TOSHIBA CARRIER

SINGLE-PHASE VRF OVERVIEW

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VRF Comfort.

Built on

Toshiba

Carrier

Confidence.

TOSHIBA
Carrier

SINGLE-PHASE VRF
PRODUCT OVERVIEW

Toshiba Carrier VRF

We Don’t Just Build Units.

We Help You Engineer Comfort.

TOSHIBA

Carrier

VRF System Types

Heat Pump

Fan coils are capable of providing either cooling or heating based on outdoor unit mode.

Outdoor Unit

- Controls compressor speed
- Maintains operational mode

Indoor Units

- Transfers heating and cooling to space
- Allows for optimal zoning

Controls

- Controls space temperature and indoor unit fan
- Remote and/or central

Heat Recovery

Fan coils are capable of providing simultaneous heating or cooling, by thermal zone, when operation temperatures are permitted.

Outdoor Unit

- Controls compressor speed
- Maintains operational mode

Flow Selector

- Reverses flow at indoor unit
- Simultaneous cooling and heating

Indoor Units

- Transfers heating and cooling to space
- Allows for optimal zoning

Controls

- Controls space temperature and indoor unit fan
- Remote and/or central

Why Single-Phase VRF?

Personalized Comfort and Control to Every Room, Virtually Every Application

Single-phase VRF Benefits:

- Compact footprints and slim profiles
- Precise temperature control
- Excellent energy efficiency
- Simplified equipment selection with a wide-variety of indoor unit options
- Quieter operation and high efficiencies
- Flexible zoning options while providing better comfort.
- Single-phase power equipment available for residential and light commercial buildings, eliminating the need for costly phase conversion

Why Single-Phase VRF?

Zoning Capabilities

Ability to connect to 9 indoor units on a single outdoor unit

Indoor Unit Options

3,4,5-ton multi-positional AHUs available for 1:1 systems (No downward flow)

Up to 12 different indoor units available.

Capacity ranging from 7,500 btu – 96,000 btu

Same indoor units as 3-phase giving the option to expand into larger projects

Expanded Piping Lengths

Vertical separations between indoor units up to 49'. ODU to IDU separation of up to 164'

Use of Y-joints and branch headers

Single phase heat pump piping flexibility up to 591 feet

Expanded Controls Options

Local controllers , central controller, and 24V interfaces for third party thermostats including Wi-Fi

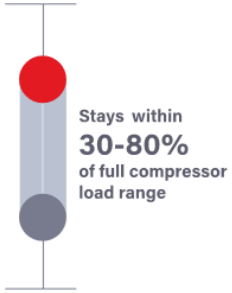
Home automaton capabilities

Local CN accessories: Ability for command input and output controls. (occupancy sensors & economizers)

Inverter Control

Tighter turn down capabilities giving more energy savings. Tighter heating capacity output meaning 100% heating capacity down to 5°.

Gas pedal control



Heat Recovery Option

Simultaneous heating and cooling for total occupant comfort. Giving your end user absolute control of their space. Up to 12-tons per system!

Piping lengths up to 3,280 feet offering greater flexibility with outdoor unit location and piping layout.

Single Phase VRF Heat Pump

Heat Pump – Single Phase

- **3, 4, 5 ton models** (40A requirement for each ODU)
- Connect 1 indoor unit or up to 9 indoor units per system
- Up to 22.7 SEER
- Sound pressure levels from 52-58 dba
- Total piping up to 591’
- Local and centralized control offerings

Model Name (MCY-)	MAP0367HS-UL	MAP0487HS-UL	MAP0607HS-UL
Ton	3	4	5
Power Supply	208/230V/1ph/60Hz		
Cooling Capacity (kBtu/h)	36	48	60
Heat Capacity (kBtu/h)	40	54	66
Dimension (Height * Width * Depth)	61.0x 39.8 x 14.6 inch		
Unit Weight (lbs)	310.6		
Max. No. of Connected Indoor Units	6	8	9
Operation Temp Range (Cooling) (° FDB)	23 to 122		
Operation Temp Range (Heating) (° FWB)	-13 to 60		

Single-Phase VRF Heat Pump

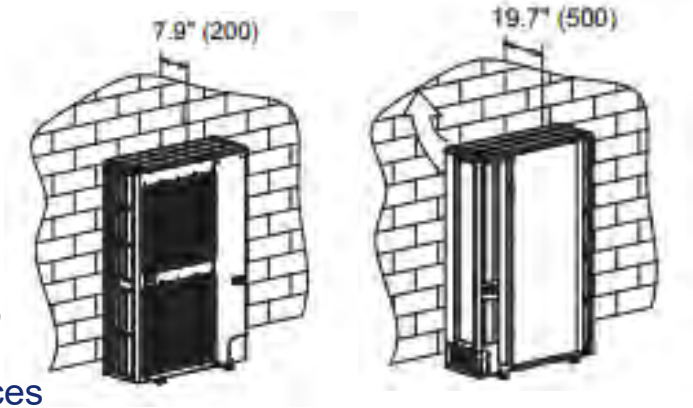
ODU Clearances and Mounting

- Slim design for a smaller footprint
- Local stand options available
- Slap mounted
- Wall mount available

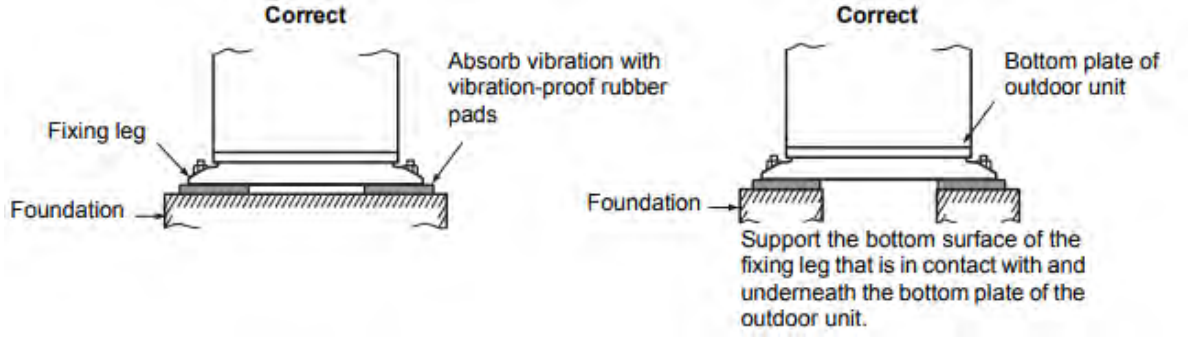
Dimension	SMMS-e 3,4,5 ton VRF
Height (In)	61.0
Width (In)	39.8
Depth (In)	14.6
Weight (lbs..)	310.6
Refrigerant R410A*(lbs.)	14.8

Clearances:

- Backside: 7.9” clearance
- Front of Unit: 19.7” clearance
- Unit Depth: 14.6”
- Total space needed including unit: 42.2”
- Always refer to local code and ordinances



Mounting units on the ground:

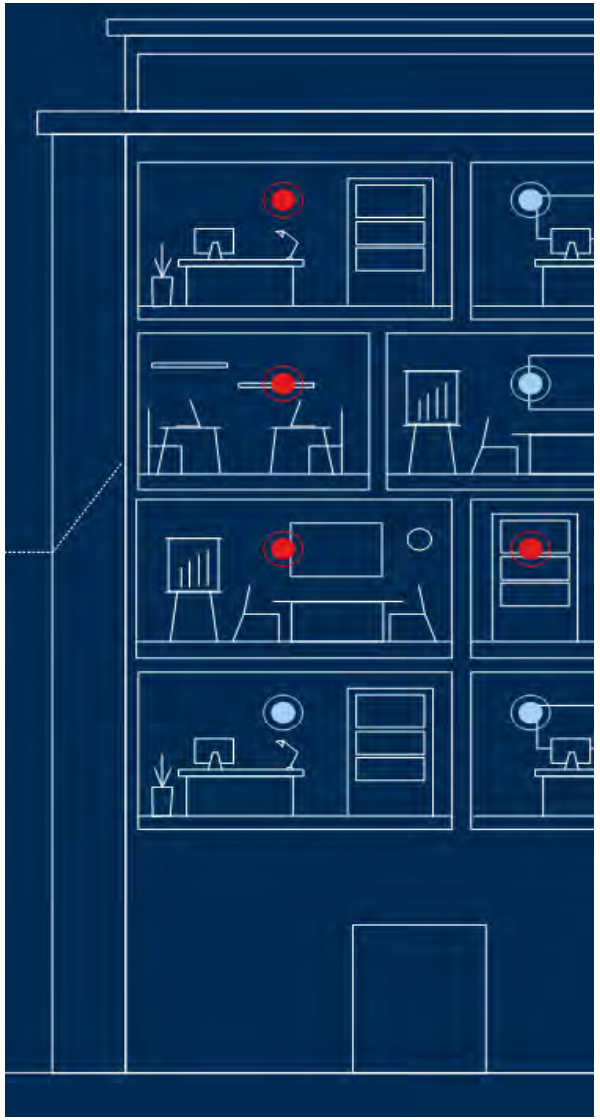


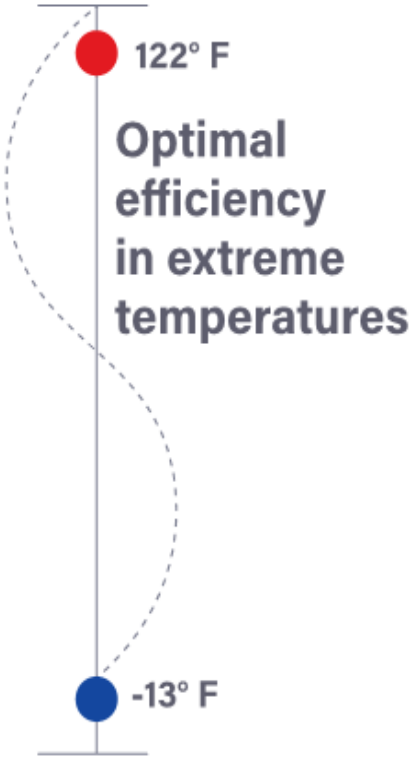
When installing the foundation for an outdoor unit with downward piping, consider the piping work.

Single-Phase VRF Heat Recovery

Heat Recovery – Single Phase (208/230-1-60)

- **6 ton or twinned 12 ton**
- 12 different indoor unit options available
- Option for 2-12 IDUs on the 6-ton and up to 25 on the 12-ton
- Different styles and sizes of flow selectors (FS) boxes
- Flexible piping arrangements (Determined by Vroom software)
- Local and centralized control offerings





Single Phase VRF

Non-Ducted Units

4-Way Cassette
Model MMU2
10 Sizes Available
7,500 Btu/h – 54,000 Btu/h

Compact 4-Way Cassette
Model MMUM
5 Sizes Available
7,500 Btu/h – 18,000 Btu/h

Floor Console Recessed
Model MMLB
6 Sizes Available
7,500 Btu/h – 24,000 Btu/h

Underceiling
Model MMC1
4 Sizes Available
18,000 Btu/h – 48,000 Btu/h

High Wall
Model MMK3
6 Sizes Available
7,500 Btu/h – 36,000 Btu/h

Floor Console Exposed
Model MML4
6 Sizes Avialable
7,500 Btu/h – 24,000 Btu/h

Ducted Units

Slim Duct (Low Profile)
Model MMDP
5 Sizes Available
7,500 Btu/h – 18,000 Btu/h

High Static Duct
Model MMD4
5 Sizes Available
30,000 Btu/h – 96,000 Btu/h

VRF RTU Fan Coil
Model 40QQ
3 Sizes Available
36,000 Btu/h – 60,000 Btu/h

Concealed Duct (Mid-Static)
Model MMDB
11 Sizes Available
7,500 Btu/h – 54,000 Btu/h

Outside Air Unit
Model MMD1
3 Sizes Available
48,000 Btu/h – 60,000 Btu/h

Vertical AHU
Model MMDV
8 Sizes Available
12,000 Btu/h – 60,000 Btu/h

Same indoor units are used for the three phase power VRF systems

Controller Options

Wired Remote Controller

The Wired Remote Controller (programmable) is a low voltage thermostat mounted on the wall that maintains room temperature by controlling system operation.

- Programmable scheduling
- Dual set-point
- Fan speed control
- Status code display
- Powered from indoor unit

RBC-AMS54E-UL

24V Thermostat Interface

The 24V Interface allows third-party conventional thermostat to communicate and operate Toshiba Carrier VRF indoor fan coil units.

Controls Advantages

- Full inverter control

Features

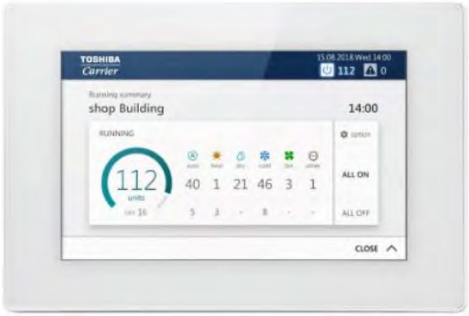
- Fan speed control: high, med, and low
- Operating modes: cooling, heating, fan and off

TCB-1FTH1GUL Note: 24v Power, Field Supplied

Size: Length 5.1”, Width is 4.6”, Depth 1.1”

Touchscreen Central Controller

•Operation Control – ON/OFF, Set Mode, Set Temperature, Set Fan Speed, Louver Function
•Monitoring Control - ON/OFF, Set Mode, Set Temperature, Set Fan Speed, Louver Function, Power Level
•Scheduling Function – Individual or Group, Daily and Weekly, 64 Schedule per day
•External Inputs – 8 Digital Input
•External Outputs – 4 Digital Output
SPECIFICATIONS
•Power Supply: 120VAC, 60Hz
•Operating Temperature/Humidity: 32° to 104°F / 10 to 90% RH



BMS-CT1280UL

VRF
DEEP DIVE ON PIPING FUNDAMENTALS

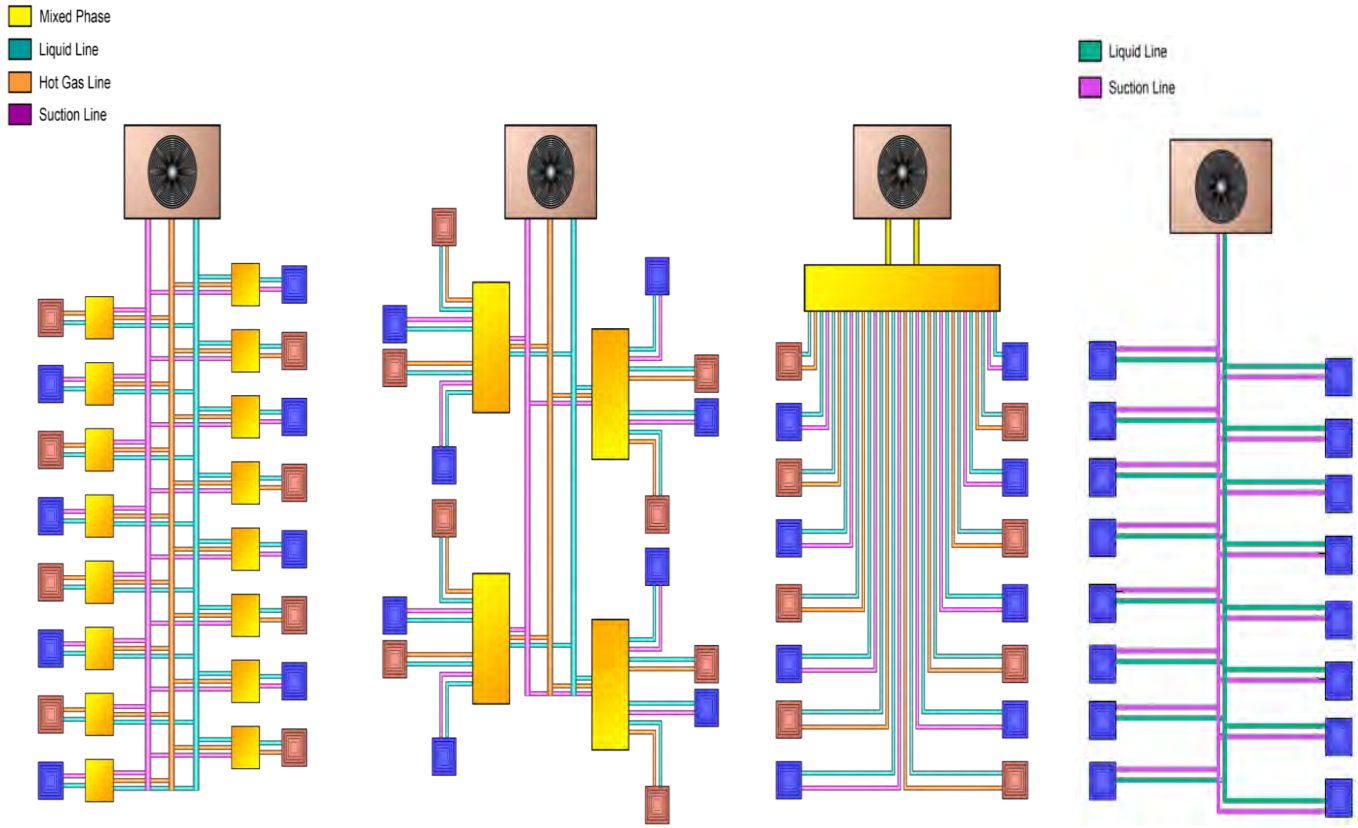
Piping Fundamentals

System Types

3 pipe heat recovery – 3 connecting pipes from outdoor unit to changeover box – this system can simultaneously heat and cool

2 pipe heat recovery – 2 connecting pipes from outdoor unit to changeover box – this system can simultaneously heat and cool

2 pipe heat pump – 2 connecting pipes from outdoor unit to indoor units. This system doesn't have a changeover box. The outdoor unit is piped directly to the indoor units through Y branches. This system will only operate in heating or cooling. It CANNOT run heat and cool simultaneously.



Piping Fundamentals

Heat Pump Systems – Two Pipe

The largest line is a refrigerant vapor return line in cooling and hot gas line in heating. This line will be hot when in heating mode and cool in cooling mode.

The small line is the liquid line. In cooling the flow is from outside to inside. In heating mode, from inside to outside. This line is usually within 10 degrees of ambient conditions..

Piping Fundamentals

Heat Recovery Systems – Three Pipe

The largest line is the refrigerant vapor return line. This line is typically cool and referred to as the suction line.

The middle-sized line is the refrigerant hot gas line. This line is supplying the inside units with heat. This line can be very hot and sometimes referred to as the discharge line.

The smallest of the three lines is the refrigerant liquid line. This line flows outside to inside for cooling and inside to outside in heating. This line is usually within 10 degrees of ambient conditions.

Piping Fundamentals

Variable Refrigerant Flow systems are unique to typical DX piping. Because the systems must perform by supplying equal refrigerant flow throughout the operating range, but also take into consideration oil return in low capacity (turn down) range.

One way of remembering VRF design considerations is by the acronym:

C.L.O.N.E.

C.L.O.N.E.

- Contamination
- Laminar Flow
- Oil Return
- Noise
- Expansion – Structural and Thermal

Piping Fundamentals

Contamination

A carbonized brazing flame will produce enough carbon inside the tubing to cause a restriction.

Normal DX systems can use filter driers to help clean up poor piping practices. VRF does not, except in rare circumstances , allow for filter driers.

During construction keep the open pipes taped off for debris/ dust contamination prevention.

Moisture and other non-condensables cause high pressure expansion, frozen moisture can restrict orifices and acid will form in the system. This is usually caused by leaks and a poor evacuation procedure.

Piping Fundamentals

Contamination

Installer must use ACR rated (dehydrated) hard drawn copper

Soft copper must also be ACR rated and typically only allowed after the changeover box. Soft copper is harder to keep level necessary for oil return.

Nitrogen purging is required while brazing. Typical flow requirements are 1-3 psi. The nitrogen displaces the oxygen around the braze. This stops the carbon from forming.

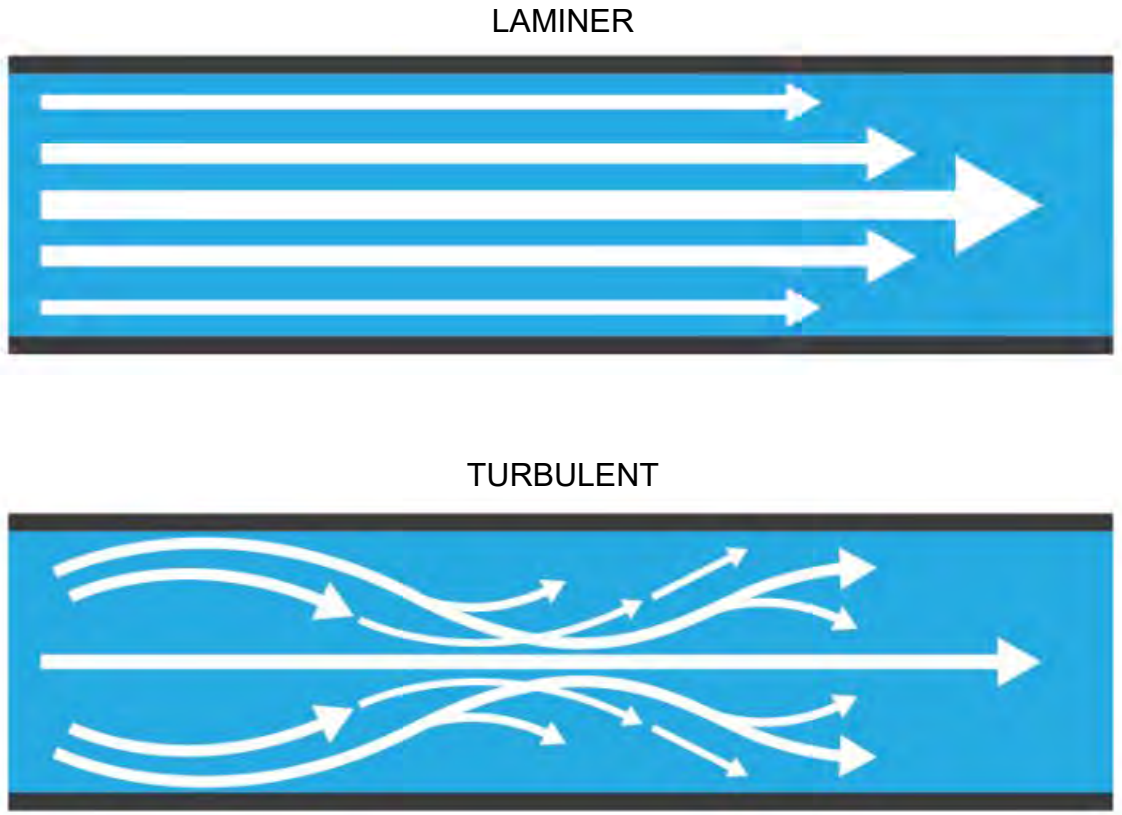
Flushing products are NOT recommended – there is no way to know if the solvent came out.

Piping Fundamentals

Laminar Flow

Laminar flow is the emphasis on equal available flow to all air handlers based upon capacity. VRF uses piping diameters and Y-branch layout to ensure equal, sustained, needed volumetric flow throughout the system. The systems operate at variable speeds which also impact flow availability.

The goal of a VRF is to match horsepower to load. This means that the volume will change over a wide variety of conditions.



Piping Fundamentals

Laminar Flow

All VRF manufacturer's have proprietary software that ensures laminar flow while performing system lay-out.

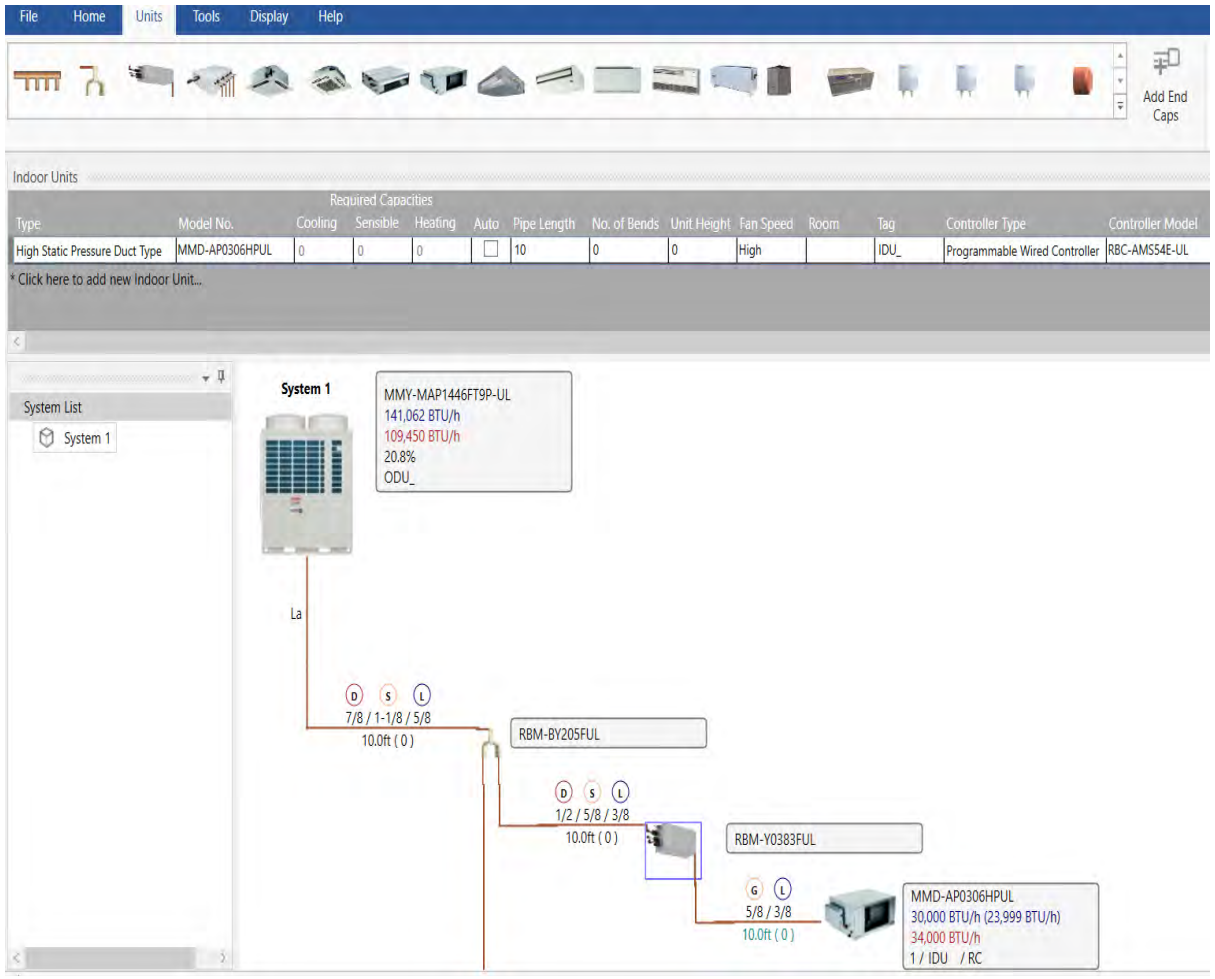
You enter each zone with capacity sizes and job specific lay-out.

When designing the job layout, take into consideration reducing the amount of piping and fittings – This will reduce material and labor cost – the quickest path is a straight line

This will supply you with appropriate Y-branches and piping diameters.

These drawings must be drawn/updated as the system is:

1. Submitted
2. Routing lay-out is complete and approximate distances are confirmed
3. Final measurements are entered/ trim charge is determined



Piping Fundamentals

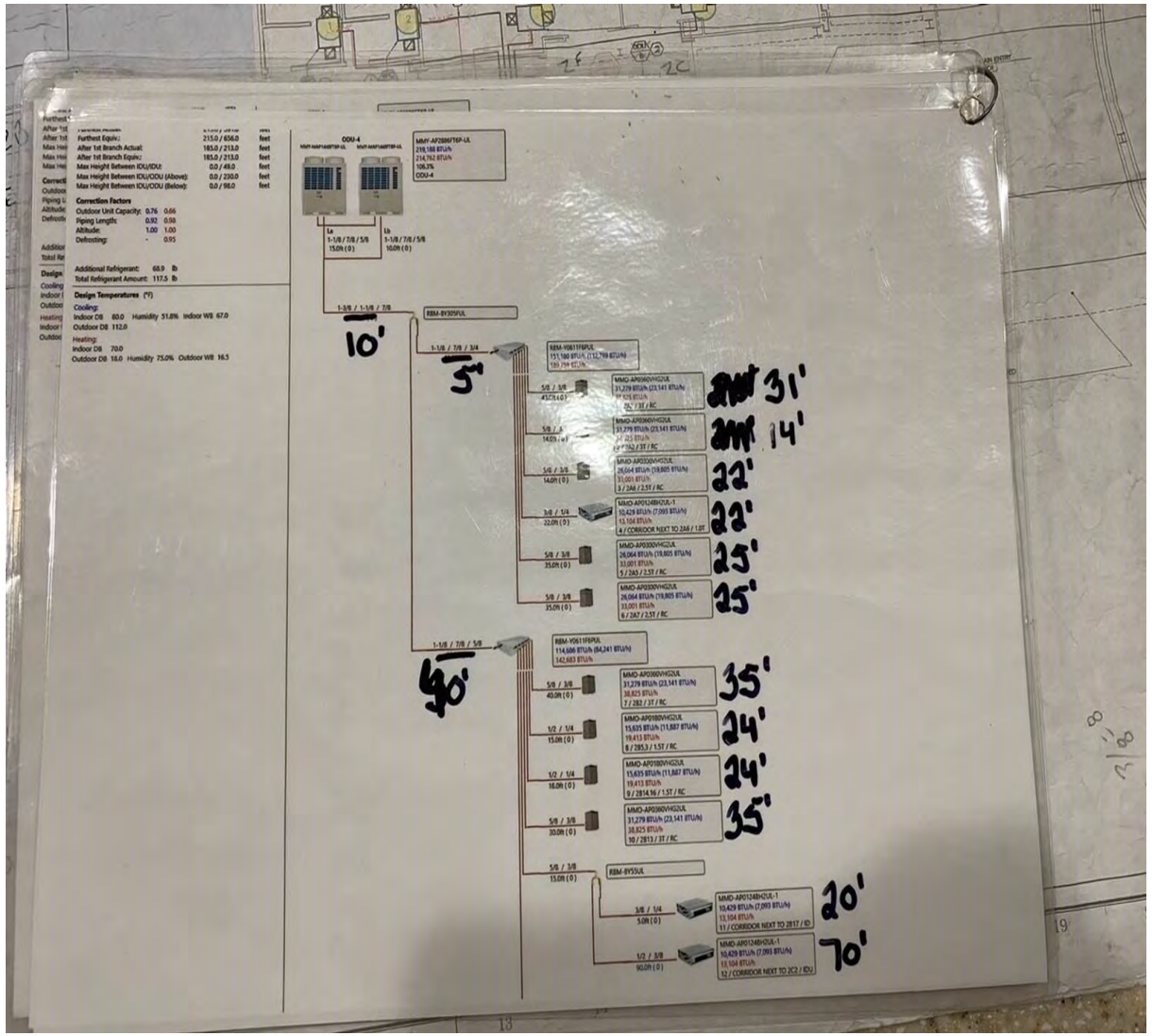
Laminar Flow

Final charge is typically determined by liquid line/ mixed phase line lengths.

90-degree long radius elbow quantities determine equivalent lengths but are not an impact in final charge. Usage of longer sweeping turns are recommended for added efficiency due to a lower friction loss.

Noise in the refrigerant lines are usually an impact in laminar flow, so noise considerations should also be evaluated.

Distance limitations also would be critical because they would limit available flow for the appropriate capacity.

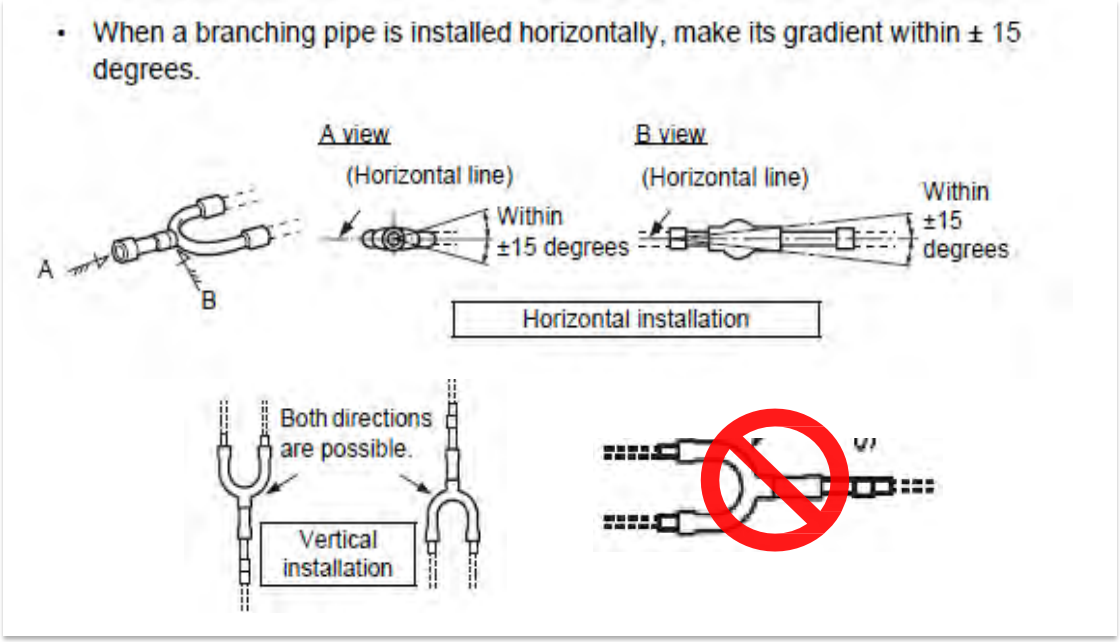


Piping Fundamentals

Laminar Flow

All Y-Branches need to be installed correctly. When the piping enters the Y-branch horizontally they need to be level. They can be installed with the piping entering and leaving vertically.

There is also a limit capacity, in BTUs, for the changeover box porting. This limit is typically around 61,000 BTUs. Anything beyond 61,000 BTUs will need a single port box that can handle larger tonnage fan coils 72-96 BTU.



Connectable Capacity	Model Number	Connectable Indoor Units*
61,000-96,000 Btu/h	RBM-Y0963FUL	8

Piping Fundamentals

Oil Return

All refrigeration systems must take oil return into consideration. In normal DX systems you may encounter the need for vertical traps, inverted traps, long line set guidelines and dual risers.

With very few exceptions, all refrigerant oil traps (standard and inverted), filter driers and sight glasses are prohibited.

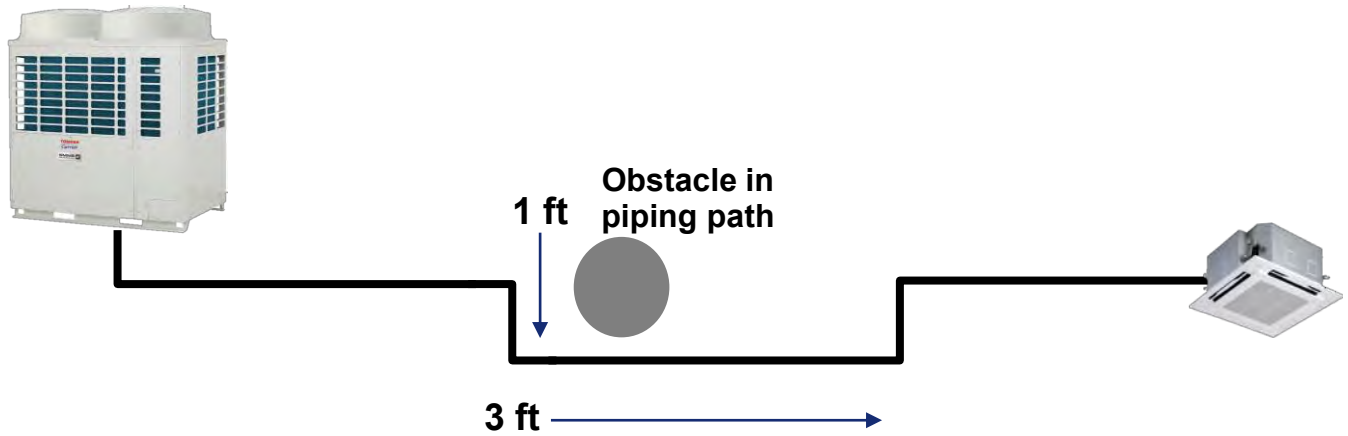
In VRF this concept is critical because, under a minimum load, we will not have sufficient volume of refrigerant flow to carry and return oil through obstacles.

Piping Fundamentals

Oil Return

Piping design can have horizontal offsets, but all vertical offsets should be avoided. If the piping is running horizontally, and a vertical offset is needed first try running the piping at the correct needed level. If the offset can't be avoided, this must comply with the 3-1 rule.

The 3-1 rule is this: if the piping is running across the ceiling and needs to drop 1 foot to run under a support beam, the horizontal run before it raises back up 1 foot needs to be at least 3 feet long. This can also be aided by using 45-degree elbows rather than 90-degree elbows.



Piping Fundamentals

Oil Return

If shut off isolation valves are approved for use, they must be installed as close to the feeding Y-branch as possible. If the system has a branch isolated for repair, the piping can accumulate and pool with oil. Because of the lack of refrigerant flow, the unit can't pull the oil out of the dead piping. This could starve and seize the compressors. Any ball valve used must be specifically for VRF applications.

In the same way shut off valves can cause pooling of oil return, so can unused changeover box ports. Using the closest ports and the last ports will ensure the box will have constant refrigerant flow through it picking up any oil drops.

Piping Fundamentals

Noise

Most manufacturers have some piping requirements for the prevention of noise. This noise is typically caused by the release of high-pressure refrigerant, flow turbulence, valve buzzing, oil return cycle flow and minimum flow bleed through.

Design suggestions are as follows:

Don’t install changeover boxes over sleeping quarters or quiet offices

Do suspend changeover boxes rather than on a solid object

Ensure at least 24” (some 36”) inlet and outlets to changeover boxes Y branches and even elbows – consult with the manufacturer for their requirements

Piping Fundamentals

Noise

Don’t install high wall/ ceiling suspended units above or around a bed or quiet office. When the unit goes through oil return or minimum position, you can hear the flow and it can be annoying. When the unit is operating, the noise is typically drowned out by the fan noise. This fan won’t be on when the system isn’t on, but the valve may still bleed through.

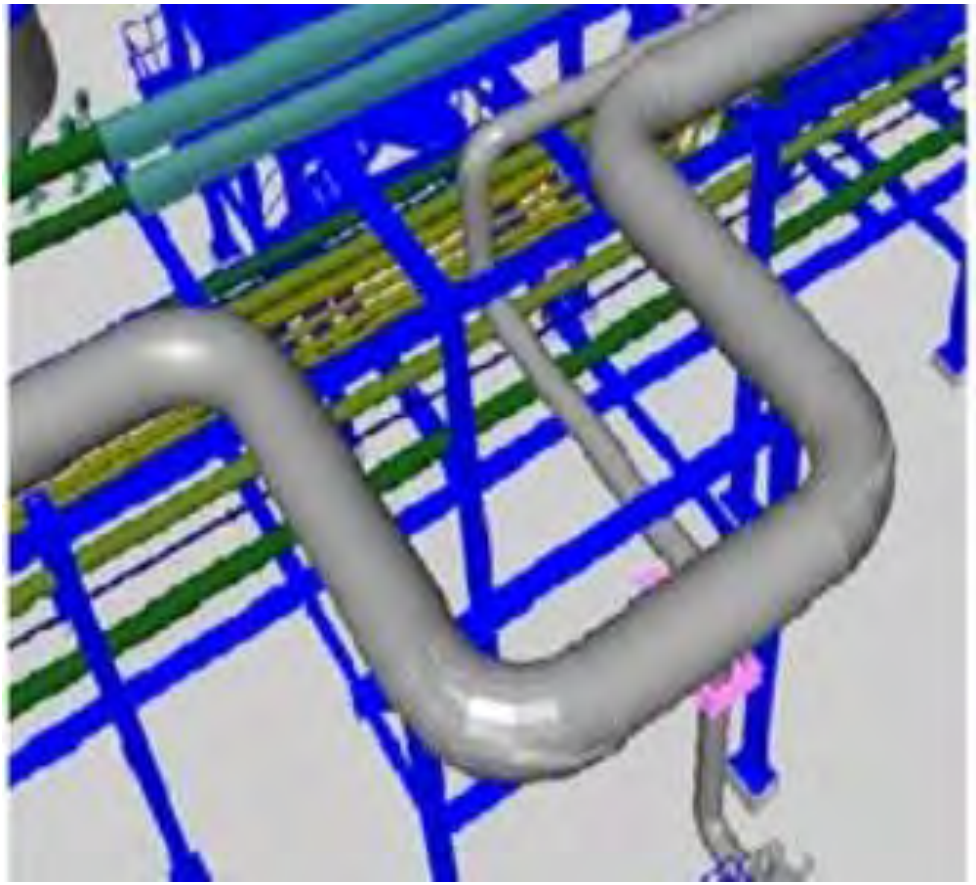
Avoid installing vibration isolators in the piping – this can cause a whirring noise under full flow. If so required, noise may be an issue. The I.D. on some vibration isolators is reduced to the required I.D. in the engineered pipe requirements. This may reduce capacity downstream.

Piping Fundamentals

Expansion- Structural

Expansion joints in VRF typically fall into two categories, structural and thermal.

In California most piping systems require structural “expansion joints” to be installed in all piping – These consist of a pre-manufactured “U” traps with vibration isolators along each side. These may cause noise through the isolator, must be verified where the I.D. must coincide with the required I.D. and must be installed horizontally to prevent the oil trap. If they are still required, please make all parties aware.



Piping Fundamentals

Expansion- Structural

Thermal expansion assemblies need to be installed at the piping professional's discretion. When you have a heating discharge line increase in temperature from room temperature to 250 degrees, the copper expands dramatically. If you don't install thermal expansion assemblies, the piping can break. Breaks usually occur at any 45-degree offset, or any weak point where the piping is pinned together. It can break through piping supports and piping racks.

Piping Fundamentals

Expansion- Structural

Take your heating line max, cooling line minimum and distance – find the difference

As you can see – at 200 feet in heating the hot gas line could be 130 degrees – this would represent 3.0” the same supply line suction in cooling could be 40 degrees – 0.8” a difference of 2.2”

Use 2.2” on the next slide

Pipe Length[1]	Fluid Temperature °F																			
	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	130°
10	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.14	0.15	0.15
20	0.08	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.22	0.23	0.26	0.28	0.29	0.30
30	0.12	0.12	0.15	0.18	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.32	0.35	0.39	0.42	0.44	0.45
40	0.16	0.16	0.20	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.43	0.46	0.52	0.56	0.58	0.60
50	0.20	0.20	0.25	0.30	0.33	0.35	0.38	0.40	0.43	0.45	0.48	0.50	0.53	0.55	0.54	0.58	0.65	0.70	0.73	0.75
60	0.24	0.24	0.30	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.65	0.69	0.78	0.84	0.87	0.90
70	0.28	0.28	0.35	0.42	0.46	0.49	0.53	0.56	0.60	0.63	0.67	0.70	0.74	0.77	0.76	0.81	0.91	0.98	1.02	1.05
80	0.32	0.32	0.40	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.86	0.92	1.04	1.12	1.16	1.20
90	0.36	0.36	0.45	0.54	0.59	0.63	0.68	0.72	0.77	0.81	0.86	0.90	0.95	0.99	0.97	1.04	1.17	1.26	1.31	1.35
100	0.40	0.40	0.50	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.08	1.15	1.30	1.40	1.45	1.50
120	0.48	0.48	0.60	0.72	0.78	0.84	0.90	0.96	1.02	1.08	1.14	1.20	1.26	1.32	1.30	1.38	1.56	1.68	1.74	1.80
140	0.56	0.56	0.70	0.84	0.91	0.98	1.05	1.12	1.19	1.26	1.33	1.40	1.47	1.54	1.51	1.61	1.82	1.96	2.03	2.10
160	0.64	0.64	0.80	0.96	1.04	1.12	1.20	1.28	1.36	1.44	1.52	1.60	1.68	1.76	1.73	1.84	2.08	2.24	2.32	2.40
180	0.72	0.72	0.90	1.08	1.17	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.89	1.98	1.94	2.07	2.34	2.52	2.61	2.70
200	0.80	0.80	1.00	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.16	2.30	2.60	2.80	2.90	3.00
220	0.88	0.88	1.10	1.32	1.43	1.54	1.65	1.76	1.87	1.98	2.09	2.20	2.31	2.42	2.38	2.53	2.86	3.08	3.19	3.30
240	0.96	0.96	1.20	1.44	1.56	1.68	1.80	1.92	2.04	2.16	2.28	2.40	2.52	2.64	2.59	2.76	3.12	3.36	3.48	3.60
260	1.04	1.04	1.30	1.56	1.69	1.82	1.95	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.81	2.99	3.38	3.64	3.77	3.90
280	1.12	1.12	1.40	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94	3.08	3.02	3.22	3.64	3.92	4.06	4.20
300	1.20	1.20	1.50	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00	3.15	3.30	3.24	3.45	3.90	4.20	4.35	4.50
320	1.28	1.28	1.60	1.92	2.08	2.24	2.40	2.56	2.72	2.88	3.04	3.20	3.36	3.52	3.46	3.68	4.16	4.48	4.64	4.80
340	1.36	1.36	1.70	2.04	2.21	2.38	2.55	2.72	2.89	3.06	3.23	3.40	3.57	3.74	3.67	3.91	4.42	4.76	4.93	5.10
360	1.44	1.44	1.80	2.16	2.34	2.52	2.70	2.88	3.06	3.24	3.42	3.60	3.78	3.96	3.89	4.14	4.68	5.04	5.22	5.40
380	1.52	1.52	1.90	2.28	2.47	2.66	2.85	3.04	3.23	3.42	3.61	3.80	3.99	4.18	4.10	4.37	4.94	5.32	5.51	5.70
400	1.60	1.60	2.00	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.32	4.60	5.20	5.60	5.80	6.00
420	1.68	1.68	2.10	2.52	2.73	2.94	3.15	3.36	3.57	3.78	3.99	4.20	4.41	4.62	4.54	4.83	5.46	5.88	6.09	6.30
440	1.76	1.76	2.20	2.64	2.86	3.08	3.30	3.52	3.74	3.96	4.18	4.40	4.62	4.84	4.75	5.06	5.72	6.16	6.38	6.60
460	1.84	1.84	2.30	2.76	2.99	3.22	3.45	3.68	3.91	4.14	4.37	4.60	4.83	5.06	4.97	5.29	5.98	6.44	6.67	6.90
480	1.92	1.92	2.40	2.88	3.12	3.36	3.60	3.84	4.08	4.32	4.56	4.80	5.04	5.28	5.18	5.52	6.24	6.72	6.96	7.20
500	2.00	2.00	2.50	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.40	5.75	6.50	7.00	7.25	7.50

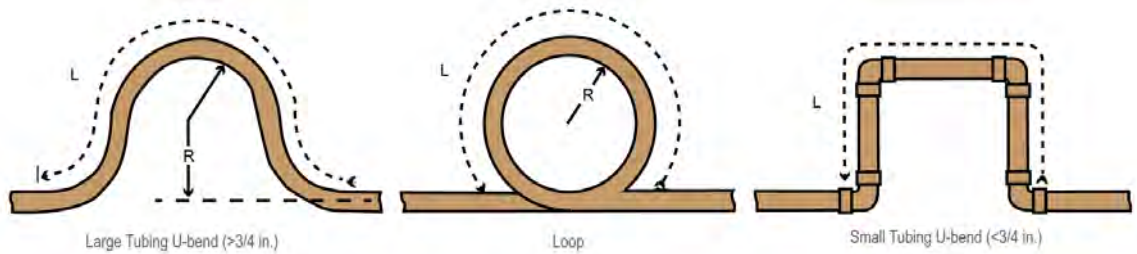
Piping Fundamentals

Expansion- Structural

Thermal Expansion joint design
Use the 2.2” on the left - I do not recommend loop design

Anticipated Linear Expansion (LE) (in.)		Nominal Tube Size (OD) inches						
		1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
1/2	R[1]	6	7	8	9	11	12	13
	L[2]	38	44	50	59	67	74	80
1	R[1]	9	10	11	13	15	17	18
	L[2]	54	63	70	83	94	104	113
1-1/2	R[1]	11	12	14	16	18	20	22
	L[2]	66	77	86	101	115	127	138
2	R[1]	12	14	16	19	21	23	25
	L[2]	77	89	99	117	133	147	160
2-1/2	R[1]	14	16	18	21	24	26	29
	L[2]	86	99	111	131	149	165	179
3	R[1]	15	17	19	23	26	29	31
	L[2]	94	109	122	143	163	180	196
3-1/2	R[1]	16	19	21	25	28	31	34
	L[2]	102	117	131	155	176	195	212
4	R[1]	17	20	22	26	30	33	36
	L[2]	109	126	140	166	188	208	226

[1]R = Centerline Length of Pipe.
[2]L = Centerline Minimum Radius (inches).



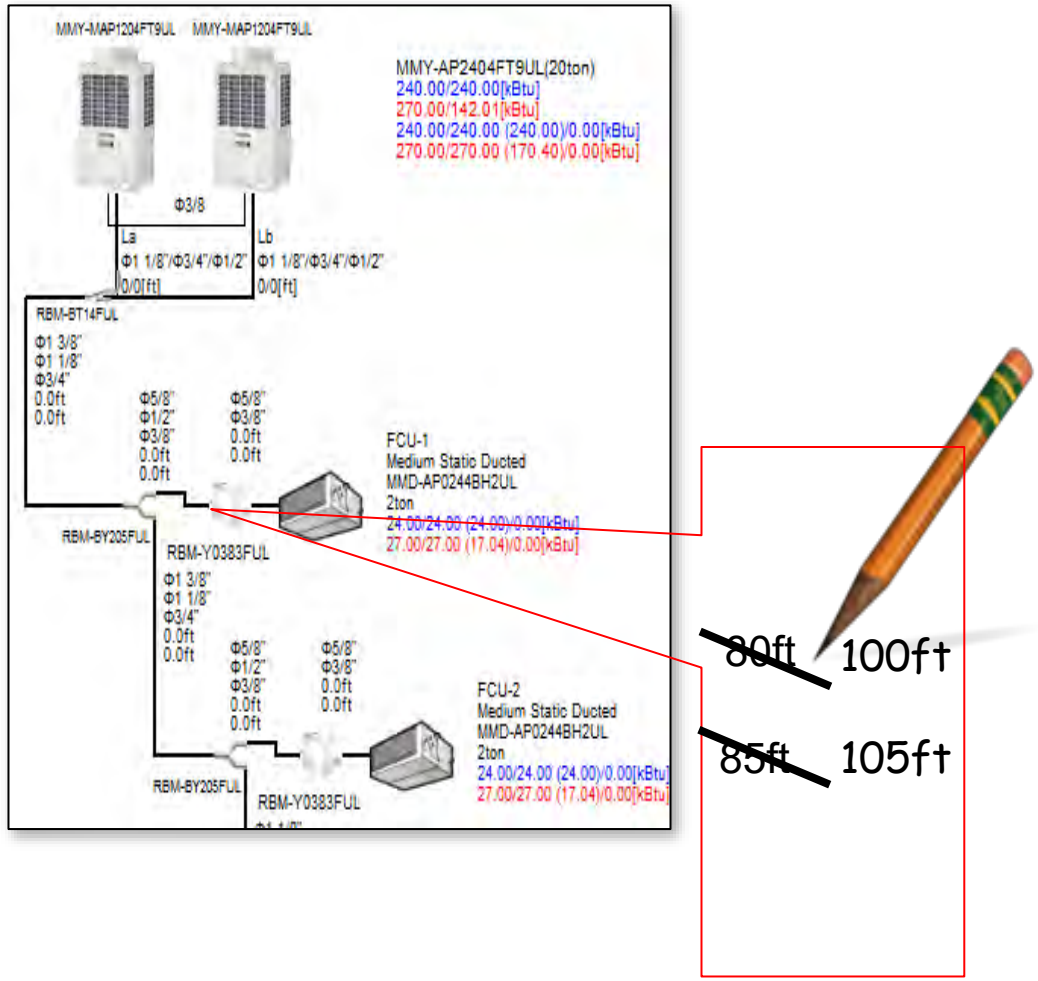
Large Tubing U-bend (>3/4 in.) Loop Small Tubing U-bend (<3/4 in.)

SINGLE-PHASE VRF HEAT PUMP
PRE PLANNING AND UNIT PLACEMENT

INSTALLATION

Pre-Planning

- Walk the job and verify ODU and IDU placement.
- Make any changes in the selection software drawing.
- Deliver updated selection software drawing back to the designer for records.
- This is necessary to verify that piping rules haven't been broken and that actual distances haven't altered the corrected capacity of the equipment.



SINGLE-PHASE VRF
INSULATION AND CONDENSATE

INSTALLATION

Insulation Work

MATERIAL

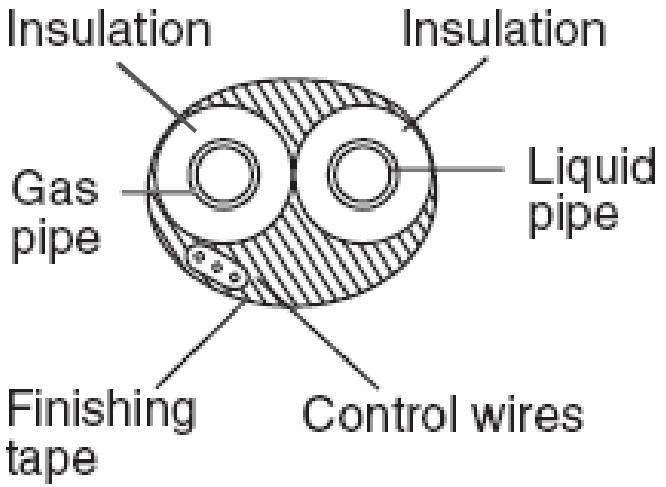
245º F Closed cell foam pipe insulation material as specified by local and national codes

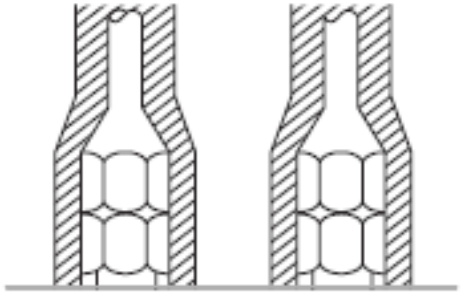
INSTALLATION

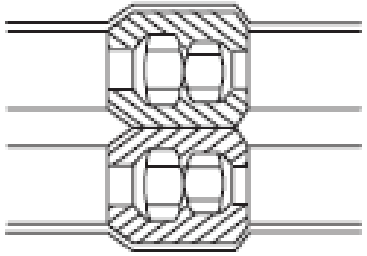
Insulation Work

INSULATION GUIDELINES

Insulating the gas pipe and liquid pipe individually, all piping joints must be insulated and sealed to the main pipe insulation.







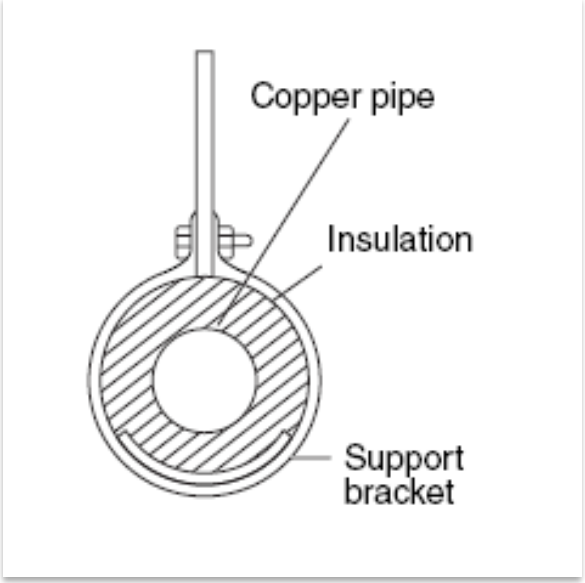
INSTALLATION

Insulation Work

INSULATION GUIDELINES

When insulating a supported section:

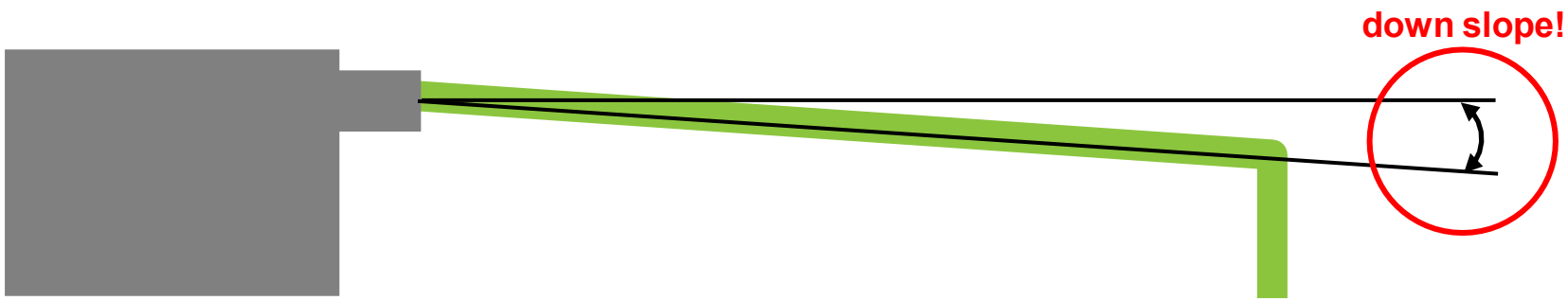
the slit in the insulation should be on the top side of the pipe as shown



INSTALLATION

Drain Piping

DRAIN PIPE PITCH

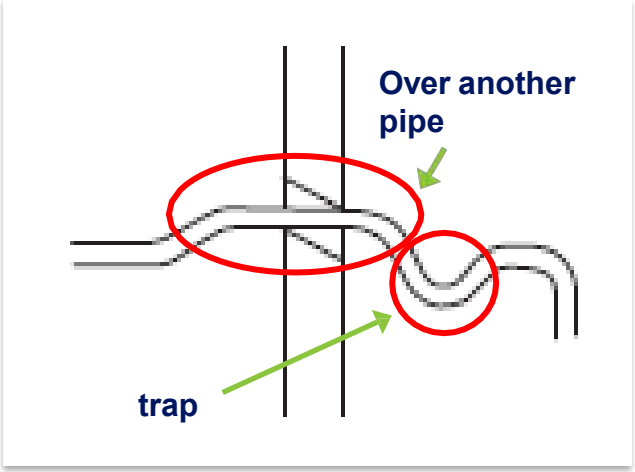


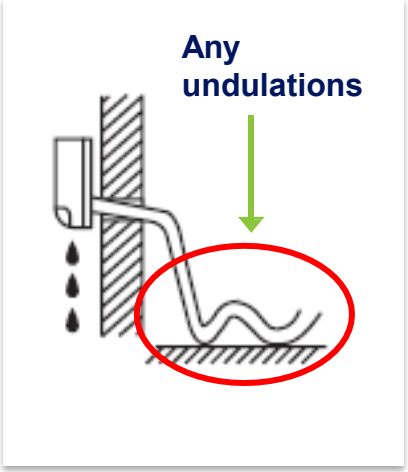
Minimum pitch to comply with local codes

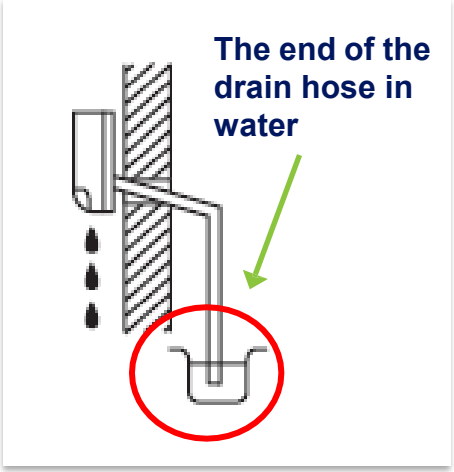
INSTALLATION

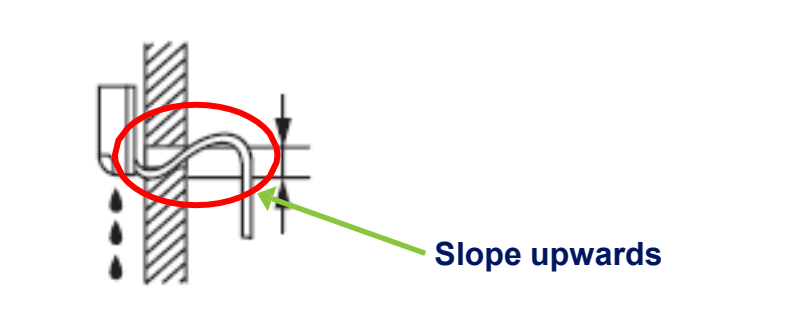
Drain Piping

DRAIN PIPING ERRORS





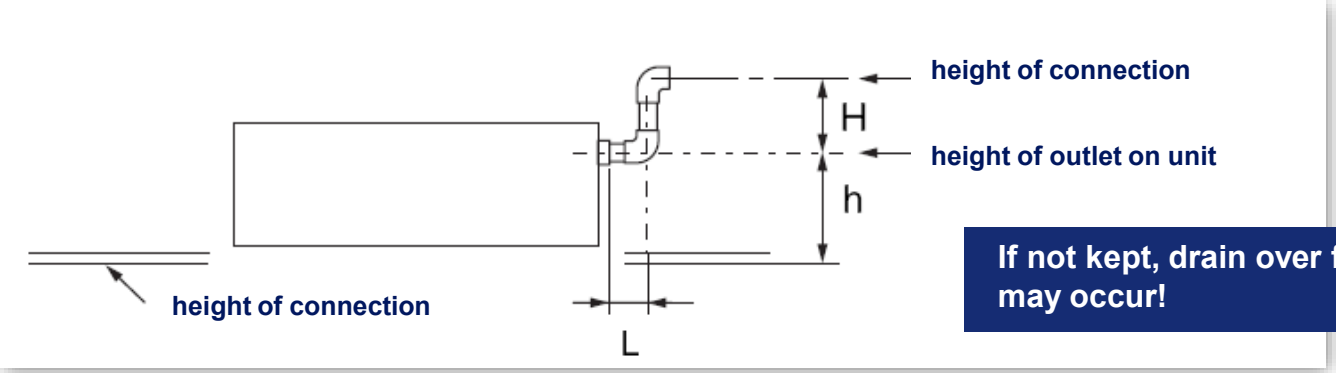




INSTALLATION

Height Of A High Drain Outside Of The Unit

Indoor unit type	Allowable height of drain-up outside of unit (Condition)		
	Position of main unit drain port	**Allowable height of drain-up** (From drain port of main unit)	**L**
FCU with Factory Pump	h = 7.5	H = 26	12 or less
Compact 4-Way cassette type	h = 9	H = 25	12 or less



If not kept, drain over flow trouble may occur!

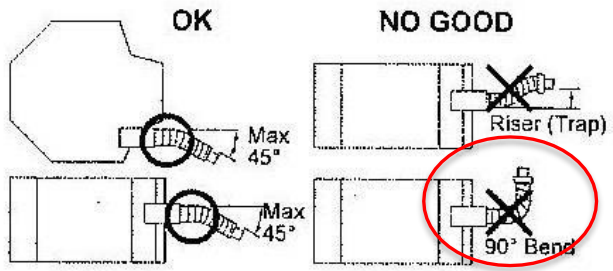
INSTALLATION

Flexible Hose—No 90-degree Bends

■ Flexible hose

Use the attached flexible hose to adjust center discrepancy of the hard vinyl chloride pipe or to adjust the angle.

- Do not use the flexible hose as stretched, or do not deform it more extent than that in the following figure.
- Fix the soft end of the flexible hose with the attached hose band.
- Use the flexible hose on a horizontal level.



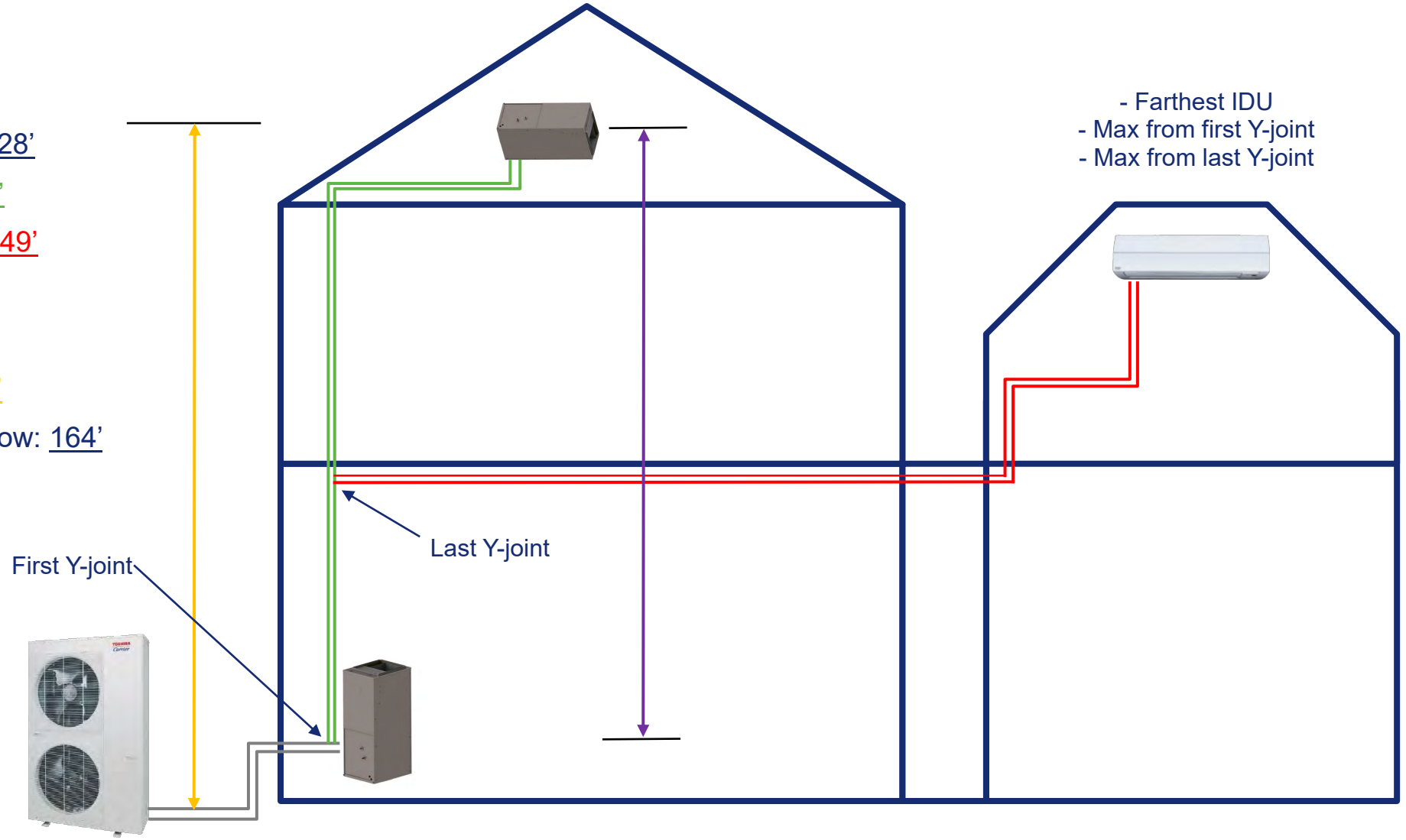
Piping Abilities

Line Lengths

- Farthest indoor unit from ODU: 328’
- Max from first y-joint/header: 115’
- Max run from last y-joint/header: 49’

Vertical Separations

- ODU below the indoor units: 131’
- ODU on the roof with indoors below: 164’
- Indoor unit to indoor unit: 49’



Piping Selection

Piping Sizes

- Select the ODU based on block load
- Selecting indoor units for peak loads
- Piping sizes based on downstream working from the ODU in to IDUs.

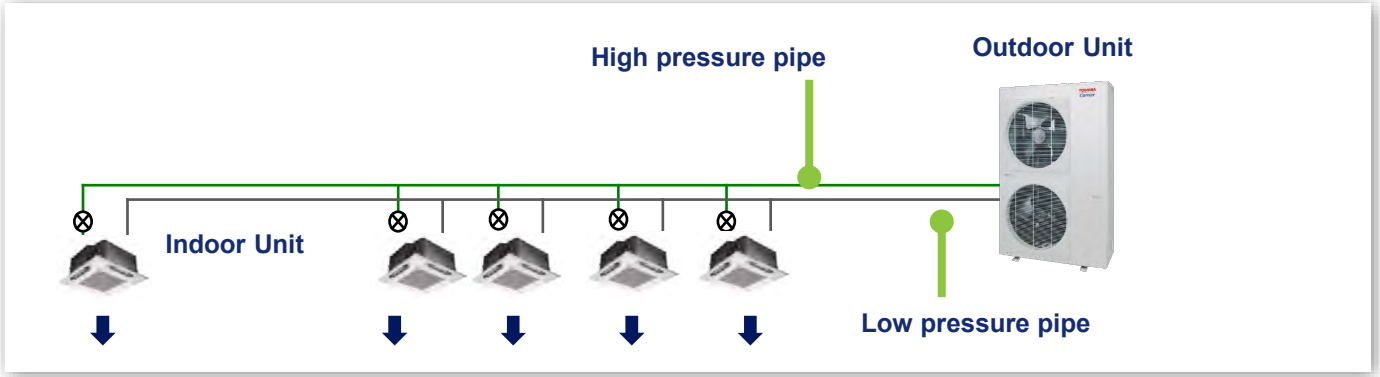
Vroom will auto select piping sizes and generate in the output. This will save time in the field

<table>
<tr><th>No.</th><th>Piping parts</th><th>Name</th><th>Selection of pipe size</th><th>Remarks</th></tr>
<tr><td>(1)</td><td>Outdoor unit
↓
1st branching section</td><td>Main pipe</td><td>Size of main pipe
<table><tr><th>Outdoor unit capacity type</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>0367 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>0487 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>0607 type</td><td>Ø3/4"</td><td>Ø3/8"</td></tr></table></td><td>Same as the outdoor unit's connecting pipe size.</td></tr>
<tr><td>(2)</td><td>Branching section
↓
Branching section</td><td>Branching pipe</td><td>Pipe size between branching sections
<table><tr><th>Total capacity codes of indoor units at down stream side
Equivalent to capacity</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>Below 23</td><td>Ø1/2"</td><td>Ø3/8"</td></tr><tr><td>23 to below 61</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>61 or more</td><td>Ø3/4"</td><td>Ø3/8"</td></tr></table></td><td>Pipe size differs based on the total capacity code value of the indoor units at the downstream side. If the total value exceeds the capacity code of the outdoor unit, apply the capacity code of the outdoor unit. (See Table 1 and 2.)</td></tr>
<tr><td>(3)</td><td>Branching section
↓
Indoor unit</td><td>Indoor unit connecting pipe</td><td>Connecting pipe size of indoor unit
<table><tr><th>Capacity rank</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>007 to 012 type</td><td>Ø3/8"</td><td>Ø1/4"</td></tr><tr><td>015 to 018 type</td><td>Ø1/2"</td><td>Ø1/4"</td></tr><tr><td>021 to 048 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr></table></td><td></td></tr>
<tr><td>(4)</td><td>Branching section</td><td>Y-shaped branching joint</td><td>Selection of branching section (Y-shaped branching joint)
<table><tr><th></th><th>Model name</th></tr><tr><td>Y-shape branch joint</td><td>RBM-BY55UL</td></tr></table></td><td></td></tr>
<tr><td>(5)</td><td>Branching section</td><td>Branching header</td><td>Selection of branching section (Branching header)
<table><tr><th colspan="2"></th><th>Model name</th></tr><tr><td rowspan="2">Branching header*</td><td>For 4 branches</td><td>RBM-HY1043UL</td></tr><tr><td>For 8 branches</td><td>RBM-HY1083UL</td></tr></table>* A capacity code up to a maximum of 57 is connectable to one line after branching from the header.</td><td></td></tr>
</table>

Piping Selection

Additional Piping Considerations

- Condensate consideration
- Filter driers are not needed for VRF. They can create a pressure drop and the strainers catch containments
- Service valve consideration



Cooling: Expansion at Indoor Unit
Heating: Expansion at Outdoor Unit

Performance Results

Indoor Units:	1 / 1 to 9		
Capacity:	60 / 30 to 60 (100.0%)		
Total Pipe Length:	25.0 / 591.0	feet	
Furthest Actual:	25.0 / 328.0	feet	
Furthest Equiv.:	25.0 / 410.0	feet	
After 1st Branch Actual:	0.0 / 115.0	feet	
After 1st Branch Equiv.:	0.0 / 115.0	feet	
Max Height Between IDU/IDU:	0.0 / 49.0	feet	
Max Height Between IDU/ODU (Above):	0.0 / 98.0	feet	
Max Height Between IDU/ODU (Below):	0.0 / 66.0	feet	

Correction Factors

Outdoor Unit Capacity:	0.98	0.92
Piping Length:	1.00	1.00
Altitude:	1.00	1.00
Defrosting:	-	0.95

Additional Refrigerant:	2.0	lb
Total Refrigerant Amount:	16.8	lb

Design Temperatures (°F)

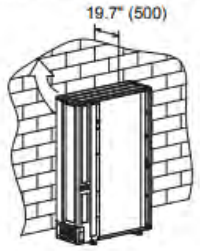
Cooling:
Indoor DB 80.0 Humidity 51.8% Indoor WB 67.0
Outdoor DB 96.0

Heating:
Indoor DB 70.0
Outdoor DB 18.0 Humidity 75.0% Outdoor WB 16.5

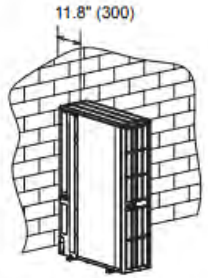
Installation - Outdoor Clearances

1. Install the outdoor unit in a location where the discharge air is not blocked.
2. When an outdoor unit is installed in a location that is always exposed to strong winds like a coast or on the high stories of a building, secure normal fan operation by using a duct or wind shield.
3. When installing the outdoor unit in a location that is constantly exposed to strong winds such as on the upper floors or rooftop of a building, apply the wind-proofing measures referred to in the following examples.
   1) Install the unit so that its discharge port faces the wall of the building.
      Keep a distance 19.7" (500) or more between the unit and the wall surface.

Unit: in (mm)

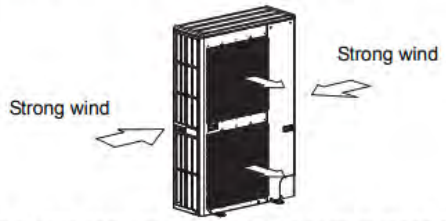


2) Leave a clearance of at least 11.8" (300) between the right side panel and wall or other surface of the building for installation and servicing purposes.



3) Leave a clearance of at least 7.9" (200) between the rear panel and wall or other surface of the building to maintain the air conditioner's performance.

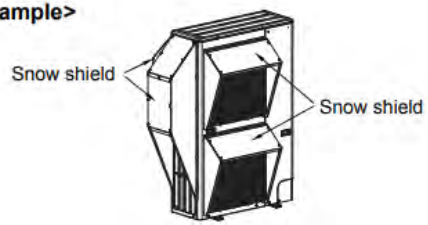
4) Consider the wind direction during the operational season of the air conditioner, and install the unit so that the discharge port is set at a right angle relative to the wind direction.



When installing the unit in an area where snowfalls may be heavy, take steps to prevent the unit from being adversely affected by the fallen or accumulated snow.

- Either make the foundation higher or install a stand (which is high enough to ensure that the unit will be above the fallen or accumulated snow) and place the unit on it.
- Attach a snow shield (field supplied).

<Example>

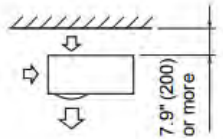


Installation - Outdoor Clearances

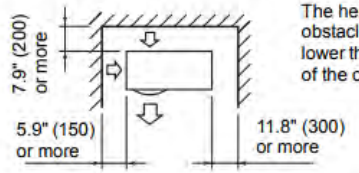
Obstacle at rear side

Upper side is free

1. Single unit installation

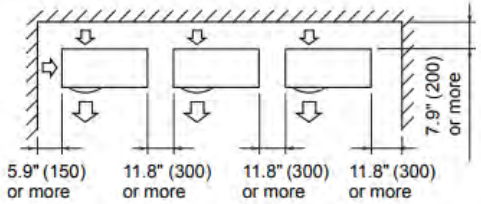


2. Obstacles on both right and left sides

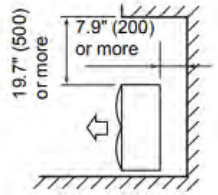


The height of the obstacle should be lower than the height of the outdoor unit.

3. Serial installation of two or more units
   The height of the obstacle should be lower than the height of the outdoor unit.



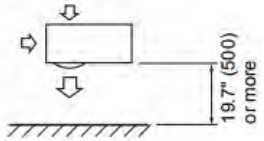
Obstacle also above unit



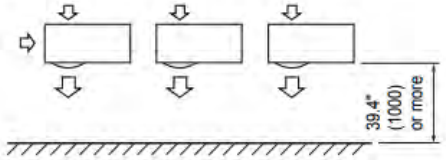
Obstacle in front

Above unit is free

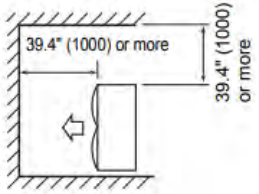
1. Single unit installation



2. Serial installation of two or more units



Obstacle also above unit

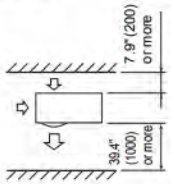


Obstacles in both front and rear of unit

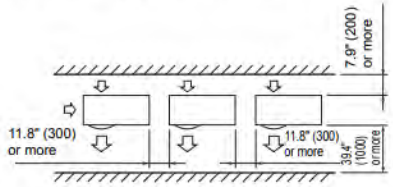
Open above and to the right and left of the unit.
The height of an obstacle in both the front and rear of the unit, should be lower than the height of the outdoor unit.

Standard installation

1. Single unit installation



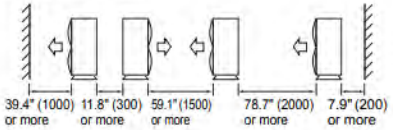
2. Serial installation of two or more units



Serial installation in front and rear

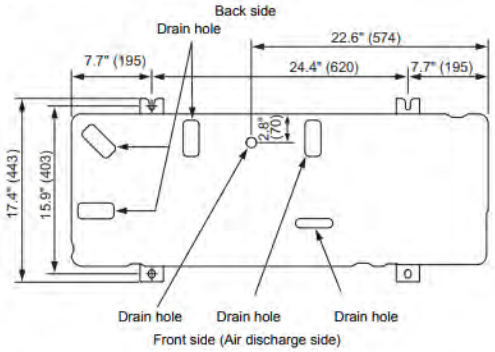
Open above and to the right and left of the unit.
The height of an obstacle in both the front and rear of the unit should be lower than the height of the outdoor unit.

Standard installation



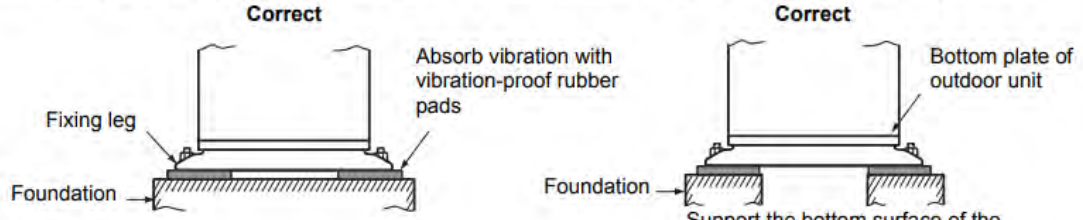
■ Installation of outdoor unit

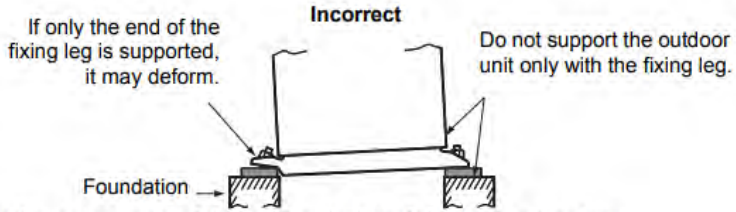
- Before installation, check the strength and leveling of the base so that abnormal sounds do not emit from the unit.
- According to the following base diagram, secure the base firmly with the anchor bolts.
  (Anchor bolt, nut: 0.4" (M10) x 4 pairs)



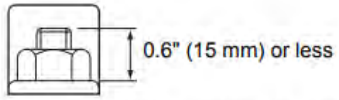
Installation - Securing Outdoor Unit

- As shown in the figure below, install vibration-proof rubber pads to directly support the bottom surface of the fixing leg.
  * When installing the foundation for an outdoor unit with downward piping, consider the piping work.

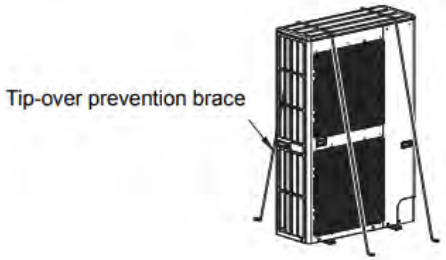


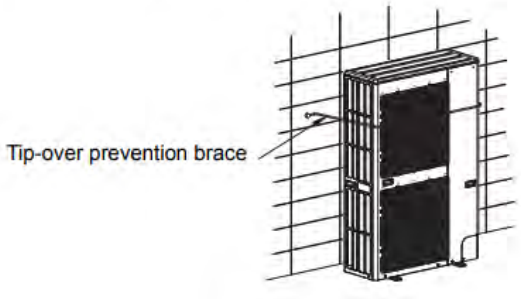


Set the out margin of the anchor bolt to 0.6" (15 mm) or less .



- When the unit is to be installed in a location where it is likely to be exposed to strong winds or where the foundation is unstable, additional measures must be taken to prevent tip-over as shown in the figure below.





Piping

IMPORTANT

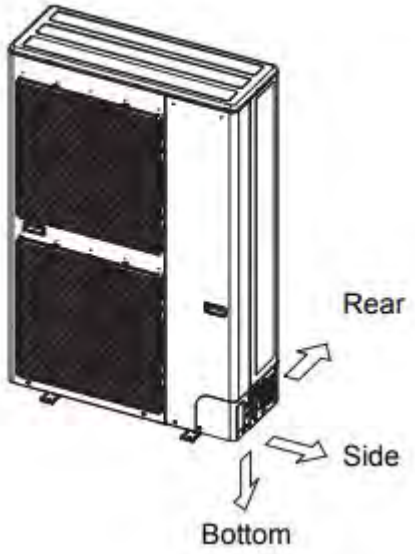
- Keep dust and moisture away from inside the connecting pipes.
- Tightly connect the connection between pipes and the unit.
- Evacuate the air in the connecting pipes using a VACUUM PUMP.
- Check for gas leaks at connection points
- When brazing the refrigerant pipes, be sure to use nitrogen gas to prevent oxidation of the inside of the pipes; otherwise clogging of the refrigerating cycle due to oxidized scale may occur
- Use clean and new pipes for the refrigerant pipes and perform the piping work so that water or dust does not contaminate the refrigerant. * Remove all flux after brazing
- Be sure to use a double spanner to loosen or tighten the flare nut. If a single spanner is used, the required level of tightening cannot be obtained. Tighten the flare nut with the specified torque
- Do not apply refrigerant oil to the surface of the flare

Installation - Outdoor Unit Piping Options

Refrigerant Piping

- The refrigerant piping can exit the unit in three directions

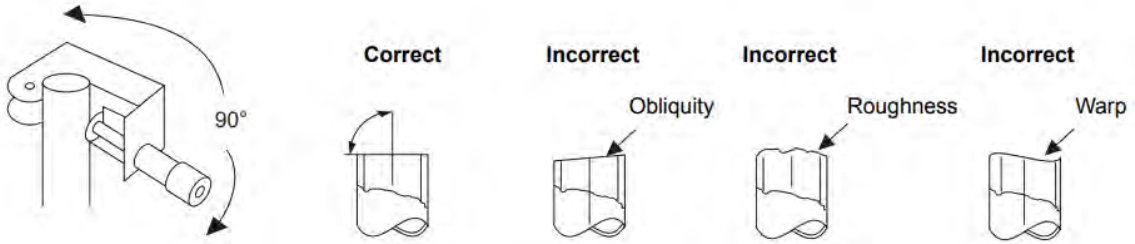
    1. Bottom
    2. Side
    3. Rear



Piping

Making Flares

- Cut the pipe with a pipe cutter
- Remove the burr inside the pipe, be careful that the chips do not fall into the pipe
- . Remove the flare nuts attached to the outdoor / indoor unit, then insert them into each of the pipes
- Flare the pipes. See the following table for the projection margin (A) and flaring size (B)

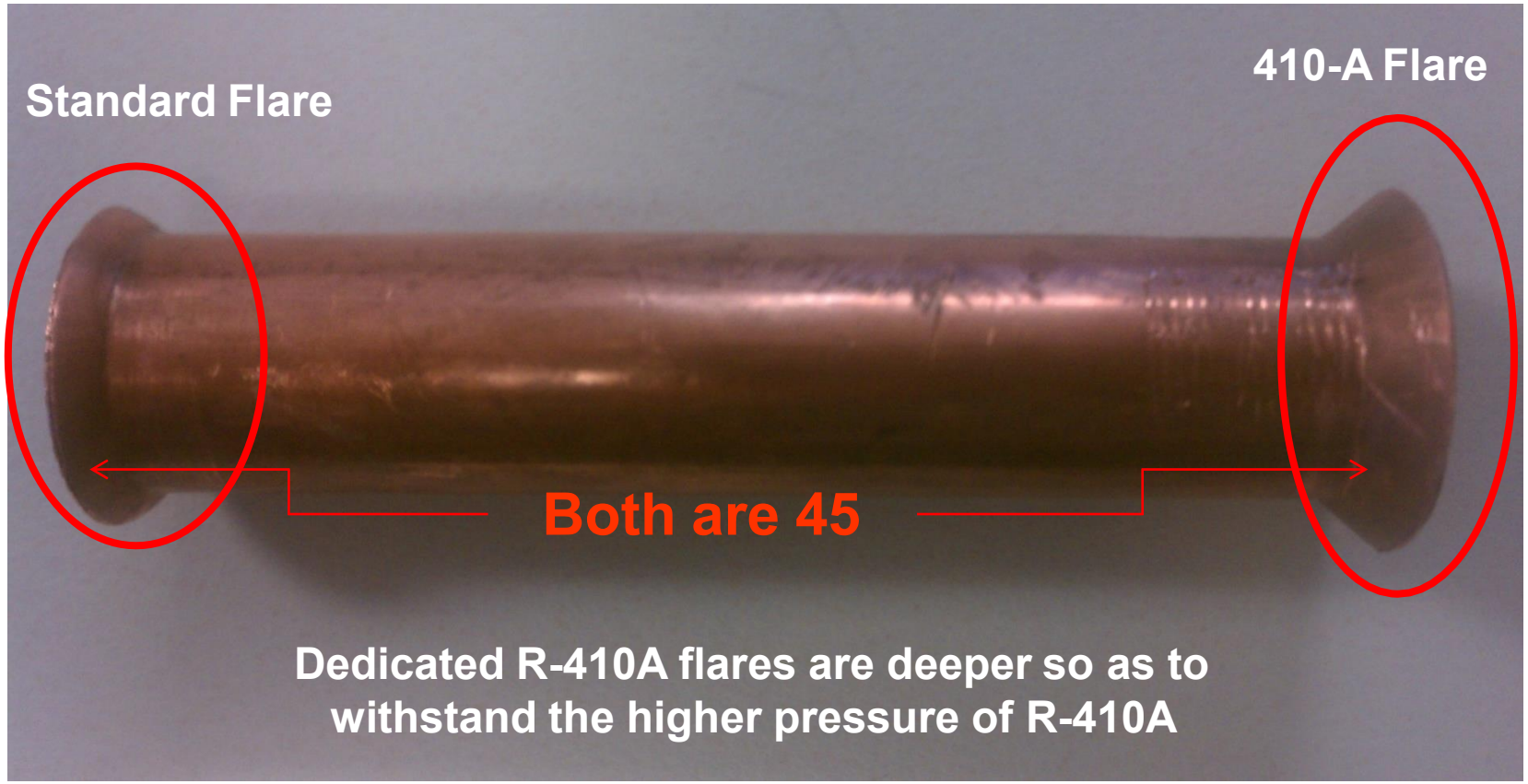


	Pipe		A		B	Flare Nut			
	Outside diameter	Thickness	Rigid (clutch type) R410A tool	Imperial (wing nut type) R410A tool		Width across flat	Tighten torque		
							lbf·ft	N·m	kgf·m
in	1/4"	0.03"	0 to 0.02"	0.04" to 0.06"	0.39"	0.67"	10.3 to 13.3	14 to 18	1.4 to 1.8
mm	6.35	0.8	0 to 0.5	1.0 to 1.5	9.9	17			
in	3/8"	0.03"	0 to 0.02"	0.04" to 0.06"	0.52"	0.87"	24.3 to 31.0	33 to 42	3.3 to 4.2
mm	9.52	0.8	0 to 0.5	1.0 to 1.5	13.2	22			
in	1/2"	0.03"	0 to 0.02"	0.04" to 0.06"	0.65"	1.02"	36.1 to 45.0	49 to 61	4.9 to 6.1
mm	12.7	0.8	0 to 0.5	1.0 to 1.5	16.6	26			
in	5/8"	0.04"	0 to 0.02"	0.04" to 0.06"	0.78"	1.14"	46.5 to 56.8	63 to 77	6.3 to 7.7
mm	15.88	1.0	0 to 0.5	1.0 to 1.5	19.7	29			
in	3/4"	0.05"	0 to 0.02"	0.04" to 0.06"	0.94"	1.42"	73.8 to 88.5	100 to 120	10.0 to 12.0
mm	19.05	1.2	0 to 0.5	1.0 to 1.5	24.0	36			

INSTALLATION

Indoor Unit Piping

WHY A DEDICATED R410A FLARING TOOL?

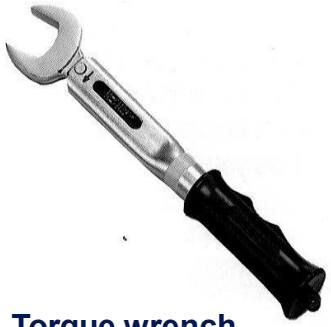


INSTALLATION

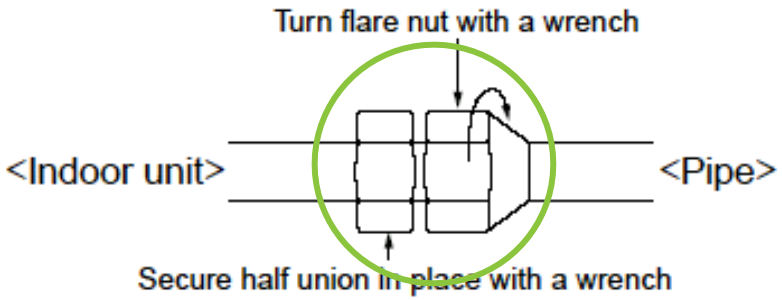
Indoor Unit Piping

TIGHTENING THE FLARE NUT

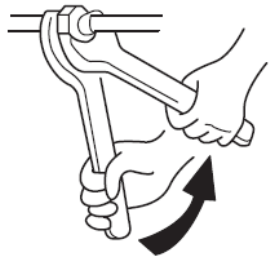
Connecting Pipe Outer Dia. (in)	Ft-lbs..
Ø1/4”	10 to 13
Ø3/8”	24 to 31
Ø1/2”	37 to 46
Ø5/8”	50 to 60



Torque wrench

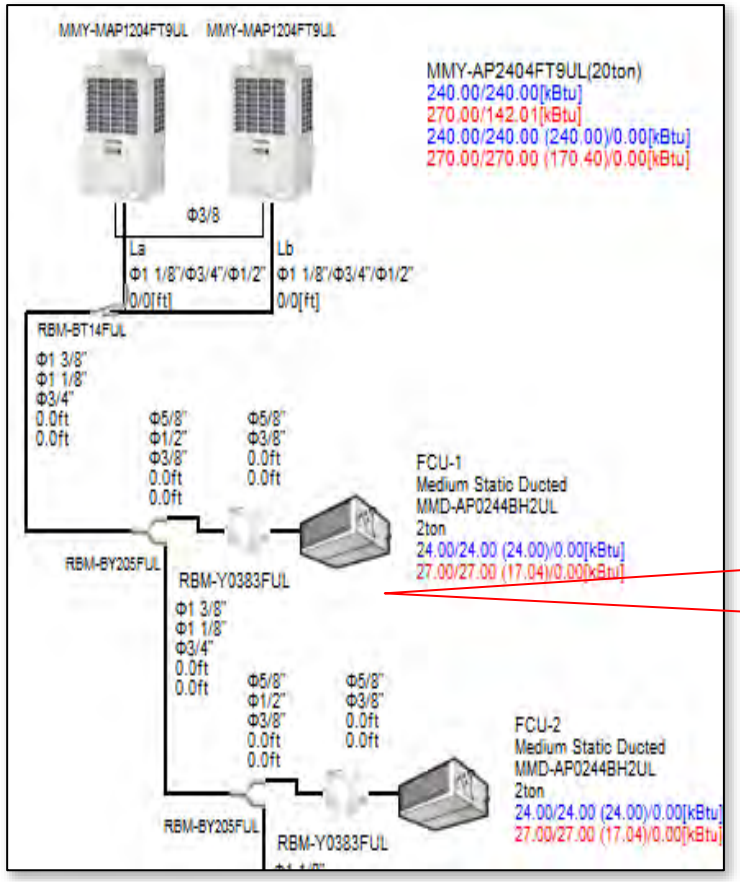


Use a backup wrench



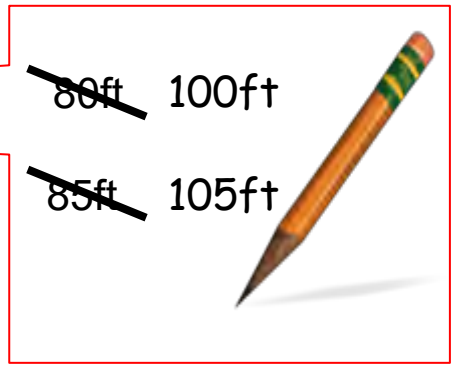
INSTALLATION

As-Built Line Lengths



DON'T FORGET!!!!

Keep track of installed Liquid refrigerant pipe lengths by size to ensure correct refrigerant charge



Refrigerant Line Size

Refrigerant Line

Minimum wall thickness for R410A application

Soft	Half Hard or Hard	OD (Inch)	OD (mm)	Minimum wall thickness (mm)
OK	OK	1/4"	6.35	0.80
OK	OK	3/8"	9.52	0.80
OK	OK	1/2"	12.70	0.80
OK	OK	5/8"	15.88	1.00
NG *(1)	OK	3/4"	19.05	1.00

*(1) If the pipe size is Ø3/4" (19.05), use a suitable material.

Refrigerant line specifications

Table 1

Indoor unit capacity type	Capacity code: Equivalent to capacity	Indoor unit capacity type	Capacity code: Equivalent to capacity
007 type	7.5	036 type	36
009 type	9.5	042 type	42
012 type	12	048 type	48
015 type	15.4	—	—
018 type	18	—	—
021 type	21	—	—
024 type	24	—	—
027 type	27	—	—
030 type	30	—	—

Indoor unit capacity information
Pay attention to the **capacity code**

Table 2

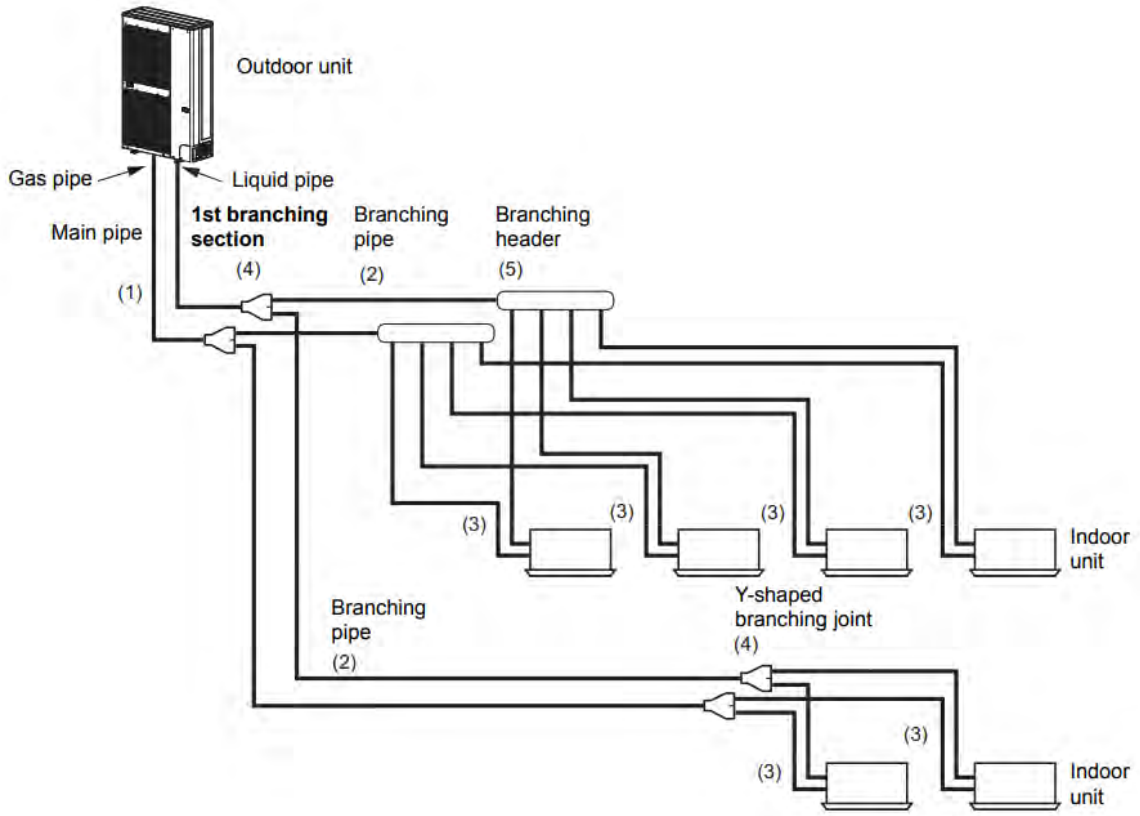
Outdoor unit capacity type	Capacity code	No. of connectable indoor units	Total capacity code of connectable indoor units	
	Equivalent to capacity		Min.*(2)	Max.
036 type	36	2 to 6	18	48
048 type	48	2 to 8	24	64
060 type	60	2 to 9	30	81

Outdoor unit capacity information

Refrigerant Line Size

Selection of refrigerant line sizes

<table>
<tr><th>No.</th><th>Piping parts</th><th>Name</th><th>Selection of pipe size</th><th>Remarks</th></tr>
<tr><td>(1)</td><td>Outdoor unit
↓
1st branching section</td><td>Main pipe</td><td>Size of main pipe<table><tr><th>Outdoor unit capacity type</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>0367 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>0487 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>0607 type</td><td>Ø3/4"</td><td>Ø3/8"</td></tr></table></td><td>Same as the outdoor unit's connecting pipe size.</td></tr>
<tr><td>(2)</td><td>Branching section
↓
Branching section</td><td>Branching pipe</td><td>Pipe size between branching sections<table><tr><th>Total capacity codes of indoor units at down stream side
Equivalent to capacity</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>Below 23</td><td>Ø1/2"</td><td>Ø3/8"</td></tr><tr><td>23 to below 61</td><td>Ø5/8"</td><td>Ø3/8"</td></tr><tr><td>61 or more</td><td>Ø3/4"</td><td>Ø3/8"</td></tr></table></td><td>Pipe size differs based on the total capacity code value of the indoor units at the downstream side. If the total value exceeds the capacity code of the outdoor unit, apply the capacity code of the outdoor unit. (See Table 1 and 2.)</td></tr>
<tr><td>(3)</td><td>Branching section
↓
Indoor unit</td><td>Indoor unit connecting pipe</td><td>Connecting pipe size of indoor unit<table><tr><th>Capacity rank</th><th>Gas pipe</th><th>Liquid pipe</th></tr><tr><td>007 to 012 type</td><td>Ø3/8"</td><td>Ø1/4"</td></tr><tr><td>015 to 018 type</td><td>Ø1/2"</td><td>Ø1/4"</td></tr><tr><td>021 to 048 type</td><td>Ø5/8"</td><td>Ø3/8"</td></tr></table></td><td></td></tr>
<tr><td>(4)</td><td>Branching section</td><td>Y-shaped branching joint</td><td>Selection of branching section (Y-shaped branching joint)<table><tr><th></th><th>Model name</th></tr><tr><td>Y-shape branch joint</td><td>RBM-BY55UL</td></tr></table></td><td></td></tr>
<tr><td>(5)</td><td>Branching section</td><td>Branching header</td><td>Selection of branching section (Branching header)<table><tr><th colspan="2"></th><th>Model name</th></tr><tr><td rowspan="2">Branching header*</td><td>For 4 branches</td><td>RBM-HY1043UL</td></tr><tr><td>For 8 branches</td><td>RBM-HY1083UL</td></tr></table>* A capacity code up to a maximum of 57 is connectable to one line after branching from the header.</td><td></td></tr>
</table>

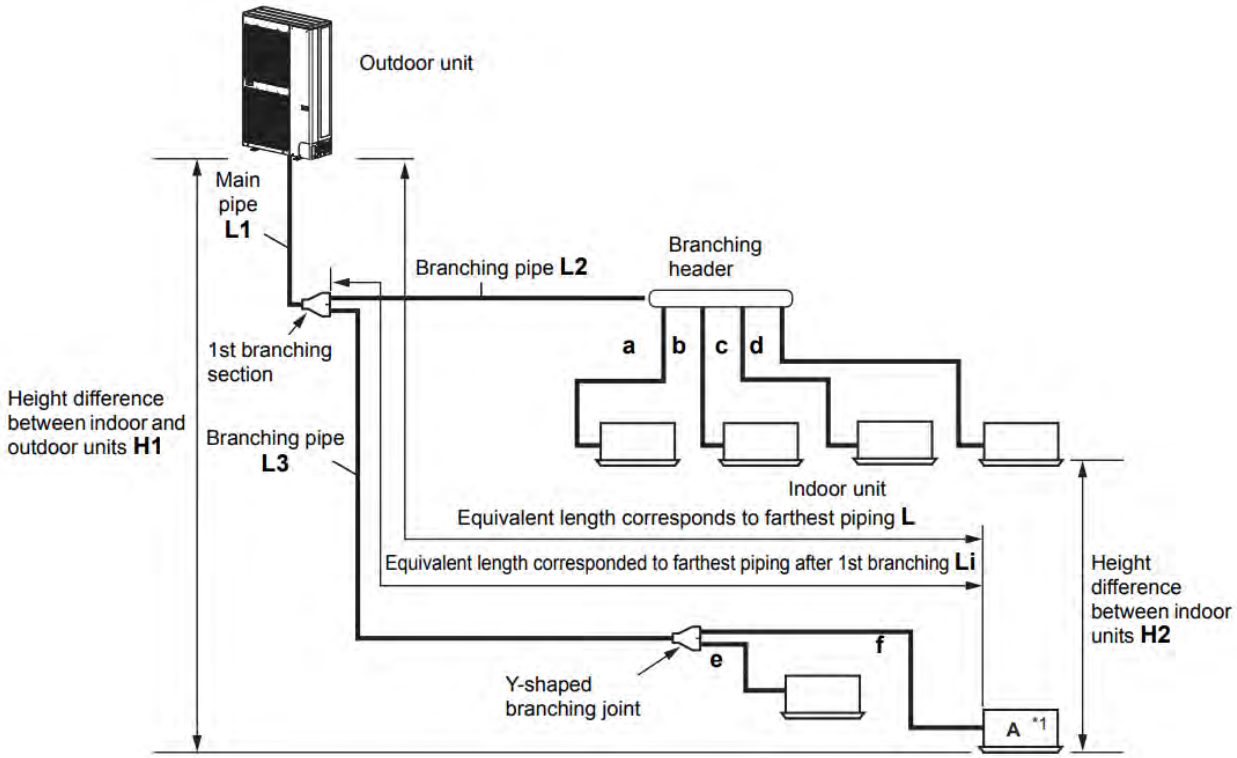


Refrigerant Line Size

Allowable Line Length & Height Difference

			Allowable value (ft (m))	Pipes
Piping Length	Total extension of pipe (liquid pipe, real length)		591 (180)	L1 + L2 + L3 + a + b + c + d + e + f
	Furthest piping length L (*1)	Real length	328 (100)	L1 + L3 + f
		Equivalent length	410 (125)	
	Max. equivalent length of main pipe		213 (65)	L1
	Max. equivalent length of furthest piping from 1st branching Li (*1)		115 (35)	L3 + f
	Max. real length of indoor unit connecting pipe		49 (15)	a, b, c, d, e, f
Height Difference	Height between indoor and outdoor units H1	Upper outdoor unit	164 (50)	
		Lower outdoor unit	131 (40)	
	Height between indoor units H2		49 (15)	

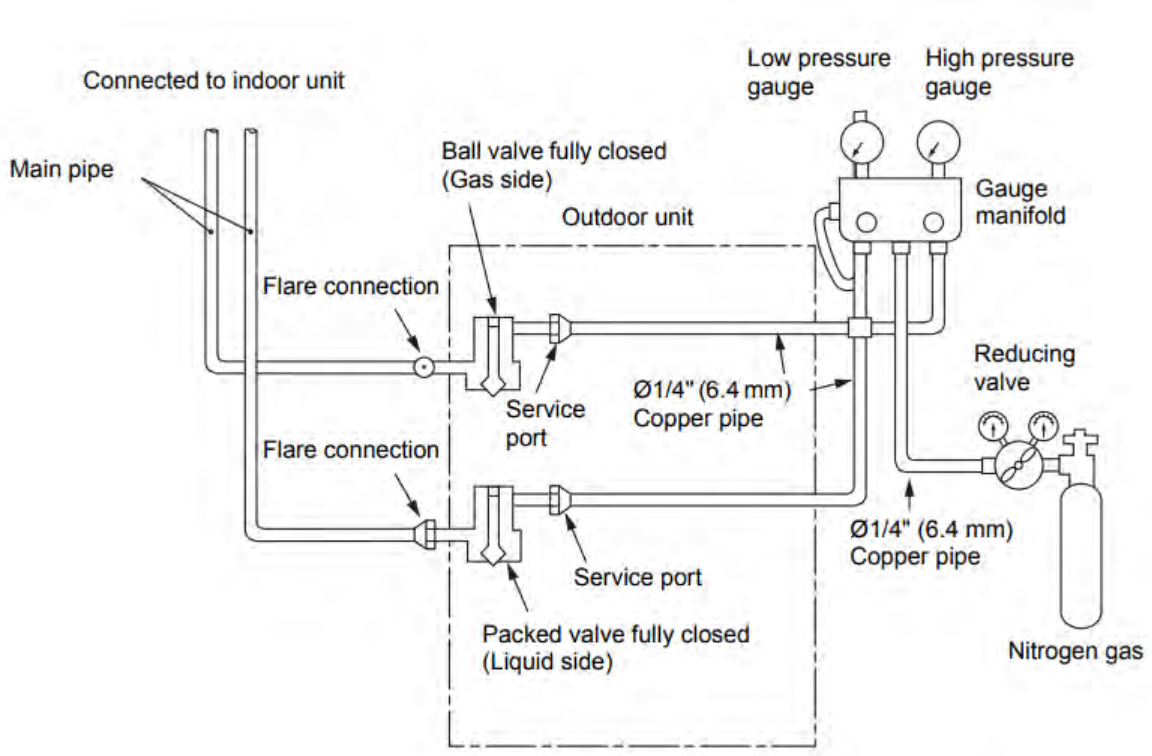
*1 Furthest indoor unit from 1st branch to be named “A”.



Pressure Test

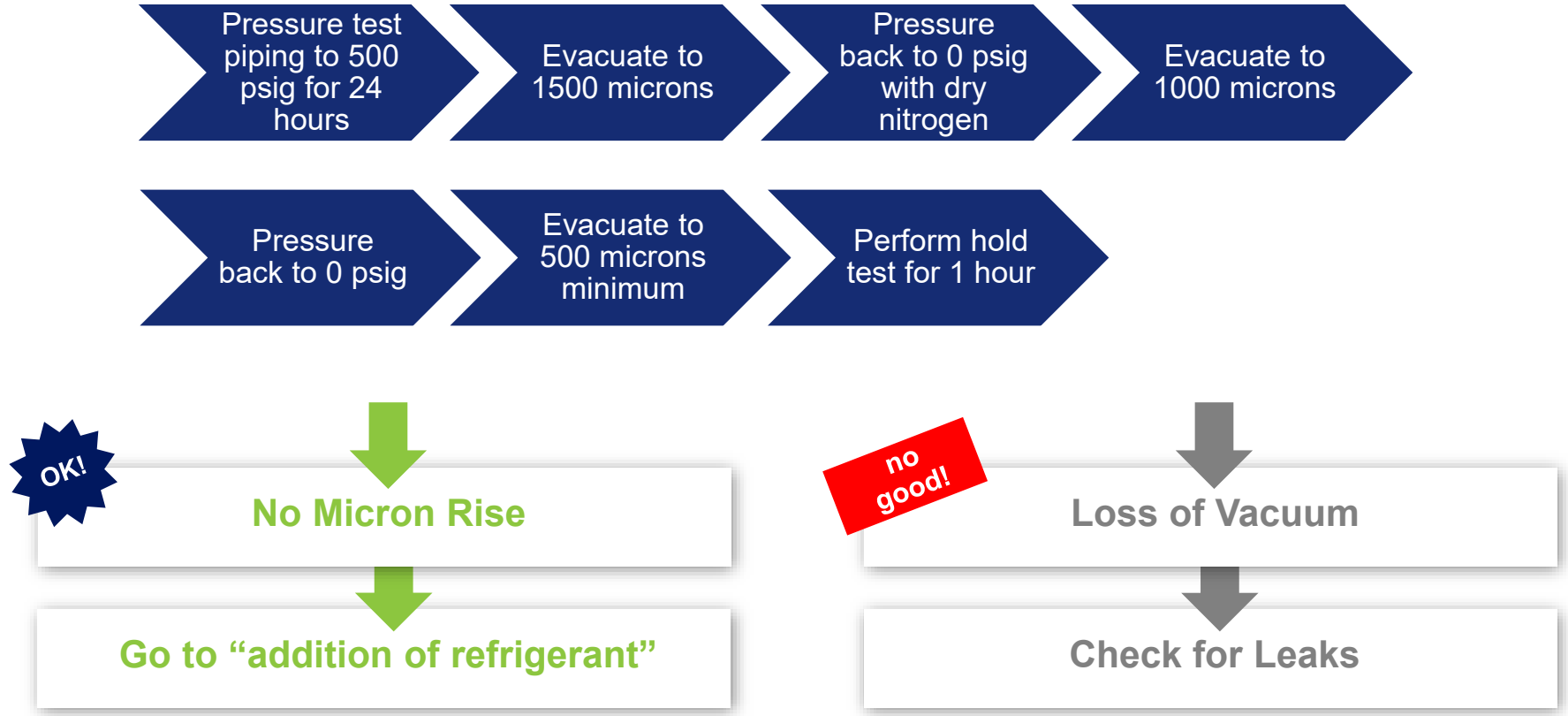
Use dry nitrogen only

- Pressure test system to insure you do not have any leaks
- Check that both liquid and gas valves are tightly closed before adding dry nitrogen
- Gradually add dry nitrogen to both sides of the system and allow pressure to stabilize
- Apply pressure 44 psi for 3 minutes or more
- Apply pressure 218 psi for 3 minutes or more
- Apply pressure 602 psi for approx. 24 hours



Pulling a Vacuum on System

- Triple Evacuation



Calculating Refrigerant Charge

- Refrigerant Charge Calculation

Lx: Real total length of liquid pipe diameter 1/4" (ft)
Ly: Real total length of liquid pipe diameter 3/8" (ft)

= {(Lx × 0.017 lbs/ft) + (Ly × 0.038 lbs/ft)} × 1.2 + (1.76 lbs)
= {(39.3 × 0.017 lbs) + (91.8 × 0.038 lbs)} × 1.2 + (1.76 lbs)
= 6.75 lbs

Calculation of additional refrigerant charge amount
The default refrigerant amount does not include the refrigerant for pipes at the local site.
For refrigerant to be charged in pipes at the local site, calculate the amount and charge it additionally.

Outdoor unit type	MAP0367	MAP0487	MAP0607
Charging amount (lbs (kg))	14.8 (6.7)	14.8 (6.7)	14.8 (6.7)

Additional refrigerant charge amount at local site	=	Real length of liquid pipe	×	Additional refrigerant charge amount per 1 ft liquid pipe (Table 1)	×	1.2	+	Compensation by outdoor HP (Table 2)

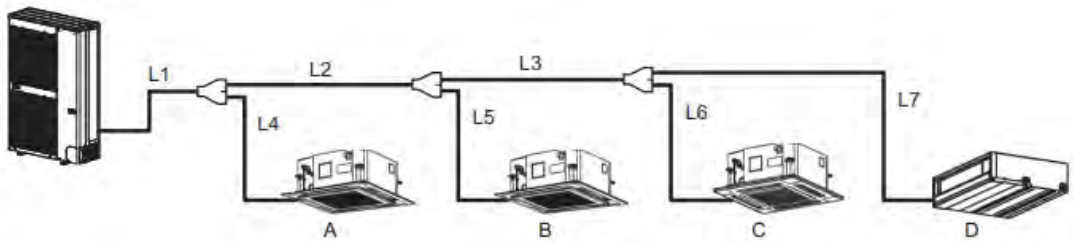
Table 1

Liquid pipe dia. (in)	Ø1/4"	Ø3/8"
Additional refrigerant amount / 1 ft liquid pipe (lbs/ft)	0.017	0.038

Table 2

Outdoor unit type	MAP0367	MAP0487	MAP0607
Compensation by outdoor capacity (lbs (kg))	0 (0)	0.88 (0.4)	1.76 (0.8)

Example: (060 type)



L1	Ø3/8": 32.8 ft	L2	Ø3/8": 32.8 ft	L3	Ø3/8": 16.4 ft	L4	Ø3/8": 9.8 ft
L5	Ø1/4": 9.8 ft	L6	Ø1/4": 13.1 ft	L7	Ø1/4": 16.4 ft		

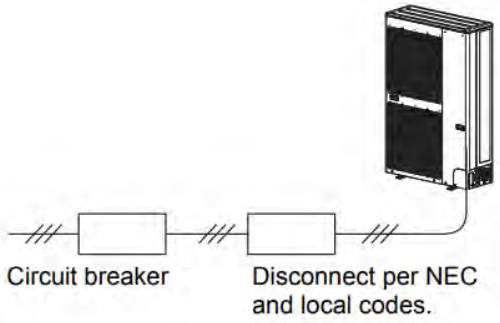
SINGLE-PHASE VRF
WIRING AND COMMUNICATION

Power Wiring

Power Wiring:

- Outdoor units powered separately
- Indoor units powered separately
- Controller powered from indoor unit
- IDUs generally have a very low amp draw giving you the ability to wire multiple indoors to a single breaker

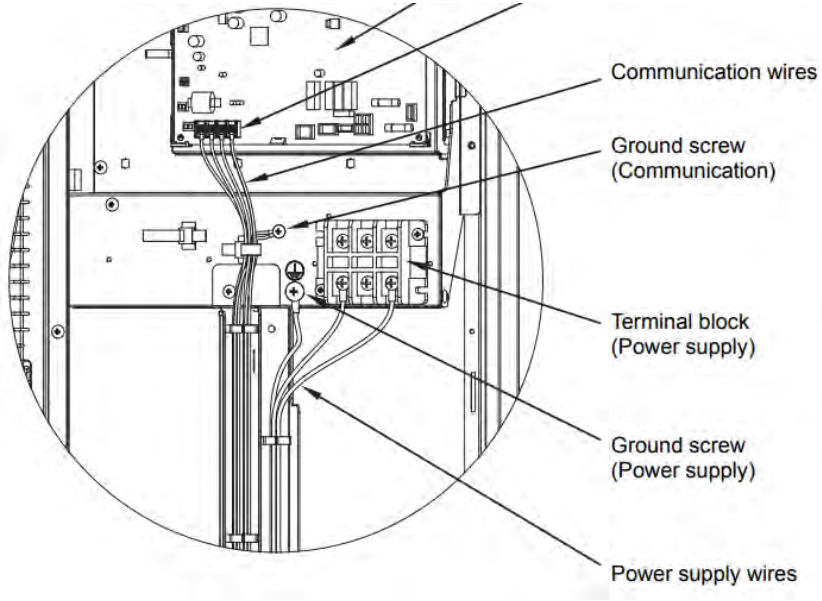
- **Power supply wiring shall be installed in compliance with NEC and local codes.**



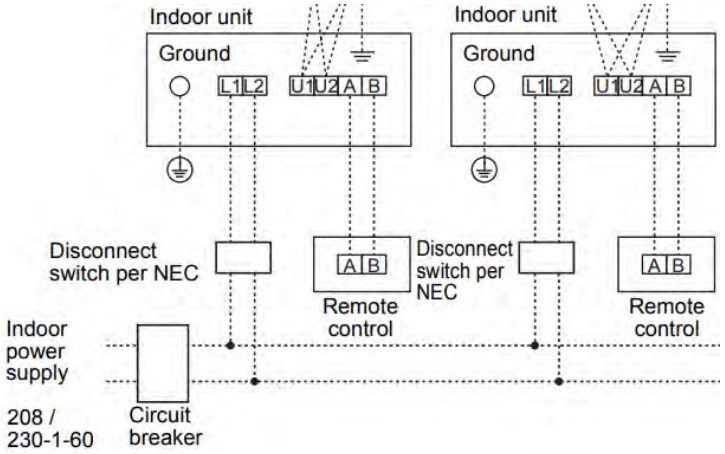
Single-Phase Heat Pump ODUs

Tons	Volts-Ph-Hz	Recommended Fuse Size (A)
3 (MCY-MAP0367HS-UL)	208/230 - 1 - 60	40
4 (MCY-MAP0487HS-UL)	208/230 - 1 - 60	40
5 (MCY-MAP0607HS-UL)	208/230 - 1 - 60	40

Power at outdoor unit



Power at Indoor unit

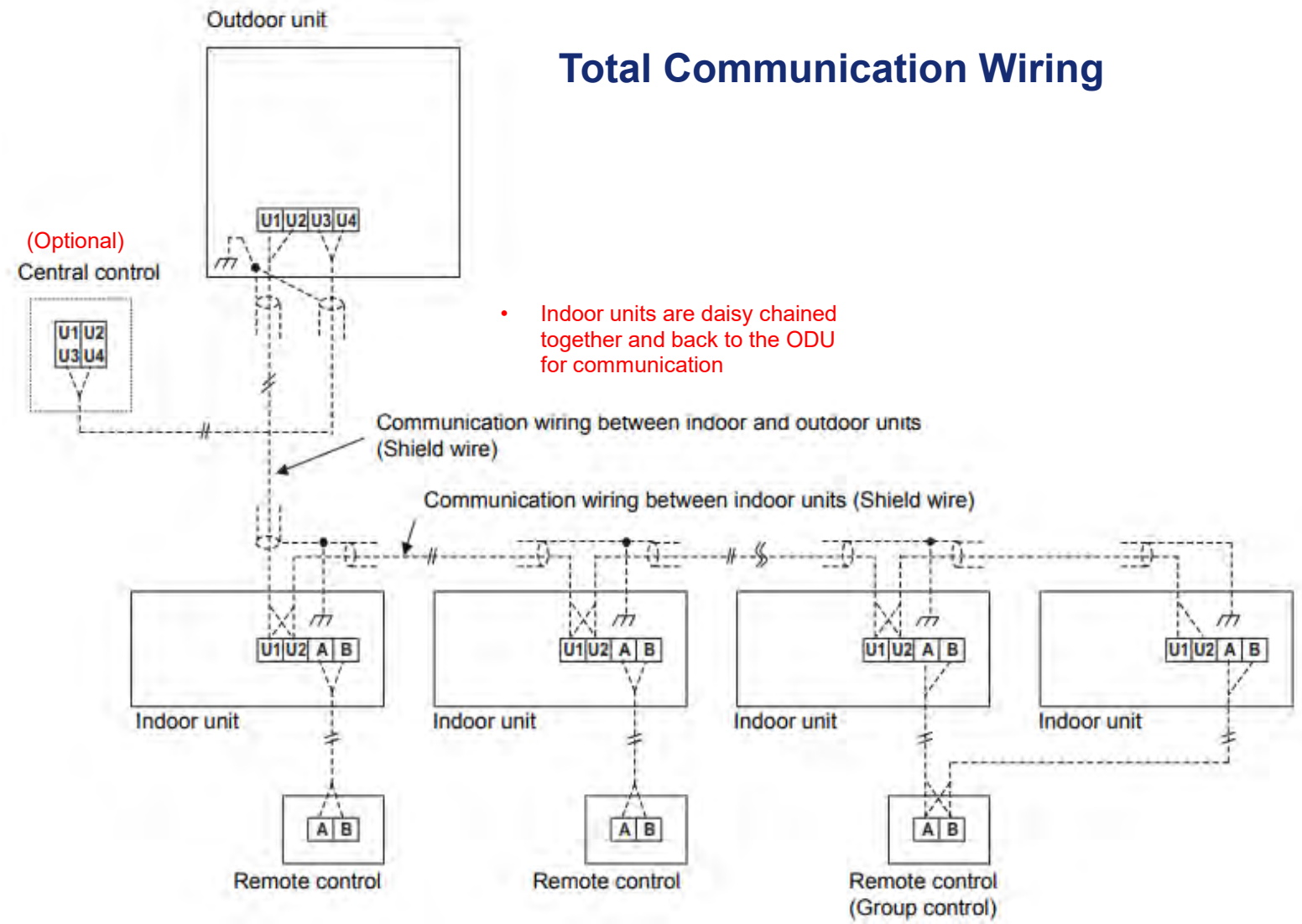


Communication Wiring

Control Wiring:

- ODU to IDU: 2-core, non-polarity shielded wire.
- Total wiring lengths: AWG16 up to 3,280’ and AWG14 up to 6,560’
- IDU to controller: 2-core AWG20 – AWG14
- Total wiring length for controller up to 1,640’
- Ground wire will be run throughout the system as shown as it acts as part of the communication

Total Communication Wiring



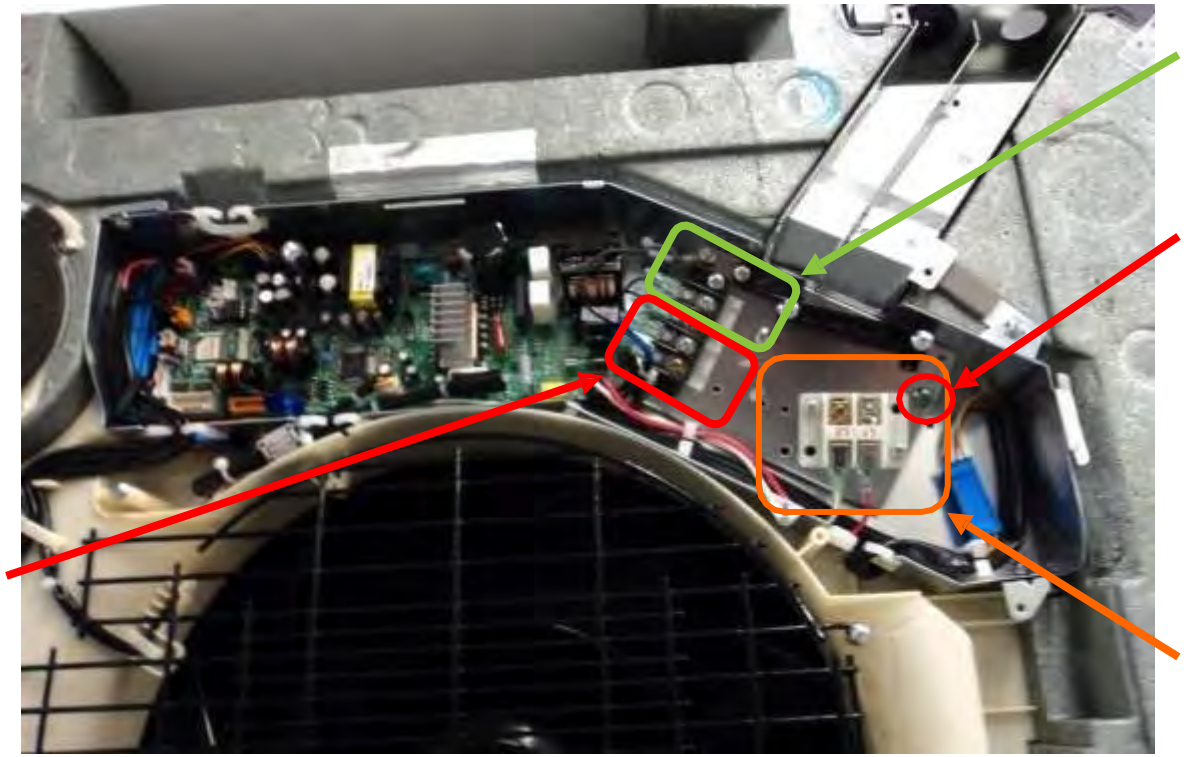
- Indoor units are daisy chained together and back to the ODU for communication

INSTALLATION

Electrical Work

CONNECTION OF INDOOR UNIT TERMINAL

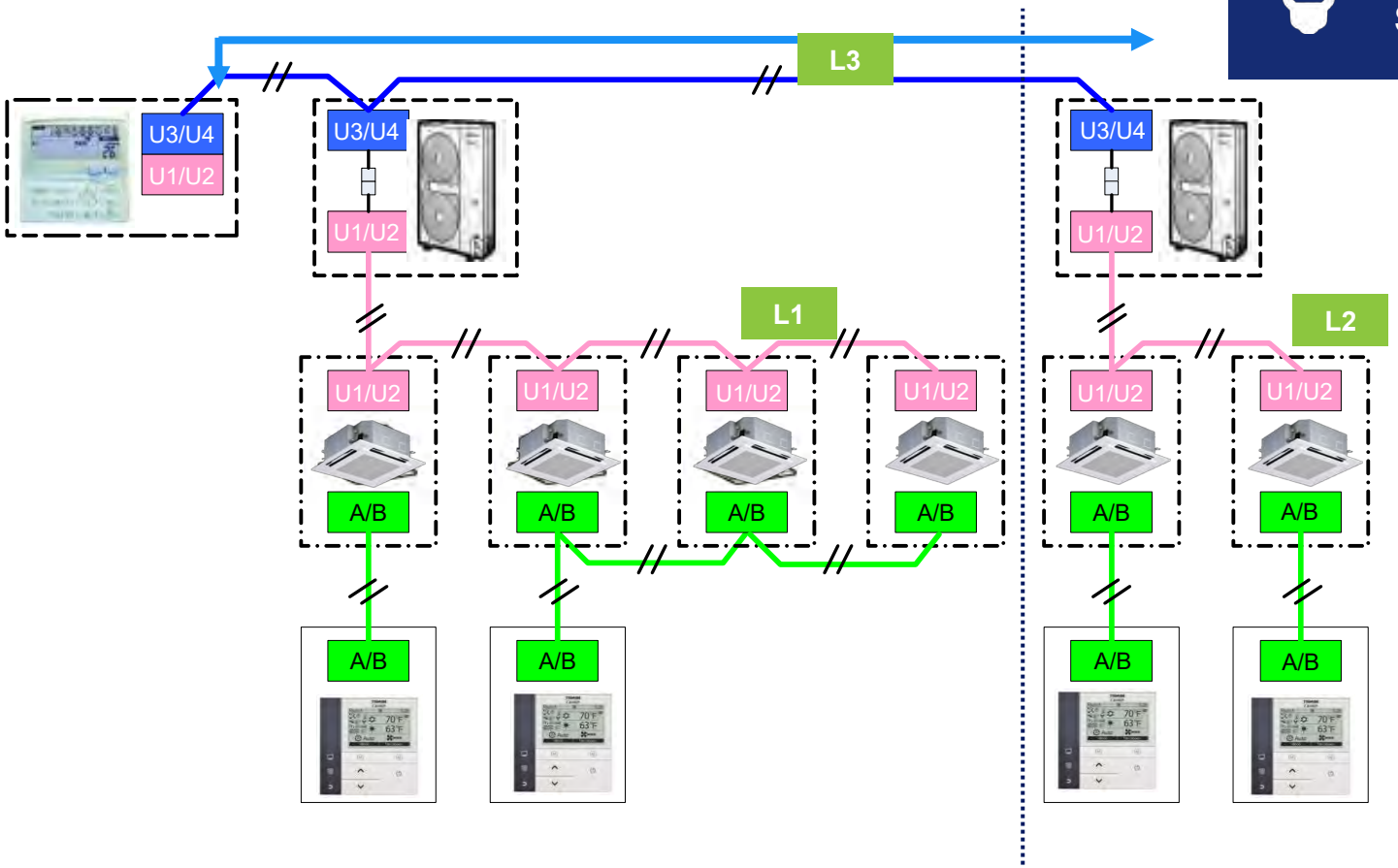
Sample: 4-way Cassette Type



Installation

CONTROL WIRING

Type: 2-core, Non-Polarity, Stranded Shielded wire
Length: L1 + L2 + L3
Size: 16 AWG 3280 ft. max. , 14 AWG 6560 ft. max.



INSTALLATION

Electrical Work

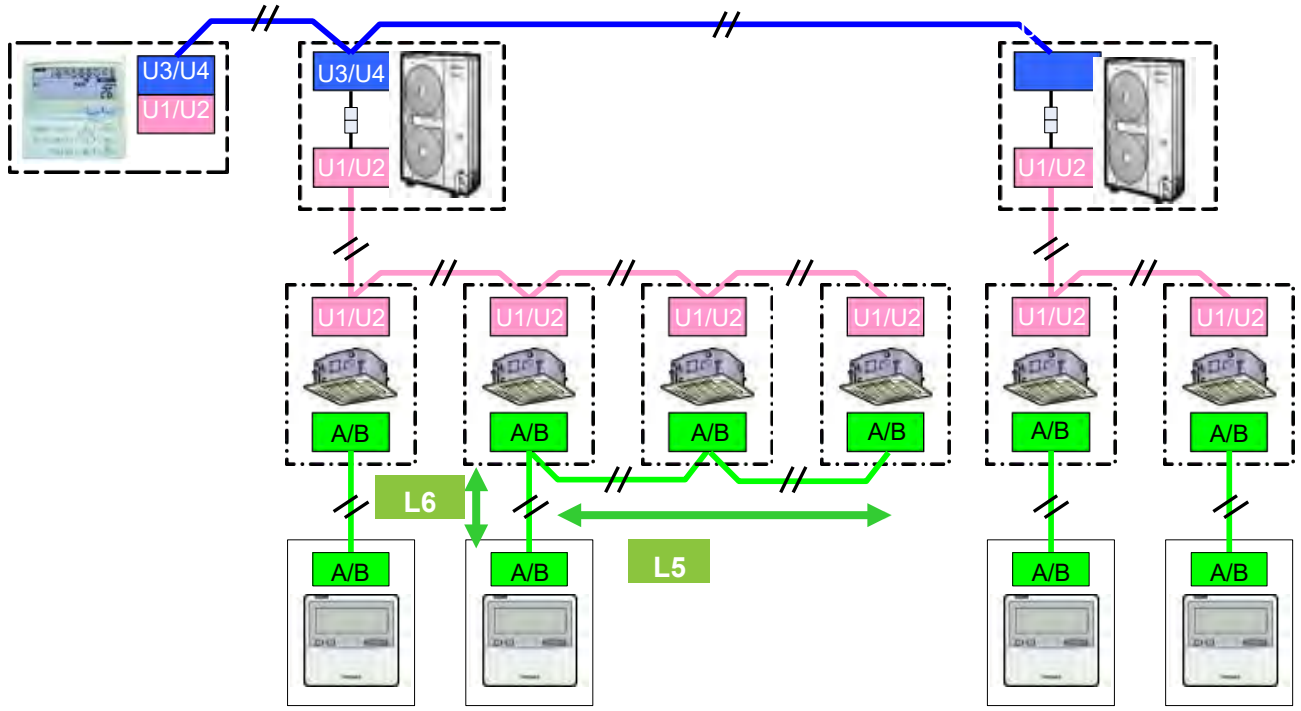
CONTROL WIRING

"Indoor to Remote Controller"

Type: 2-core, Non-Polarity, Stranded Shielded wire

Length: L5+L6: 1640 ft. max., 1310 ft. when wireless control is used; L5: 660 ft. max.

Size: 20 AWG to 14 AWG



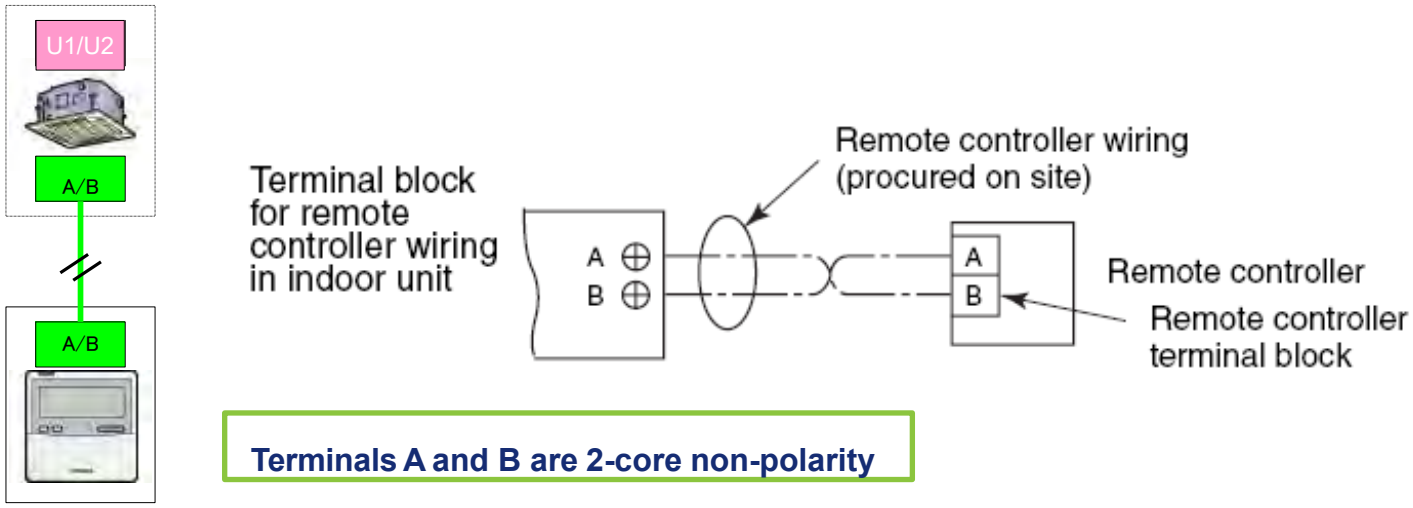
Indoor to Remote Controller

INSTALLATION

Electrical Work

CONNECTION OF REMOTE CONTROL

Individual Control (1:1)



Terminals A and B are 2-core non-polarity

INSTALLATION

Group Control Wiring

Max. 8 indoor units connectable for one group control.

Communication Wiring

16 AWG

CABLE SPECIFICATIONS

DESCRIPTION	16 AWG 2 Conductor Bare Copper, Shielded Plenum, UL Listed C(UL)US CMP or FPLP (UL)
CONDUCTOR	16 (19/29 Bare Copper)
INSULATION	Low-Smoke PVC .008"
COLOR CODE	Black/White
LAY LENGTH	3.5" LHL (approx. 3.4 TPF)
SHIELD	Aluminum Mylar

Sigler part# VRF-001320
1,000' box
good for a total of up to 3280ft total/combined comm length

14 AWG

CABLE SPECIFICATIONS

DESCRIPTION	14 AWG 2 Conductor Bare Copper, Shielded Plenum, UL Listed C(UL)US CL3P or FPLP (UL)
CONDUCTOR	14 (19/27 Bare Copper)
INSULATION	Low-Smoke PVC .008"
COLOR CODE	Black/White
SHIELD	Aluminum Mylar

Sigler part# VRF-007920
1,000' box
good for a total of up to 6560ft total/combined comm length

SINGLE-PHASE VRF HEAT PUMP
START-UP / ADDRESSING

START UP

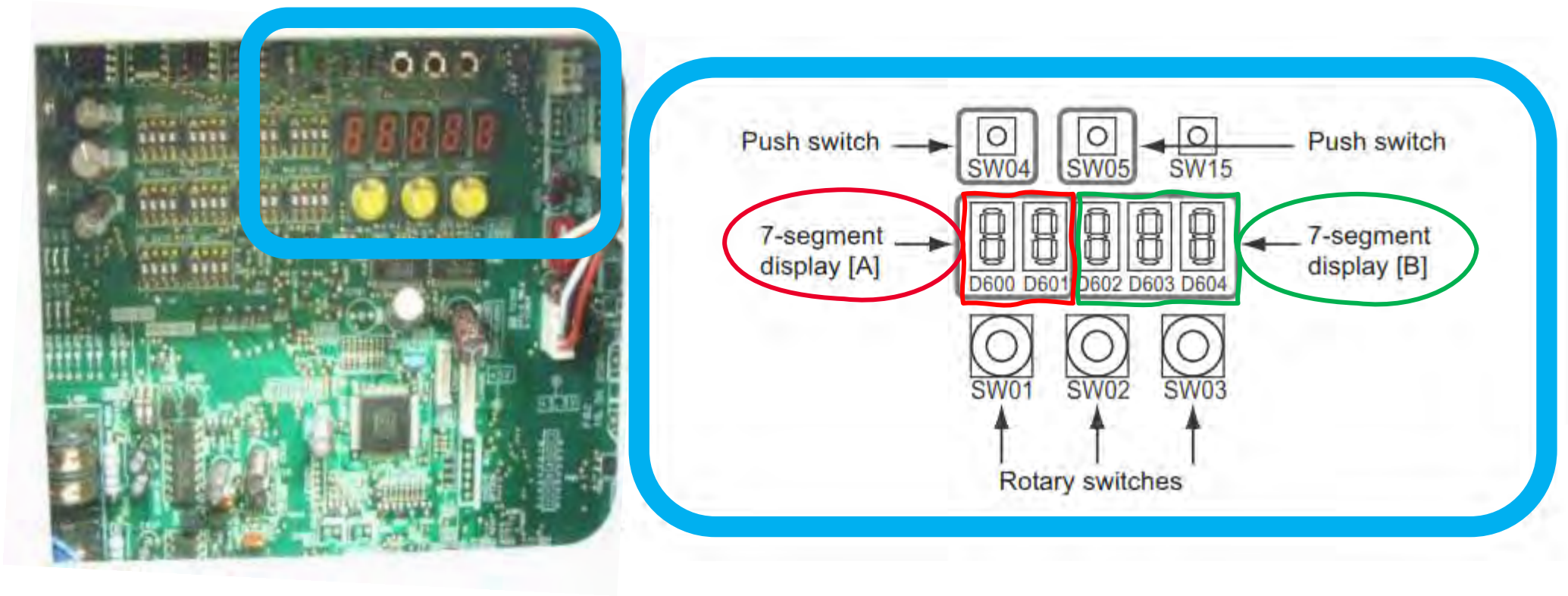
Powering Up The System

CAUTION

Prior to System Start up ensure that the system has had power energized for at least 24 hours

START UP

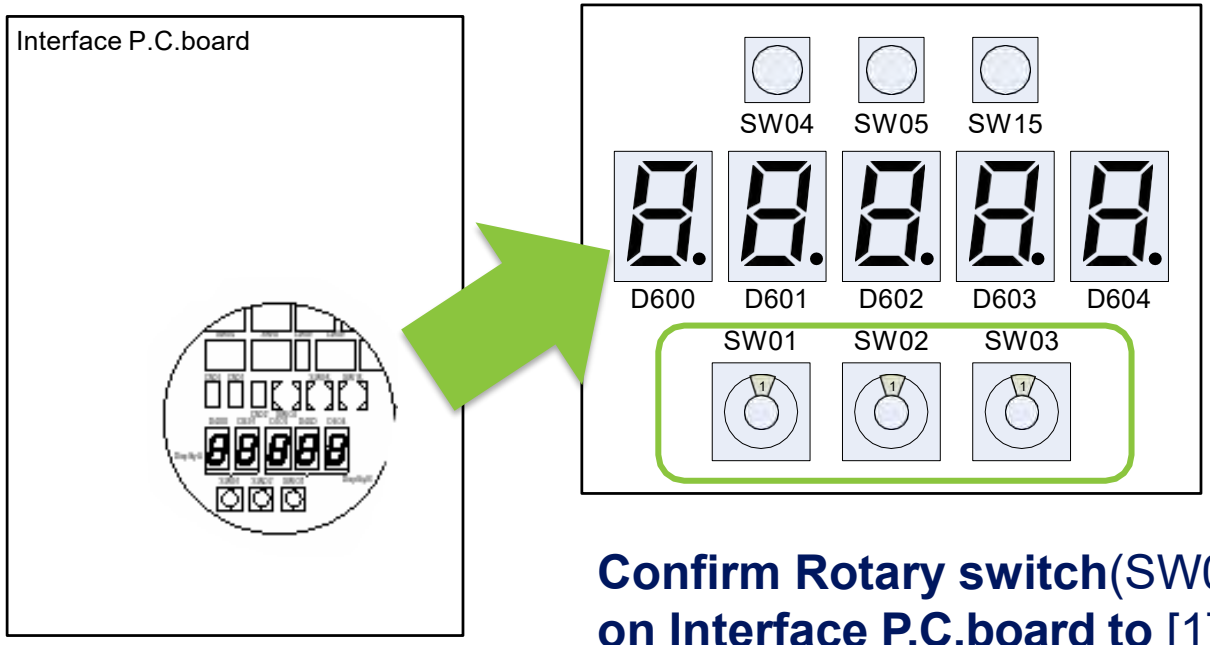
PC Board Display



START UP

Addressing

CAUTION



Confirm Rotary switch(SW01 to 03)
on Interface P.C.board to [1][1][1]

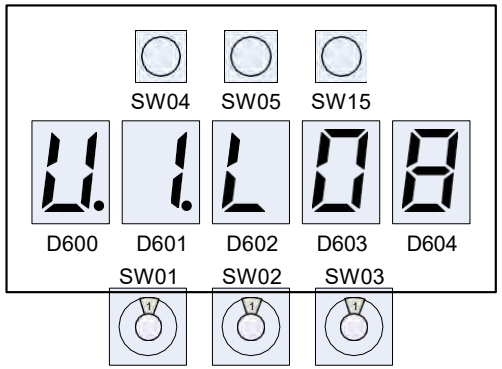
AUTOMATIC ADDRESS SETTING
PROCEDURE 1

Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 1

STEP 1 ☑ Turn on the power of indoor units and VERIFY- Then cycle power on outdoor unit



STEP 2 ☑ Check [U.1. L08] is displayed on 7-segment display on interface P.C. board of header unit.

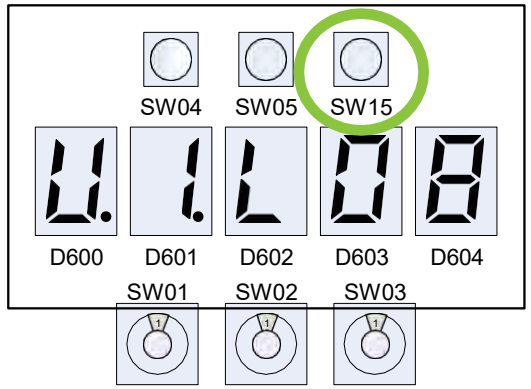
Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 1

STEP 3 ☑ Push SW15! Start automatic address setting.

STEP 4 ☑ Auto 1➡Auto 2➡Auto is displayed on 7-segment display during Automatic setting progress.

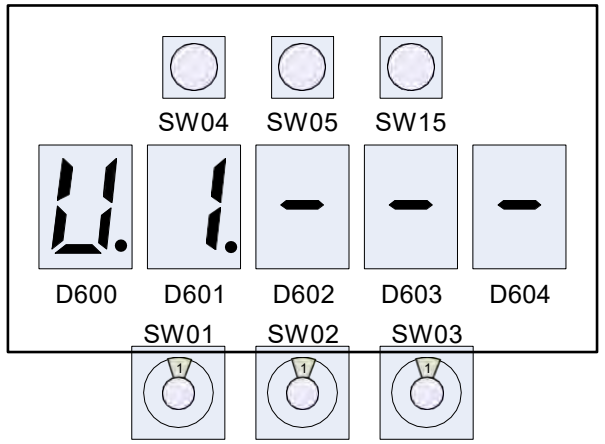


Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 1

STEP 5 ☑ When 7-segment display changes from **[U.1. - - -]** flash to **[U.1. - - -]** steady, Automatic setup finished.

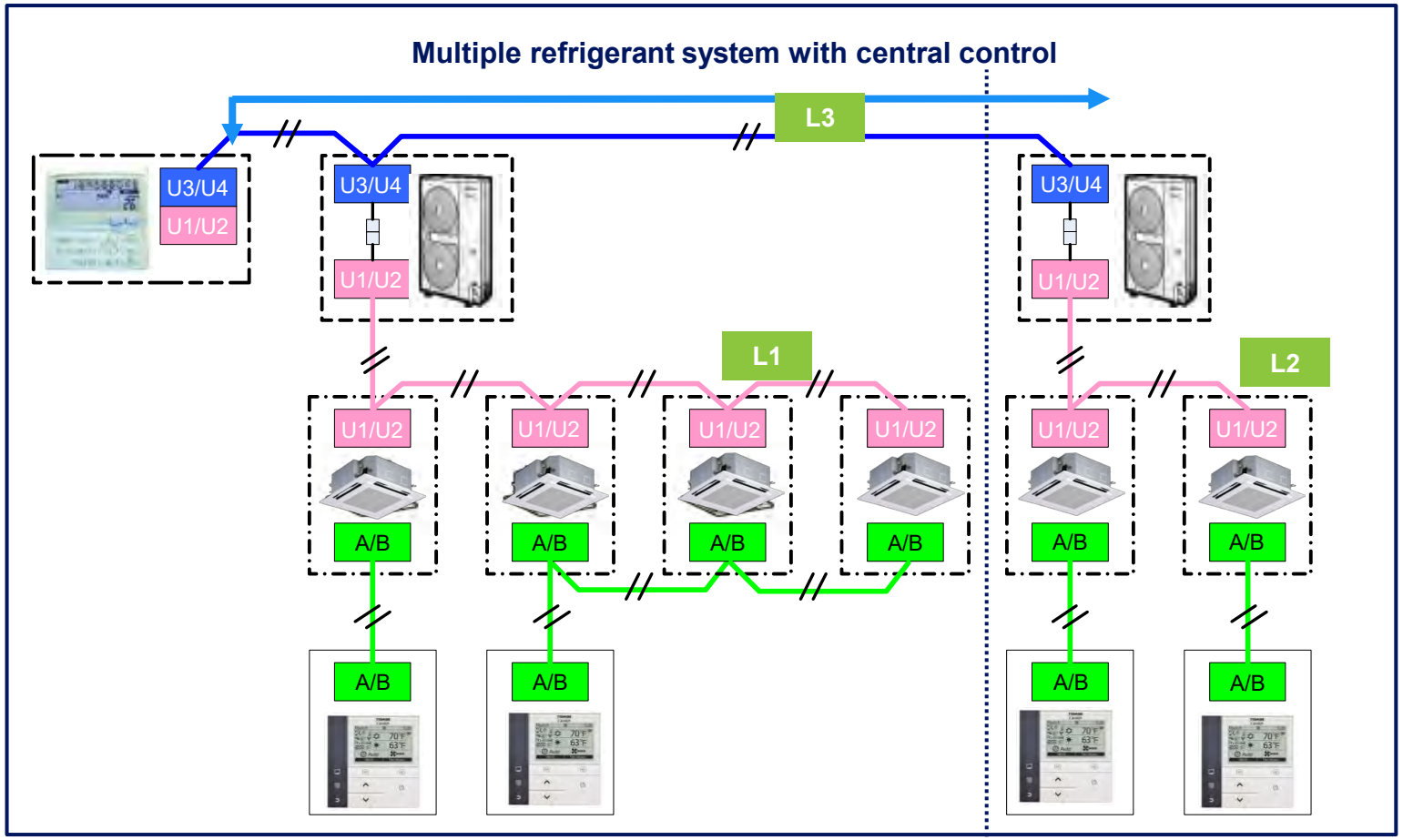


AUTOMATIC ADDRESS SETTING PROCEDURE 2

Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2



Addressing System

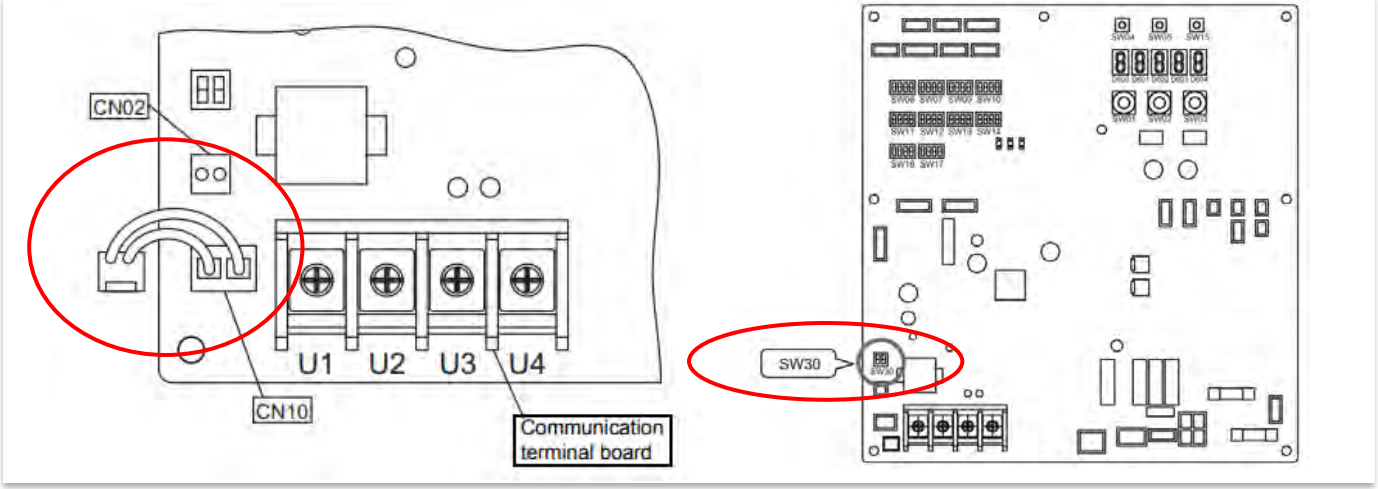
Addressing

RELAY CONNECTOR AND SW30-2

CAUTION

- **Don't** connect relay connector and **Don't** set SW30-2 on P.C. board until address setup completes and Trial operation for all refrigerant system.

Otherwise, address can't be set correctly!



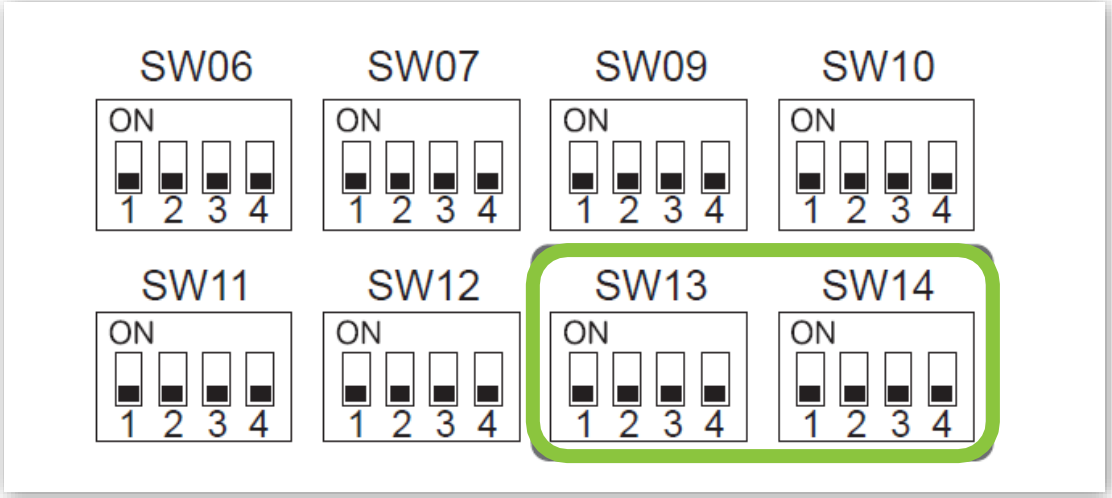
Addressing System

System Line Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

Line Address

STEP 1 ☑ Set up line address by using SW13, SW14 on interface P.C.board



At shipment : Line Address is “1”

Addressing System

System Line Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 1 ☑ Set up line address by using SW13, SW14.

Don't duplicate with other system.
Up to 28 can be selected for "Line Address".

Line address switches on the outdoor interface PC board (O : switch on, × : switch off)

Line address	SW13 1	SW13 2	SW13 3	SW13 4	SW14 1	SW14 2	SW14 3	SW14 4
1				×	×	×	×	×
2				×	O	×	×	×
3				×	×	O	×	×
4				×	O	O	×	×
5				×	×	×	O	×
6				×	O	×	O	×
7				×	×	O	O	×
8				×	O	O	O	×
9				×	×	×	×	O
10				×	O	×	×	O
11				×	×	O	×	O
12				×	O	O	×	O
13				×	×	×	O	O
14				×	O	×	O	O

Line address	SW13 1	SW13 2	SW13 3	SW13 4	SW14 1	SW14 2	SW14 3	SW14 4
15				×	×	O	O	O
16				×	O	O	O	O
17				O	×	×	×	×
18				O	O	×	×	×
19				O	×	O	×	×
20				O	O	O	×	×
21				O	×	×	O	×
22				O	O	×	O	×
23				O	×	O	O	×
24				O	O	O	O	×
25				O	×	×	×	O
26				O	O	×	×	O
27				O	×	O	×	O
28				O	O	O	×	O

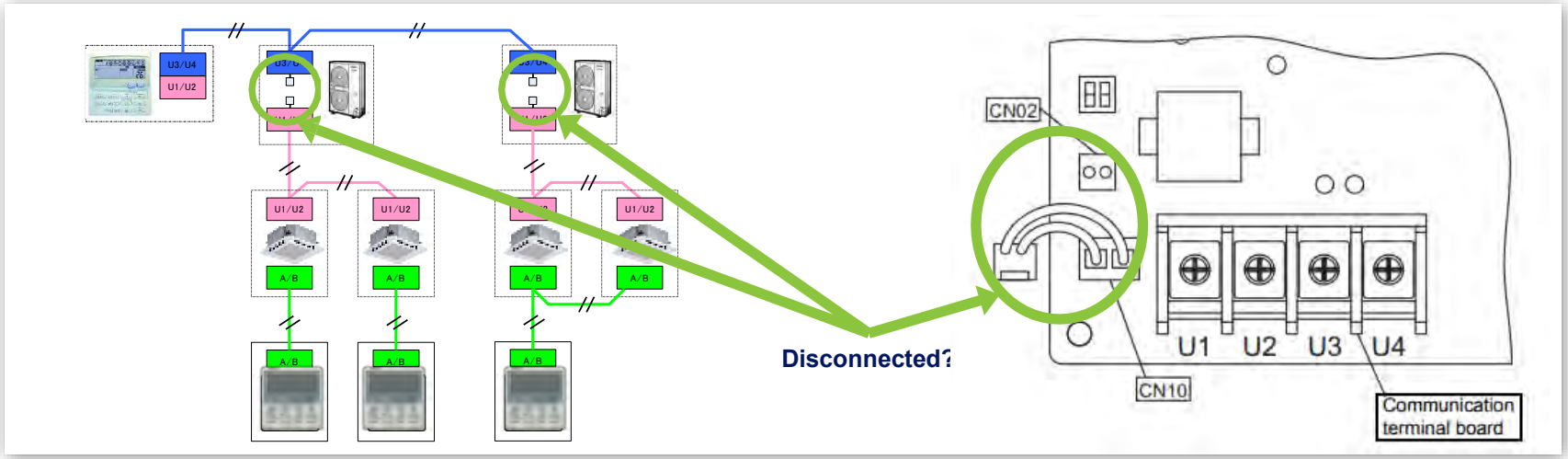
Not used for setup of line address (do not change setup.)

Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 2 ☑ Check that relay connectors are disconnected in all outdoor units.



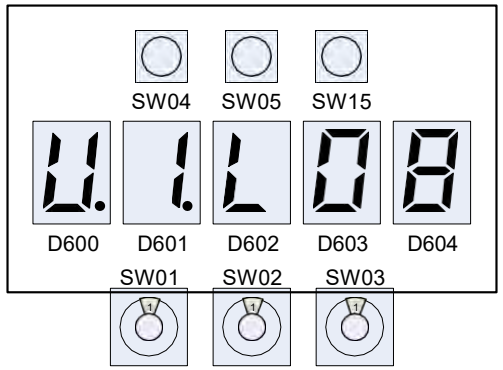
At shipment: Disconnected

Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 3 ☑ Turn on the power of indoor units and VERIFY- then cycle power on outdoor unit.



STEP 4 ☑ Check **[U.1. L08]** is displayed on 7-segment display on interface P.C. board of header unit.

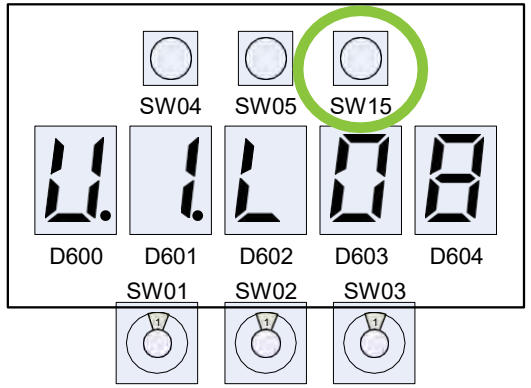
Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 5 ☑ Push SW15! Start automatic address setting.

STEP 6 ☑ Auto 1 ➡ Auto 2 ➡ Auto 3 is displayed on 7-segment display during Automatic setting progress.

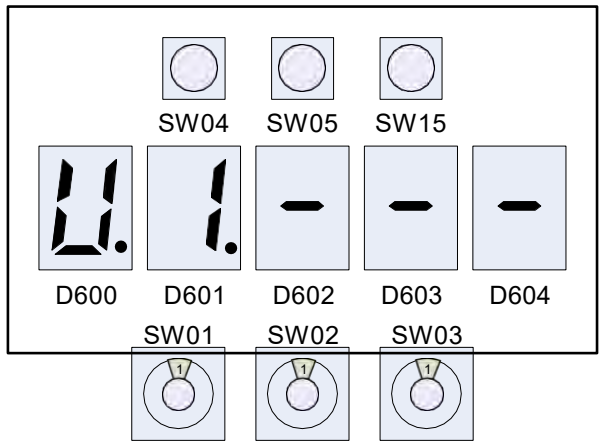


Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 7 ☑ When 7-segment display changes from **[U.1. - - -]** flash to **[U.1. - - -]** steady Automatic setup finished.



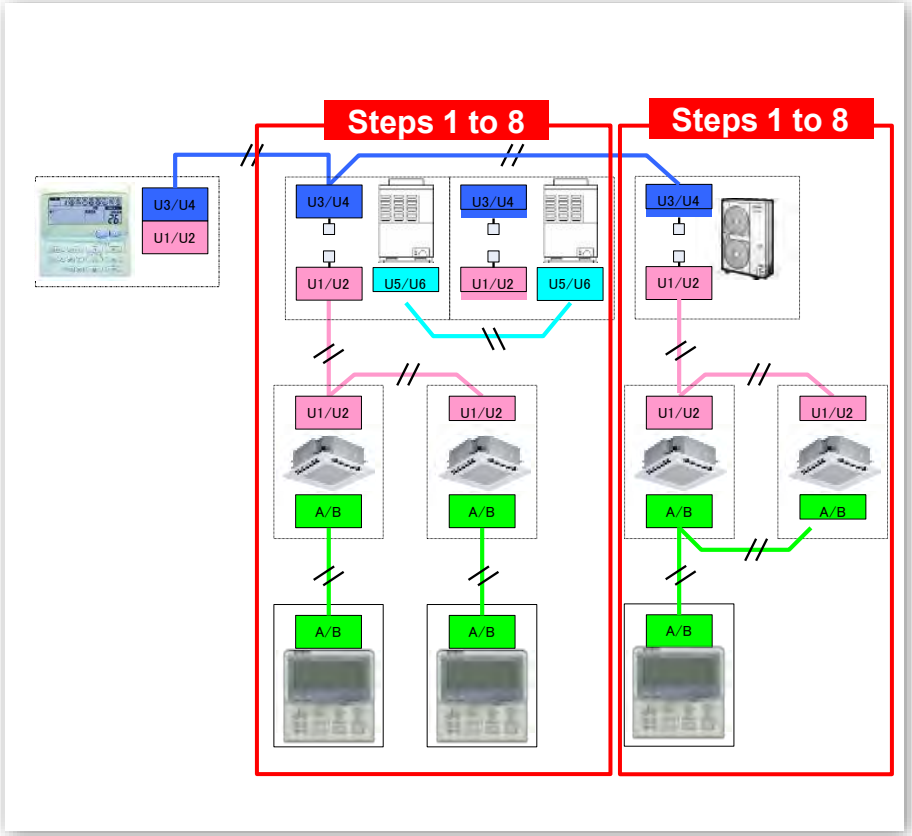
Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

STEP 8 ☑

Step 1 to 8 are repeated for other refrigerant system.

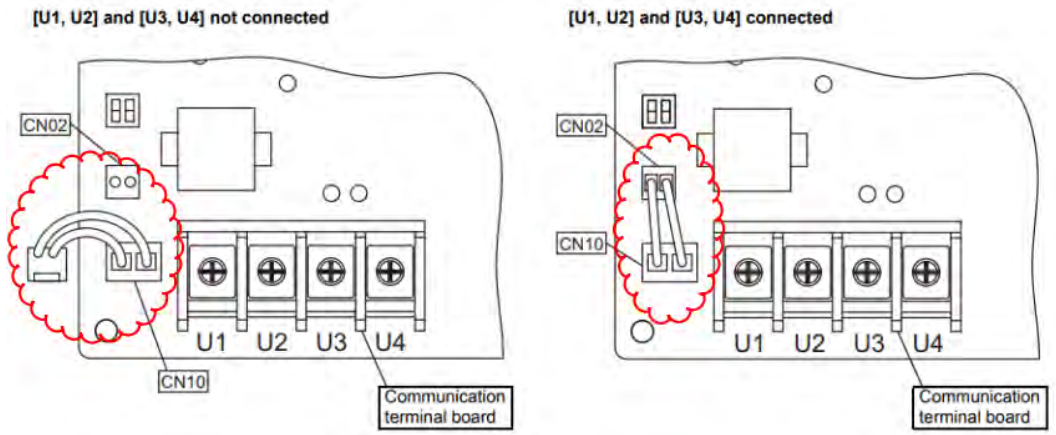


Addressing System

Addressing

AUTOMATIC ADDRESS SETTING – PROCEDURE 2

Connect control jumper between U1/U2 and U3/U4 terminal for all outdoor units.



Connect Control Jumper and set SW30-2 for all other refrigerant systems.

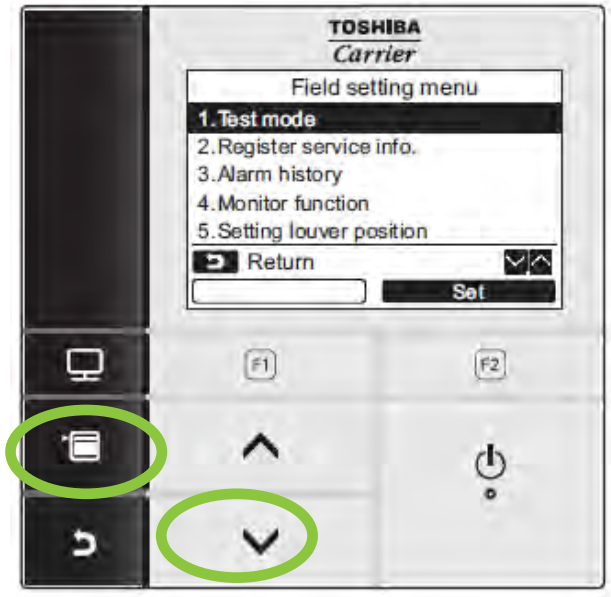
SINGLE-PHASE VRF HEAT PUMP
DN CODES SETTINGS

DN Code Settings

- Integration considerations

STEP 1 ☑

1. Push the button to display the menu screen.
2. Push and hold the button and the button at the same time to display the “Field setting menu”.
3. Press the button to select the “DN setting” on the “Field setting menu” screen, then push the “Set” button.

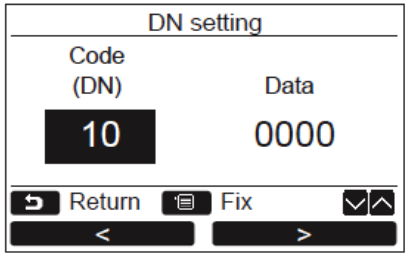


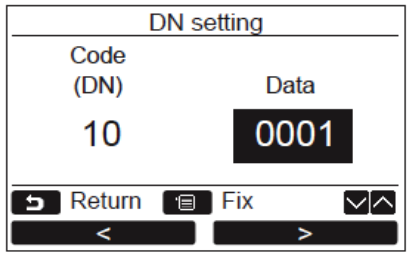
DN Code Settings

The fan and louver of the indoor unit will operate. When the group control is used, the fan and louver of the selected indoor unit will operate.

Move the cursor to select “DN code” with the “**<**“ [F1] button, then set “DN code” with the [^ v] button.

Move the cursor to select “data” with the “**>**“ [F2] button, then set “data” with the [^ v] button.





Refer to the Installation Manual supplied with the indoor unit or service manual for details about the DN code and data.

DN Code Settings

Common DN Codes for Toshiba Carrier

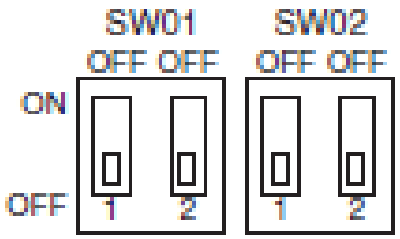
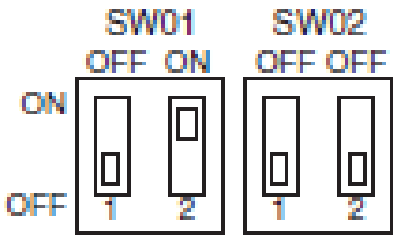
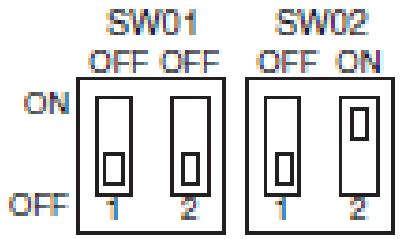
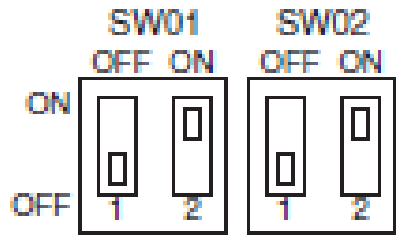
DN Codes are configuration settings at the fan coil level.

DN codes are configured with the wired remote controller.

- **DN-03** - Central Control / Group Address
- **DN-12** - Line Address
- **DN-13** - Indoor Unit Address
- **DN-14** - Group Address
- **DN-28** - Auto Restart
- **DN-2E** - CN61 for aux. drain safety
- **DN-32** - TA Sensor Location
- **DN-33** - Temperature Unit Select F vs C
- **DN-7A** - 1 degree F temperature Adjustment
- **DN-0E** - FS Box individual or multiple indoor units
- **DN-DB** - Diff T Secondary Heat
- **DN-DC** - Delta T Secondary Heat

DN Code Settings

MEDIUM STATIC DUCTED TYPE

DN	Item	Description			Atshipment
5d	SET DATA	0000	0001	0003	0006
	External static pressure	0.008psi (55Pa)	0.013psi (90Pa)	0.017psi (120Pa)	0.006psi (40Pa)
		Standard (Factory default)	High static pressure 1	High static pressure 3	Low static pressure
	DIP Switch position				

DN Code Settings

CASSETTE CEILING SETTING

<table>
<tr><th>DN</th><th>Item</th><th>Description</th><th>Atshipment</th></tr>
<tr><td>5d</td><td>High-ceiling adjustment
(Air flow selection)</td><td>4-way Cassette
<table>
<tr><th rowspan="2">Value</th><th>Type</th><th colspan="3">AP018</th><th colspan="3">AP021, AP024, AP030</th><th colspan="3">AP036, AP042</th></tr>
<tr><th>Air flow at outlet</th><th>4-Way</th><th>3-Way</th><th>2-Way</th><th>4-Way</th><th>3-Way</th><th>2-Way</th><th>4-Way</th><th>3-Way</th><th>2-Way</th></tr>
<tr><td>0000</td><td>Standard
(factory default)</td><td>9'2"
(2.8)</td><td>10'6"
(3.2)</td><td>11'6"
(3.5)</td><td>9'10"
(3.0)</td><td>10'10"
(3.3)</td><td>11'10"
(3.6)</td><td>12'10"
(3.9)</td><td>13'9"
(4.2)</td><td>14'9"
(4.5)</td></tr>
<tr><td>0001</td><td>High-ceiling (1)</td><td>10'6"
(3.2)</td><td>11'6"
(3.5)</td><td>12'6"
(3.8)</td><td>10'10"
(3.3)</td><td>11'6"
(3.5)</td><td>12'6"
(3.8)</td><td>13'9"
(4.2)</td><td>14'5"
(4.4)</td><td>15'1"
(4.6)</td></tr>
<tr><td>0003</td><td>High-ceiling (3)</td><td>11'6"
(3.5)</td><td>12'6"
(3.8)</td><td>—</td><td>11'10"
(3.6)</td><td>12'6"
(3.8)</td><td>—</td><td>14'9"
(4.5)</td><td>15'1"
(4.6)</td><td>—</td></tr>
</table>
Ceiling
<table>
<tr><th>Value</th><th>Type</th><th>AP015–AP056</th></tr>
<tr><td>0000</td><td>Standard (factory default)</td><td>11.5 ft (3.5 m) or less</td></tr>
<tr><td>0001</td><td>High-ceiling (1)</td><td>13 ft (4.0 m) or less</td></tr>
</table></td><td>0000: Standard</td></tr>
</table>

SINGLE-PHASE VRF HEAT PUMP
MONITORING MODE

Monitor Mode

ENTERING “FIELD SETTING MENU”

STEP 1 ☑

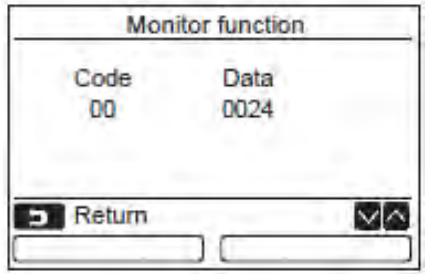
Push the  button to display the menu screen.

Push and hold the  button and the  button at the same time to for about 4 seconds to display the “Field setting menu”.

Monitor Mode

STEP 2 ☑ Select the Monitor function from the field setting menu.

STEP 3 ☑ Using the ^ v buttons, select the item code to be monitored.



Monitor Mode

System Information from the indoor unit

MONITOR ITEM CODE TABLE

	CODE No.	Data name	Display format	Unit	Remote controller display example
Indoor unit data *2	00	Room temperature (During control)	×1	°C	[0024] = 24°C
	01	Room temperature (Remote controller)	×1	°C	
	02	Indoor suction temperature (TA)	×1	°F	[0080] = 80°F
	03	Indoor coil temperature (TCJ)	×1	°F	
	04	Indoor coil temperature (TC2)	×1	°F	
	05	Indoor coil temperature (TC1)	×1	°F	
	06	Indoor discharge temperature (TF) *1	×1	°F	
	08	Indoor PMV opening	×1 / 10	pls	[0150] = 1500 pls
System data	0A	No. of connected indoor units	×1	unit	[0006] = 6 units
	0B	Total capacity of connected indoor units	×10	ton	[0050] = 5 ton
	0C	No. of connected outdoor units	×1	unit	[0001] = 1 units
	0D	Total capacity of outdoor units	×10	ton	[0050] = 5 ton

Monitor Mode

System Information from the indoor unit

MONITOR ITEM CODE TABLE CONT.

Outdoor unit individual data *3	10	Compressor discharge temperature (TD)	×1	°F	[0075] = 75°F
	12	High-pressure sensor detection pressure (PD)	×10	psi	[4350] = 435 psi
	13	Low-pressure sensor detection pressure (PS)	×10	psi	
	14	Suction temperature (TS)	×1	°F	[0086] = 80°F
	15	Outdoor coil temperature (TE)	×1	°F	
	16	Temperature at liquid side (TL)	×1	°F	
	17	Outside ambient temperature (TO)	×1	°F	
	18	Low-pressure saturation temperature (TU)	×1	°F	
	19	Compressor current (I)	×10	A	[0105] = 10.5 A
	1B	PMV opening	×1 / 10	pls	[0050] = 500 pls
	1D	Compressor revolutions	×10	rps	[0933] = 93.3 rps
	1E	Outdoor fan mode	×1	mode	[0027] = 27 mode
	1F	Outdoor unit capacity	×1	ton	[0005] = 5 ton
	E0	Refrigerant leakage detection	-	-	[- - - -] = Not available [0000] = Normal [0001] = Possibility of leakage

*1 Only a part of indoor unit types is installed with the discharge temperature sensor. This temperature is not displayed for other types.
*2 When the units are connected to group, data of the header indoor unit only can be displayed.
*3 The upper digit of "CODE No." indicates the outdoor unit number.

Monitor Mode

STEP 4 ☑ Push ‘Return’ button to finish the monitor function.

FINISH

‘Return’ button

Monitor Mode

System Information from the Outdoor unit

SW01	SW02	SW03	Display detail				
1	1	3	Refrigerant name	Display refrigerant name		A	B
				Refrigerant R410A		r4	10A
	2		System capacity	A	[3] ~ [5]: 3 to 5		
				B	[ton]		
	3		Total capacity of indoor units	A	[I. **. **]		
				B			
	4		No. of indoor units connected / No. of units with cooling thermostat ON	A	[...0.] ~ [9.]: 0 to 9 (No. of units connected)		
				B	[C...0] ~ [C9]: 0 to 9 (No. of units with cooling thermostat ON)		
	5		No. of indoor units connected / No. of units with heating thermostat ON	A	[...0.] ~ [9.]: 0 to 9 (No. of units connected)		
				B	[H...0] ~ [H9]: 0 to 9 (No. of units with heating thermostat ON)		
	6		Amount of compressor command correction	A	Value displayed in hexadecimal format		
				B			
	7		Release control	A	Normal: [r. ...], During release control: [r.1]		
				B	[P. **]		
	8		–	A	–		
				B	–		
	9		–	A	–		
				B	–		
	10		Refrigerant / oil recovery operation	A	Oil recovery in cooling: [C1], Normal: [C ...]		
				B	Refrigerant recovery in heating: [H1], Normal: [H ...]		
	11		Automatic addressing	A	[Ad]		
				B	During automatic addressing: [... FF], Normal: [... ... ...]		
	12		Power pick-cut	A	[dU]		
				B	Normal: [... ... ...], During 50-90 % capacity operation: [_50-_90] While control is based on BUS line input: [E50-E90]		
	13		Optional control (P.C. board input)	Displays optional control status		A	B
				Operation mode selection: During priority heating (normal)		-.*.	*.*.*.
					Priority cooling	C.*.	*.*.*.
					Heating only	H.*.	*.*.*.
					Cooling only	C.*.	*.*.*.
					Priority given to quantity of indoor units in operation	n.*.	*.*.*.
					Priority given to specific indoor unit	U.*.	*.*.*.
				External master ON / OFF: Normal		*.....	*.*.*.
					Start input	*.1.	*.*.*.
					Stop input	*.0.	*.*.*.
				Night operation: Normal		*.*.	....*.*.
					Start input	*.*.	1.*.*.
				Snowfall operation: Normal		*.*.	*.....*.
					Start input	*.*.	*.1.*.
	14		Optional control (BUS line input)	Same as above			
	15		Unused				
	16		–	A	–		
				B	–		

Monitor Mode

System Information from the Outdoor unit

SW01	SW02	SW03	Display detail				
1	1	1	Check code data	A	Outdoor unit No.: [U1]		
				B	Check code (only latest one displayed) If there is no check code, [– – –] is displayed. If there is sub-code, check code [∗ ∗ ∗] and sub-code [– ∗ ∗] are displayed alternately, for 3 seconds and 1 second, respectively.		
	2		–	A	–		
				B	–		
	3		Operation mode	A	Stop [… …] Normal cooling: [… C], Normal heating: [… H], Normal defrosting: [… J]		
				B	–		
	4		Outdoor unit capacity	A	[3]: 3 ton, [4]: 4 ton, [5]: 5 ton		
				B	[…ton]		
	5		Compressor operation command	* Operation data of compressor is displayed. Data display with hexadecimal notation.			
	6		Outdoor fan mode	A	[FP]		
				B	Mode 0 to 31: [… 0] to [31]		
	7		–	A	–		
				B	–		
	8		–	A	–		
				B	–		
	9		4-way valve output data	Displays control output status of solenoid valve		A	B
				4-way valve: ON		H. 1	… … …
				4-way valve: OFF		H. 0	… … …
	10		SV2 and SV5 valve output data	SV2: ON / SV5: OFF		2.1	5.0
				SV2: OFF / SV5: ON		2.0	5.1
	11		SV4 valve output data	SV4: ON		4. 1	… … …
				SV4: OFF		4. 0	… … …
	12		–	–		–	–
	13		–	–		–	–
	14		PMV1 / PMV2 opening	Displays opening data in decimal format (total opening)		∗ ∗	∗ ∗. P
	15		–	–		–	–
	16		–	A	–		
				B	–		

Monitor Mode

System Information from the Outdoor unit

SW01	SW02	SW03	Display detail				
1	1	2	PD pressure data	PD pressure (psi) is displayed in decimal format. (psi: Approx. 10 times magnitude of kg/cm^{2}G)		A	B
						P d.	*. * *
	2		PS pressure data	PS pressure (psi) is displayed in decimal format.		P S.	*. * *
	3		PL pressure conversion data	Converted PL pressure (psi) is displayed in decimal format.		P L.	*. * *
	4		TD sensor data	Temperature sensor reading (°F) is displayed in decimal format. • Letter symbol and data are displayed alternately, for 1 second and display for 3 seconds, respectively. • Data with negative value is displayed as [– *] [* * *].	Letter symbol	t d	… … …
					Data	*	* *. *
	5		TS sensor data		Letter symbol	t S	… … …
					Data	*	* *. *
	6		TE sensor data		Letter symbol	t E	… … …
					Data	*	* *. *
	7		TL sensor data		Letter symbol	t L	… … …
					Data	*	* *. *
	8		TO sensor data		Letter symbol	t o	… … …
					Data	*	* *. *
	9		–		–	–	–
					–	–	–
	10		–		–	–	–
					–	–	–
	11		–		–	–	–
					–	–	–
	12		–		–	–	–
					–	–	–
	13		–		–	–	–
					–	–	–
	14		–		–	–	–
					–	–	–

Monitor Mode

System Information from the Outdoor unit

SW01	SW02	SW03	Display detail		
4	1~16	1~4	Indoor BUS communication signal receiving status	B	Upon receiving signal: [… … 1], Other times: [… … …]
5			Indoor check code	B	No check code: [– – –]
6			Indoor capacity	B	0.6 to 4.5 ton: […0.6] to […4.5]
7			Indoor request command (S code, operation mode)	B	[#. … ∗] # represents mode: COOL: [C. … ∗], HEAT: [H. … ∗] FAN: [F. … ∗], OFF: [S. … ∗] ∗ represents S code: [#. … 0] to [#. … F]
8			Indoor PMV opening data	B	Displayed in decimal format 30~1500pls : […. … 3]~[150]
9			Indoor TA sensor data	B	Displayed in decimal format
11		1~4	Indoor TCJ sensor data	B	Displayed in decimal format
12			Indoor TC1 sensor data	B	Displayed in decimal format
13			Indoor TC2 sensor data	B	Displayed in decimal format

Note: Indoor address No. is selected by setting SW02 and SW03 and displayed on 7-segment display, section A.

SW03	SW02	Indoor address	7-segment display section A
1	1~16	SW02 setting number	[...1.]~[16.]
2	1~16	SW02 setting number +16	[17.]~[32.]
3	1~16	SW02 setting number +32	[33.]~[48.]
4	1~16	SW02 setting number +48	[49.]~[64.]

* Although 64 indoor unit addresses (Nos. 01-64) are theoretically available, the number of indoor units that can be connected to the same refrigerant piping system is limited to 12.

(5) Display of outdoor EEPROM writing check code (displayed on outdoor unit)

* The latest check code written in the EEPROM of outdoor unit is displayed.
(This function is used to check the check code after the resetting of the power supply.)

To display the check code, press SW04 and hold for at least 5 seconds after setting SW01 to 03 as shown in the table below.

SW01	SW02	SW03	Indoor address	7-segment display section A	
1	1	16	Latest check code of outdoor unit (U1)	E. 1.	***

THANK YOU

Optional contact information