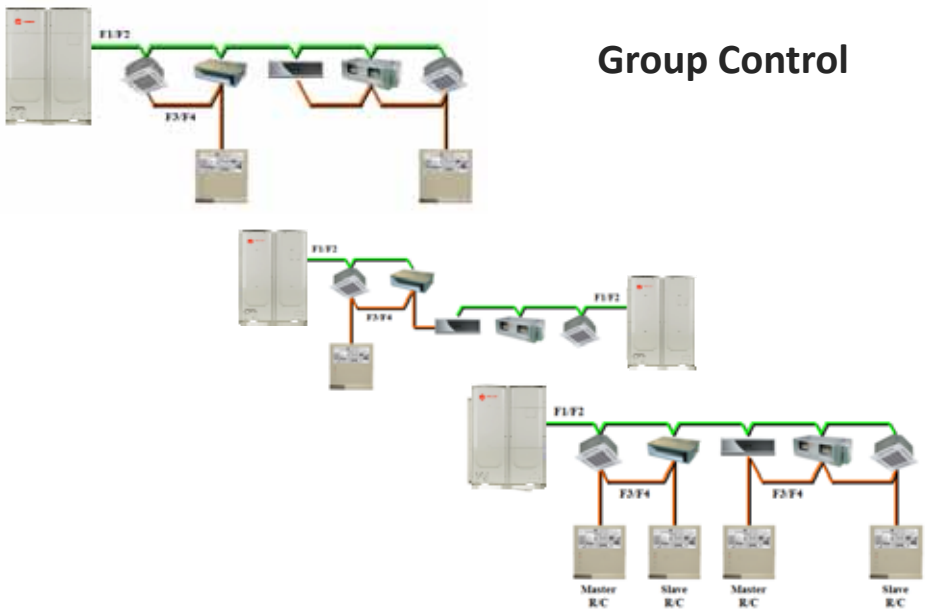
Reminder…

- Wired controllers are communicating devices, not “On/Off” contact switches like standard thermostats
- It is important to use communications cable for connections to the associated Indoor Unit(s)
- Recommendation is to use Tracer type Comm4/BACnet “purple” wire
  - 18 AWG stranded
  - Twisted, shielded pair

Individual Control



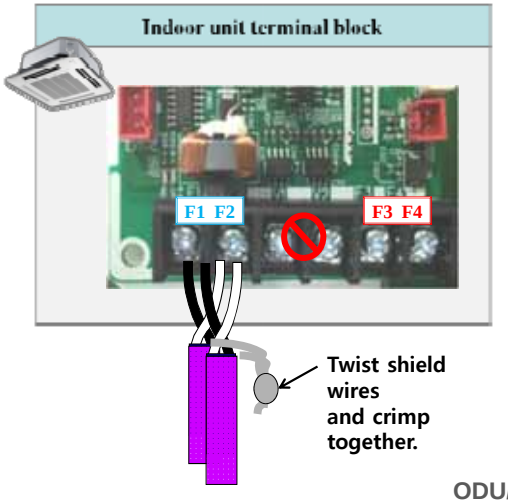
ODUs, WCUs & IDUs:
Step 70:



Group Control

ODUs, WCUs & IDUs:
Step 71:

Step-71: Communication (F1/F2) cable has bare wire bonded to the bare wire that will connect to the next indoor unit, MCU, or EEV kits in daisy chain (do not ground at indoor units).



ODU/WCU/IDU - 60

ODUs, WCUs & IDUs:
Steps 72-73:

Step-72: Shielded and bare wire in communication cable (F1/F2) is not touching indoor unit PCB's or other communication or voltage connections.

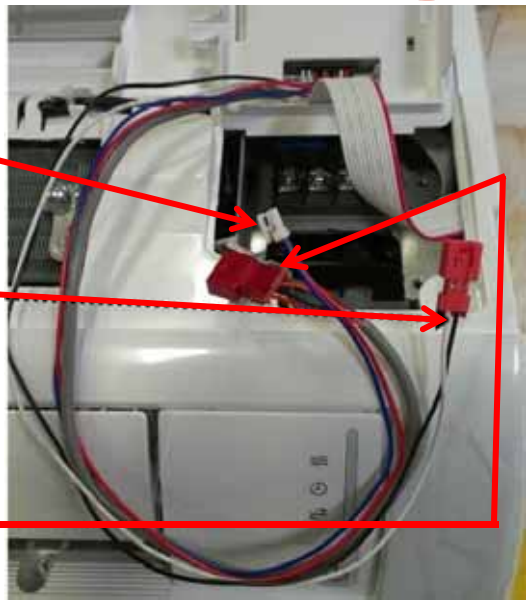
Step-73: Main addresses have been set for each IDU.
- ❑ Nothing to set in IDU's
- ❑ Auto addressing will take place during initialization.
- ❑ After auto addressing you can go back in and accept or change to desired address.
- ❑ Be sure one IDU per system is addressed 00

ODUs, WCUs & IDUs:
Steps 75-76:

Step-75: Condensate pumps have been installed in wall mounted units (optional).

Step-76: Condensate pump overflow relay is connected to break unit operation for high wall and convertible units (optional).

ODUs, WCUs & IDUs:
Steps 75-76:

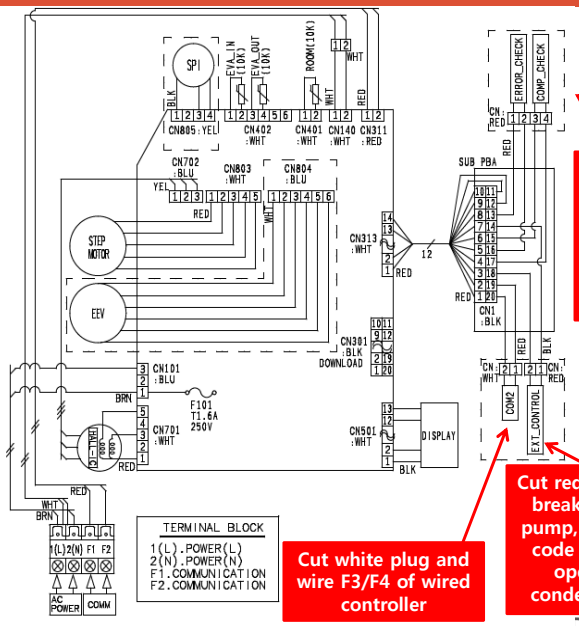


F3/F4, Wired Remote Controller

Ext Control for condensate pump

Interlock and Error Check Function

ODUs, WCUs & IDUs:
Steps 75-76:



Cut red, 4 wire plug to interlock "something" to unit operation (erv, etc.) and/or to utilize the "error check" function.

Cut red plug, wire to break condensate pump, select option code to have unit operate with condensate pump

Cut white plug and wire F3/F4 of wired controller

ODUs, WCUs & IDUs:
Step 77:

Step-77: Condensate pumps have been installed in ducted units and connected to indoor unit PCB (optional).

Trane brand condensate pumps, internal installation

ODUs, WCUs & IDUs:

➢ **Settings for IDU installation:**

Set the additional function with option code
- **Refer to installation Manual for option code information**
- **Wrong setting can cause malfunction or reliability problem**

When you change out a board, be sure to remove the EEPROM so you can use it with the new board.

Note

The option-code will be saved in EEPROM

Function	No. of digits to set (Logical [physical])	Code structure (Logical)
Indoor unit Product Code setting (Digit 2=1)	24 [20]	01xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting1 (Digit 2=2)	24 [19]	02xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting2 (Digit 2=5)	24 [19]	05xxxx-1xxxxx-2xxxxx-3xxxxx

ODUs, WCUs & IDUs:
Steps 78-81:

Step-78: Indoor Unit option code has been set for Trane condensate pumps that were installed inside ducted units.

Step-79: Indoor Unit option code has been set to accept a Central Controller.

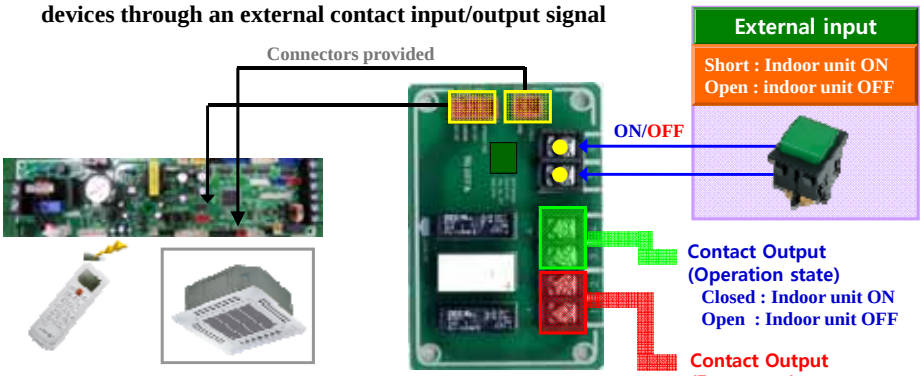
Step-80: Indoor Unit option code has been set for units that will be controlled with an external contact control (optional).

Step-81: If using external contact control, the indoor unit option code has been set for Thermo ON/OFF or Operation ON/OFF.

ODUs, WCUs & IDUs:
Step 81:

External Contact Interface module

- **To control the indoor unit and interlock control with other devices through an external contact input/output signal**



Optional for all IDU's except Hi-Wall.
Hi-Wall already has board integrated into main into the unit. For everything else, this is not standard factory installed option and must be ordered as an accessory.

ODUs, WCUs & IDUs:
Steps 82-84:

Step-82: 4-way and Mini 4-way cassette panels (trim covers) have been installed (ships separately from cassette units).

Step-83: Cassette unit height has been adjusted for proper level difference between ceiling and unit chassis (cardboard guide included with indoor units).

No special tools are provided.

Step-84: Cassette panels have been installed and properly connected to indoor unit PCB to "DISPLAY" and "LOUVER" connections.

ODUs, WCUs & IDUs:
Steps 85-87:

Step-85: All equipment filters are installed.

Step-86: Ducted unit duct connections are complete and sealed.

Per Local, State or National codes

Step-87: Duct design allows the units to operate within specified static pressure range.

Static pressure information is available in installation manuals, submittals, and other technical documents.

ODUs, WCUs & IDUs:
Steps 88-89:

Step-88: All wall-mounted units have a separate expansion valve (EEV) installed.

Use single port unit EEV only on HR, 1/2/3 port EEV kits for HP.

Single Port EEV: 12-Vdc
2/3 Port EEV: 208/230-Vac

Step-89: Ducted unit static pressure settings have been adjusted for installed duct design.

Product Code change, refer to service manuals.

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Part-3: ODUs, WCUs & IDUs

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Wiring – Communications and Power Wiring

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

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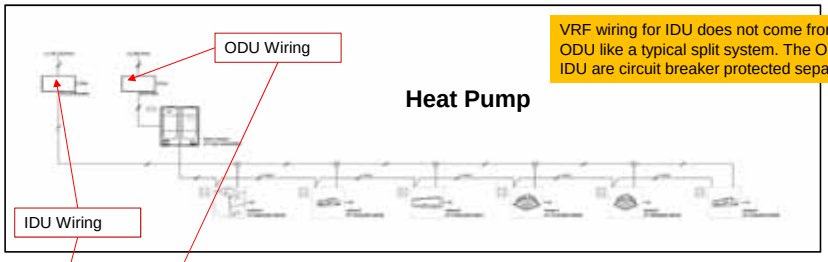
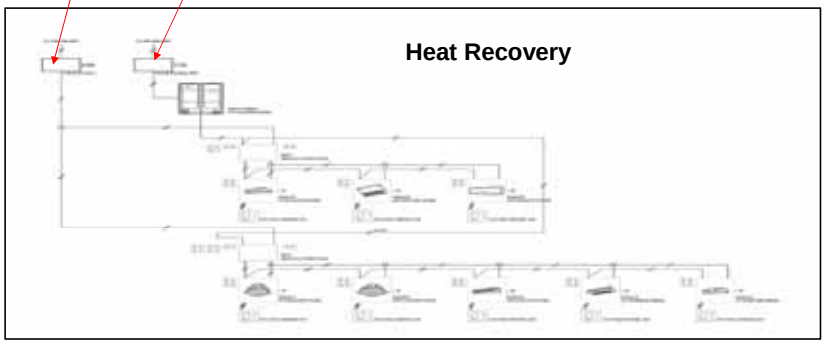
Power Wiring

TRANE

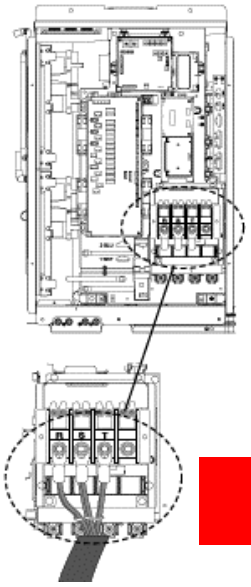


VRF wiring for IDU does not come from the ODU like a typical split system. The ODU and IDU are circuit breaker protected separately.



Wiring-2

ODU Power Wiring

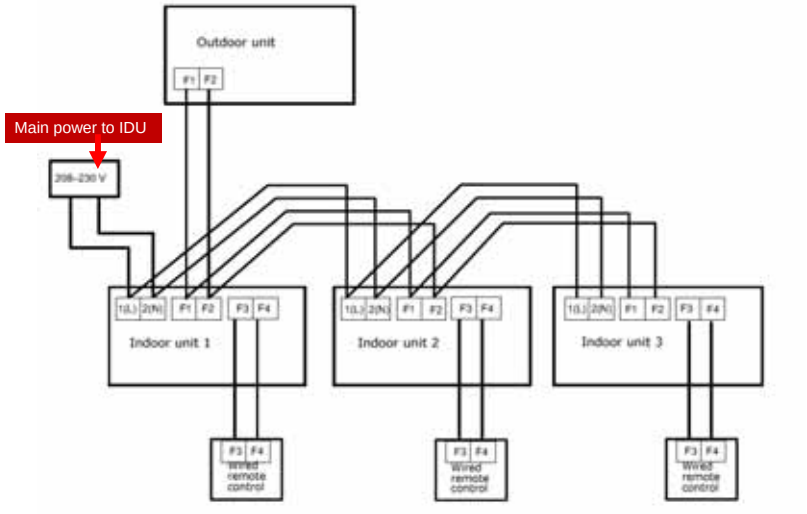


2. Cut the power cable to an appropriate length and connect it to the terminals in the power supply box with a solderless ring terminal (see Figure 25, p. 42).

Use ring terminals

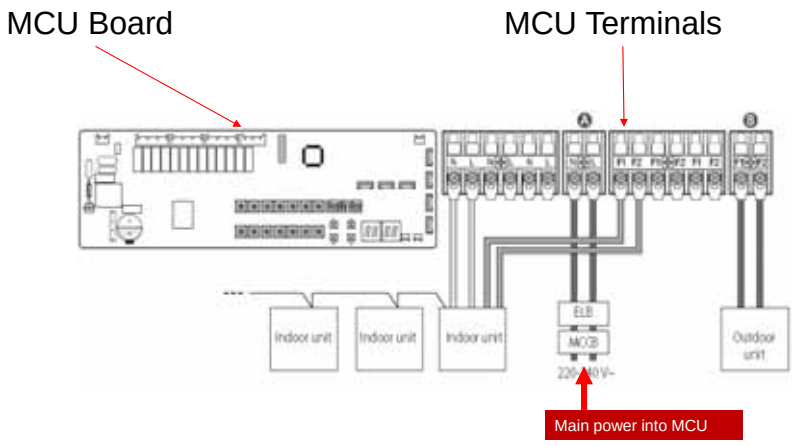
Wiring-3

IDU Power Wiring – Heat Pump



Wiring-4

IDU Power Wiring – Heat Recovery



Wiring-5

Wiring

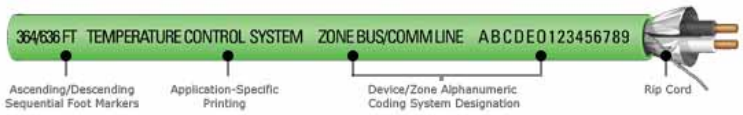
Communication Wiring Requirements

1. Copper
2. 2 conductor wire
3. 18AWG
4. Twisted
5. Shielded
6. Stranded
7. Use the same wire type for all VRF 2-wire communication links:
   - OF1/OF2, F1/F2, R1/R2, F3/F4

Recommendation is to use Tracer Comm4/BACnet MSTP "Trane purple" wire. Windy City Wire sells this Trane Communications Cable also suitable for VRF Systems (# 052003-S). It is not required though as long as the wire used meets the specifications outlined above.

Wiring-6

Wiring



FEATURING SMARTWIRE GLIDE TECHNOLOGY

Note: See individual cable specs for detailed product descriptions for each part number.

Conductor: Tinned Copper Temperature Rating: See Spec			NEC Reference: Art. 800 Jacket: Low-Smoke PVC		Insulation: FEP Color Code: Chart #2
Part Number	**AWG**	**Cond**	**Jacket**	**Stripe**	**Notes**
052003-S	18	2	Violet	None	Trane Comm 3/4; BACnet
0520033-S	18	2	Yellow	None	Trane Comm 3/4; BACnet
0520034-S	18	2	Orange	None	Trane Comm 3/4; BACnet
0520036-S	18	2	Green	None	Trane Comm 3/4; BACnet

Wiring-7

Wiring - Techniques

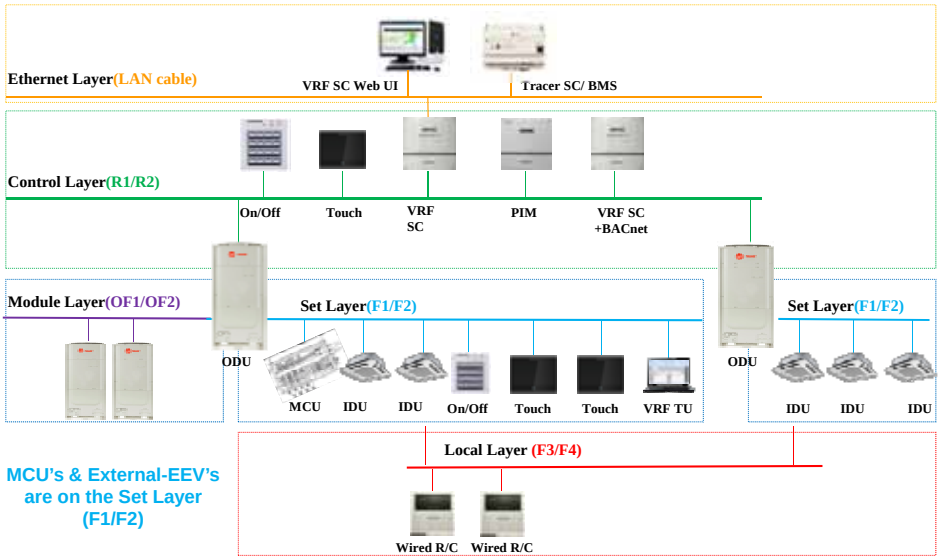
Wiring Techniques

1. Two methods allowed
   - Home run
   - Daisy Chain
     - When wiring a heat recovery, the F1/F2 layer can look like a modified daisy chain or modified star configuration
2. Everything comes or goes from the main ODU. The only thing that would land on a Sub unit is OF1/OF2 from the Main.
3. No breaks in the wiring
4. Use electrical fork connectors or ring terminals supplied with the units.

Wiring-8

Wiring – Hierarchy

Control System Diagram



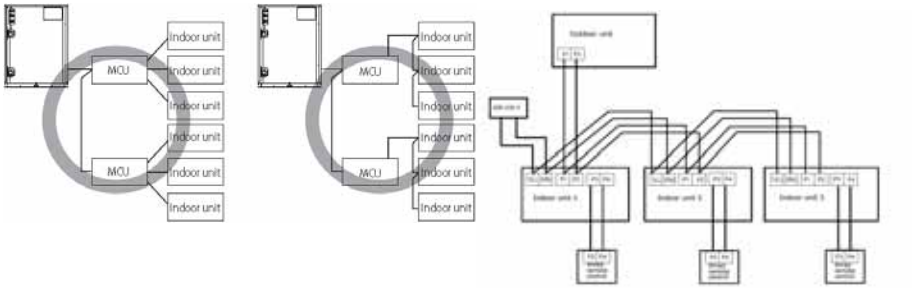
MCU's & External-EEV's are on the Set Layer (F1/F2)

Wiring-9

Wiring – F1/F2

F1/F2 is used as the service layer and for communication between the ODU and indoor equipment (MCU, EEV, Indoor unit).

- As a communication layer, F1/F2 is used to receive and transmit information that pertains to system health and system requirements to and from the OD equipment and the ID equipment.
- As a service layer you can connect the TUT to troubleshoot and make changes to the option codes associated with the IDU.



HR wiring

HP wiring

Wiring-10

Wiring – R1/R2

R1/R2 is used for the upper layer of communication between the main ODU and the upper level controller. The upper level controller could be a VRF SC or a touchscreen controller.

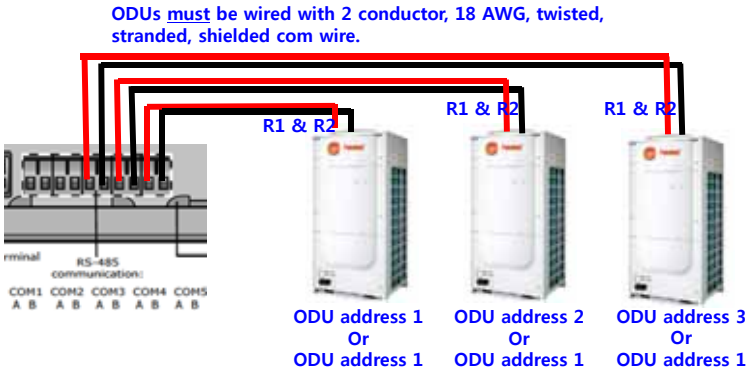
Two wiring options -

1. Home run
2. Daisy chain

Wiring-11

Wiring – R1/R2

Home Run

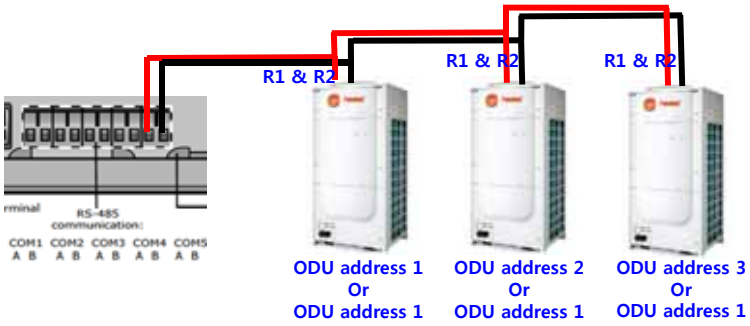


Wiring-12

Wiring – R1/R2

Daisy Chain

ODUs must be wired with 2 conductor, 18 AWG, twisted, stranded, shielded com wire.



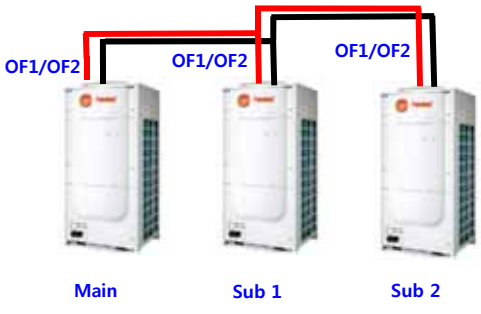
Wiring-13

Wiring – OF1/OF2

OF1/OF2 is used to communicate between the main and sub outdoor units.

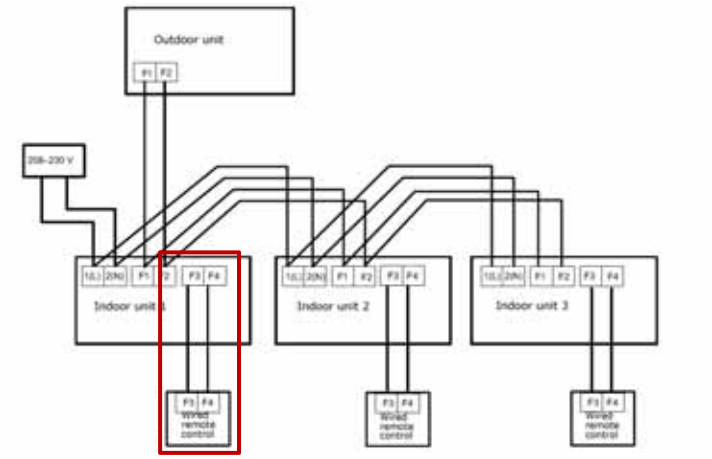
- OF1/OF2 is limited to the specific system. You cannot wire OF1 and OF2 between ODU's that are not on the same system.

ODUs must be wired with 2 conductor, 18 AWG, twisted, stranded, shielded com wire.



Wiring-14

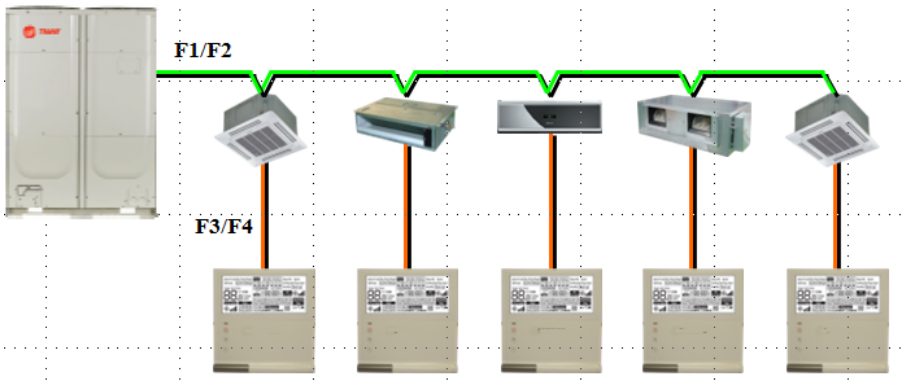
Wiring – F3/F4



Wiring-15

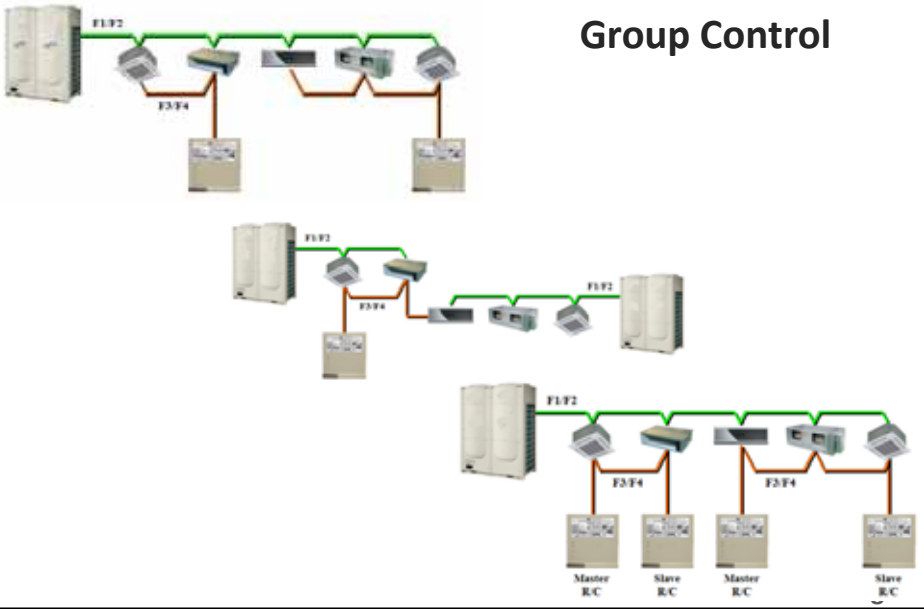
Wiring – F3/F4

Individual Control



Wiring-16

Wiring – F3/F4



Group Control

Any Questions?

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Part-4: Addressing

Presented by:

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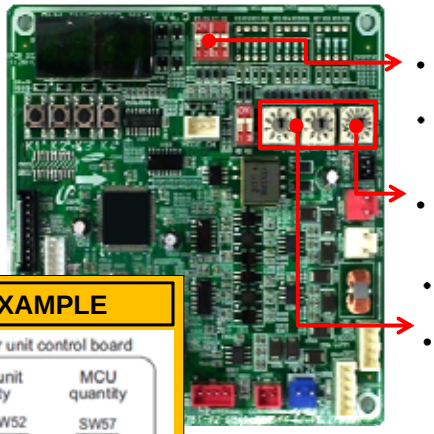
Addressing:
Step 51:

TRANE

Indoor unit quantity and MCU quantity rotary switches have been set in MAIN outdoor unit.

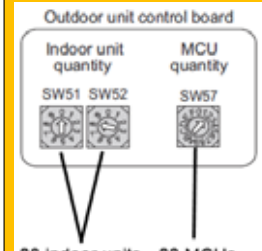
There is nothing physically to set in the indoor units.

Addressing:
Step 51:



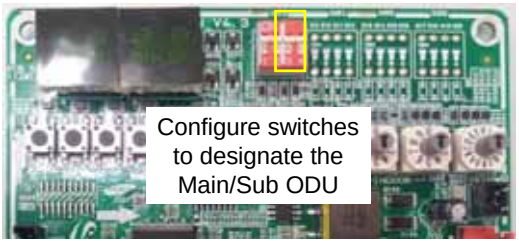
- Main and sub dip switches
- Rotary switch to set mode control unit (MCU) **Quantity** for heat recovery units
- Set switches only at Main ODU-WCU (sub-units set to 0)
- Switches to Set Indoor Unit **Quantity**
- Set switches only at Main ODU-WCU (sub-units set to 0)

EXAMPLE



Addressing:
Step 52:

DIP switches have been configured in all of the outdoor units.

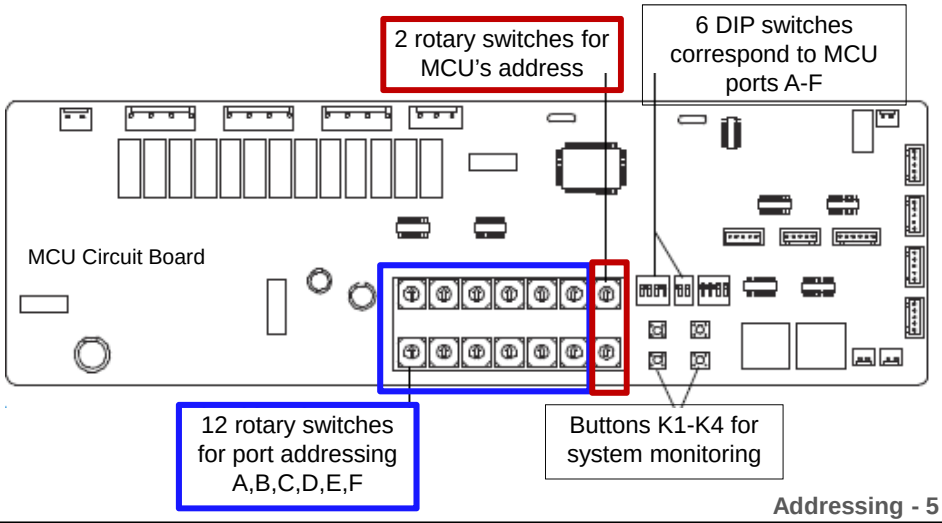


On/On : Main Unit | On/Off : Sub Unit 1 | Off/On : Sub Unit 2

Ex: Designate the MAIN, SUB1, SUB2

Addressing:
Step 38:

MCU's address and MCU's port addresses have been setup and documented on the component location sheet.



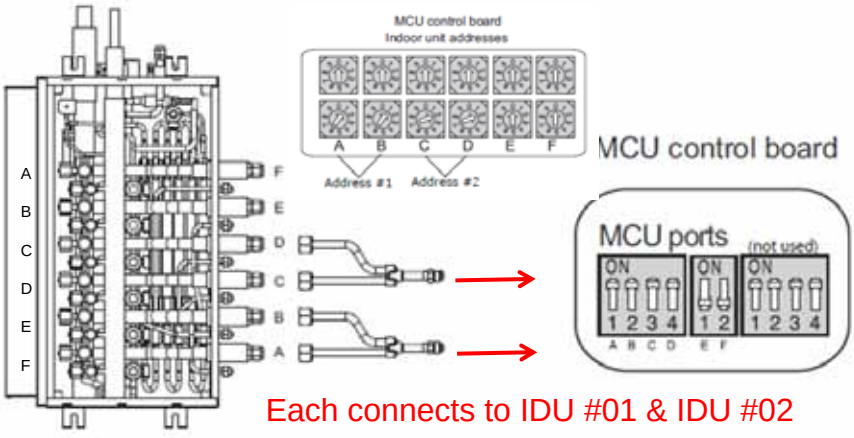
Addressing - 5

Addressing:
Step 39:

Addressing the Mode Control Unit Step #39

If a Y-joint is used to connect two ports to a single indoor unit, set the two DIP switches corresponding to those ports to **On**.

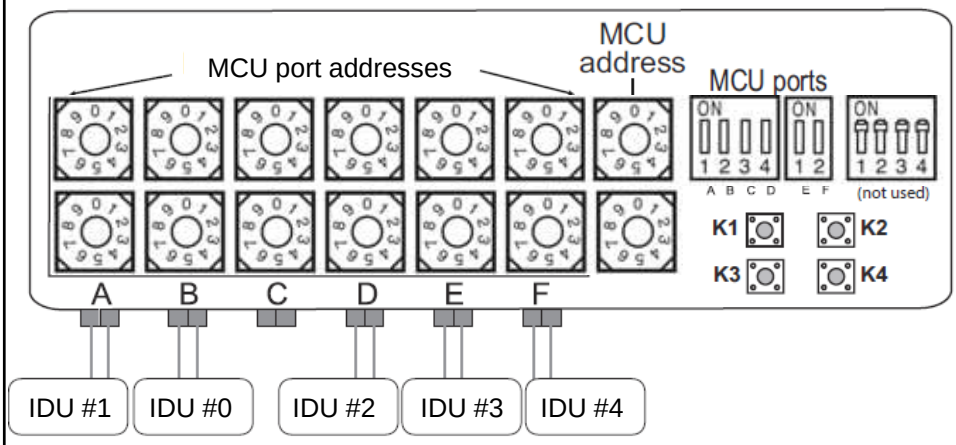
Figure 9. Example of DIP switch settings for an MCU connected to indoor units with Y-joints



Each connects to IDU #01 & IDU #02

Addressing:
Step 39:

Addressing the Mode Control Unit for IDUs -Step #39



Addressing:
Step 39:

- Visually track piping from MCU to IDU
- Port and IDU addresses need to match!
- Use VRF Technician Utilities Tool to:
  - View IDU serial numbers and IDU addresses
  - Cycle IDU On/Off to identify unit
  - Change IDU address
- More details during controls discussion

Example Problem

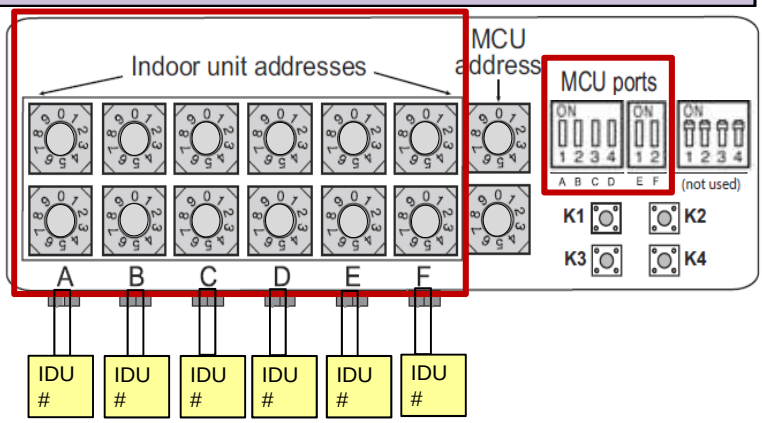
Based on what we have learned, let's fill out our Component Location Sheet for the Clarksville Lab.

Locate your VRF Select Report and Component Location Sheet provided to you.

Example Problem (part-2)

Set Indoor unit main addresses on the MCU PCB(s) according to the MCU port they are connected to (A,B,C,D,E,F). Don't forget to turn off any MCU ports not used in DIP switches 1-6.

MCU mounted low

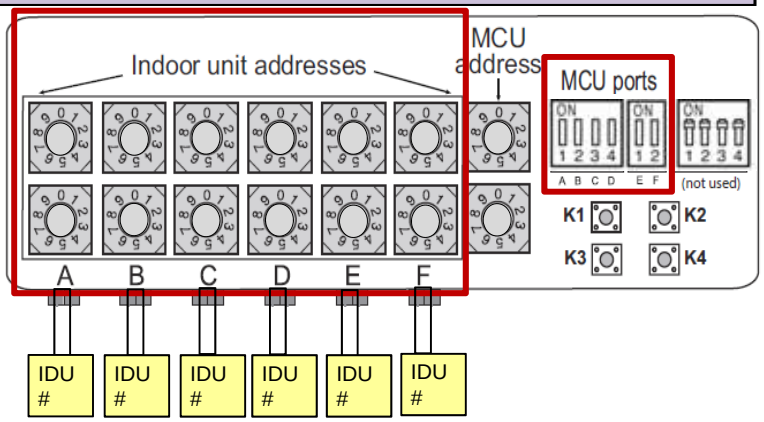


Place the IDU number that you used on your Component Location Sheet in the yellow boxes & set the switches above to match by use of your pen.

Example Problem (part-2)

Set Indoor unit main addresses on the MCU PCB(s) according to the MCU port they are connected to (A,B,C,D,E,F). Don't forget to turn off any MCU ports not used in DIP switches 1-6.

MCU mounted high



Place the IDU number that you used on your Component Location Sheet in the yellow boxes & set the switches above to match by use of your pen.

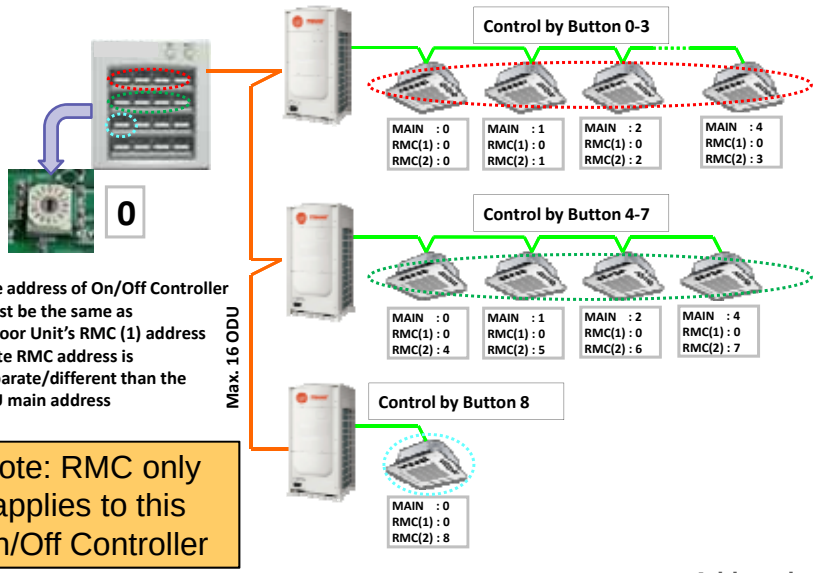
Addressing:
Step 74:

Step-74: The RMC(1) address in the IDU matches the Rotary Switch address in the On-Off Controller (0 ~ F).

The RMC(2) in the IDU has been set by the remote controller (wired or wireless) to specify the button on the ON/OFF controller that will control that unit (0 ~ F).

Note: RMC only applies to On/Off Controllers & Group Controls.

Addressing:
Step 74:



The address of On/Off Controller must be the same as Indoor Unit's RMC (1) address
Note RMC address is separate/different than the IDU main address

Note: RMC only applies to this On/Off Controller

ODUs, WCUs & IDUs:

- Settings for IDU installation:

Set the additional function with option code
- Refer to installation Manual for option code information
- Wrong setting can cause malfunction or reliability problem

When you change out a board, be sure to remove the EEPROM so you can use it with the new board.

Note
The option-code will be saved in EEPROM

Function	No. of digits to set (Logical [physical])	Code structure (Logical)
Indoor unit Product Code setting (Digit 2=1)	24 [20]	01xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting1 (Digit 2=2)	24 [19]	02xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting2 (Digit 2=5)	24 [19]	05xxxx-1xxxxx-2xxxxx-3xxxxx

TRANE

VRF 2-day Installer Training

Part-4: Addressing

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand.

VRF 2-day Installer Training

Part-5: Controllers

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

Controllers: 3. Tech Utility Tool

Step-98:

Objective - Confirm option codes and addresses are correctly programmed into the Indoor Units (written to the EEPROM).

Controllers
Writing Option Code to Indoor Units

- Indoor unit configuration setting

Function	No of digits to set (Logical [physical])	Code structure (Logical)
Indoor unit product option code(Basic)	24 [20]	01xxxx-1xxxxx-2xxxxx-3xxxxx
Installation option 1	24 [19]	02xxxx-1xxxxx-2xxxxx-3xxxxx
Installation option 2	24 [19]	05xxxx-1xxxxx-2xxxxx-3xxxxx
Indoor unit address (MAIN/RMC)	24[8]	0Axxxx-1xxxx-2xxxxx-3xxxxx
Specific bit setting (option, address,…)	24[5]	0Dxxxx-1xxxxx-2xxxxx-3xxxxx

Controllers - 3

Controllers: 3. Tech Utility Tool
Step-98:

Both addressing and option codes for indoor units are modified electronically which allows the technician to setup the system from one location.

- Recommend method: VRF Technician Utilities tool

Using VRF Technician Utilities, we will demonstrate

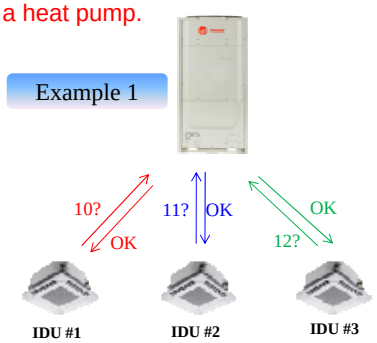
- Setting/changing the address of indoor units
- Re-configuring indoor unit control options

Controllers - 4

Automatic Addressing of Indoor Units

2.48-50

- **Automatic Addressing**
  - When you initially power the outdoor unit (ODU), it will send a command down the F1 & F2 layer asking “who is communicating”.
  - The indoor units will respond saying “I am here” as they receive the command
  - *The indoor units respond randomly. This has nothing to do with how it is wired*.
  - Once the indoor units acknowledge the ODU, the outdoor unit will send an address to them in consecutive order (0,1,2,3,4,etc..)
  - These virtual addresses now need to be matched to the port addresses that were assigned by the rotary switches on the MCU box, or they need to be confirmed if this is a heat pump.



Heat Pump Startup

Heat Pump Application

2.48-50

Indoor units	IDU #0	IDU #1	IDU #2
Auto address	0	1	2
Confirm address	0	1	2

With a heat pump application, there are no MCU ports to match. You can simply confirm the addresses with TUT so they do not change.

Note: If you don't confirm the addresses on a heat pump, and you bring them into a VRFSC, this will cause issues. If the IDU addresses get randomly addressed again, the VRFSC will be controlling the incorrect unit. Always confirm your addresses and setup the system before setting up the controls.

Controllers: 3. Tech Utility Tool

Step-98: Addressing Indoor Units

Heat Pump System Startup

- **FILL OUT COMPONENT LOCATION SHEET COMPLETELY AND METHODICALLY.**
- Power up outdoor unit to initialize "tracking"
  - outdoor unit automatically assigns an address to each indoor unit
- Verify indoor unit quantity on the outdoor unit display (AdXX)
- If error(s), correct issues
- Press K3 button on ODU to reset and re-initialize tracking
- Use VRF Technician Utilities (TUT) to confirm addresses of indoor units
- Match IDU addresses (given during auto-addressing) to component location sheet
  (*there are no physical rotary switches on IDUs*)
  - ✓ Using "Change Address" icon, confirm IDU addresses so that they match with the component location sheet.

Heat Recovery Startup

Controllers: 3. Tech Utility Tool

Step-98: Addressing Indoor Units

Heat Recovery Systems with MCUs

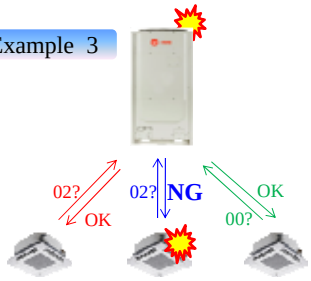
- **FILL OUT COMPONENT LOCATION SHEET COMPLETELY AND METHODICALLY.**
- (Manually) address ports at MCUs using rotary switches
- Power up system to initialize the tracking process.
- Correct any error codes that may happen. Initialize tracking again.
- Match IDU addresses (given during auto-addressing) by serial number to the port addresses on the MCU rotary switches. This information will be on the component location sheet.
  - ✓ Two choices:
    - Confirm the addresses with TUT, then manually change the rotary switches to match your port addresses with your IDU addresses. Update the component location sheet.
    - Change the auto address to match the port address using the component location sheet.

Heat Recovery application

2.48-50

Do not change addresses one at a time with TUT. By doing so you will create a duplicate addresses. This will cause an E108 error code.

Example 3



MCU Port addresses	0	1	2
IDU auto address	2	1	0
Change address	0	X	X

MCU Port addresses	0	1	2
IDU auto address	2	1	0
Change address	X	1	X

MCU Port addresses	0	1	2
IDU auto address	2	1	0
Change address	X	1	2

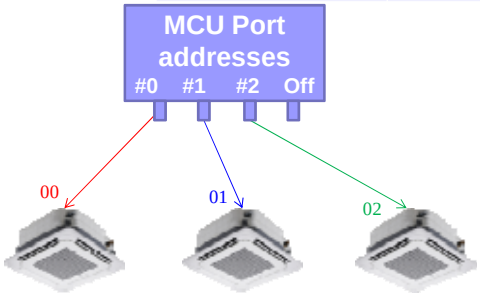
Controllers - 11

Heat Recovery application

2.48-50

Change addresses to match the port address all at once to avoid error codes.

MCU Port addresses	0	1	2
IDU auto address	2	1	0
Change address	0	1	2



Controllers - 12

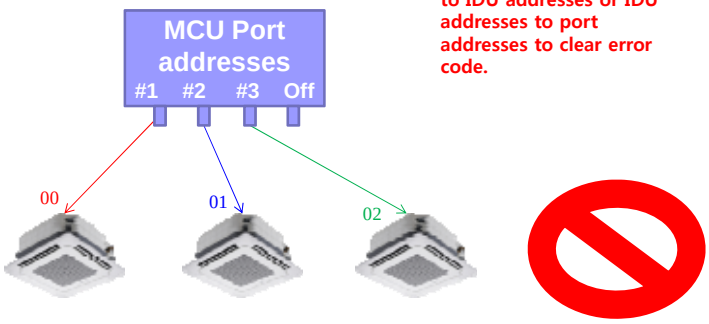
Heat Recovery application

2.48-50

If the range of MCU port addresses are different from the range of IDU addresses an E108 will also be present. Since the auto address starts with 0, we always start our port addressing with 0 to prevent this issue.

MCU Port addresses	1	2	3
IDU address	0	1	2

Two different ranges. Match either port address to IDU addresses or IDU addresses to port addresses to clear error code.



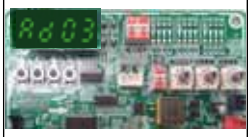
Controllers: 3. Tech Utility Tool

Step-98: Addressing Indoor Units

Sequence	Display	Check point
1		● Check display digit - Digit “8” flicker consecutively from left to right - Check whether seven-digit defect or not
2		● Starting Tracking - “Ad” means starting tracking - Right 2 digits show number of communicated indoor units.

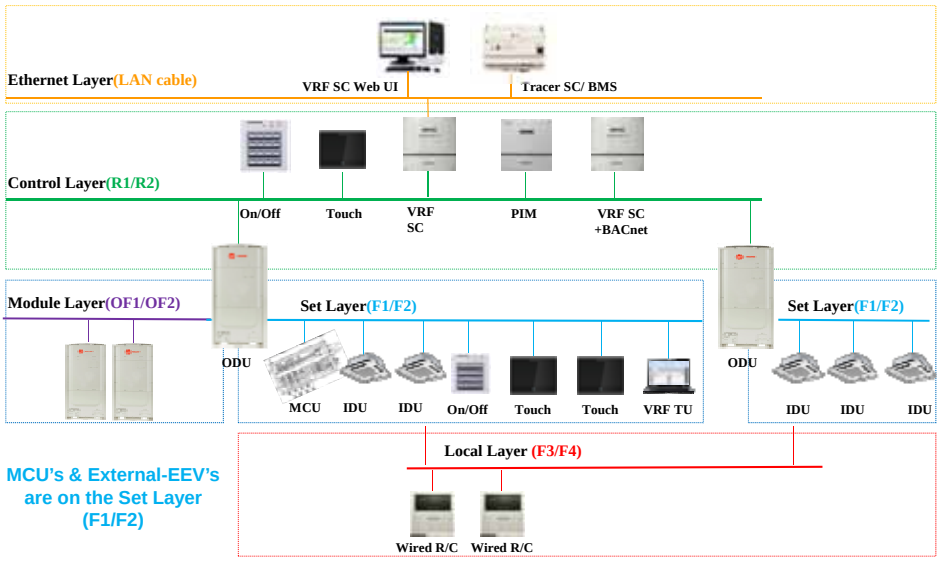
Controllers: 3. Tech Utility Tool

Step-98: Addressing Indoor Units

Sequence	Display	Check point
3		● Communication between outdoor and indoor unit - ODU tracking indoor unit address 0 to 63 - If ODU receives response from indoor unit, the address displays on the right side ★ 0~63 : Indoor address
4		● UP display - After tracking complete, "UP" is shown on display at initial installation. - "UP" means UnPrepared : Not ready to operation - Hit K1 5-sec to implement **Auto Commissioning** (Clg/Htg mode) → more than 1 hour or implement Auto Trial Operation → "UP" disappearance → normal operation
5	 	● Digit meaning - A0 XX : Indoor address - C1 XX : MCU address

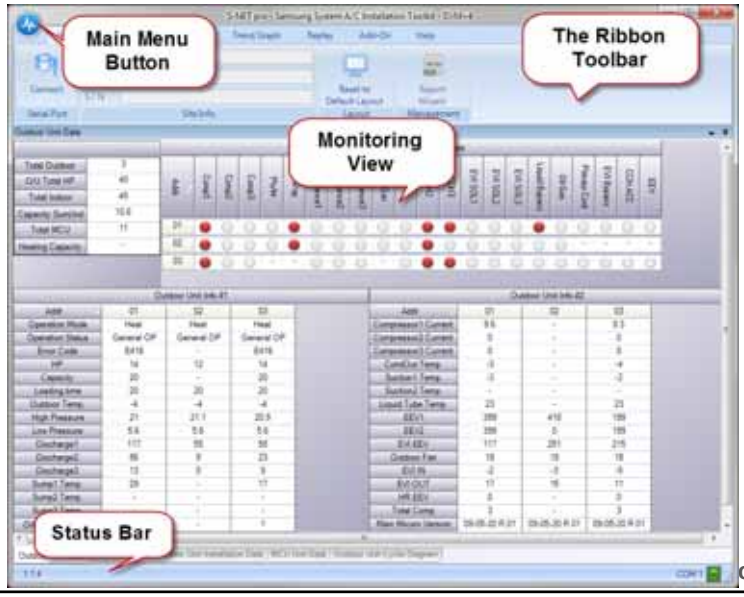
Installation Wiring Across a VRF System

Control System Diagram



Controllers: 3. Tech Utility Tool
Step-98: Addressing Indoor Units

VRF Technician Utilities Main Screen



Controllers: 3. Tech Utility Tool
Step-98: Addressing Indoor Units

VRF Technician Utilities – Changing Addresses

VRF TU Home Screen – Indoor Unit Data tab
Note: Serial numbers will be included on actual systems

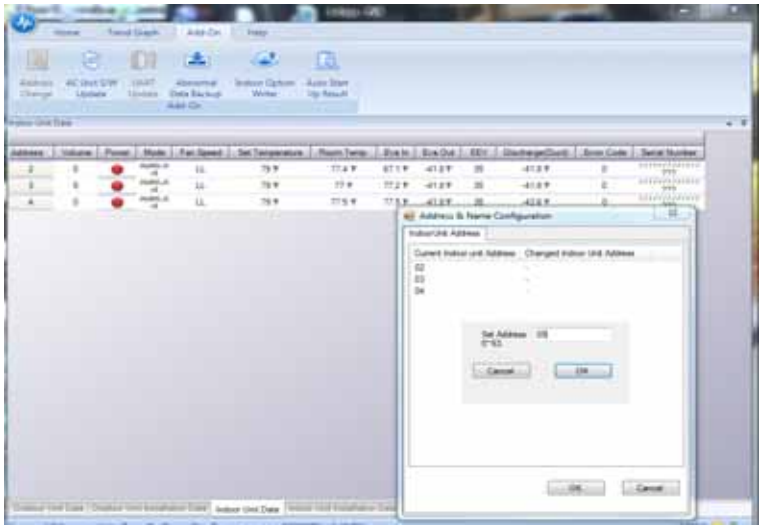
Controllers: 3. Tech Utility Tool
Step-98: Addressing Indoor Units

VRF Technician Utilities – Changing Addresses

Indoor Unit Data, Add-On Tab
Changing Address Window

Controllers: 3. Tech Utility Tool
Step-98: Addressing Indoor Units

VRF Technician Utilities – Changing Addresses



Changing the Address of an Indoor Unit

Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

03.3

Indoor unit configuration setting

Function	No of digits to set (Logical [physical])	Code structure (Logical)
Indoor unit product option code(Basic)	24 [20]	01xxxx-1xxxxx-2xxxxx-3xxxxx
Installation option 1	24 [19]	02xxxx-1xxxxx-2xxxxx-3xxxxx
Installation option 2	24 [19]	05xxxx-1xxxxx-2xxxxx-3xxxxx
Indoor unit address (MAIN/RMC)	24[8]	0Axxxx-1xxxx-2xxxxx-3xxxxx
Specific bit setting (option, address,…)	24[5]	0Dxxxx-1xxxxx-2xxxxx-3xxxxx

Installation Option 1 (Code 2) and
Installation Option 2 (Code 5)
are where most configuration changes are done

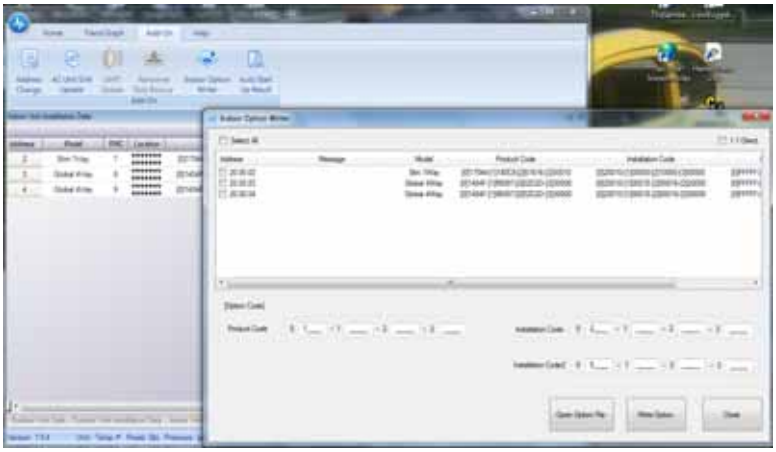
Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

VRF Technician Utilities – Installation Options

Viewing Product Options and Installation Options
Installation Option (1) and (less frequent) 2 are most common field changes

Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

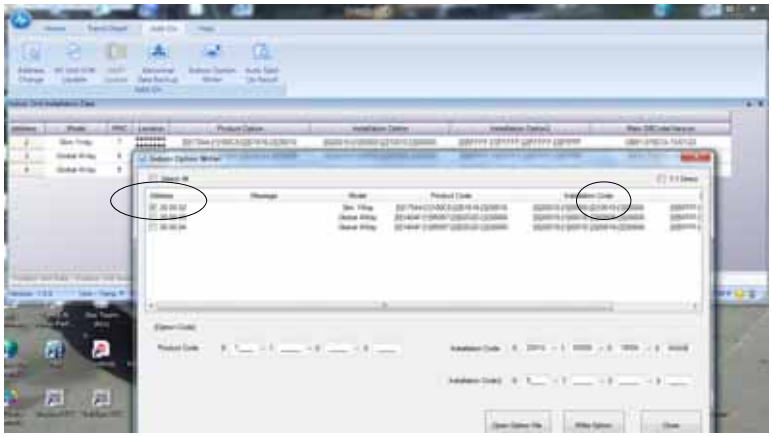
VRF Technician Utilities – Installation Options



Indoor Option Writer screen
This is where modifications to Indoor Unit controls is done

Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

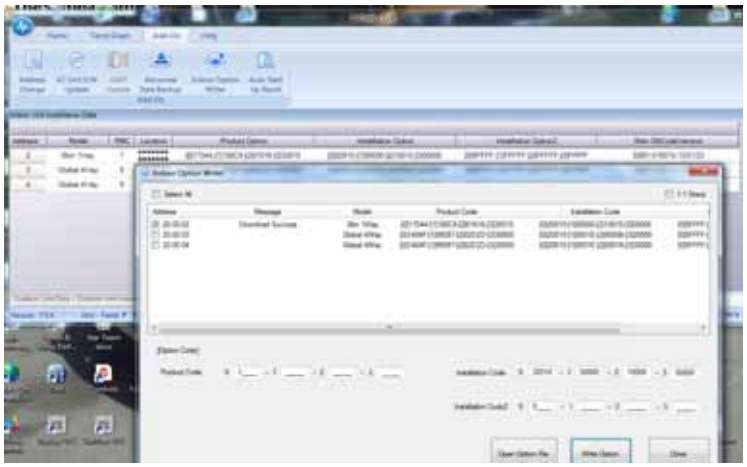
VRF Technician Utilities – Installation Options



Refer to Duct Indoor Unit Installation guide VRF-SVX32B-EN, pg.30-31 for the available options to change: Examples: Digit 2=2 schedule
Selected address is 20.00.02
Digit 17, Buzzer - changed from “1” (disable) to “0” (enable)

Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

VRF Technician Utilities – Installation Options



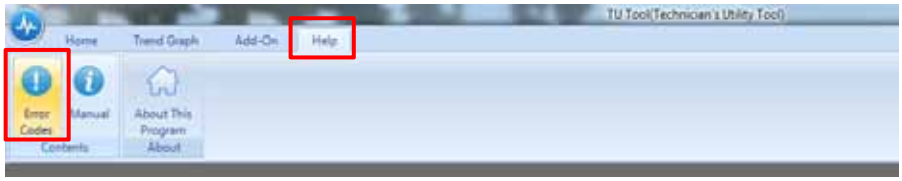
Installation Code change “Download Successful”.
Shut down VRF Technician Utility Tool
Restart VRF TU and connect, to see new Installation Code

Controllers: 3. Tech Utility Tool
Step-99: Modifying Installation Options

VRF Technician Utilities – Installation Options

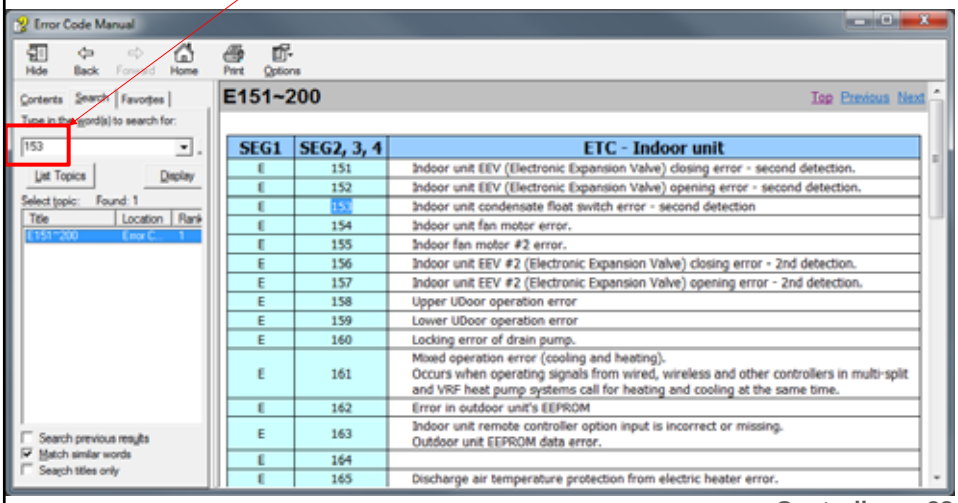
Changing Installation Option2 = Code –“5” option settings
Refer to doc # VRF-SVX26A-EN, pg.25-26.
Option setting mode: Digit 2=5 chart

VRF Technician Utilities – Error Codes



VRF Technician Utilities – Error Codes

Type in error code without the "E"

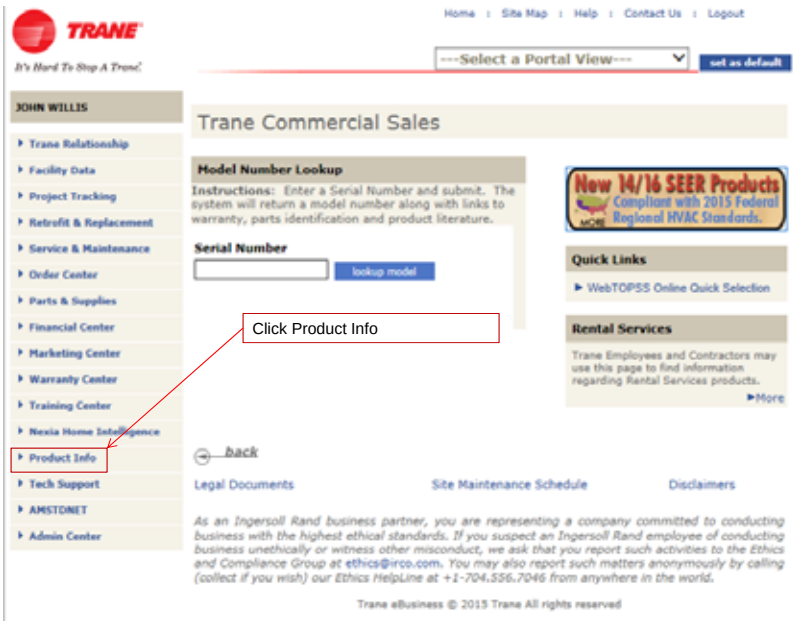


SEG1	SEG2, 3, 4	ETC - Indoor unit
E	151	Indoor unit EEV (Electronic Expansion Valve) closing error - second detection.
E	152	Indoor unit EEV (Electronic Expansion Valve) opening error - second detection.
E	153	Indoor unit condensate float switch error - second detection
E	154	Indoor unit fan motor error.
E	155	Indoor fan motor #2 error.
E	156	Indoor unit EEV #2 (Electronic Expansion Valve) closing error - 2nd detection.
E	157	Indoor unit EEV #2 (Electronic Expansion Valve) opening error - 2nd detection.
E	158	Upper UDoor operation error
E	159	Lower UDoor operation error
E	160	Locking error of drain pump.
E	161	Mixed operation error (cooling and heating). Occurs when operating signals from wired, wireless and other controllers in multi-split and VRF heat pump systems call for heating and cooling at the same time.
E	162	Error in outdoor unit's EEPROM
E	163	Indoor unit remote controller option input is incorrect or missing. Outdoor unit EEPROM data error.
E	164	
E	165	Discharge air temperature protection from electric heater error.

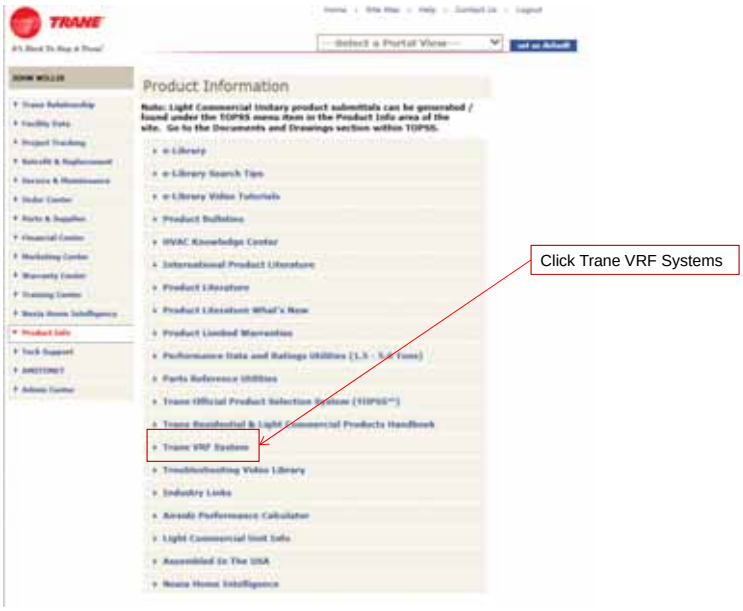
Comfortsite:

- www.comfortsite.com
- How to access?
  - It is username and password protected so if you do not have access, contact your local office and ask for the Comfortsite manager for access.
- Benefits
  - VRF Select download
  - Training videos for VRF Select
  - Technician Utility Tool (TUT) Download
  - TUT updates
  - Links to other VRF sites (Equipment videos, literature)
  - Firmware updates
  - Product Changes or Announcements
  - Training Links for all locations

Comfortsite:



Comfortsite:



Controllers - 31

Comfortsite:

Controllers - 32

TRANE

VRF 2-day Installer Training

Part-5: Controllers

Now, that you have finished the Controller steps, it's time for Troubleshooting, Startup, Commissioning & Warranty…

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand.

TRANE

VRF 2-day Installers Training

Part-6: Troubleshooting Error Codes

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand.

Troubleshooting Error Codes

TRANE

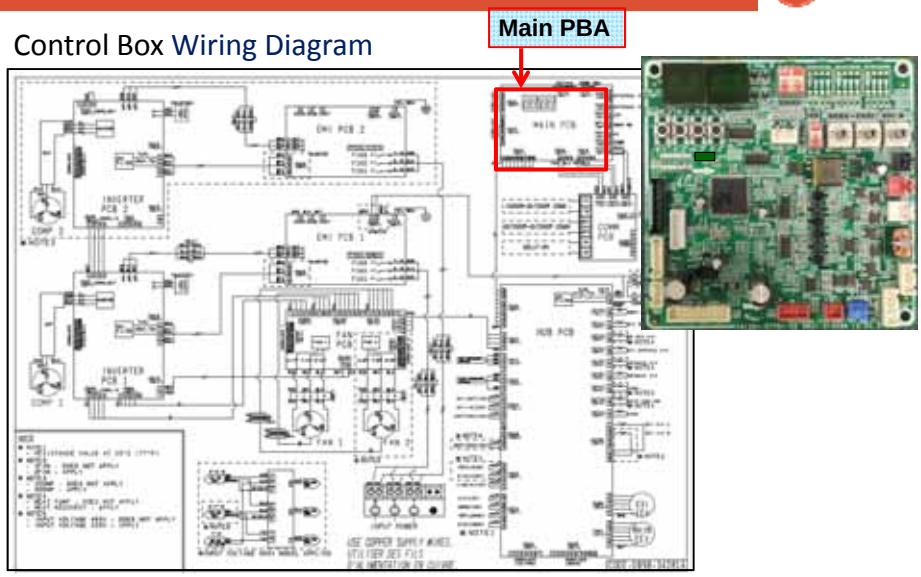
Caution before checking

Turn off the power to check work inside the outdoor unit's Control Box

- It needs 15 min. after power is disconnected to discharge the capacitors on the inverter boards.
- Or disconnect unit from power, discharge capacitor by pressing the K2, six times.

Troubleshooting Error Codes

Control Box Wiring Diagram



Troubleshooting Error Codes

Display Descriptions: Error code on main PCB

The meaning of first alphabet of the error number

E	P	U	A	C
Display error number from 101 to 700 Displays when an error is detected through self diagnosis	Display number from 701 to 800 Display an item that requires more than 2 detections.	Display the outdoor unit address where an error has occurred. U200 : Main Outdoor Unit U201 : Sub1 Outdoor Unit U202 : Sub2 Outdoor Unit	Display the indoor unit address where an error has occurred. Ex) A000 : An error is occurred at number 0 address indoor unit A047 : An error is occurred at number 47 address indoor unit	Display the PCB where a communication error code that has occurred. C001 : Hub PCB C002 : Fan PCB C003 : Inverter1 PCB C004 : Inverter2 PCB

Error display sequence

Classification	Error display method	Display example
Display method of an error that has occurred at the indoor unit	Error No. → Indoor unit address → Error No., repeat display	E153 → A002 → E153 → A002
Display method of an error that has occurred at the outdoor unit.	Error No. → Outdoor unit address → Error No., repeat display	E438 → U200 → E438 → U200 E206 → C002 → E206 → C002

Troubleshooting Error Codes:
K1 Button

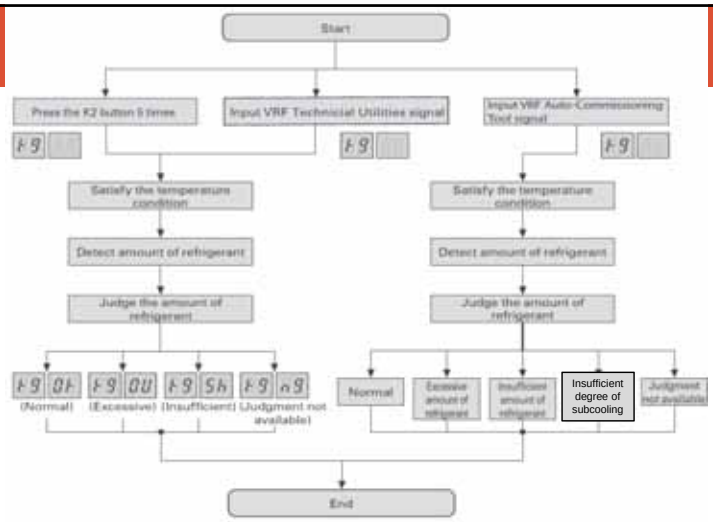
Number of times button K1 is pressed	Operation	4-digit display
1 (hold for 5 sec)	Auto Commissioning Mode	K - K- Blank - Blank
1	Refrigerant charging in heating mode	K - 1 - Blank - Blank
2	Test operation in heating mode	K - 2 - Blank - Blank
3	Pump out in heating mode (ODU address 1)	K - 3 - Blank - 1
4	Pump out in heating mode (ODU address 2)	K - 3 - Blank - 2
5	Pump out in heating mode (ODU address 3)	K - 3 - Blank - 3
6	Not Used in North America	NA
7	Vacuuming (ODU address 1)	K - 4 - Blank - 1
8	Vacuuming (ODU address 2)	K - 4 - Blank - 2
9	Vacuuming (ODU address 3)	K - 4 - Blank - 3
10	Not Used in North America	NA
11	Vacuuming (All)	K - 4- Blank - A
12	End operation	—

Troubleshooting Error Codes:
K2 Button

Number of times button K2 is pressed	Operation	4-digit display
1	Refrigerant charging in cooling mode	K - 5 - Blank - Blank
2	Test operation in cooling mode	K - 6 - Blank - Blank
3	Pump down all units in cooling mode	K - 7 - Blank - Blank
4	HR Pipe inspection (for HP use test operation)	K - 8 - Blank - Blank
5	Checking the amount of refrigerant	K - 9 - X - X (last digits may differ depending on status)
6	Discharge mode(a)	K - A - Blank - Blank
7	Forced defrost	K - B - Blank - Blank
8	Forced oil collection	K - C - Blank - Blank
9	Inverter check compressor 1(b)	K - D - Blank - Blank
10	Inverter check for compressor 2(b)	K - E - Blank - Blank
11	Inverter check for fan 1(b)	K - F - Blank - Blank
12	Inverter check for fan 2(b)	K - G - Blank - Blank
13	End operation	—

a) Discharge mode may not operate normally if an error code occurs. If an E464 or E364 occurs, do not use the discharge mode because the power element may be damaged.

b) If button K2 is pressed the specified number of times and the inverter check is not successful, an error code will appear on the 4-digit display.



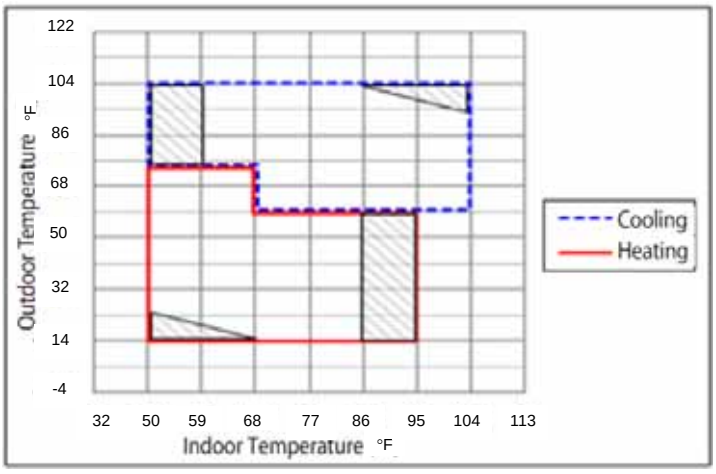
After the refrigerant detection operation is complete, take the following actions:

- If the amount of refrigerant is excessive, discharge 5% of the detected amount and restart the refrigerant amount detection operation.
- If the amount of refrigerant is insufficient, add 5% of the detected amount and restart the refrigerant amount detection operation.
- If the degree of subcooling is insufficient, add 10% of the detected amount and restart the refrigerant amount detection operation.
- If the result is unavailable, check that the refrigerant detection operation was executed within the guaranteed temperature range. Perform a test operation to determine if there are any other problems with the system.

TS/Error Codes - 7

Charge Check Mode

Charge Check Mode Envelope



TS/Error Codes - 8

Troubleshooting Error Codes:
K3 Button

Number of times button K3 is pressed	operation	4 Digit Display
1	Initialize (reset) operation	Same as power up "8888"

Troubleshooting Error Codes:
K4 Button (1-14)

Number of times button K4 is pressed	Operation	4-digit display	
		Digit 1	Digits 2, 3, 4
1	4TV*0072***** (6 ton)	1	Off, 0, 8
	4TV*0096***** (8 ton)		Off, 1, 0
	4TV*0120***** (10 ton)		Off, 1, 2
	4TV*0144***** (12 ton)		Off, 1, 4
2	Command frequency of the compressor 1	2	120 Hz ¥ 1, 2, 0
3	Command frequency of the compressor 2	3	120 Hz ¥ 1, 2, 0
4	High pressure	4	220.46 psi (1.52 MPa) ¥ 1, 5, 2
5	Low pressure	5	62.37 psi (0.43 MPa) ¥ 0, 4, 3
6	Discharge temperature of COMP1	6	188.6°F (87°C) ¥ 0, 8, 7
7	Discharge temperature of COMP2	7	188.6°F (87°C) ¥ 0, 8, 7
8	IPM temperature of COMP1	8	188.6°F (87 ?) ¥ 0, 8, 7
9	IPM temperature of COMP2	9	188.6°F (87 ?) ¥ 0, 8, 7
10	CT sensor value of COMP1	A	2 A ¥ 0, 2, 0
11	CT sensor value of COMP2	B	2 A ¥ 0, 2, 0
12	Suction temperature	C	-43.6°F (-42°C) ¥ -, 4, 2
13	COND Out temperature	D	-43.6°F (-42°C) ¥ -, 4, 2
14	Temperature of liquid pipe	E	-43.6°F(-42°C) ¥ -, 4, 2

Troubleshooting Error Codes:
K4 Button (15-28)

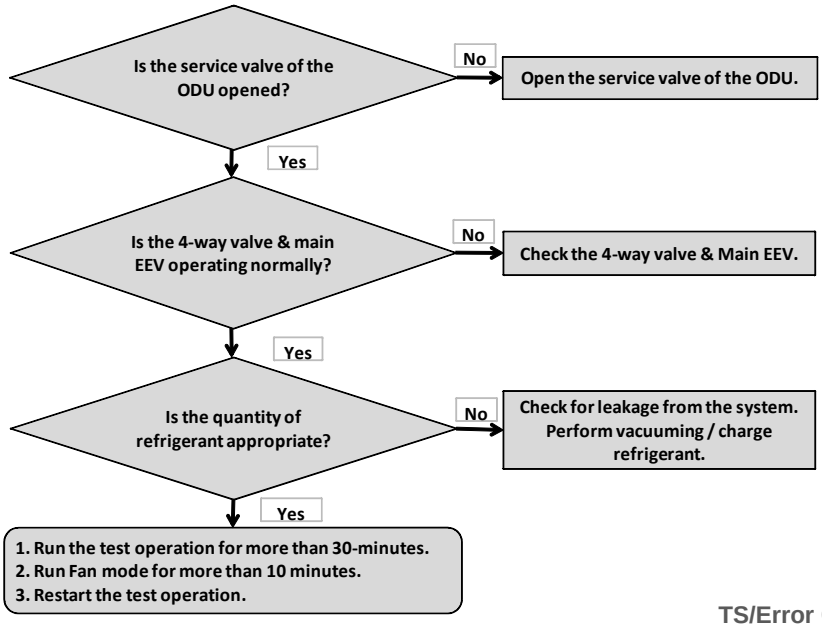
Number of times button K4 is pressed	Operation	4-digit display	
		Digit 1	Digits 2, 3, 4
15	TOP temperature of COMP1	F	-43.6°F (-42°C) ¥ -, 4, 2
16	TOP temperature of COMP2	G	-43.6°F (-42°C) ¥ -, 4, 2
17	Outdoor temperature	H	-43.6°F (-42°C) ¥ -, 4, 2
18	ESC inlet temperature	I	-43.6°F (-42°C) ¥ -, 4, 2
19	ESC outlet temperature	J	-43.6°F (-42°C) ¥ -, 4, 2
20	Main EEV1 step	K	2000 steps ¥ 2, 0, 0
21	Main EEV2 step	L	2000 steps ¥ 2, 0, 0
22	ESC EEV step	M	300 steps ¥ 3, 0, 0
23	HR EEV step	N	300 steps ¥ 3, 0, 0
24	Fan step (SSR or BLDC)	O	13 steps ¥ 0, 1, 3
25	Current frequency of COMP1	P	120 Hz ¥ 1,2,0
26	Current frequency of COMP2	Q	120 Hz ¥ 1,2,0
27	Suction 2 temperature (HR)	R	-43.6°F (-42°C) ¥ -, 4, 2
28	Master indoor unit address	S	If master indoor unit is not selected ¥ Blank, N, D If indoor unit No. 1 is selected as master indoor unit ¥ 0, 0, 1

Troubleshooting Error Codes:
K4 Button (3-sec)

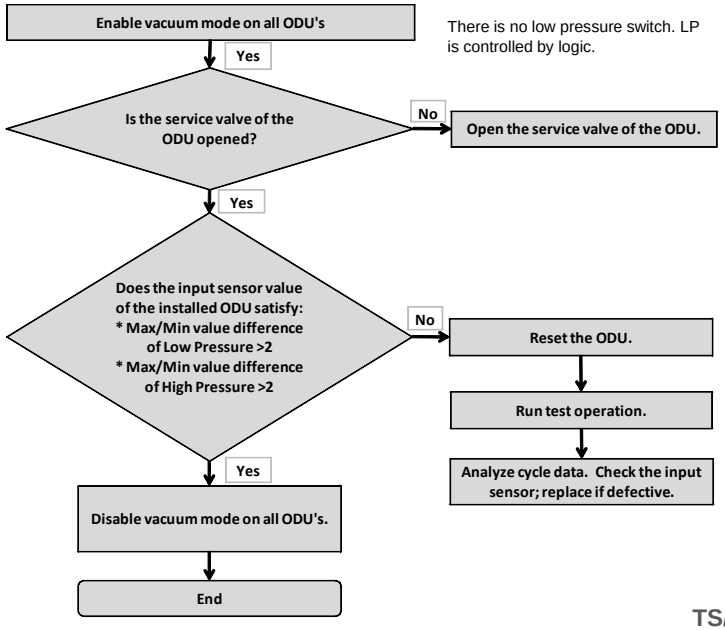
Number of times K4 is pressed and held after initial 3 sec. hold	Software version	4-digit display: toggles between (1) and (2)			
		Device (1)	Version (2): examples		
1	Main circuit board version	"MAIN"	"1412"		
2	Hub circuit board version	"HUB"	"1412"		
3	Inverter 1 version	"INV1"	"1412"		
4	Inverter 2 version	"INV2"	"1412"		
5	Fan 1 version	"FAN1"	"1412"		
6	Fan 2 version	"FAN2"	"1412"		
7	EEP version	"EEP"	"1412"		
			Digit 1	Digit 2	Digit 3, 4
			Address (example)		
8(a)	Automatically assigned unit addresses	"AUTO"	Indoor unit: "A" MCU: "C"	Indoor unit: "0" MCU: "1"	"07"
9(a)	Manually assigned unit addresses	"MAIN"	Indoor unit: "A" MCU: "C"	Indoor unit: "0" MCU: "1"	"15"

(a) Toggles between IDU and MCU.

Troubleshooting Error Codes:
Error Code – E503

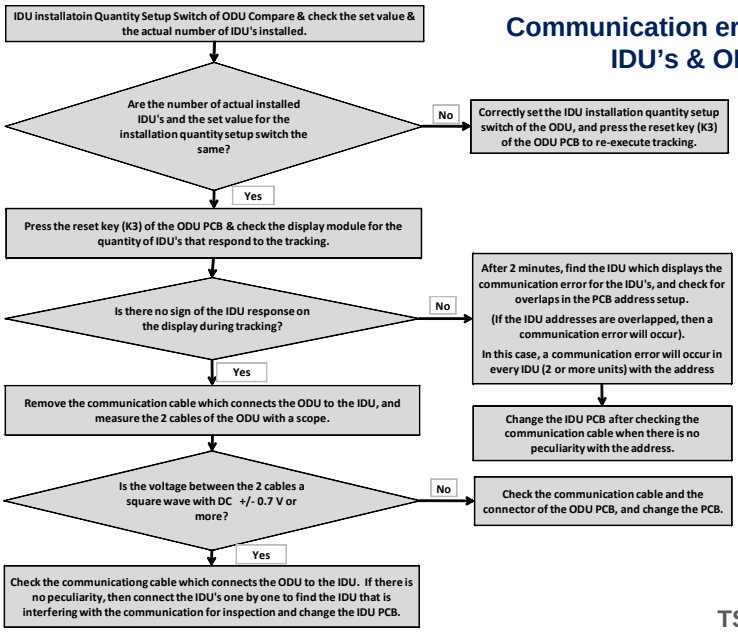


Troubleshooting Error Codes:
Error Codes – E505(HP switch) & E506(LP)



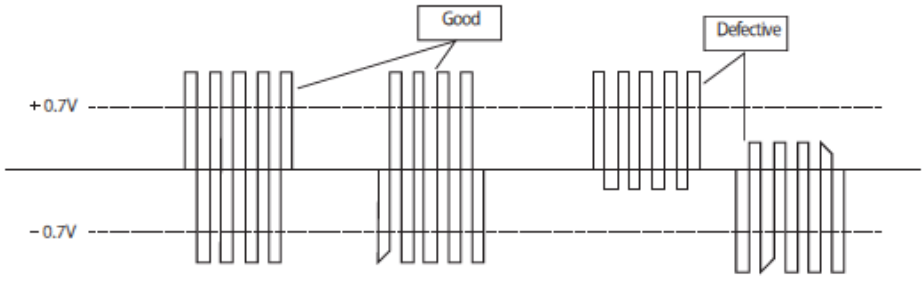
Troubleshooting Error Codes:
Error Code – E201

Communication error between IDU's & ODU's



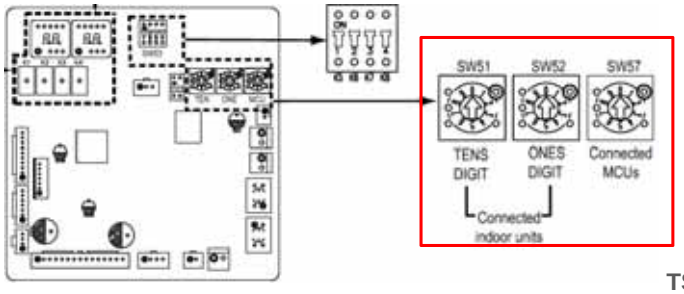
Troubleshooting Error Codes:
Error Code – E201

Communication error between IDU's & ODU's



Troubleshooting Error Codes:
Error Code – E201

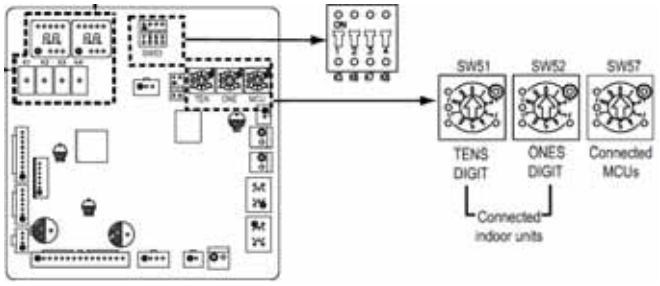
- Verify that the indoor unit quantity rotary switch on the outdoor units main PCB board is set to the physical number of indoor units.
- Verify that all indoor units and MCU's are powered up.
- Hit your K3 button on the ODU. Check to see if your ODU is finding any IDUs. It should say ADXX (XX is the IDU quantity)



TS/Error Codes - 17

Troubleshooting Error Codes:
Error Code – E201 (1 option)

- Reduce the quantity count on the rotary switch (SW52) by 1. Kit K3 button. Continue to do this until UP is displayed.

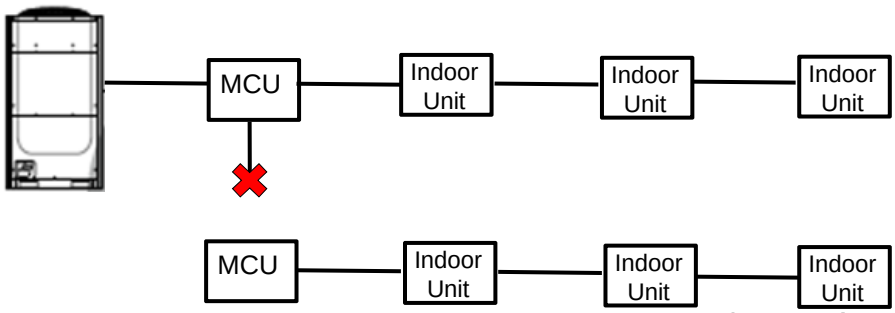


- Connect TUT to the system and verify what the ODU is communicating with.
  - Component location sheet makes this a very easy and a quick process.

TS/Error Codes - 18

Troubleshooting Error Codes:
Error Code – E201 (2nd option)

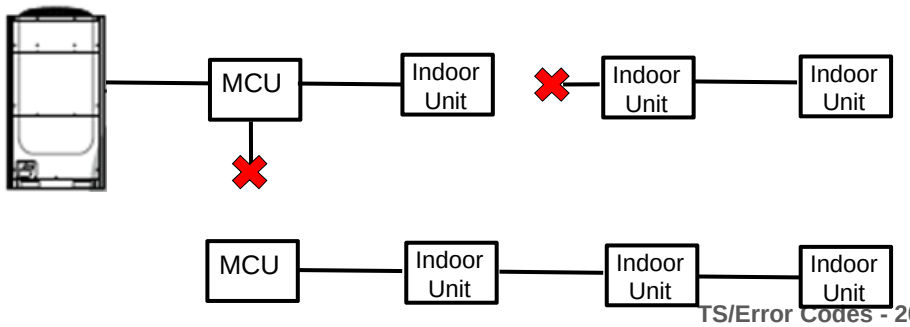
- Divide the F1/F2 communication link by removing the F1/F2 connections that feed MCU#2 and its associated indoor units.
- Reset the rotary switches on the outdoor unit to match the 1 MCU and 3 indoor unit quantity count
- Hit K3 button and check for “UP”



TS/Error Codes - 19

Troubleshooting Error Codes:
Error Code – E201(2nd option continued)

- If E201 still present then divide the F1/F2 communication link down to 1 MCU and 1 indoor unit
- Divide the F1/F2 communication link by removing the F1/F2 connections tthat feeds the remaining indoor units.
- Reset the rotary switches on the outdoor unit to match the 1 MCU and 1 indoor unit quantity count. Don’t forget to turn the disconnected IDU’s MCU ports off.
- Hit K3 button and check for “UP”. If error codes is cleared then add 1 indoor unit or section at a time until the error code is cleared.



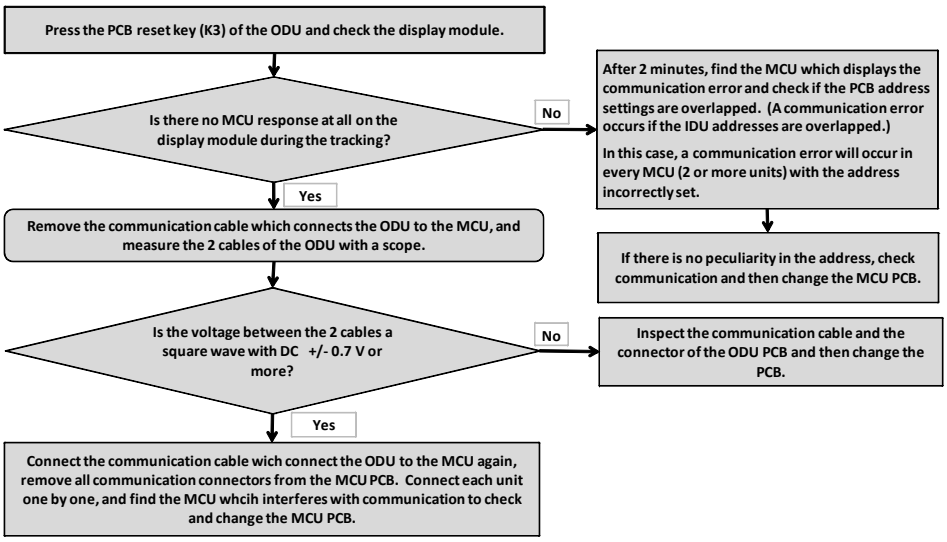
TS/Error Codes - 20

Troubleshooting Error Codes:
Error Code – E203

Communication error between ODUs.

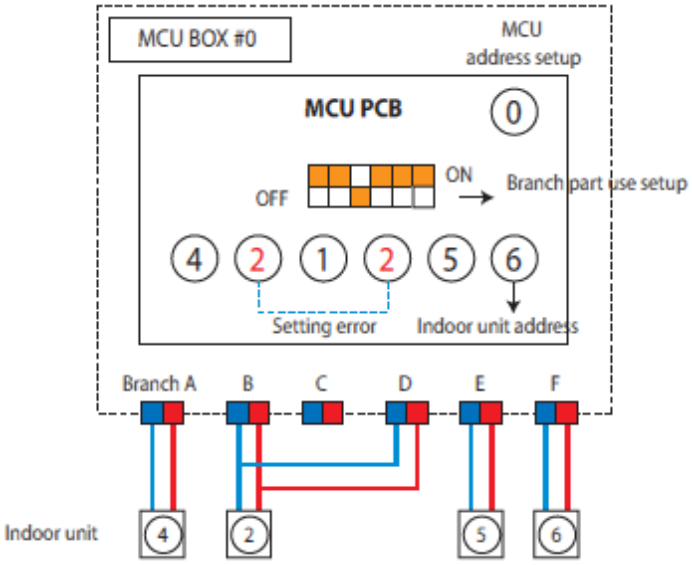
Troubleshooting Error Codes:
Error Code – E210

Communication error between IDU's & ODU's & setup error for ID unit installation quantity.



Troubleshooting Error Codes:
Error Code – E211

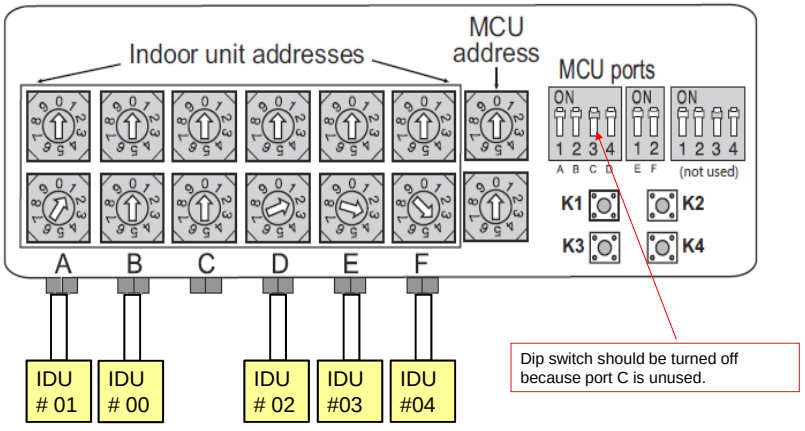
Incorrect port addressing when 2 branches are needed.



Error Codes - 23

Troubleshooting Error Codes:
Error Code – E216

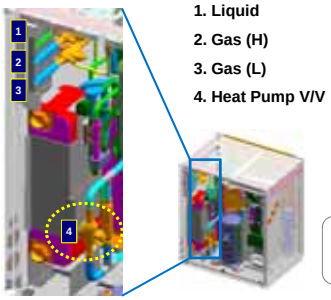
Setting error of indoor unit activating dip switch on MCU.(There is no indoor unit connected to this port but the switch is on)



TS/Error Codes - 24

Troubleshooting Error Codes:
WCU Error Code – E573

- **To use as Heat Recovery**



1. Liquid
2. Gas (H)
3. Gas (L)
4. Heat Pump V/V

For module installation, make sure that each heat pump valve and K5 switch setting is adjusted according to purpose.

E573 error may occur when HP & HR settings are different between WCUs in module installation.

Valve	Heat Pump V/V	K5 option	Low pressure Service V/V
Heat Pump	Open (factory setting)	ON (factory setting)	**No use**
Heat Recovery	**Closed**	OFF	Use

TRANE

VRF 2-day Installers Training

Part-6: Troubleshooting Error Codes & Pump Down

100+ Years of Performance, Innovation, Commitment and Knowledge

Ingersoll Rand

VRF 2-day Installers Training

Part-7: Startup, Commissioning & Warranty

Presented by:

Supported by: *John Willis, Jay Broadrick, Peter Kallas, Jason Hamm Jim Lawrence & Paul Solberg*

100+ Years of Performance, Innovation, Commitment and Knowledge

1. Startup

Process

Check Installation Condition	- Check installation condition - Inspection before trial operation
Check & Record product information	- Record S/N & Model name of each unit on Component Location Sheet
Trial operation with function key	- Turn power on - Use trial operation K button(s) in outdoor/water unit - Check if the system is running well
Record with Trane Technician Utility or Auto Commissioning	- Record the data
Trial operation with individual remote controller	-Verify operation of each indoor unit by remote controller
Completion	

1. Startup

A. Check Installation

Installation work	Outdoor unit	• Have you checked the external surface and the inside of the outdoor unit? • Is there any possibility of short-circuit caused by the heat of an outdoor unit? • Is the place well-ventilated and ensures space for service? • Is the outdoor unit fixed securely to withstand any external force?
	Indoor unit	• Have you checked the external surface and the inside of the indoor unit? • Is there enough space for service? • Have you checked if the center of the indoor unit is ensured and it is installed horizontally?
Refrigerant pipe work		• Have you selected correct pipes? • Are the liquid and gas valve open? • Is the total number of connected indoor units within the allowable range? • Are the length and the height difference between the refrigerant pipes within the allowable range? • Are the branch joints properly installed? • Did you check the connection of liquid and gas pipes? • Have you selected correct insulator for pipes and insulated them correctly? • Did you insulate the pipes and connection part correctly? • Is the quantity of the additional refrigerant correctly weighed in? (You must record the amount of additional refrigerant on the service record paper placed inside of the outdoor unit.)

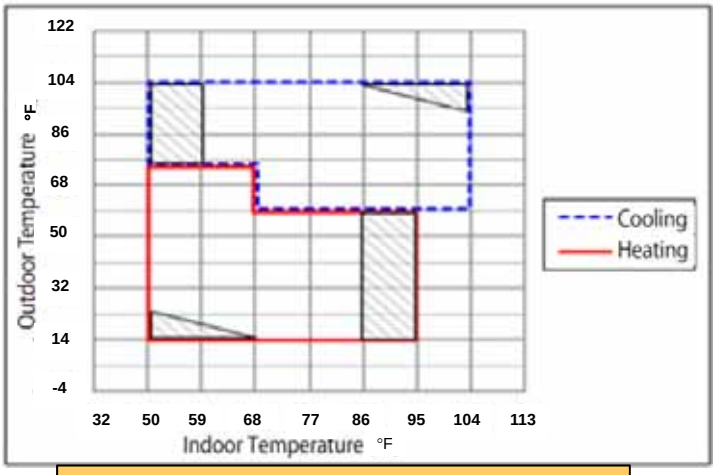
1. Startup

A. Check Installation

Drain pipe work	• Have you checked if the drain pipes of the indoor and outdoor unit are connected together? • Have you completed the drain test? • Is the drain pipe properly insulated?
Electrical wiring work	• Are the power cable and communication cable tightened firmly on the terminal board within the range of rated tightening torque? • Have you checked for cross-connection of the power and communication cables? • Have you performed the earthing work 3 to the outdoor unit? • Did you make sure to use 2-core cable (not multi-core cable) for the communication cable? • Is the length of the wire within allowed range? • Is the wiring route correct?
Setting address	• Did you set the address of the indoor and outdoor units properly? • Did you set the address of the indoor and outdoor units properly? (When using multiple remote controllers)

1. Startup

Auto Commissioning Operations Envelope



Outdoor operating envelope for Test Operation / Commissioning is: **14 to 104 deg F**

2. Commissioning

✓**Check setting of system**

An incorrect setting will generate a system error & not allow the unit(s) to run.

Main address & RMC address

- Manual address for Heat Recovery
- Set address in MCU the same as connected indoor unit's address, confirm using the Trane Technician Utility Tool.
- Compare address with component location sheet, design and layout sheets

For future reference, record model & address information with drawing if possible. When servicing or maintaining units it will help you determine where units are

2. Commissioning

. Installation option code

- Check each indoor & outdoor unit's option setting according to the installation condition.

Function	No. of digits to set (Logical [physical])	Code structure (Logical)
Indoor unit Product Code setting	24 [20]	01xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting1	24 [19]	02xxxx-1xxxxx-2xxxxx-3xxxxx
Install option setting2	24 [19]	05xxxx-1xxxxx-2xxxxx-3xxxxx
Indoor unit address (MAIN/RMC)	24 [8]	0Axxxx-1xxxx-2xxxxx-3xxxxx
Specific bit setting(option, address,…)	24 [5]	0Dxxxx-1xxxxx-2xxxxx-3xxxxx

2. Commissioning

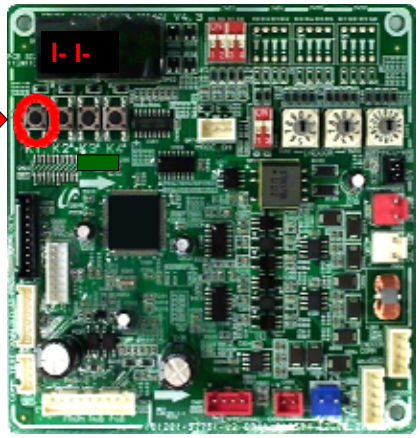
C. Auto Commissioning

✓ Proceed trial operation to release "UP"

- When the system is powered on for the first time, after tracking is complete the ODU will display "UP" (Unprepared), To release "UP"

1. Begin the Auto Commissioning operation by pressing the K1 button for 5 seconds.

K1 Button



Push and hold the K1 button for 5 seconds. After approximately 1 to 2 minutes AUTO COMMISSIONING will begin. You should see I- I- in the left LED screen.

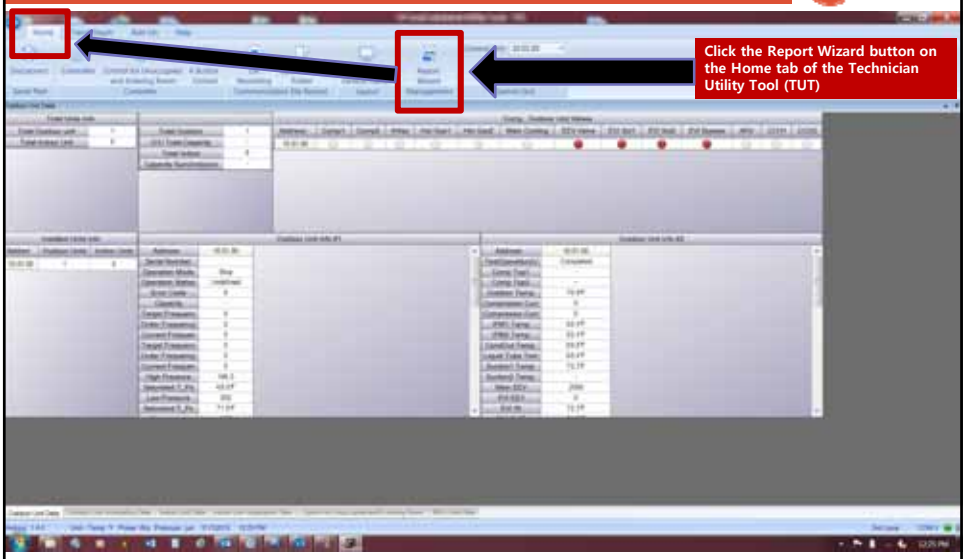
Don't forget to start the recording on Trane Utility Tool!!!!!!!!!!!!!

How to Obtain the Auto Commissioning Report

The first steps to getting the Auto Commissioning Report for the purpose of warranty.

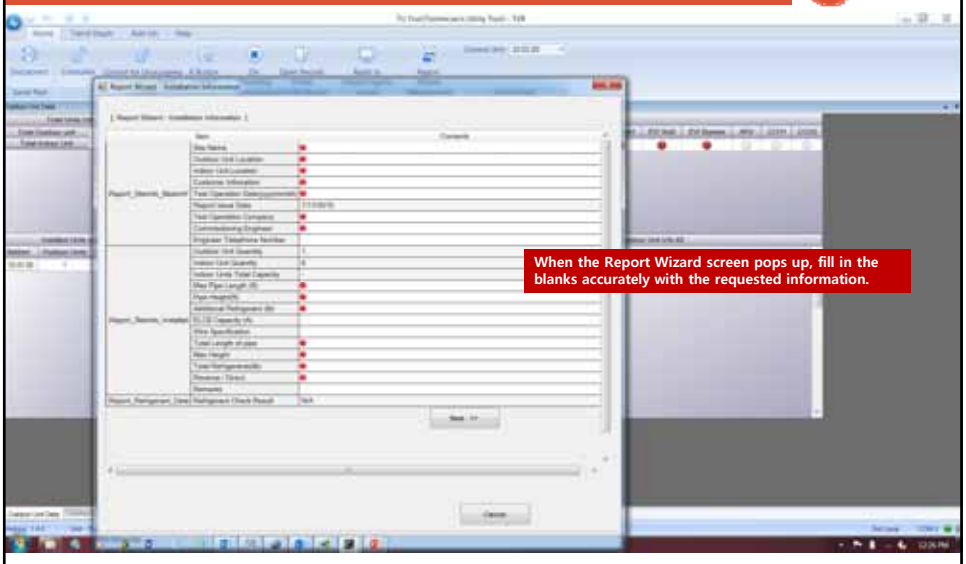
1. **Connect to the system using the Technician Utility Tool(TUT) using the latest Technician Utility software. The latest software is available at www.comfortsite.com**
2. **Once Auto Commissioning is completed (K1 for 5 seconds), the Auto Commissioning Report is stored on each outdoor unit EEPROM. If it is a multi module system, it will be stored on the main outdoor unit.**
3. **Once the TUT and the VRF system is communicating, follow the next slides to obtain the report.**
4. **Upload all of the warranty requirements to vrfwarrantyupdocs@irco.com**

2. Commissioning



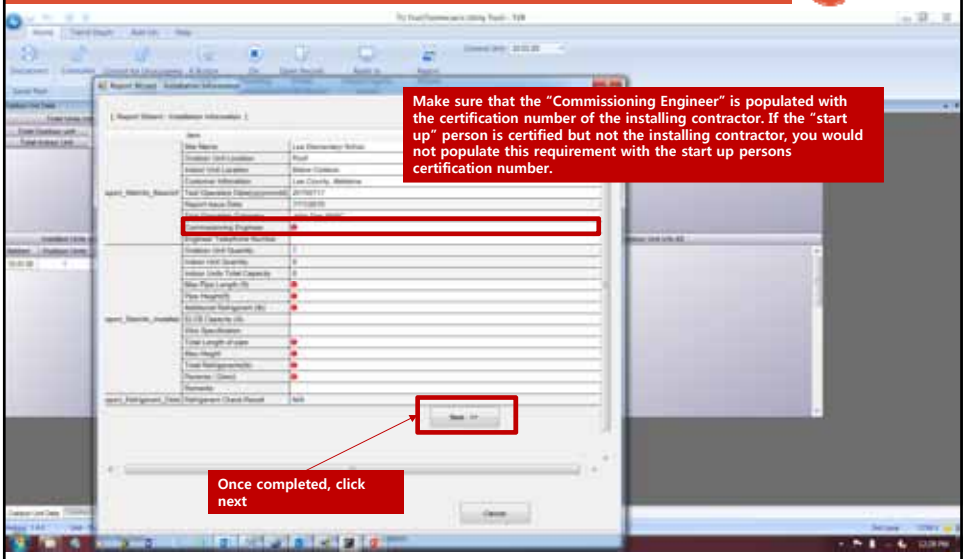
Comm/Warranty - 11

2. Commissioning



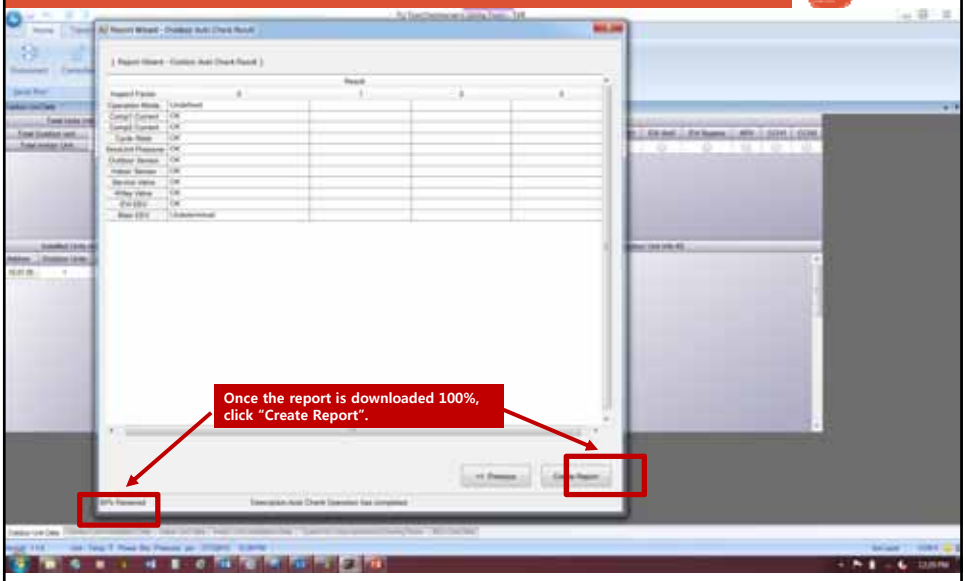
Comm/Warranty - 12

2. Commissioning



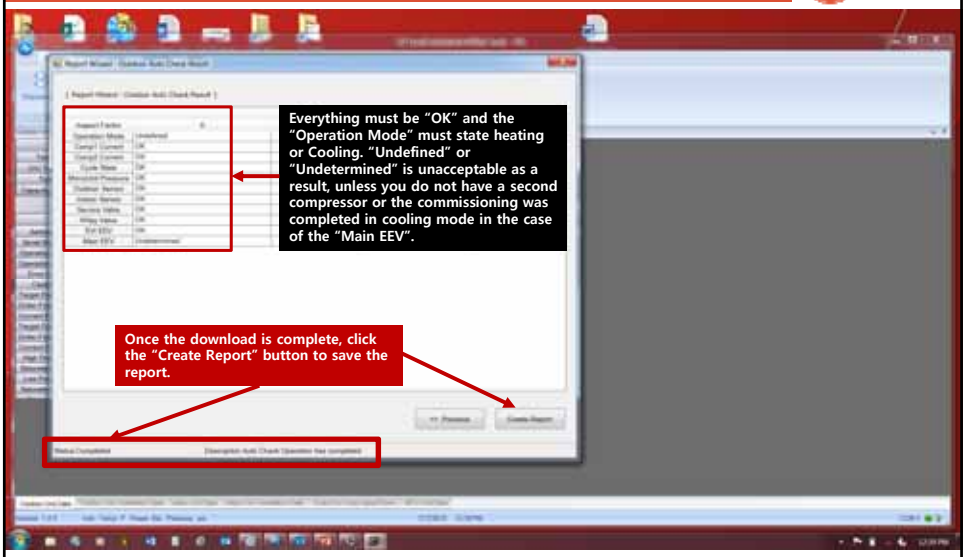
Comm/Warranty - 13

2. Commissioning



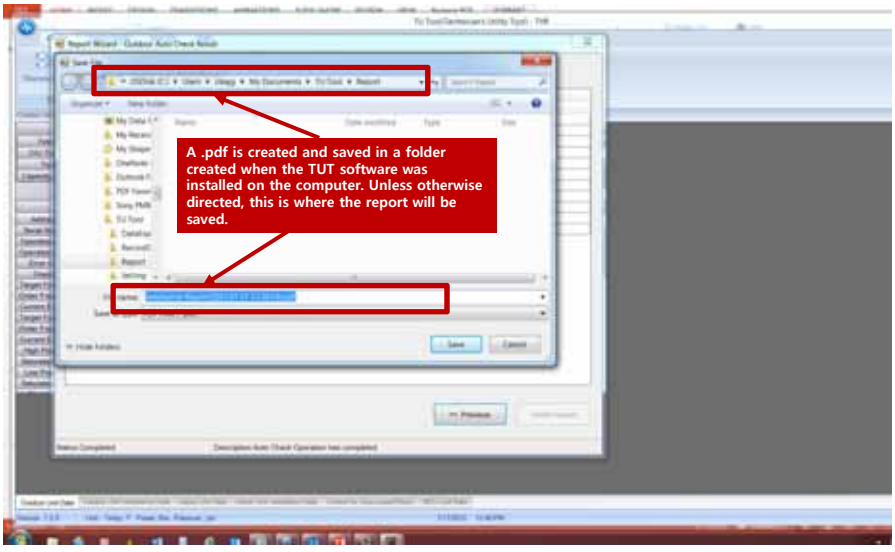
Comm/Warranty - 14

2. Commissioning



Comm/Warranty - 15

2. Commissioning



Comm/Warranty - 16

2. Commissioning

E. Test Indoor Units

✓ Test each indoor unit if they work properly

- Test each indoor unit for proper operation. (turn on, off, fan on/off, and determine if the airflow is proper.)
  * Especially when duct is installed with ductwork. Because of E.S.P air flow may not proper.

* Heat Recovery system
  - Turn on and off each indoor unit to check the refrigerant pipe is connected properly to MCU.
  - Checking the Pipe connection test run(K2 4times) can be used as well.

*** Recommendation**

- Based on envelope of operation, place all units in one direction (heat or cool).
- After system settles out (30min), change one unit to the opposite direction (heat or cool).
- Using TUT, verify EVA_{in} and EVA_{out} change for the exact unit placed in the opposite mode.
- If another unit changes….the system is mis-addressed.

3. Warranty

Standard vs. Qualified

- **Standard Warranty (12/18)**
  - Unit is installed with no expectation of an qualified warranty.
  - No requirements

3. Warranty

Standard vs. Qualified

- **Qualified warranty (5/5)**
  - Three requirements
  - Submit the following
    - Approved layout with VRF Select
    - Submit required paperwork within 60 days of start up.
      - Successful commissioning report
      - Associated pictures (Pressure test, vacuum test)
      - Final “as built” VRF select report
      - Installing contractor has attended and passed factory training
  - Submission will be done via email at

vrfwarrantyupdocs@irco.com

3. Warranty

Extended Labor Warranty for Purchase

- Now available
- Must be ordered when equipment is ordered

TRANE

VRF 2-day Installers Training

Part-7: Startup, Commissioning & Warranty

100+ Years of Performance, Innovation, Commitment and Knowledge

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Trane ProSpace Error Codes

Unit Error Codes	Error Type	Code Number	Error Comment
IDU	Communication	101	Communication error in indoor unit. It displays when the indoor unit receives no data from the outdoor unit.
IDU	Communication	102	Communication error between indoor and outdoor unit. It displays in indoor unit.
IDU	Communication	103	Communication error between indoor and outdoor unit. It displays in indoor unit.
IDU	Sensor	121	Room temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	122	Eva_in temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	123	Eva_out temperature sensor of indoor unit. (Open or Short)
IDU	Communication	124	Communication error between indoor and outdoor unit. It displays in outdoor unit.
IDU	Sensor	125	Mid 2 temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	128	Eva_in temperature sensor is detached from eva_in pipe of indoor unit.
IDU	Sensor	129	Eva_out temperature sensor is detached from eva_out pipe of indoor unit.
IDU	Sensor	130	Eva_in and eva_out temperature sensors are detached from eva_in and out pipes of indoor unit at the same time.
IDU	Sensor	137	VOC sensor of ERV product. (Open or Short)
IDU	Sensor	138	Gas sensor of ERV product. (Open or Short)
IDU	Sensor	139	CO2 sensor of ERV product. (Open or Short)
IDU	Operation	151	EEV opening error of indoor unit (2nd detection)
IDU	Operation	152	EEV closing error of indoor unit (2nd detection)
IDU	Operation	153	Floating switch error of indoor unit (2nd detection)
IDU	Operation	154	RPM feed back error of indoor unit.
IDU	Operation	155	RPM feed back error of indoor unit. (The second motor of indoor unit)
IDU	Operation	161	Mixed operation mode of indoor units. It occurs when outdoor unit is operating or going to operate in cooling mode (or heating mode) and then other indoor unit is going to operate in heating mode (or cooling mode).
IDU	Operation	162	EEPROM error of MICOM. (Physical damage)
IDU	Operation	163	Option code error of indoor unit's EEPROM.
IDU	Operation	167	Option setting error of indoor unit's dip switch.
IDU	Operation	170	Temperature display setting error for USA market product. (Mixed setting with Celsius and Fahrenheit temperature)
ODU	MCU	180	Opening error of cooling and heating solenoid valve simultaneously in MCU (1st detection)
ODU	MCU	181	Opening error of cooling and heating solenoid valve simultaneously in MCU (2nd detection)
IDU	Operation	185	Cross wiring error between communication and power of indoor unit.
IDU	Operation	186	SPI wrong wiring or SPI malfunction error.
ODU	Pipe Check	190	No matching between indoor unit’s address and eva_in sensor in pipe checking operation
ODU	Remote Control	190	No matching between indoor unit’s address and eva_in sensor in pipe checking operation
ODU	Pipe Check	191	No matching between indoor unit’s address and eva_out sensor in pipe checking operation
ODU	Remote Control	191	No matching between indoor unit’s address and eva_out sensor in pipe checking operation
ODU	Pipe Check	199	It displays when pipe checking operation is not operated.
ODU	Remote Control	199	It displays when pipe checking operation is not operated.
ODU	Communication	201	Communication error between indoor and outdoor unit. (Tracking failure or the setting quantity of indoor unit on outdoor unit's PCB differs from the quantity of installed indoor unit.)
ODU	Communication	202	Communication error between indoor and outdoor unit. (After tracking is completed, and then no response from indoor unit)
ODU	Communication	203	Communication error between main and sub outdoor unit. Communication error between main micom and inverter micom.
ODU	Communication	204	The setting quantity of MCU on outdoor unit's PCB differs from the quantity of installed MCU.
ODU	Communication	205	Communication error of all PCB among main, Hub, Fan, Inverter micoms.
ODU	Communication	206	Communication error of individual PCB. (C001 : Hub, C002 : Fan, C003 : Inverter 1, C004 : Inverter 2)
ODU	Pipe Check	210	Communication error between MCU and outdoor unit.
ODU	Remote Control	210	Communication error between MCU and outdoor unit.

Trane ProSpace Error Codes

ODU	Pipe Check	211	Indoor unit's address overlapped on the MCU
ODU	Remote Control	211	Indoor unit's address overlapped on the MCU
ODU	Pipe Check	213	No matching between installed indoor unit's address and indoor unit's address on the MC
ODU	Remote Control	213	No matching between installed indoor unit's address and indoor unit's address on the MC
ODU	Pipe Check	214	Setting error of MCU's quantity in outdoor unit's P
ODU	Remote Control	214	Setting error of MCU's quantity in outdoor unit's P
ODU	Pipe Check	215	Indoor unit's address setting error on the MCU. (There is same address among the MCUs
ODU	Remote Control	215	Indoor unit's address setting error on the MCU. (There is same address among the MCUs
ODU	Pipe Check	216	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is not connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns o
ODU	Remote Control	216	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is not connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns o
ODU	Pipe Check	217	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns of
ODU	Remote Control	217	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns of
ODU	Pipe Check	218	Setting error of indoor unit's quantity on MCU's PCB.(The quantity of installed indoor units exceeds the setting number of the MCU's PC
ODU	Remote Control	218	Setting error of indoor unit's quantity on MCU's PCB.(The quantity of installed indoor units exceeds the setting number of the MCU's PC
ODU	Sensor	221	Ambient air temperature sensor of outdoor unit. (Open or Short)
WCU	Sensor	224	Water Sensor (Short or Open)
WCU	Sensor	225	Control Box temperature Sensor (Short or Open)
ODU	Sensor	226	Ambient air temperature sensor is detached from outdoor unit.
ODU	Sensor	231	Cond_out temperature sensor of main outdoor unit. (Open or Short)
ODU	Sensor	236	Cond_out temperature sensor of the outdoor unit. (Open or Short)
ODU	Sensor	237	Cond temperature sensor of outdoor unit. (Open or Short)
ODU	Sensor	241	Cond_mid temperature sensor is detached from sensor hold of the pipe.
ODU	Sensor	246	Cond_out 1 temperature sensor is detached from sensor hold of the pipe.
ODU	Sensor	251	Discharge temperature sensor of compressor 1. (Open or Short)
ODU	Sensor	256	Discharge temperature sensor of compressor 1. (Open or Short)
ODU	Sensor	257	Discharge temperature sensor of compressor 2. (Open or Short)
ODU	Sensor	258	Discharge temperature sensor of compressor 3. (Open or Short)
ODU	Sensor	261	Discharge temperature sensor of compressor 1 is detached from the sensor hold of the pipe.
ODU	Sensor	262	Discharge temperature sensor of compressor 1 is detached from the sensor hold of the pipe.
ODU	Sensor	263	Discharge temperature sensor of compressor 2 is detached from the sensor hold of the pipe.
ODU	Sensor	264	Discharge temperature sensor of compressor 3 compressor is detached from the
ODU	Operation	312	Main cooling solenoid valve opening error.
IDU	Sensor	321	EVI_in temperature sensor. (Open or Short)
IDU	Sensor	322	EVI_out temperature sensor. (Open or Short)
ODU	Operation	346	Motor starting failure error of fan 2.
ODU	Operation	347	Motor wiring disconnection error of fan 2.
ODU	Operation	348	Motor locking error of fan 2.
ODU	Operation	353	Motor overheated error of fan 2.
ODU	Operation	355	IPM overheated error of fan 2.
ODU	Operation	361	Starting failure error of compressor 2.
ODU	Operation	364	Over current error of compressor 2.
ODU	Operation	365	Overload error of compressor 2.
ODU	Operation	366	DC-link over/under voltage error of INV PBA 2.
ODU	Operation	367	Wiring disconnection error of compressor 2.
ODU	Operation	368	Current sensor error of INV PBA 2.
ODU	Operation	369	DC-link voltage sensor error of INV PBA 2.
ODU	Operation	374	Heat sink temp. sensor error of INV PBA 2.

Trane ProSpace Error Codes

ODU	Operation	378	Over current of fan 2.
ODU	Operation	385	Input current sensor error of INV PCB 2.
ODU	Operation	387	Hall sensor error of fan 2.
ODU	Operation	389	Motor overload error of fan 2.
ODU	Operation	393	Motor current sensor error of fan 2.
ODU	Operation	396	DC-link voltage sensor error of fan 2.
ODU	Operation	399	Heat sink temp. sensor error of fan 2.
ODU	Operation	400	IGBT module overheated error of INV PCB 2.
ODU	Protection	401	OUT DOOR FREEZING CHECK1
ODU	Protection	402	OUT DOOR FREEZING CHECK2
ODU	Protection	403	OUT DOOR FREEZING CHECK3
ODU	Operation	407	Compressor stop by abnormal high pressure.
ODU	Protection	407	Compressor stop by high pressure's protection control.
ODU	Protection	408	Compressor stop by high pressure's protection control 2.
ODU	Protection	409	Compressor stop by high pressure's protection control 3.
ODU	Operation	410	Compressor stop by low pressure protection control or refrigerant leakage.
ODU	Protection	410	Compressor stop by low pressure's protection control.
ODU	Protection	411	Compressor stop by low pressure's protection control 2.
ODU	Protection	412	Compressor stop by low pressure's protection control 3.
ODU	Protection	413	Protection control by sump sensor.
ODU	Protection	414	Protection control by sump sensor 2.
ODU	Protection	415	Protection control by sump sensor 3.
ODU	Operation	416	Compressor stop by discharge temperature protection control.
ODU	Protection	416	Compressor stop by discharge temperature's protection control.
ODU	Self-Detection	419	OUTDOOR UNIT EEV 1 OPENSELF-DETECTION ERROR
ODU	Self-Detection	420	OUTDOOR UNIT EEV 2 OPENSELF-DETECTION ERROR
ODU	Self-Detection	421	OUTDOOR UNIT EEV 3 OPENSELF-DETECTION ERROR
ODU	Self-Detection	422	OUTDOOR UNIT EEV 1 CLOSEDSELF-DETECTION ERROR
ODU	Self-Detection	423	OUTDOOR UNIT EEV 2 CLOSEDSELF-DETECTION ERROR
ODU	Self-Detection	424	OUTDOOR UNIT EEV 3 CLOSEDSELF-DETECTION ERROR
ODU	Operation	425	Missing or disconnection error of 3 phase wiring.
ODU	Self-Detection	425	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N)
ODU	Self-Detection	426	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N) 2
ODU	Self-Detection	427	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N) 3
ODU	Operation	428	Compressor stop by compression protection control.
ODU	Self-Detection	428	Compressor stop by abnormal compression ratio.
ODU	Self-Detection	429	Compressor stop by abnormal compression ratio 2.
ODU	Self-Detection	430	Compressor stop by abnormal compression ratio 3.
ODU	Self-Detection	431	Self-diagnosis of oil solenoid valve. (Open and Close error)
ODU	Self-Detection	434	OIL BALANCE VALVE OPEN ERROR
WCU	Sensor	435	Flow Switch Error
WCU	Operation	436	Heat exchanger anti-freeze protection Error
ODU	Self-Detection	437	OIL BALANCE VALVE CLOSED ERROR
IDU	Operation	438	EVI EEV opening error.
ODU	Operation	438	System stop by refrigerant flood back operation.(EVI EEV leakage, Intercooler internal leakage, Indoor EEV leakage)
ODU	Operation	439	Abnormal low and high pressure (Judgment before starting)
ODU	Operation	440	Limitation of heating operation. (Out of ambient temp. operating range)
ODU	Self-Detection	440	Prohibition of heating operation when the ambient air temperature is over 30¡ÆC
WCU	Operation	440	Restriction due to high temperature
ODU	Operation	441	Limitation of cooling operation. (Out of ambient temp. operating range)
ODU	Self-Detection	441	DO NOT OPERATE COOLING MODE WHENOUTDOOR UNIT IS BELOW -5¢®É
WCU	Operation	441	Restriction due to low temperature
ODU	Operation	442	Limitation of refrigerant charging in heating operation (Over 15c of ambient
ODU	Self-Detection	442	Prohibition of refrigerant charging with heating operation when outdoor ambient air temperature is over 15¡ÆC.
ODU	Operation	443	Abnormal high pressure error (Judgment after starting)

Trane ProSpace Error Codes

ODU	Self-Detection	443	Prohibition of operating when the high pressure of system is too low.
ODU	Operation	445	Crank case heat failure.
ODU	Operation	446	Motor starting failure error of fan 1.
ODU	Operation	447	Motor wiring disconnection error of fan 1.
ODU	Operation	448	Motor locking error of fan 1.
ODU	Operation	452	Power supply failure temporary or zero crossing error.
ODU	Operation	453	Motor overheated error of fan 1.
ODU	Operation	454	RPM error of outdoor unit's motor
ODU	Operation	455	IPM overheated error of fan1.
ODU	Operation	457	Backlash error of outdoor unit's motor
ODU	Operation	458	Over current of CT sensor. (Or outdoors motor locking of inverter system.)
ODU	Operation	461	Low current of CT sensor. (Or compressor starting failure of inverter system.)
ODU	Operation	462	Compressor stop by over current of input.
ODU	Operation	464	Over current error of compressor 1.
ODU	Operation	465	Inverter Compressor1 V-limit error
ODU	Operation	466	DC-link over/under voltage error of INV PBA 1.
ODU	Operation	467	Wiring disconnection error of compressor 1.
ODU	Operation	468	Current sensor error of INV PBA 1.
ODU	Operation	469	DC-link voltage sensor error of INV PBA 1.
ODU	Operation	474	Heat sink temp. sensor error of INV PBA 1.
ODU	Operation	478	Over current of fan 1.
ODU	Operation	485	Input current sensor error of INV PCB 1.
ODU	Operation	486	DC-link over/under voltage error. (Fan PCB's detection)
ODU	Operation	487	Hall sensor error of fan 1.
ODU	Operation	489	Motor overload error of fan 1.
ODU	Operation	493	Motor current sensor error of fan 1.
ODU	Operation	496	DC-link voltage sensor error of fan 1.
ODU	Operation	499	Heat sink temp. sensor error of fan 1.
ODU	Operation	500	IGBT module overheated error of INV PCB 1.
ODU	Operation	503	Restriction in refrigerant system
ODU	Operation	505	Input sensor failure
ODU	Operation	506	Input sensor failure
WCU	Operation	515	The internal temperature of Control Box was too high
WCU	Operation	516	DC-FAN of Control Box feedback error
ODU	Operation	559	Indoor unit stop by unidentified error from outdoor units.
ODU	Operation	560	Option setting error of outdoor unit.
ODU	Operation	560	Option switch setting error of outdoor unit. (napplicable option switch turns on.)
ODU	Operation	561	Fan RPM error of ERV SA (Supply air).
ODU	Operation	562	Fan RPM error of ERV RA (Return air).
ODU	Operation	563	Incompatible indoor unit's installation error.
ODU	Operation	563	Model mismatching of Indoor unit.
ODU	Operation	573	Incompatible outdoor unit's installaton error in module installation.
WCU	Operation	573	Error due to using single type outdoor unit in a module installation
ODU	Operation	608	Can't detect ERV controller.
ODU	Operation	609	Indoor unit is not detected for synchronous control.
ODU	Communication	610	Communication error between centralized controller and interface module.
ODU	Communication	611	Communication error between DMS and centralized controller.
ODU	Communication	613	Communication error between DMS and SIM interface module.
ODU	Communication	614	Communication error between SIM and power meter.
ODU	Communication	615	Communication error between interface module and indoor unit.
ODU	Communication	616	Communication error between interface module and outdoor unit.
ODU	Operation	618	The connected indoor units to ERV exceeded 16 units.
IDU	Operation	701	Floating switch error of indoor unit. (1st detection)
IDU	Operation	702	EEV closing error of indoor unit. (1st detection)
ODU	Operation	702	EEV closing error of the indoor unit (1st detection)
IDU	Operation	703	EEV opening error of indoor unit. (1st detection)
ODU	Operation	703	EEV opening error of the indoor unit (1st detection)

Trane ProSpace Error Codes
by Group

Unit Error Codes	Error Type	Code Number	Error Comment
IDU	Communication	101	Communication error in indoor unit. It displays when the indoor unit receives no data from the outdoor unit.
IDU	Communication	102	Communication error between indoor and outdoor unit. It displays in indoor unit.
IDU	Communication	103	Communication error between indoor and outdoor unit. It displays in indoor unit.
IDU	Communication	124	Communication error between indoor and outdoor unit. It displays in outdoor unit.
		NUM	**ERROR COMMENT**
IDU	Operation	151	EEV opening error of indoor unit (2nd detection)
IDU	Operation	152	EEV closing error of indoor unit (2nd detection)
IDU	Operation	153	Floating switch error of indoor unit (2nd detection)
IDU	Operation	154	RPM feed back error of indoor unit.
IDU	Operation	155	RPM feed back error of indoor unit. (The second motor of indoor unit)
IDU	Operation	161	Mixed operation mode of indoor units. It occurs when outdoor unit is operating or going to operate in cooling mode (or heating mode) and then other indoor unit is going to operate in heating mode (or cooling mode).
IDU	Operation	162	EEPROM error of MICOM. (Physical damage)
IDU	Operation	163	Option code error of indoor unit's EEPROM.
IDU	Operation	167	Option setting error of indoor unit's dip switch.
IDU	Operation	170	Temperature display setting error for USA market product. (Mixed setting with Celsius and Fahrenheit temperature)
IDU	Operation	185	Cross wiring error between communication and power of indoor unit.
IDU	Operation	186	SPI wrong wiring or SPI malfunction error.
IDU	Operation	438	EVI EEV opening error.
IDU	Operation	701	Floating switch error of indoor unit. (1st detection)
IDU	Operation	702	EEV closing error of indoor unit. (1st detection)
IDU	Operation	703	EEV opening error of indoor unit. (1st detection)
		NUM	**ERROR COMMENT**
IDU	Sensor	121	Room temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	122	Eva_in temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	123	Eva_out temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	125	Mid 2 temperature sensor of indoor unit. (Open or Short)
IDU	Sensor	128	Eva_in temperature sensor is detached from eva_in pipe of indoor unit.
IDU	Sensor	129	Eva_out temperature sensor is detached from eva_out pipe of indoor unit.
IDU	Sensor	130	Eva_in and eva_out temperature sensors are detached from eva_in and out pipes of indoor unit at the same time.
IDU	Sensor	137	VOC sensor of ERV product. (Open or Short)
IDU	Sensor	138	Gas sensor of ERV product. (Open or Short)
IDU	Sensor	139	CO2 sensor of ERV product. (Open or Short)
IDU	Sensor	321	EVI_in temperature sensor. (Open or Short)
IDU	Sensor	322	EVI_out temperature sensor. (Open or Short)
		NUM	**ERROR COMMENT**
ODU	Communication	201	Communication error between indoor and outdoor unit. (Tracking failure or the setting quantity of indoor unit on outdoor unit's PCB differs from the quantity of installed indoor unit.)
ODU	Communication	202	Communication error between indoor and outdoor unit. (After tracking is completed, and then no response from indoor unit)
ODU	Communication	203	Communication error between main and sub outdoor unit. Communication error between main micom and inverter micom.
ODU	Communication	204	The setting quantity of MCU on outdoor unit's PCB differs from the quantity of installed MCU.
ODU	Communication	205	Communication error of all PCB among main, Hub, Fan, Inverter micoms.
ODU	Communication	206	Communication error of individual PCB. (C001 : Hub, C002 : Fan, C003 : Inverter 1, C004 : Inverter 2)
ODU	Communication	610	Communication error between centralized controller and interface module.
ODU	Communication	611	Communication error between DMS and centralized controller.
ODU	Communication	613	Communication error between DMS and SIM interface module.
ODU	Communication	614	Communication error between SIM and power meter.
ODU	Communication	615	Communication error between interface module and indoor unit.
ODU	Communication	616	Communication error between interface module and outdoor unit.
		NUM	**ERROR COMMENT**

Trane ProSpace Error Codes
by Group

ODU	Operation	312	Main cooling solenoid valve opening error.
ODU	Operation	346	Motor starting failure error of fan 2.
ODU	Operation	347	Motor wiring disconnection error of fan 2.
ODU	Operation	348	Motor locking error of fan 2.
ODU	Operation	353	Motor overheated error of fan 2.
ODU	Operation	355	IPM overheated error of fan 2.
ODU	Operation	361	Starting failure error of compressor 2.
ODU	Operation	364	Over current error of compressor 2.
ODU	Operation	365	Overload error of compressor 2.
ODU	Operation	366	DC-link over/under voltage error of INV PBA 2.
ODU	Operation	367	Wiring disconnection error of compressor 2.
ODU	Operation	368	Current sensor error of INV PBA 2.
ODU	Operation	369	DC-link voltage sensor error of INV PBA 2.
ODU	Operation	374	Heat sink temp. sensor error of INV PBA 2.
ODU	Operation	378	Over current of fan 2.
ODU	Operation	385	Input current sensor error of INV PCB 2.
ODU	Operation	387	Hall sensor error of fan 2.
ODU	Operation	389	Motor overload error of fan 2.
ODU	Operation	393	Motor current sensor error of fan 2.
ODU	Operation	396	DC-link voltage sensor error of fan 2.
ODU	Operation	399	Heat sink temp. sensor error of fan 2.
ODU	Operation	400	IGBT module overheated error of INV PCB 2.
ODU	Operation	407	Compressor stop by abnormal high pressure.
ODU	Operation	410	Compressor stop by low pressure protection control or refrigerant leakage.
ODU	Operation	416	Compressor stop by discharge temperature protection control.
ODU	Operation	425	Missing or disconnection error of 3 phase wiring.
ODU	Operation	428	Compressor stop by compression protection control.
ODU	Operation	438	System stop by refrigerant flood back operation.(EVI EEV leakage, Intercooler internal leakage, Indoor EEV leakage)
ODU	Operation	439	Abnormal low and high pressure (Judgment before starting)
ODU	Operation	440	Limitation of heating operation. (Out of ambient temp. operating range)
ODU	Operation	441	Limitation of cooling operation. (Out of ambient temp. operating range)
ODU	Operation	442	Limitation of refrigerant charging in heating operation (Over 15℃ of ambient
ODU	Operation	443	Abnormal high pressure error (Judgment after starting)
ODU	Operation	445	Crank case heat failure.
ODU	Operation	446	Motor starting failure error of fan 1.
ODU	Operation	447	Motor wiring disconnection error of fan 1.
ODU	Operation	448	Motor locking error of fan 1.
ODU	Operation	452	Power supply failure temporary or zero crossing error.
ODU	Operation	453	Motor overheated error of fan 1.
ODU	Operation	454	RPM error of outdoor unit's motor
ODU	Operation	455	IPM overheated error of fan1.
ODU	Operation	457	Backlash error of outdoor unit's motor
ODU	Operation	458	Over current of CT sensor. (Or outdoors motor locking of inverter system.)
ODU	Operation	461	Low current of CT sensor. (Or compressor starting failure of inverter system.)
ODU	Operation	462	Compressor stop by over current of input.
ODU	Operation	464	Over current error of compressor 1.
ODU	Operation	465	Inverter Compressor1 V-limit error
ODU	Operation	466	DC-link over/under voltage error of INV PBA 1.
ODU	Operation	467	Wiring disconnection error of compressor 1.
ODU	Operation	468	Current sensor error of INV PBA 1.
ODU	Operation	469	DC-link voltage sensor error of INV PBA 1.
ODU	Operation	474	Heat sink temp. sensor error of INV PBA 1.
ODU	Operation	478	Over current of fan 1.
ODU	Operation	485	Input current sensor error of INV PCB 1.
ODU	Operation	486	DC-link over/under voltage error. (Fan PCB's detection)
ODU	Operation	487	Hall sensor error of fan 1.
ODU	Operation	489	Motor overload error of fan 1.
ODU	Operation	493	Motor current sensor error of fan 1.

Trane ProSpace Error Codes
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ODU	Operation	496	DC-link voltage sensor error of fan 1.
ODU	Operation	499	Heat sink temp. sensor error of fan 1.
ODU	Operation	500	IGBT module overheated error of INV PCB 1.
ODU	Operation	503	Restriction in refrigerant system
ODU	Operation	505	Input sensor failure
ODU	Operation	506	Input sensor failure
ODU	Operation	560	Option setting error of outdoor unit.
ODU	Operation	563	Incompatible indoor unit's installation error.
ODU	Operation	559	Indoor unit stop by unidentified error from outdoor units.
ODU	Operation	560	Option switch setting error of outdoor unit. (napplicable option switch turns on.)
ODU	Operation	561	Fan RPM error of ERV SA (Supply air).
ODU	Operation	562	Fan RPM error of ERV RA (Return air).
ODU	Operation	563	Model mismatching of Indoor unit.
ODU	Operation	573	Incompatible outdoor unit's installaton error in module installation.
ODU	Operation	608	Can't detect ERV controller.
ODU	Operation	609	Indoor unit is not detected for synchronous control.
ODU	Operation	618	The connected indoor units to ERV exceeded 16 units.
ODU	Operation	702	EEV closing error of the indoor unit (1st detection)
ODU	Operation	703	EEV opening error of the indoor unit (1st detection)
		NUM	**ERROR COMMENT**
ODU	Sensor	221	Ambient air temperature sensor of outdoor unit. (Open or Short)
ODU	Sensor	226	Ambient air temperature sensor is detached from outdoor unit.
ODU	Sensor	231	Cond_out temperature sensor of main outdoor unit. (Open or Short)
ODU	Sensor	236	Cond_out temperature sensor of the outdoor unit. (Open or Short)
ODU	Sensor	237	Cond temperature sensor of outdoor unit. (Open or Short)
ODU	Sensor	241	Cond_mid temperature sensor is detached from sensor hold of the pipe.
ODU	Sensor	246	Cond_out 1 temperature sensor is detached from sensor hold of the pipe.
ODU	Sensor	251	Discharge temperature sensor of compressor 1. (Open or Short)
ODU	Sensor	256	Discharge temperature sensor of compressor 1. (Open or Short)
ODU	Sensor	257	Discharge temperature sensor of compressor 2. (Open or Short)
ODU	Sensor	258	Discharge temperature sensor of compressor 3. (Open or Short)
ODU	Sensor	261	Discharge temperature sensor of compressor 1 is detached from the sensor hold of the pipe.
ODU	Sensor	262	Discharge temperature sensor of compressor 1 is detached from the sensor hold of the pipe.
ODU	Sensor	263	Discharge temperature sensor of compressor 2 is detached from the sensor hold of the pipe.
ODU	Sensor	264	Discharge temperature sensor of compressor 3 compressor is detached from the
		NUM	**ERROR COMMENT**
ODU	Protection	401	OUT DOOR FREEZING CHECK1
ODU	Protection	402	OUT DOOR FREEZING CHECK2
ODU	Protection	403	OUT DOOR FREEZING CHECK3
ODU	Protection	407	Compressor stop by high pressure's protection control.
ODU	Protection	408	Compressor stop by high pressure's protection control 2.
ODU	Protection	409	Compressor stop by high pressure's protection control 3.
ODU	Protection	410	Compressor stop by low pressure's protection control.
ODU	Protection	411	Compressor stop by low pressure's protection control 2.
ODU	Protection	412	Compressor stop by low pressure's protection control 3.
ODU	Protection	413	Protection control by sump sensor.
ODU	Protection	414	Protection control by sump sensor 2.
ODU	Protection	415	Protection control by sump sensor 3.
ODU	Protection	416	Compressor stop by discharge temperature's protection control.
		NUM	**ERROR COMMENT**
ODU	Self-Detection	419	OUTDOOR UNIT EEV 1 OPENSELF-DETECTION ERROR
ODU	Self-Detection	420	OUTDOOR UNIT EEV 2 OPENSELF-DETECTION ERROR
ODU	Self-Detection	421	OUTDOOR UNIT EEV 3 OPENSELF-DETECTION ERROR
ODU	Self-Detection	422	OUTDOOR UNIT EEV 1 CLOSEDSELF-DETECTION ERROR
ODU	Self-Detection	423	OUTDOOR UNIT EEV 2 CLOSEDSELF-DETECTION ERROR
ODU	Self-Detection	424	OUTDOOR UNIT EEV 3 CLOSEDSELF-DETECTION ERROR
ODU	Self-Detection	425	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N)
ODU	Self-Detection	426	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N) 2

Trane ProSpace Error Codes
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ODU	Self-Detection	427	Reverse phase or phase open. (3©ª Wiring of outdoor unit, R-S-T-N) 3
ODU	Self-Detection	428	Compressor stop by abnormal compression ratio.
ODU	Self-Detection	429	Compressor stop by abnormal compression ratio 2.
ODU	Self-Detection	430	Compressor stop by abnormal compression ratio 3.
ODU	Self-Detection	431	Self-diagnosis of oil solenoid valve. (Open and Close error)
ODU	Self-Detection	434	OIL BALANCE VALVE OPEN ERROR
ODU	Self-Detection	437	OIL BALANCE VALVE CLOSED ERROR
ODU	Self-Detection	440	Prohibition of heating operation when the ambient air temperature is over 30¡ÆC
ODU	Self-Detection	441	DO NOT OPERATE COOLING MODE WHENOUTDOOR UNIT IS BELOW -5¢®É
ODU	Self-Detection	442	Prohibition of refrigerant charging with heating operation when outdoor ambient air temperature is over 15¡ÆC.
ODU	Self-Detection	443	Prohibition of operating when the high pressure of system is too low.
		NUM	**ERROR COMMENT**
ODU	MCU	180	Opening error of cooling and heating solenoid valve simultaneously in MCU (1st detection)
ODU	MCU	181	Opening error of cooling and heating solenoid valve simultaneously in MCU (2nd detection)
		NUM	**ERROR COMMENT**
ODU	Pipe Check	190	No matching between indoor unit's address and eva_in sensor in pipe checking operation
ODU	Pipe Check	191	No matching between indoor unit's address and eva_out sensor in pipe checking operation
ODU	Pipe Check	199	It displays when pipe checking operation is not operated.
ODU	Pipe Check	210	Communication error between MCU and outdoor unit.
ODU	Pipe Check	211	Indoor unit's address overlapped on the MCU
ODU	Pipe Check	213	No matching between installed indoor unit's address and indoor unit's address on the MC
ODU	Pipe Check	214	Setting error of MCU's quantity in outdoor unit's P
ODU	Pipe Check	215	Indoor unit's address setting error on the MCU. (There is same address among the MCUs
ODU	Pipe Check	216	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is not connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns o
ODU	Pipe Check	217	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns of
ODU	Pipe Check	218	Setting error of indoor unit's quantity on MCU's PCB.(The quantity of installed indoor units exceeds the setting number of the MCU's PC
		NUM	**ERROR COMMENT**
ODU	Remote Control	190	No matching between indoor unit's address and eva_in sensor in pipe checking operation
ODU	Remote Control	191	No matching between indoor unit's address and eva_out sensor in pipe checking operation
ODU	Remote Control	199	It displays when pipe checking operation is not operated.
ODU	Remote Control	210	Communication error between MCU and outdoor unit.
ODU	Remote Control	211	Indoor unit's address overlapped on the MCU
ODU	Remote Control	213	No matching between installed indoor unit's address and indoor unit's address on the MC
ODU	Remote Control	214	Setting error of MCU's quantity in outdoor unit's P
ODU	Remote Control	215	Indoor unit's address setting error on the MCU. (There is same address among the MCUs
ODU	Remote Control	216	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is not connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns o
ODU	Remote Control	217	Setting error of indoor unit activating dip switch on MCU's PCB.(The indoor unit is connected with the MCU's port but indoor unit activating dip switch on MCU's PCB turns of
ODU	Remote Control	218	Setting error of indoor unit's quantity on MCU's PCB.(The quantity of installed indoor units exceeds the setting number of the MCU's PC
		NUM	**ERROR COMMENT**
WCU	Sensor	224	Water Sensor (Short or Open)
WCU	Sensor	225	Control Box temperature Sensor (Short or Open)
WCU	Sensor	435	Flow Switch Error
WCU	Operation	436	Heat exchanger anti-freeze protection Error
WCU	Operation	440	Restriction due to high temperature
WCU	Operation	441	Restriction due to low temperature
WCU	Operation	515	The internal temperature of Control Box was too high
WCU	Operation	516	DC-FAN of Control Box feedback error
WCU	Operation	573	Error due to using single type outdoor unit in a module installation

Component Location

JOB NAME _____

LOCATION _____ DATE _____

TRANE VRF

Outdoor Unit Set Up

	Rotary Switch Set At	
	SW-51	SW-52
TOTAL INDOOR UNITS		

SWITCH 53	K5	K6	K7	K8
MAIN				
SUB -A				
SUB B				

Rotary Switch Set At		
	SW-57	
TOTAL MCU UNITS		

MAIN -MODEL / SERIAL _____ / _____

SUB A -MODEL / SERIAL _____ / _____

SUB B -MODEL / SERIAL _____ / _____

MCU-1

LOCATION	
PORTS USED	

MCU-5

LOCATION	
PORTS USED	

MCU-2

LOCATION	
PORTS USED	

MCU-6

LOCATION	
PORTS USED	

MCU-2

LOCATION	
PORTS USED	

MCU-6

LOCATION	
PORTS USED	

Component Location

MCU - 1	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	5

AHUs

LOCATION		
Place Model / Serial box sticker here	MCU ADDRESS	OO
	MCU PORT	A
	ROTARY SW	OO
	DIP SW POS.	ON

LOCATION		
Place Model / Serial box sticker here	MCU PORT	B
	ROTARY SW	O1
	DIP SW POS.	ON

LOCATION		
Place Model / Serial box sticker here	MCU PORT	C
	ROTARY SW	O2
	DIP SW POS.	ON

LOCATION		
Place Model / Serial box sticker here	MCU PORT	D
	ROTARY SW	O3
	DIP SW POS.	ON

LOCATION		
Place Model / Serial box sticker here	MCU PORT	E
	ROTARY SW	O4
	DIP SW POS.	ON

LOCATION		
Place Model / Serial box sticker here	MCU PORT	F
	ROTARY SW	OO
	DIP SW POS.	OFF

Component Location

MCU - 1	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION
Place Model / Serial box sticker here

MCU ADDRESS	OO
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Component Location

MCU - 2	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION
Place Model / Serial box sticker here

MCU ADDRESS	O1
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Component Location

MCU - 3	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION	
Place Model / Serial box sticker here	
MCU ADDRESS	O2
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Component Location

MCU - 4	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION
Place Model / Serial box sticker here

MCU ADDRESS	O3
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Component Location

MCU - 5	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION
Place Model / Serial box sticker here

MCU ADDRESS	O4
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Component Location

MCU - 6	MCU Model No.	
	MCU Serial No.	
	Number of Connected Ports >	

AHUs

LOCATION
Place Model / Serial box sticker here

MCU ADDRESS	O5
MCU PORT	A
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	
DIP SW POS.	ON or OFF

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	
DIP SW POS.	ON or OFF

Appendix-2b

MCU - 1

MCU Model No. _____

MCU Serial No. _____

Number of Connected Ports > 5

AHUs

LOCATION
Place Model / Serial box sticker here

First MCU starts its number sequence with OO

MCU ADDRESS	OO
MCU PORT	A
ROTARY SW	OO
DIP SW POS.	ON

LOCATION
Place Model / Serial box sticker here

MCU PORT	B
ROTARY SW	O1
DIP SW POS.	ON

LOCATION
Place Model / Serial box sticker here

MCU PORT	C
ROTARY SW	O2
DIP SW POS.	ON

LOCATION
Place Model / Serial box sticker here

MCU PORT	D
ROTARY SW	O3
DIP SW POS.	ON

LOCATION
Place Model / Serial box sticker here

MCU PORT	E
ROTARY SW	O4
DIP SW POS.	ON

LOCATION
Place Model / Serial box sticker here

MCU PORT	F
ROTARY SW	OO
DIP SW POS.	OFF

Appendix-2b

MCU - 2

MCU Model No.

MCU Serial No.

Number of Connected Ports > 4

Second MCU starts its number sequence with O1

AHUs

LOCATION	
Place Model / Serial box sticker here	
MCU ADDRESS	O1
MCU PORT	A
ROTARY SW	O5
DIP SW POS.	ON

Number sequence picks up where the last AHU identified as O4 on MCU 1 stopped

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	B
ROTARY SW	O6
DIP SW POS.	ON

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	C
ROTARY SW	O7
DIP SW POS.	ON

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	D
ROTARY SW	O8
DIP SW POS.	ON

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	E
ROTARY SW	OO
DIP SW POS.	OFF

LOCATION	
Place Model / Serial box sticker here	
MCU PORT	F
ROTARY SW	OO
DIP SW POS.	OFF

Appendix-2b

MCU - 3

MCU Model No.

MCU Serial No.

Number of Connected Ports > 3

Third MCU starts its number sequence with O2

AHUs

LOCATION	
Place Model / Serial box sticker here	
	MCU ADDRESS: O2
	MCU PORT: A
	ROTARY SW: O9
	DIP SW POS.: ON

Number sequence picks up where the last AHU identified as O4 on MCU 2 stopped

LOCATION	
Place Model / Serial box sticker here	
	MCU PORT: B
	ROTARY SW: 10
	DIP SW POS.: ON

LOCATION	
Place Model / Serial box sticker here	
	MCU PORT: C
	ROTARY SW: 11
	DIP SW POS.: ON

LOCATION	
Place Model / Serial box sticker here	
	MCU PORT: D
	ROTARY SW: OO
	DIP SW POS.: OFF

LOCATION	
Place Model / Serial box sticker here	
	MCU PORT: E
	ROTARY SW: OO
	DIP SW POS.: OFF

LOCATION	
Place Model / Serial box sticker here	
	MCU PORT: F
	ROTARY SW: OO
	DIP SW POS.: OFF

Appendix-2c

JOB NAME _____

LOCATION _____ DATE _____

TRANE VRF

Outdoor Unit Set Up

Rotary Switch Set At		
	SW-51	SW-52
TOTAL INDOOR UNITS		

SWITCH 53	K5	K6	K7	K8
MAIN				
SUB -A				
SUB B				

MAIN -MODEL / SERIAL _____ / _____

SUB A -MODEL / SERIAL _____ / _____

SUB B -MODEL / SERIAL _____ / _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

Appendix-2c

JOB NAME _____

LOCATION _____ **DATE** _____

AHUs

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

LOCATION
Place Model / Serial box sticker here

99-Steps

Refrigerant & Drain Piping		
Step	**Item to Check**	**Remark**
1	Obtain the latest VRF Select Report from the Trane Account Manager responsible for this project.	Eqpt List, Piping Diagram & Wiring Diagram
2	All refrigerant pipe used must be ACR & nitrogen purged during the braze process.	
3	Outdoor joints are installed level, not pointing up or down (multi module systems only).	
4	Indoor refrigerant Y-joints are installed level +/- 15° in either direction.	Vertical installation of Y-joints is allowed.
5	Distribution header fittings are installed level within +/- 10^0/15° in either direction (vertical installation is not allowed).	
6	Unused distribution header ports are brazed shut & insulated.	Field supplied braze caps or pinch braze acceptable.
7	Refrigerant pipes are insulated with 1/2" wall minimum insulation (3/4" minimum on refrigerant pipes 1- 1/2" and larger).	Verify local, state and national codes.
8	All refrigerant pipe insulation joints are sealed with appropriate adhesives and/or tape. (be sure to mark joints)	Verify local, state and national codes.
9	All condensate drain pipes are installed, insulated, and supported at minimum of 3 – 5 feet.	Verify local, state and national codes.
10	All refrigerant fittings are insulated with supplied polystyrene insulation & taped/sealed to prevent condensation.	
11	All refrigerant pipes are to be supported between 3 – 5 feet.	Verify local, state and national codes.
12	Refrigerant Y-joints are supported on both sides within 18 inches of the braze.	
13	Refrigerant charge has been verified to be the appropriate amount in each system per applicable ASHRAE 15 standard.	
14	There is a minimum 19.5" between a radius and the inlet or outlet of the Y-joint.	
15	There is a minimum 36" between Y-joints.	
16	All isolation valves (when used) are installed in the appropriate direction, verified to be fully open & insulated.	Isolation valves with service ports are recommended. Install so the service port is towards the indoor unit(s) or MCU(s).
17	Refrigerant pipe system has been pressure tested per Trane recommendation.	
18	Vacuum process was performed on the refrigerant pipe system per Trane recommendation.	To 200 microns.

99-Steps

19	**Verify Installed Refrigerant Required outside of ODU:** Additional refrigerant amount was calculated based on total installed line length and diameter the liquid refrigerant pipe as well as the installed equipment.	see IOM example (John works through Original Report as example - then class verifies actual lengths and re-calculates refrigerant amount.)
20	Additional refrigerant is to be weighed in with an accurate digital scale before releasing factory charge. (Press K2 once to initiate refrigerant charging in the Cooling mode.) or (Press K1 once for refrigerant charging in the Heating mode.)	Length & Diameter of each liquid refrigerant pipe must be recorded to accurately calculate additional refrigerant.
21	Condensing unit service valves are open with valve covers reinstalled & tightened.	
22	Refrigerant piping was installed as the engineering plans described.	Pipe layout, diameter, and equipment must match precisely.
23	Final refrigerant pipe line lengths must be turned over to the Trane Salesperson of record for final selection program layout.	Most accurate layout from VRF Select is used for warranty.
24		

Appendix-3b

MCU & MXD EEV KITS				
Step	**Layout**	**Final**	**Item to Check**	**Remark**
25			MCU(s) are installed in an unoccupied area to minimize the noise from mixed heating and cooling operation. If not, precautions have been taken to minimize such noise	
26			Make sure MCU's are installed level.	
27			Make sure EEV Kits are installed level.	
28			For the purpose of servicing the MCU, the space between the top of the MCU(s) and the structure/obstructions above it should meet minimum clearances. (refer to the Trane IOM)	Trane recommends 10" minimum. Leave more space if possible to make future service easier.
29			MCU drain pipe is connected and insulated.	
30			MCU liquid, suction, and high pressure gas incoming refrigerant pipes are connected to the corresponding ports and torqued to specification.	See MCU installation manual training materials. Cut flare connection & braze - won't void warranty)
31			Indoor units have been connected to the outlet side of the MCU(s) and torqued to factory specification. (liquid and gas)	Farthest IDU first - to improve efficiency
32			The sum of connected indoor units to each MCU must not exceed its capacity: 120,000 Btu/h for the 4 port 180,000 Btu/h for the 6 port 192,000 Btu/h for the dedicated 4/2 port	
33			Multi-port EEV kit liquid and suction incoming refrigerant pipes are connected to their corresponding ports.	
34			The sum of connected indoor units to each EEV kit does not exceed design specifications	HR only has a 1-port
35			All 208/230 VAC supply voltage to the MCU(s) has been connected by a licensed electrician.	Verify all local, state and National codes.
36			Each MCU has a service disconnect nearby per NEC installed by a licensed electrician.	Verify all local, state and National codes.
37			Unused MCU outlet ports are sealed against leaks and insulated to prevent condensation.	
38			Main addresses have been set on for all MCU's (MCU MAIN address)	send them out to address - fill in the component location sheet
39			Indoor unit Main addresses are set on the MCU PCB(s) according to the MCU port they are connected to (A,B,C,D,E,F)	send them out to address - fill in the component location sheet

Outdoor & Indoor Units				
Step	**Layout**	**Final**	**Item to Check**	**Remark**
40			Outdoor unit(s) not placed too close to nearby walls or obstructions. Trane recommends 12” between units for the purpose of cleaning.	Refer to the Trane IOM for installation clearances
41			Outdoor unit(s) discharge air is unobstructed and/or properly ducted.	Refer to the Trane IOM for installation clearances
42			Outdoor unit(s) properly secured to structure/stand.	Per local, state or National codes
43			Outdoor unit(s) properly drained.	Per IOM
44			Outdoor unit(s) piping complete.	Per Trane recommendations. Per local, state or National codes
45			All piping is insulated and supported.	Per Trane recommendations. Per local, state or National codes
46			Correct supply voltage to the outdoor unit(s) has been connected by a licensed electrician.	Per local, state or National codes
47			Outdoor unit(s) are properly grounded per NEC.	Per local, state or National codes
48			All outdoor unit(s) have proper overcurrent protection and service disconnects per NEC.	Verify overcurrent protection meets condensing unit data plate specifications.
49			All communication wires (F1/F2, OF1/0F2) have been connected (between ODUs)	
50			Shielded communication cable sheilding wire is grounded at the outdoor unit on a separate terminal than the main service ground connection	
51			Indoor unit quantity rotary switches have been set in MAIN outdoor units	
52			DIP switches have been adjusted in all of the outdoor units.	Ex: designate as MAIN, SUB1, SUB2
53			All indoor units are securely suspended/hung with appropriate hardware.	Per Trane recommendations. Per Local, State and National requirements.
54			4-way and Mini 4-way cassette units are 59" minimum from nearby walls and obstructions on all sides.	Minimum 10' between installed 4-way and mini 4-way cassettes.
55			1-way a cassette units are 59" minimum from nearby walls and obstructions (on all sides excluding return air side of unit)	
56			Wall mounted units must have sufficient space in front of them to the nearest wall or obstruction as follows: 6-12 MBH requires 15" minimum 18-24 MBH requires 23" minimum (All must be at least 6-inches from the floor.)	
57			High Wall mounted units must be at least 6-ft from the floor.	
58			All condensate drain pipes are sized properly, installed and insulated.	Per Local, State & National Codes.

59			All condensate drain pipes are supported per local and state requirements.	Trane recommends every 3-5 feet.
60			Condensate lines from units with Trane condensate pumps (cassette units, optional pumps for ducted units) tap into the top of main drain (not in side or bottom).	
61			P-traps from ducted units are primed before operation.	On applicable units
62			All flare connections are torqued to factory specification.	
63			All refrigerant pipe insulation is installed and sealed.	Per Trane recommendations. Verify local, state and National codes.
64			All refrigerant pipe and fittings are insulated, sealed, and supported.	Per Trane recommendations. Verify local, state and National codes.
65			All indoor units are installed level.	
66			All 208/230VAC supply voltage to the indoor unit has been connected by a licensed electrician per NEC.	Verify local, state and National codes.
67			Each indoor unit has a service disconnect nearby per NEC, installed by a licensed electrician.	Verify local, state and National codes.
68			All communication cable (F1/F2, F3/F4) wire is 18 AWG, twisted shielded cable. (see Step-10 for more information)	
69			All communication wires (F1/F2) have been connected	
70			All wired controllers F3/F4 communication connections are connected to indoor unit(s)	Maximum 16 indoor units.
71			Communication (F1/F2) cable has bare wire bonded to the bare wire that will connect to the next indoor unit, MCU, or EEV kits in daisy chain (do not ground at indoor units)	
72			Shielded and bare wire in communication cable (F1/F2) is not touching indoor unit PCB's or other communication or voltage connections.	
73			Main addresses have been set in each indoor unit	Nothing to set in ID units. Auto addressing will take place during initialization. After auto addressing you can go back in and accept or change to desired address.
74			The RMC(1) address in the IDU matches the Rotary Switch address in the On-Off Controller (0 ~ F). The RMC(2) in the IDU has been set by the remote controller (wired or wireless) to specify the button on the ON/OFF controller that will control that unit (0 ~ F).	

75			Condensate pumps have been installed in wall mounted units (optional).	
76			Condensate pump overflow relay is connected to break communications for high wall or convertible units (optional).	
77			Condensate pumps have been installed in ducted units and connected to indoor unit PCB (optional).	Trane brand condensate pumps, internal installation
78			Indoor Unit option code has been set for Trane condensate pumps that were installed inside ducted units.	change code on suit-cases
79			Indoor Unit option code has been set to accept a Central Controller.	
80			Indoor Unit option code has been set for units that will be controlled with an external contact control (optional).	
81			If using external contact control, the indoor unit option code has been set for Thermo ON/OFF or Operation ON/OFF.	
82			4-way and Mini 4-way cassette panels (trim covers) have been installed (ships separately from cassette units).	
83			Cassette unit height has been adjusted for proper level difference between ceiling and unit chassis (cardboard guide included with indoor units).	No special tools are provided.
84			Cassette panels have been installed and properly connected to indoor unit PCB to "DISPLAY" and "LOUVER" connections.	
85			All equipment filters are installed.	
86			Ducted unit duct connections are complete and sealed.	Verify all local, state and national codes.
87			Duct design allows the units to operate within specified static pressure range.	Static pressure information is available in installation manuals, submittals, and other technical documents.
88			All wall-mounted units have a separate expansion valve (EEV) installed.	Use single port unit EEV only on HR, 1/2/3 port EEV kits for HP. Single Port EEV: 12-Vdc 2/3 Port EEV: 208/230-Vac
89			Ducted unit static pressure settings have been adjusted for installed duct design.	Option code change, refer to service manuals.

Appendix-3d

Controllers				
Step	**Layout**	**Final**	**Item to Check**	**Remark**
90			Wired controllers have been adjusted for °F	
91			Wired controllers have been set to sense temperature with built-in temperature sensor located in the wired remote controller.	
92			V1/V2 voltage connections are **NOT** connected to the wired controllers	
93			F3/F4 communication connections are connected to appropriate wired controllers	E.g. 1 Wired controller connected to up to 16 IDUs
94			Time and date has been set on wired controllers	
95			R1/R2 central control wires have been run from the MAIN outdoor unit to the installation location of central controller(s) including VRF System Controller and/or System Touchscreen.	18 AWG, 2 conductor, shielded cable per Trane spec.
96			Optional remote temperature sensor (if used) TVCTRLTRWTA000 has been connected to indoor unit(s) and SEG4 in Installation Option 1 has been changed from 0 to 1.	Need to set SEG4 in Option 1 from 0 to 1.
97			Verification that a Wired Controller operates all the associated IDUs - (e.g. 2-16 units) (Confirming operation of step 4)	
98			Confirm configuration installation options are programmed into the Indoor Units	suit-cases with remote sensor & wired remote
99			Modifying Installation Options	Tech Util Tool

TRANE

Project Report

Name : Original Design (before installation)
Tel. :
E-mail :
Address :

Name : John Doe
Tel. : 123-456-7890
E-mail : john.doe@trane.com
Address : 2701 Wilma Rudolph Blvd

Clarksville Display 8ton HR

08-08-2013

1 Total Load Profile

1.1 Building1

Dept	Fl	Room	Area		Load per unit area		Required Capacity			Sum of capacity			Model	Qty	Nominal Capacity			Outdoor	Model	Nominal Capacity		Combi. Ratio	
			CAD	SALES	Cooling	Heating	Cooling		Heating	Cooling		Heating			Cooling		Heating			Clg	Htg	Clg	Htg
							TC	SHC	TC	TC	SHC	TC			TC	SHC	TC			TC	TC		
			sq.ft.	sq.ft.	BTU/h/sq.ft.	BTU/h/sq.ft.	BTU/h	BTU/h	BTU/h	BTU/h	BTU/h	BTU/h			BTU/h	BTU/h	BTU/h	-	-	BTU/h	BTU/h	%	%
Bldg 1	1F									113000	100000	126000	4TVE0007B100NB	1	7500	5100	8500	New Outdoor	4TVR0096B300NB	96000	108000	118	117
													4TVL0007B100NB	1	7500	11600	8500						
													4TVW0007B100NB	1	7500	11600	8500						
													4TVC0009B100NB	1	9000	10600	10000						
													4TVB0009B100NB	1	9500	6800	10500						
													4TVD0018B100NB	1	18000	13800	20000						
													4TVX0018B100NB	1	18000	13800	20000						
													4TVA0036B100NB	1	36000	26700	40000						

2 Piping & Wiring

2.1 New Outdoor

2.1.1 Detail Load Profile

1) Design condition: USA, Tennessee, Nashville, Cooling 97.0/75.0, Heating 9.0/32.0

2) Load profile

Building			Unit		Liquid	Gas	H.P. Gas	Airflow	Nominal Capacity			Simulated Capacity			Combi. Ratio	
Dept	Fl	Room	Name	Model name					Cooling		Heating	Cooling		Heating	Cooling	Heating
									TC	SHC	TC	TC	SHC	TC		
-	-	-	-	-	in	in	in	CFM	BTU/h	BTU/h	BTU/h	BTU/h	BTU/h	BTU/h	%	%
Bldg 1	1F		New Outdoor	4TVR0096B300NB	3/8"	7/8"	3/4"	9182	96000		108000	0		0	117.71	116.67
			Indoor1	4TVE0007B100NB	1/4"	1/2"		211	7500	5100	8500	0	0	0		
			Indoor4	4TVL0007B100NB	1/4"	1/2"		247	7500	11600	8500	0	0	0		
			Indoor8	4TVW0007B100NB	1/4"	1/2"		240	7500	11600	8500	0	0	0		
			Indoor2	4TVC0009B100NB	1/4"	1/2"		459	9000	10600	10000	0	0	0		
			Indoor7	4TVB0009B100NB	1/4"	1/2"		300	9500	6800	10500	0	0	0		
			Indoor3	4TVD0018B100NB	1/4"	1/2"		459	18000	13800	20000	0	0	0		
			Indoor6	4TVX0018B100NB	1/4"	1/2"		459	18000	13800	20000	0	0	0		
			Indoor5	4TVA0036B100NB	3/8"	5/8"			36000	26700	40000	0	0	0		

2.1.2 Control

1) This data is for reference only. Verify local, state, and national electric codes. Trane does not guarantee this data.

2) Configuration

Building			Unit		Transmission wires	Power wires	Breaker Fuse	Main Address		RMC Address		Accessories	
Dept	Fl	Room	Name	Model name								Optional accessories	Basic accessories
-	-	-	-	-	in2	in2	A						
Bldg 1	1F		New Outdoor	4TVR0096B300NB	AWG~	AWG~	50						
			Indoor1	4TVE0007B100NB	AWG 18~16	AWG 16~14		0	4	0	0	TVCTRLTRDH00UT,TVCTRLTWRWE10T	TVEPANPC1NUSET
			Indoor2	4TVC0009B100NB	AWG 18~16	AWG 16~14		0	6	0	0	TVCTRLTRDH00UT,TVCTRLTWRWE10T	TVEPANPC4NUSET
			Indoor3	4TVD0018B100NB	AWG 18~16	AWG 16~14		0	3	0	0	CONDPUMPXVMB01,TVCTRLTWRWE10T	
			Indoor4	4TVL0007B100NB	AWG 18~16	AWG 16~14		0	5	0	0	TVCTRLTWRWE10T,CONDPUMPXVLB01	
			Indoor5	4TVA0036B100NB	AWG 18~16	AWG 16~14		0	2	0	0	TVCTRLTWRWE10T,CONDPUMPXVDB01	
			Indoor6	4TVX0018B100NB	AWG 18~16	AWG 16~14		0	1	0	0	TVCTRLTWRWE10T	
			Indoor7	4TVB0009B100NB	AWG 18~16	AWG 16~14		0	7	0	0	TVCTRLTWRWE10T	TVEPANPC4SUSET
			Indoor8	4TVW0007B100NB	AWG 18~16	AWG 16~14		0	0	0	0	TVCTRLTWRWE10T,TVCTRLTRDH00UT	

2.1.3 Equipment list

1) Equipment list

Categories		Model name	Qty	Categories		Model name	Qty
VRF		4TVR0096B300NB	1	4 WAY CASSETTE PANEL		TVEPANPC4NUSET	1
1 WAY CASSETTE		4TVE0007B100NB	1	DRAIN PUMP		CONDPUMPXVMB01	1
4 WAY CASSETTE		4TVC0009B100NB	1	DRAIN PUMP		CONDPUMPXVLB01	1
MSP DUCT		4TVD0018B100NB	1	DRAIN PUMP		CONDPUMPXVDB01	1
SLIM DUCT		4TVL0007B100NB	1	4 WAY CASSETTE (Mini) PANEL		TVEPANPC4SUSET	1
HSP DUCT		4TVA0036B100NB	1	Distributor Kit		4EEVEVA32SA000	1
CEILING		4TVX0018B100NB	1	Distributor Kit		4EEVEVA24SA000	1
4 WAY CASSETTE (Mini)		4TVB0009B100NB	1	Y-Joint		4YDK2512B0138A	1
HIGH WALL		4TVW0007B100NB	1	Y-Joint		4YDK2500B0240A	1
1 WAY CASSETTE PANEL		TVEPANPC1NUSET	1	Mode Change Unit		4MCUCUY4NCE000	1
WIRELESS REMOTE CONTROLLER		TVCTRLTRDH00UT	3	Mode Change Unit		4MCUCUY6NCE000	1
WIRED REMOTE CONTROLLER		TVCTRLTWRWE10T	8				

2) Piping length

Length as pipe diameter		1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"	1 5/8"	1 3/4"	1 7/8"	2"	2 1/8"
1. Liquid piping	ft	246.56	191.57														
2. Gas piping	ft			246.56	35.01	50.00	106.56										
3. High pressure gas piping	ft				50.00	106.56											

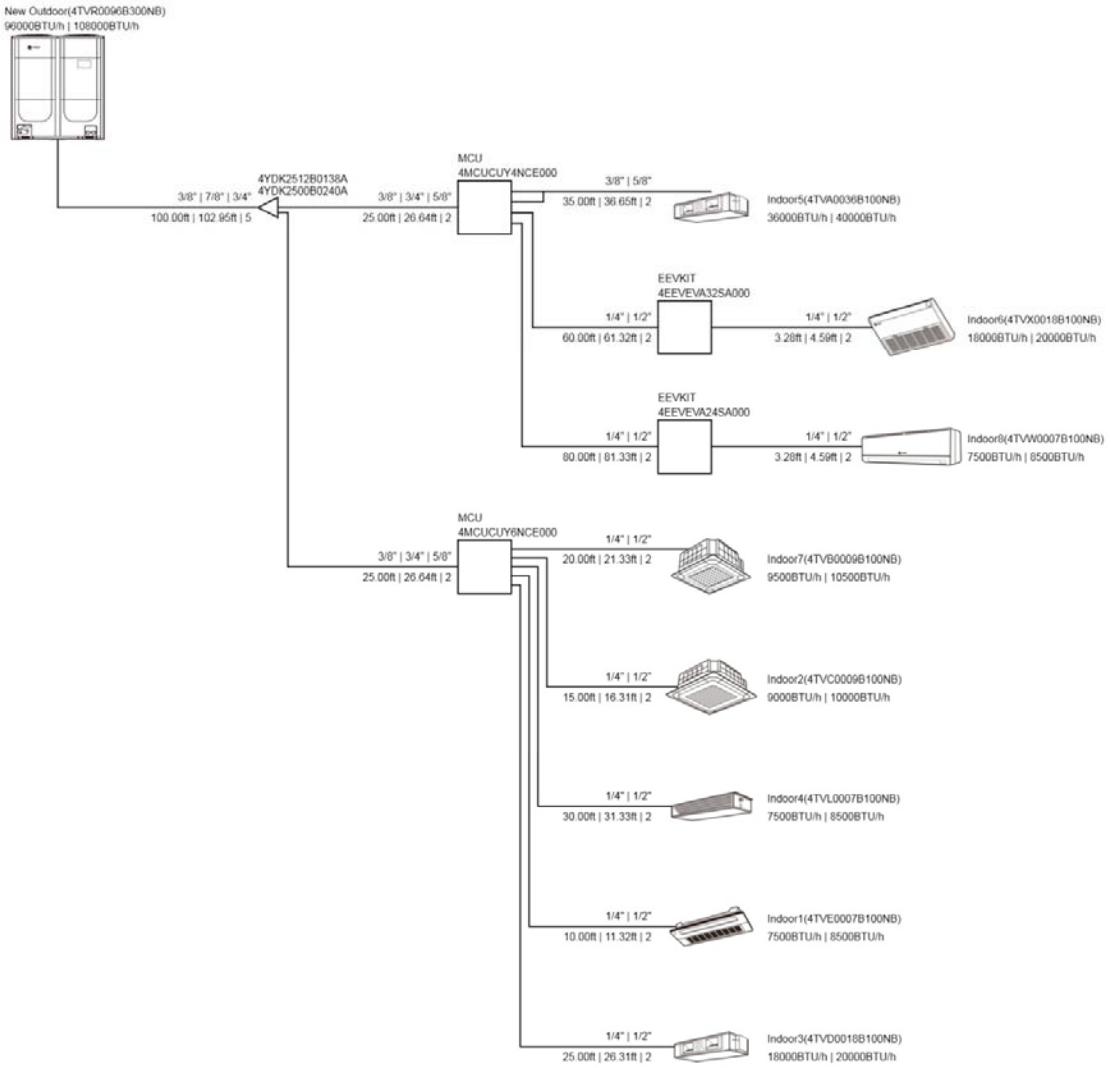
Restriction of pipe length		Restriction (Based on installation manual)	Actual piping length	Equivalent piping length
1. Total piping length	ft	3280.84	441.08	
2. Maximum piping length	ft	656.17	216.80	219.13
3. Main pipe length	ft		106.56	
4. Piping length between the first branch and the farthest indoor unit	ft	147.64/0.00	110.24	
5. Level difference between outdoor and indoor unit(Max) (OD above ID unit / OD below ID unit)	ft	164.04/131.23	-6.56	
6. Level difference between indoor units	ft	49.21		

3) Basic and additional refrigerant amount

Basic refrigerant charge amount : 16.31 lbs

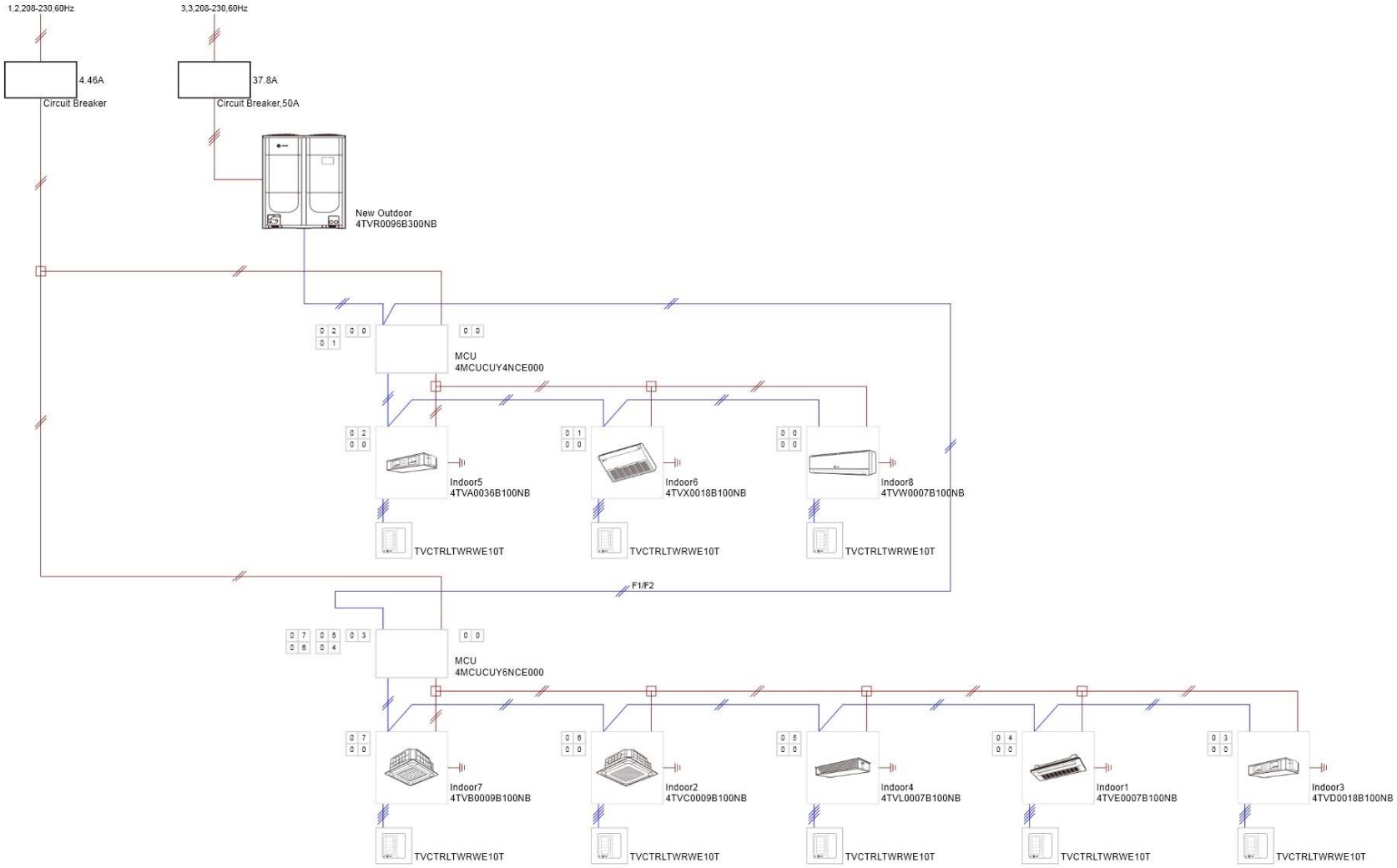
Additional refrigerant amount : 19.62 lbs

2.1.4 Piping



- The system configuration may be different from the actual installation conditions, refer to the installation manual.

2.1.5 Wiring



- The system configuration may be different from the actual installation conditions, refer to the installation manual.

3 Specification

3.1 VRF

3.1.1 Outdoor units

Model name				4TVR0096B300NB		
Power supply			Ø, #, V, Hz	3,3,208-230,60Hz		
Mode			-	HEAT RECOVERY		
Performance	TON		TON	8.00		
	Capacity(Nominal)	Cooling	kW	28.1348		
			BTU/h	96000		
		Cooling 114.8°F	kW	-		
			BTU/h	N/A		
		Heating	kW	31.6517		
			BTU/h	108000		
	-4 °F	Heating(Low ambient temp.)	kW	-		
			BTU/h	N/A		
Power	Power Input(Nominal)	Cooling	kW	6.2424		
		Heating	kW	6.682		
	Power Input (at specific)		kW	N/A		
	Power Input(Nominal)	Cooling	A	18.2		
		Heating	A	19.5		
	Max. Current Input		A	37.8		
	Circuit Breaker		A	50		
COP	Cooling		-	4.51		
	Heating		-	4.74		
Compressor	Type		-	SSC Scrollx2		
	Output		kW × n	4.9529x2		
Fan	Type		-	Propeller		
	Output		W	620x2		
	Number of Units		EA	2		
	Air Flow Rate		CFM	9182.16x2		
	External Static Pressure	Max.	W.G.	0.0796		
Piping Connections	Liquid Pipe		Ø,in(mm)	3/8"(9.52)		
	Gas Pipe		Ø,in(mm)	7/8"(22.22)		
	Discharge Gas Pipe		Ø,in(mm)	3/4"(19.05)		
	Oil Equalizing Pipe		Ø,in(mm)	N/A(N/A)		
Field Wiring	Power Source Wire		in2	AWG		
	Transmission Cable		in2	AWG/		
Refrigerant	Type		-	R410A		
	Factory Charging		lbs	16.31		
Sound	Sound pressure		dB(A)	61		
External Dimension	Net Weight		lbs	612.88		
	Shipping Weight		lbs	661.38		
	Net Dimensions (WxHxD)		in	50.98x66.73x30.11		
	Shipping Dimensions (WxHxD)		in	53.66x74.29x32.75		
Operating Temp.	Cooling		F	23.00~120.00		
	Heating		F	-4.00~75.00		

3.1.2 Indoor units

Model				4TVA0036B100NB	4TVC0009B100NB	4TVD0018B100NB	4TVE0007B100NB	4TVL0007B100NB
Power supply			Ø, #, V, Hz	1,2,208-230,60Hz	1,2,208-230,60Hz	1,2,208-230,60Hz	1,2,208-230,60Hz	1,2,208-230,60Hz
Performance	Capacity (Nominal)	Cooling	kW	10.5506	2.6376	5.28	2.198	2.2
			BTU/h	36000	9000	18000	7500	7500
		Cooling (SHC)	kW	7.825	3.1066	4.04	1.4947	3.4
			BTU/h	26700	10600	13800	5100	11600
		Heating	kW	11.7228	2.9307	5.86	2.4911	2.49
			BTU/h	40000	10000	20000	8500	8500
Power	Power Input (Nominal)	Cooling	W	210	28	165	40	47
		Heating		210	28	165	40	47
	Current Input	Cooling	A	1.47	0.2	1.4	0.23	0.32
		Heating		1.47	0.2	1.4	0.23	0.32
Fan	Motor	Type	-	Sirocco Fan	Turbo Fan	Sirocco Fan	Crossflow Fan	Sirocco Fan
		Output	W	183x2		124	20	40
		Number of unit	EA	2	1	1	1	1
	Air Flow Rate	H/M/L (UL)	CFM	988.84/-/-	512.08/459.10/388.47	512.08/459.10/406.13	247.21/211.89/176.58	282.52/247.21/211.89
	External Pressure	Min / Std / Max	W.G.	5 / 10 / 20	-	0 / 4 / 8	-	0 / 2 / 4
Piping Connections	Liquid Pipe		Ø,in(mm)	3/8"(9.52)	1/4"(6.35)	1/4"(6.35)	1/4"(6.35)	1/4"(6.35)
	Gas Pipe		Ø,in(mm)	5/8"(15.88)	1/2"(12.7)	1/2"(12.7)	1/2"(12.7)	1/2"(12.7)
	Drain Pipe		Ø,mm	VP25 (OD 32,ID 25)	VP25 (OD 32,ID 25)	VP25 (OD 32,ID 25)	VP20 (OD 26,ID 20)	VP25 (OD 32,ID 25)
Field Wiring	Power Source Wire		in2	AWG 16~14	AWG 16~14	AWG 16~14	AWG 16~14	AWG 16~14
	Transmission Cable		in2	AWG 18/16	AWG 18/16	AWG 18/16	AWG 18/16	AWG 18/16
Refrigerant	Type		-	R410A	R410A	R410A	R410A	R410A
	Control Method		-	EEV INCLUDED	EEV INCLUDED	EEV INCLUDED	EEV INCLUDED	EEV INCLUDED
Sound	Sound pressure	High / Low	dBA	40/37	34/31	35/31	27/23	26/21
Dimensions	Net Weight		lbs	136.68	55.11	68.34	23.14	57.32
	Shipping Weight		lbs	158.73	68.34	79.36	29.76	68.34
	Net Dimensions (WxHxD)		in	47.24x14.17x25.59	33.07x8.03x33.07	35.43x10.23x18.89	38.18x5.31x16.14	35.43x7.83x23.62
	Shipping Dimensions (WxHxD)		in	58.26x16.53x31.10	35.35x10.82x35.35	46.06x13.38x23.42	45.82x8.34x18.81	44.60x12.99x28.74
Panel Size	Panel model		-		TVEPANPC4NUSET		TVEPANPC1NUSET	
	Panel Net Weight		lbs		14.77		6.61	
	Shipping Weight		lbs		19.62		11.02	
	Net Dimensions (WxHxD)		in		37.40x1.18x37.40		46.45x0.98x18.11	
	Shipping Dimensions (WxHxD)		in		41.02x3.66x41.02		49.56x5.66x21.22	

Model				4TVB0009B100NB	4TVW0007B100NB	4TVX0018B100NB		
Power supply			Ø, #, V, Hz	1,2,208-230,60Hz	1,2,208-230,60Hz	1,2,208-230,60Hz		
Performance	Capacity (Nominal)	Cooling	kW	2.7842	2.2	5.28		
			BTU/h	9500	7500	18000		
		Cooling (SHC)	kW	1.9929	3.4	4.04		
			BTU/h	6800	11600	13800		
		Heating	kW	3.0772	2.49	5.86		
			BTU/h	10500	8500	20000		
Power	Power Input (Nominal)	Cooling	W	24	37	70		
		Heating		24	37	70		
	Current Input	Cooling	A	0.17	0.25	0.42		
		Heating		0.17	0.25	0.42		
Fan	Motor	Type	-	Turbo Fan	Crossflow Fan	Sirocco Fan		
		Output	W	65	23	25		
		Number of unit	EA	1	1	1		
	Air Flow Rate	H/M/L (UL)	CFM	353.16/300.18/264.87	275.46/240.14/204.83	494.42/459.10/423.79		
	External Pressure	Min / Std / Max	W.G.	-	-	-		
Piping Connections	Liquid Pipe		Ø,in(mm)	1/4"(6.35)	1/4"(6.35)	1/4"(6.35)		
	Gas Pipe		Ø,in(mm)	1/2"(12.7)	1/2"(12.7)	1/2"(12.7)		
	Drain Pipe		Ø,mm	VP25 (OD 32,ID 25)	ID 18 HOSE	ID 18 HOSE		
Field Wiring	Power Source Wire		in2	AWG 16~14	AWG 16~14	AWG 16~14		
	Transmission Cable		in2	AWG 18/16	AWG 18/16	AWG 18/16		
Refrigerant	Type		-	R410A	R410A	R410A		
	Control Method		-	EEV INCLUDED	EEV NOT INCLUDED	EEV NOT INCLUDED		
Sound	Sound pressure	High / Low	dBA	34/26	31/27	40/34		
Dimensions	Net Weight		lbs	26.45	17.63	48.50		
	Shipping Weight		lbs	30.86	19.84	57.32		
	Net Dimensions (WxHxD)		in	22.63x9.84x22.63	32.48x11.22x7.44	39.37x25.59x7.87		
	Shipping Dimensions (WxHxD)		in	24.52x11.73x25.70	35.59x13.74x9.92	42.28x28.58x11.57		
Panel Size	Panel model		-	TVEPANPC4SUSET				
	Panel Net Weight		lbs	5.95				
	Shipping Weight		lbs	9.25				
	Net Dimensions (WxHxD)		in	26.37x1.77x26.37				
	Shipping Dimensions (WxHxD)		in	28.11x4.17x28.50				

4 Controller

5 Total Equipment List

Index	Model	Qty	Remark(Categories)	Unit Price	Amount
Outdoor unit	4TVR0096B300NB	1	VRF	0	0
Indoor unit	4TVE0007B100NB	1	1 WAY CASSETTE	0	0
	4TVC0009B100NB	1	4 WAY CASSETTE	0	0
	4TVB0009B100NB	1	4 WAY CASSETTE (Mini)	0	0
	4TVD0018B100NB	1	MSP DUCT	0	0
	4TVA0036B100NB	1	HSP DUCT	0	0
	4TVL0007B100NB	1	SLIM DUCT	0	0
	4TVW0007B100NB	1	HIGH WALL	0	0
	4TVX0018B100NB	1	CEILING	0	0
Piping	4MCUCUY4NCE000	1	Mode Change Unit	0	0
	4MCUCUY6NCE000	1	Mode Change Unit	0	0
	4EEVEVA32SA000	1	Distributor Kit	0	0
	4EEVEVA24SA000	1	Distributor Kit	0	0
	4YDK2512B0138A	1	Y-Joint	0	0
	4YDK2500B0240A	1	Y-Joint	0	0
Optional accessories	TVCTRLTRDH00UT	3	WIRELESS REMOTE CONTROLLER	0	0
	TVCTRLTWRWE10T	8	WIRED REMOTE CONTROLLER	0	0
	CONDPUMPXVMB01	1	DRAIN PUMP	0	0
	CONDPUMPXVLB01	1	DRAIN PUMP	0	0
	CONDPUMPXVDB01	1	DRAIN PUMP	0	0
Ref. Pipe	1/4"(6.35)	246.56	ft	0	0
	3/8"(9.52)	191.57	ft	0	0
	1/2"(12.70)	246.56	ft	0	0
	5/8"(15.88)	85.01	ft	0	0
	3/4"(19.05)	156.56	ft	0	0
	7/8"(22.22)	106.56	ft	0	0
Additional Ref. Quantity	R410A	19.62	lbs	0	0
Total					**0**

Non-Compliance Form

Be advised that the following Trane® unit(s) are installed in violation of Trane *Installation, Operation, and Maintenance* manual requirements. Ignoring these installation requirements may result in catastrophic damage to the unit(s) and void factory warranties. Trane shall have no responsibility of any kind or type for any resulting damage to either the unit(s) and/or property of the project owner due to improper installation of the unit(s) and/or start-up not performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products.

Important: *Start-up must be performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products. This includes pressure testing, evacuation, electrical checks, refrigerant charging, actual start-up, and operator instruction. A two-week advance notice is required to ensure that the initial start-up is scheduled as close to the requested date as possible.*

	Work Order #:
Trane Technician:	Office:
Job Name:	Date:
Serial #:	Model #:

☐ **Installation Non-Compliance** *Example: Flow switches not installed.*

and/or

☐ **Start-up Non-Compliance** *Example: Required start-up done by others.*

Reason for Non-Compliance: _____

_____

_____

_____

_____

_____

_____

_____

As an authorized agent of _____

Company (print)

I, _____ _____

Name (print) Title (print)

do hereby acknowledge the aforementioned deficiencies and accept the responsibility associated with any damage caused by the above non-compliance. Furthermore, I release Trane of responsibility of any kind or type for any resulting damage to either the unit and/or project owner due to improper installation of the unit(s) and/or start-up not performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane® products.

_____ _____

Signature Date

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.

PROD-ADF001-EN 11 Jun 2012
New

Appendix-6 VRF Recommended Tool List

Recommended VRF Advantage Tools – these are representative and in no way endorse a particular model or brand.

1. **Tool Kit** – mini split tool kits contain most of the tools needed for VRF installation

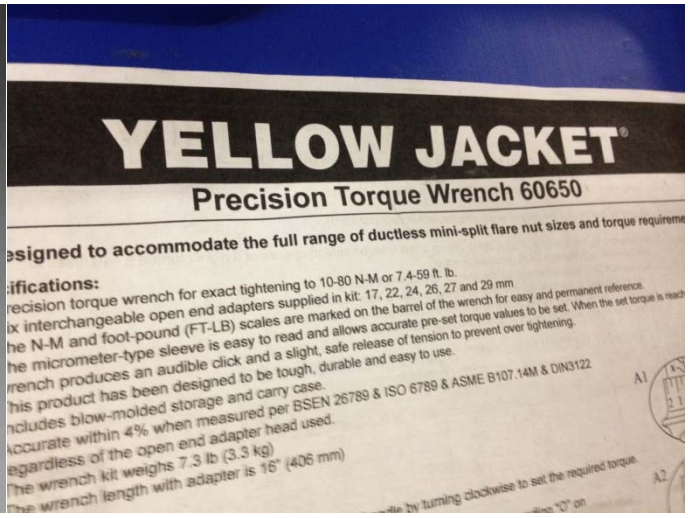
2. High pressure regulator – pressure testing at 590psi for 24hrs

3. **Flow Meter** – nitrogen purge during brazing purge at 1.76cf/h)

4. **45° R-410A Coupler 5/16” Female quick coupler x 1/4” Male flare**

Appendix-6 VRF Recommended Tool List

5. **Torque Wrenches** – flare connections



6. **Flaring Block** - Eccentric Cone Flare Tool, 3/16" to 3/4" O.D. tubing

7. **Vacuum Pump** – High volume pump to achieve 200 microns “quickly” on the last step of the triple evacuation.

.

Appendix-6 VRF Recommended Tool List

8. Digital Micron Gauge –

9. Wireless Remote (TVCTRLTRDH00UT)

10. Trane Technician Utility Tool (TUT – TVCTRLTIM0300)

11. Inverter Phase Checker

Appendix-6 VRF Recommended Tool List

11. Team Viewer 10

https://www.teamviewer.com/en/download/previous-versions/

12. Service Manual

VRF Warranty Upgrade Processing Sheet and Checklist

Please include the requested information below to help improve processing time.

Name of Person who Installed System: _____
Certification Number: _____
Name of Job: _____
Sales Order Number(s): _____
Model Numbers: _____
Serial Numbers: _____

VRF Warranty upgrade from standard Trane 12/18 month parts warranty to an additional 2nd through 5th year warranty
Qualifications:

- The system is designed using VRF Select.
- The system is installed by a contractor who has successfully completed an approved factory training class.

Customer gathers and submits commissioning package containing:

- Final “as built” VRF Select Report
- Commissioning report from Trane’s Technician Utility Tool (TUT)
- Before and after pictures of test gauge for the pressure test and vacuum test.
- Trane VRF Installation Class, Certificate of Completion

Checklist for processing documentation:

☐ - This Process/Checklist Sheet

☐ - Final “as built” VRF Select Report

☐ - Commissioning report from Trane’s Technician Utility Tool (TUT)

☐ - Before and after pictures of test gauge for the pressure test and vacuum test.

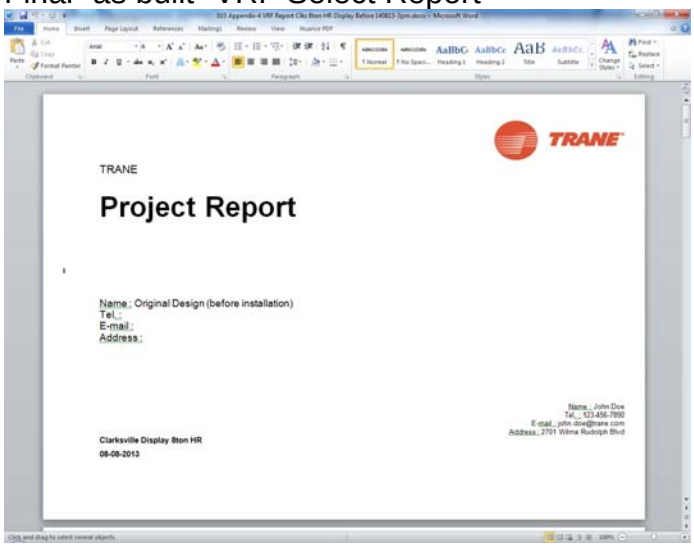
.
Note: Please attach appropriate information including this checklist and submit to:
vrfwarrantyupdocs@irco.com

Note: If proper documentation is not included warranty will remain as standard

VRF Warranty Upgrade Processing Sheet and Checklist

Visual Examples of requirements:

- Final “as built” VRF Select Report



TRANE

Project Report

Name : Original Design (before installation)
Tel. :
E-mail :
Address :

Name : John Doe
Tel. : 123-456-7890
E-mail : john.doe@trane.com
Address : 2701 Wilma Rudolph Blvd

Clarksville Display Ston HR
08-08-2013

- Commissioning report from Trane’s Technician Utility Tool (TUT)

Item	Contents
Site Name	SpoutSprings 1
Outdoor Unit Location	Roof
Indoor Unit Location	Below
Customer Information	Spout Springs Elementary
Test Operation Date	July 23 2013
Report Issue Date	7/23/2013
Test Operation Company	Lawson Heating and Cooling
Commissioning Engineer	John Willis
Engineer Telephone Number	
Outdoor Unit Quantity	1
Indoor Unit Quantity	10
Indoor Units Total Capacity (HP)	92048.5
Max Pipe Length (m)	260ft
Pipe Height	5ft
Additional Refrigerant (Kg)	6.71
ELCB Capacity (A)	
Wire Specification	
Remarks	

- Before and after pictures of test gauge for the pressure test and vacuum test.

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Ingersoll Rand has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.

VRF-TRG004B-EN 15 Aug 2016
Supersedes VRF-TRG004A-EN (10 Dec 2015)

We are committed to using environmentally conscious print practices that reduce waste.