Application Guide

Split System Air Conditioners Odyssey™

Long Line Tube Size and Component Selection TTA and TWA (6 to 25 Tons)

(TTA Models)
TTA072K*A/D****B
TTA090K*A/D****B
TTA120K*C/D****B
TTA150K*D****B
TTA180K*C/D****B
TTA240K*C/D****B
TTA300K*C****B

(TWA Models)
TWA072K*A/D****B
TWA090K*A/D****B
TWA120K*A/D****B
TWA150K*D****B
TWA180K*D****B
TWA240K*D****B
TWA300K*D****B

⚠ 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.

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Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.

Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/ sleeves, butyl gloves, safety glasses, hard hat/ bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠ WARNING

Cancer and Reproductive Harm!

This product can expose you to chemicals including lead and bisphenol A (BPA), which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

⚠ WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.
System contains refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠ WARNING

Explosion Hazard!

Failure to follow instructions below could result in an explosion which could result in death or serious injury, and equipment damage.
NEVER bypass system safeties in order to pump down the unit component's refrigerant into the microchannel heat exchanger (MCHE) coil. Do NOT depress the compressor contactor since it effectively bypasses the high-pressure control.

Copyright

Trademarks

Revision History

- Added TWA150K*D****B and "TWA300K*D****B model in the document.
- Added Refrigerant Piping Guidelines table in Overview chapter.
- Added TWA150K*D and TWA300K*D data in Components selections for TWA heat pump table in Parts chapter.

Table of Contents

Overview

Trane's TTA and TWA, 6 to 25 ton condensing unit product line (specific model numbers are listed on the cover) has been designed for use only with R–454B and POE oil. R–454B is a higher pressure refrigerant that requires the other components of the system to be rated for the higher pressures. For compressor lubrication, the refrigerant requires POE oil.

Traditionally, refrigerant piping practices were guided by four principles:

- Return the oil to the compressor.
- Maintain a column of liquid at the expansion valve.
- Minimize the loss of capacity.
- Minimize the refrigerant charge in the system.

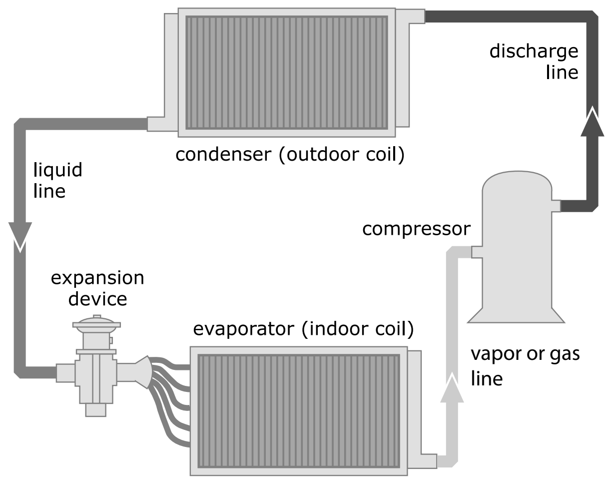
These piping practices remain the same. However, because of the different mass flows and pressures, the line diameter recommended to carry the oil and refrigerant may not be the same as a similar tonnage using a different refrigerant.

Evidence accumulated over years of observation demonstrates that the lower the refrigerant charge, the more reliably a split air-conditioning system performs. Any amount of refrigerant in excess of the minimum design charge becomes difficult to manage. The excess refrigerant tends to collect in areas that can interfere with proper operation and eventually shortens the service life of the system. To successfully minimize the system refrigerant charge, the correct line size should be used and the line length must be kept to a minimum.

Background

In a split air-conditioning system, the four major components of the refrigeration system are connected by field-assembled refrigerant piping. A vapor or gas line connects the evaporator to the compressor, the discharge line connects the compressor to the condenser, and the liquid line connects the condenser to the expansion device, which is located near the evaporator inlet. Operational problems can occur if these refrigerant lines are designed or installed improperly.

Figure 1. Interconnecting refrigerant lines in a typical split air-conditioning system



The origin of the requirements for equivalent line lengths of components, line pressure drop, and minimum and maximum refrigerant velocities is uncertain. It appears likely that at least some of the supporting data was derived from measurements and/or equations involving water. Some resource materials even show water components when illustrating refrigerant piping requirements.

Subsequent reviews of analytical and empirical data for refrigerant piping resulted in the publication of two research papers: *Pressure Losses in Tubing, Pipe, and Fittings* by R. J.S. Pigott and *Refrigerant Piping Systems — Refrigerants 12, 22, 500* by the American Society of Refrigeration Engineers (ASRE). In his paper, Pigott described his use of refrigerant as the fluid and his direct measurement of pressure drops. His findings indicated that the pressure drop of many line components is small and difficult to measure. For these components, he used experimental data to derive a formula relating the geometry of the component to its pressure drop. Overall, his calculated pressure loss of the components was less than originally determined.

The conclusion of the ASRE research paper stated that the minimum recommended velocity to maintain oil entrainment in vertical risers and horizontal lines will vary with the diameter of the tube and with the saturation temperature of the suction gas. In other words, the minimum recommended velocity for oil entrainment is not constant.

Updated Guidelines

Liquid Lines

Liquid lines are sized to minimize the pressure losses within the piping circuit. Oil movement through the piping is not a concern, as oil is miscible in liquid refrigerant at normal liquid-line temperatures. With R-454B refrigerant and POE oil, the pressure drop can be as high as 50 psid. Within these guidelines, refrigeration operation is maintained while minimizing the refrigerant charge. Limit the liquid line velocity to 600 ft/min to help avoid issues with water hammer.

Suction Lines

R–454B is a high-pressure refrigerant and allows higher-pressure drops in the suction lines. With R–454B refrigerant, that a 2°F loss is equivalent to a 5 psi drop. Additional pressure drop may be tolerated in certain applications.

Suction line oil traps hinder oil return and create unaccounted for suction pressure drops. This may reduce the operational life of compressors. Suction line oil traps should not be installed. Instead, R–454B refrigerant suction lines must be sized to maintain oil-entrainment velocities in both the horizontal lines and vertical risers without the use of suction oil traps. Oil entrainment for R-454B is based on suction temperature as well as tube diameter. Trane has used ASHRAE data to properly size the suction lines such that the refrigerant velocity is capable of returning the oil to the compressor. These pipe size are listed in component selection Table 4, p. 28 and Table 5, p. 28.

Equipment Placement

Minimize Distance Between Components

For a split air-conditioning system to perform as reliably and inexpensively as possible, the refrigerant charge must be kept to a minimum. To help accomplish this design goal:

- Site the outdoor unit (cooling-only condensing unit or heat pump) as close to the indoor unit as possible.
- Route each interconnecting refrigerant line by the shortest and most direct path so that line lengths and riser heights are no longer than absolutely necessary.
- Use only horizontal and vertical piping configurations.
- Determine whether the total length of each refrigerant line requires Trane review. Be sure to account for the difference in elevations of the indoor and outdoor units when calculating the total line length.

Interconnecting lines of 250 lineal ft (76.2 m) or less that comply with the tables in the following section do not require Trane review. Reference the following section for the maximum liquid and suction riser elevation.

Refrigerant Piping Guidelines

Table 1. Allowable elevation difference and cooling capacity – TTA cooling unit w/TWE matched air handler

Matched Model	Total Interconnecting Tube Length (ft)		25	40	50	75	100	125	150	175	200	225	250
TTA072K*A w/ TWE090K*A	Max. Change in Elevation (ft)	Liquid Lift	25	40	40	38	36	33	31	29	27	25	23
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	96%	95%	95%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	1	1
TTA072K*D w/ TWE072K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	39	38	37	34	32	29	27	24	22
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	97%	96%	95%	94%	93%	92%	91%	90%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	0	0
TTA090K*A w/ TWE090K*A	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	29	26	24	21	18	15	12
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	97%	96%	95%	94%	93%	92%	91%	90%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	1	2	3
TTA090K*D w/ TWE090K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	37	36	31	27	23	18	14	10
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	97%	96%	95%	95%	94%	93%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	0	0
TTA120K*C w/ TWE120K*A	Max. Change in Elevation (ft)	Liquid Lift	25	40	40	36	32	27	23	19	15	11	—
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	97%	96%	95%	95%	94%	93%
	Additional Oil Charge (oz)		0	1	1	2	2	3	3	4	4	5	5

Table 1. Allowable elevation difference and cooling capacity – TTA cooling unit w/TWE matched air handler (continued)

Matched Model	Total Interconnecting Tube Length (ft)		25	40	50	75	100	125	150	175	200	225	250
TTA120K*D w/ TWE120K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	30	28	27	25	24	22	21
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	100%	99%	99%	98%	98%	97%	97%	97%	96%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	1	1
TTA150K*D w/ TWE150K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	33	32	31	29	28	26	25
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	96%	96%	95%
	Additional Oil Charge (oz)		0	0	0	1	1	1	1	1	2	2	3
TTA180K*C w/ TWE180K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	35	32	29	26	23	20	17	15
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	100%	99%	99%	99%	98%	98%	98%	97%	97%
	Additional Oil Charge (oz)		3	4	5	6	7	8	9	10	11	13	14
TTA180K*D w/ TWE180K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	29	25	20	15	11	—	—
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	96%	96%	95%	94%	93%	93%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	1	1	2	3
TTA240K*C w/ TWE240K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	29	25	21	19	17	15	13
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	99%	98%	98%	97%	96%	95%	95%	94%	93%
	Additional Oil Charge (oz)		1	2	3	4	6	8	9	11	13	15	16
TTA240K*D w/ TWE240K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	38	34	29	25	20	15	10	—	—
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	96%	96%	95%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	1	2	3	4
TTA300K*C w/ TWE300K*B	Max. Change in Elevation (ft)	Liquid Lift	25	40	40	39	38	35	33	31	29	27	25
		Suction Lift	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	100%	99%	99%	99%	98%	98%	98%	97%	97%
	Additional Oil Charge (oz)		8	9	10	12	14	15	17	19	21	23	25

Notes:

1. Regardless of orientation, hot gas bypass (HGBP) lines are limited to 75 feet. See *Hot Gas Bypass Installation Guidelines for R-454B Direct Expansion (DX) Split Systems Application Guide* (APP-APG017*-EN) for more details.
2. For line lengths over 150 ft., condensing unit maximum operating ambient may be reduced.
3. Table assumes 1 elbow for every 10 feet of interconnecting tube length.
4. It is recommended to insulate all liquid lines exceeding 150 total feet.
5. It is recommended to insulate all liquid lines that pass through a space exceeding 115°F.
6. For dual circuit units, additional oil charge shown is per individual circuit.

Table 2. Allowable elevation difference and cooling capacity – TWA heat pump w/TWE matched air handler

Matched Model	Total Interconnecting Tube Length (ft)		25	40	50	75	100	125	150	175	200	225	250
TWA072K*A w/ TWE090K*A	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	40	39	38	36	35	34	33	31	30
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	97%	96%	95%	94%	94%	93%
	Heating Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	96%	96%	95%
	Additional Oil Charge (oz)		0	0	0	1	2	3	4	5	6	7	8
TWA072K*D w/ TWE072K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	39	36	34	31	29	27	24	22	20
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	98%	97%	95%	94%	92%	91%	90%	89%	87%
	Heating Capacity (% of Rating)		100%	100%	99%	99%	98%	97%	97%	96%	96%	95%	95%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	0	0
TWA090K*A w/ TWE090K*A	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	38	34	29	25	20	19	18	16	15
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	98%	97%	95%	94%	92%	91%	90%	89%	87%
	Heating Capacity (% of Rating)		100%	100%	100%	99%	99%	98%	98%	98%	97%	97%	96%
	Additional Oil Charge (oz)		4	4	4	4	6	8	10	12	13	15	17
TWA090K*D w/ TWE090K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	38	34	29	25	20	15	10	—	—
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	96%	95%	94%	94%	93%	92%	91%
	Heating Capacity (% of Rating)		100%	100%	99%	99%	98%	97%	97%	96%	96%	95%	95%
	Additional Oil Charge (oz)		0	0	0	0	0	0	0	0	0	0	0
TWA120K*A w/ TWE120K*A	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	40	37	34	31	28	26	23	20	18
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	96%	95%	94%	94%	93%	92%	91%
	Heating Capacity (% of Rating)		100%	100%	100%	99%	99%	98%	98%	98%	97%	97%	97%
	Additional Oil Charge (oz)		3	3	4	5	6	7	8	9	10	11	11
TWA120K*D w/ TWE120K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	40	39	38	37	36	34	33	32	31
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	100%	99%	99%	98%	97%	97%	96%	96%	95%	95%
	Heating Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	96%	96%	95%
	Additional Oil Charge (oz)		0	0	0	0	0	0	1	1	1	2	2

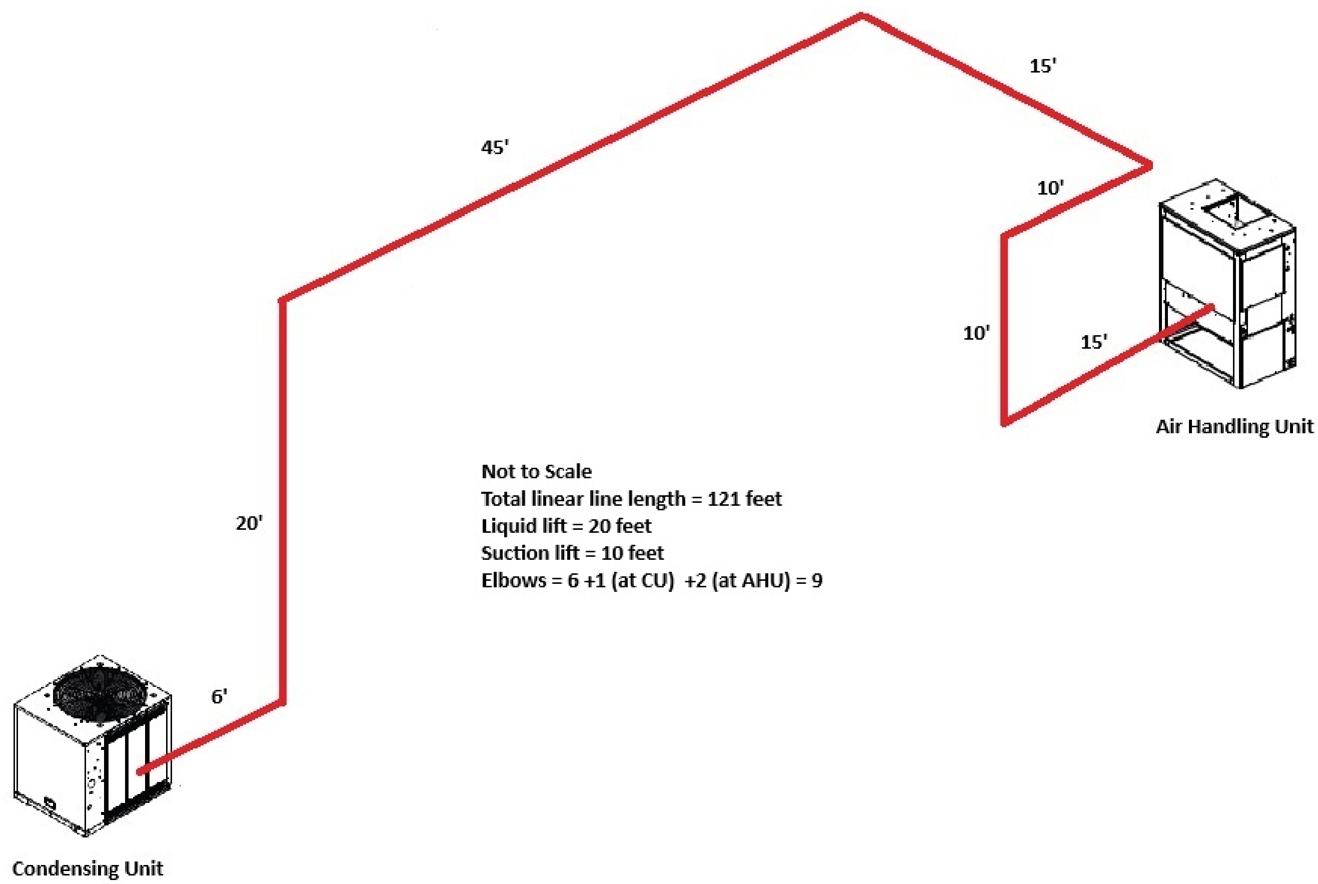
Table 2. Allowable elevation difference and cooling capacity – TWA heat pump w/TWE matched air handler (continued)

Matched Model	Total Interconnecting Tube Length (ft)		25	40	50	75	100	125	150	175	200	225	250
TWA150K*D w/ TWE150K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	38	34	29	25	20	17	11	10	10
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	97%	96%	95%	94%	94%	93%
	Heating Capacity (% of Rating)		100%	100%	99%	99%	98%	98%	97%	97%	97%	96%	96%
	Additional Oil Charge (oz)		0	0	0	0	0	1	1	2	3	4	5
TWA180K*D w/ TWE180K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	40	38	36	34	32	30	28	26	24
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	96%	94%	94%	93%	92%	91%
	Heating Capacity (% of Rating)		100%	100%	100%	99%	99%	98%	98%	98%	97%	97%	97%
	Additional Oil Charge (oz)		2	2	2	3	4	5	6	7	8	9	10
TWA240K*D w/ TWE240K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	38	34	29	25	20	15	10	—	—
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	97%	96%	95%	94%	94%	93%
	Heating Capacity (% of Rating)		100%	100%	100%	99%	99%	99%	98%	98%	98%	97%	97%
	Additional Oil Charge (oz)		0	1	1	2	3	4	5	6	7	8	9
TWA300K*D w/ TWE300K*B	Max. Change in Elevation (ft)	Liquid Lift (Clg Mode)	25	40	38	34	29	25	20	15	10	—	—
		Suction Lift (Clg Mode)	25	40	50	50	50	50	50	50	50	50	50
	Cooling Capacity (% of Rating)		100%	99%	99%	98%	97%	96%	95%	94%	93%	93%	92%
	Heating Capacity (% of Rating)		100%	100%	100%	99%	99%	99%	99%	98%	98%	98%	98%
	Additional Oil Charge (oz)		2	3	3	4	5	6	7	8	9	10	11

Notes:

1. Regardless of orientation, hot gas bypass (HGBP) lines are limited to 75 feet. See *Hot Gas Bypass Installation Guidelines for R-454B Direct Expansion (DX) Split Systems Application Guide* (APP-APG017*-EN) for more details.
2. For line lengths over 150 ft., condensing unit maximum operating ambient may be reduced.
3. Table assumes 1 elbow for every 10 feet of interconnecting tube length.
4. It is recommended to insulate all liquid lines exceeding 150 total feet.
5. It is recommended to insulate all liquid lines that pass through a space exceeding 115°F.
6. For dual circuit units, additional oil charge shown is per individual circuit.

Figure 2. Piping example



Note: *All upflow liquid lines (in cooling mode) should be summed without respect to downflow liquid lines. All upflow suction lines (in cooling mode) should be summed without respect to downflow suction lines.*

Line Sizing, Routing, and Component Selection

"Refrigerant Piping Examples," p. 19 provides illustrations of TTA/TWA split system component arrangement. Use them to determine the proper, relative sequence of the components in the refrigerant lines that connect the TTA/ TWA outdoor unit to an evaporator coil. The TTA/TWA units are R-454B machines and all the selected components installed in the field must also be rated for use with R-454B.

Liquid Lines

Line Sizing

When sizing liquid lines 25 feet or less, the installer may refer to the Component Selection tables, found in "Parts," p. 28 or the IOM. For lines more than 25 feet, the installer should refer exclusively to the Component Selection Tables. The recommended liquid-line sizing for each TTA/TWA model is based on its nominal capacity. Increasing the line size will not increase the allowable line length.

Routing

Install the liquid line with a slight slope in the direction of flow so that it can be routed with the suction line. Due to the normal force of gravity, there is a maximum liquid riser height limitation. As the liquid riser grows in height gravity produces a pressure drop that may result in a loss of subcooling. Table 1, p. 6 and Table 2, p. 8 show the permissible rise in the liquid line (without excessive loss of subcooling). System designs outside the application envelope of the TTA/TWA unit require Trane review.

Insulation

The liquid line is generally warmer than the surrounding air, so it does not require insulation. For lines less than 150 feet, heat loss from the liquid line improves system capacity because it provides additional subcooling. However, if the lines are longer than 150 feet, or if the liquid line is routed through a high temperature area exceeding 115 °F, such as an attic or mechanical room, insulation would be required.

Components

Liquid-line refrigerant components necessary for a successful job include a filter drier, access port, moisture-indicating sight glass, and expansion valve(s). The examples in "Refrigerant Piping Examples," p. 19, illustrate the proper sequence for positioning the components in the liquid line. Position the components as close to the indoor unit as possible. The Component Selection tables, found in "Parts," p. 28, identify suitable components, by part number, of each TTA/TWA model. Note there are two access ports: one located at the TTA/TWA and one located at the evaporator. Table 6, p. 29 lists suitable expansion valves.

Liquid Filter Drier

There is no substitute for cleanliness during system installation. The liquid filter drier prevents residual contaminants, introduced during installation, from entering the expansion valve. The TTA/TWA outdoor units have a filter drier pre-installed. However, if the refrigerant line length exceeds 80 ft, this filter should be removed and a new one selected from the Component Selection tables found in "Parts," p. 28. The new drier should be installed as close as possible to the indoor unit and between the TXVs and compressor. If choosing a filter other than the one listed in these tables, make sure its volume, filtering, and moisture-absorbing characteristics are equivalent.

Note: *Due to the reverse flow nature of a heat pump, if the liquid line exceeds 80 ft, the heat pump will require a bi-flow filter drier (see Figure 7, p. 21 and Figure 8, p. 22).*

Access Port

The access port located at the TTA/TWA allows the unit to be charged with liquid refrigerant and is used to determine charge level. This port is usually a Schraeder valve with a core. There are three factory access ports inside the condensing unit. Additional field installed access ports are recommended after the sight glass and close to each TXV. If the liquid line length is longer than 80 feet, the liquid line filter drier must be removed and a new drier installed just prior to the sight glass. The filter drier requires an additional access port on the entering side to allow for service. Please see Figure 5, p. 19 and Figure 6, p. 20. See Note 1 on Table 4, p. 28 and Table 5, p. 28 for more details.

Solenoid Valve

For TTA split systems, the TXV is sufficient to prevent refrigerant migration. As the units do not have pump down, solenoid valves are not required or recommended.

Notes:

- *Solenoid valves piped in series with a check valve create the possibility of a dangerous over pressures. Solenoids should not be used with a TWA or with a TTA using a check valve.*
- *Solenoids are seldom used and not included in the Component Selection tables found in "Parts," p. 28.*

Service Valve

Service Valves may be convenient for servicing the condensing unit. However, they may not be used for pump down refrigerate isolation. If a field installed service valve is added to the system, it must be full port and should have a factory installed access port.

⚠ WARNING

Risk of Explosion with Refrigerant Line!

Failure to follow instructions could cause a refrigerant line to explode under pressure which could result in death or serious injury.

Liquid refrigerant trapped between two valves can become highly pressurized if the ambient temperature increases. DO NOT add a liquid line solenoid valve in a cooling-only system that is already equipped with a check valve.

Moisture-Indicating Sightglass

Be sure to install one moisture-indicating sight glass in the main liquid line.

Note: *The sole value of the glass is its moisture-indicating ability. Use the Installation manual charging curves —not the sightglass—to determine proper charge levels. A correctly charged system may still exhibit bubbles in the sightglass.*

Expansion Valve

The expansion valve is the throttling device that meters the refrigerant into the evaporator coil. Metering too much refrigerant floods the compressor; metering too little elevates the compressor temperature. Choosing the correct size and type of expansion valve is critical to ensure that it will correctly meter refrigerant into the evaporator coil throughout the entire operating envelope of the system. **Correct refrigerant distribution into the coil requires an expansion valve for each distributor.**

For improved modulation, choose expansion valves with balanced port construction and external equalization. Table 6, p. 29, identifies the part number of the valve recommended for TTA/TWA systems. The tonnage of the valve should represent the design tonnage of the portion of coil that the TXV/ distributor will feed.

Some expansion valve models have built-in check valves for heat pump operation and do not require additional external check valves for reverse flow operation. TXVs containing a check valve are identified in Table 6, p. 29.

The TWE air handler ships with a factory installed expansion device and heat pump check valve. If an alternate device is recommended, these factory shipped components must be removed.

The Microchannel condenser cooling-only units do not require a bleed TXV valve as required on some other product types. TXV for TTA microchannel units can also be selected from Table 6, p. 29.

Check Valves

⚠ WARNING

Risk of Explosion with Refrigerant Line!

Failure to follow instructions could cause a refrigerant line to explode under pressure which could result in death or serious injury.

Liquid refrigerant trapped between two valves can become highly pressurized if the ambient temperature increases. DO NOT add a liquid line solenoid valve in a cooling-only system that is already equipped with a check valve.

TWA: Due to the reverse cycle of the TWA heat pump, a check valve is required to bypass refrigerant around the TXV while the unit is in heating mode. If the air handler is a TWE, it includes both the TXV and check valve.

Gas Line

Line Sizing

Proper line sizing is recommended to guarantee that the oil returns to the compressor throughout the system's operating envelope. At the same time, the line must be sized so that the pressure drop does not excessively affect capacity or efficiency. To accomplish both objectives, it may be necessary to use two different line diameters: one for the horizontal and down flowing suction lines and another one for up flowing suction risers.

Note: *Preselected suction-line diameters shown in the Component Selection tables found in* *"Parts," p. 28**, are independent of total line length for properly charged 6 to 25 ton TTA/TWA in normal air-conditioning applications.*

Routing

Route the line as straight (horizontally and vertically) as possible. Avoid unnecessary changes of direction. To prevent residual or condensed refrigerant from "free-flowing" toward the compressor, install the gas line so that it slopes by 1/4 to 1 inch per 10 feet of run (1 cm per 3 m) toward the indoor coil.

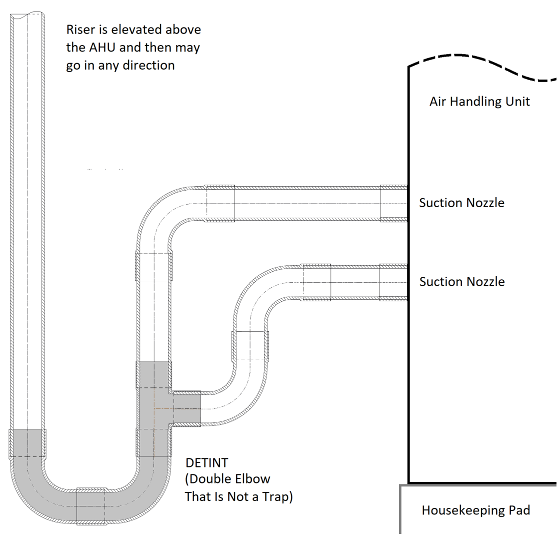
Do not install suction riser oil traps. With field-supplied air-handler coils, what appears to be a riser trap is located at the coil outlet. This is actually a DETINT. See Figure 3, p. 13 for an example. This piping arrangement is the result of two requirements:

- Drain the coil to the common low point.
- Preventing any off-cycle condensed refrigerant in the coil from attempting to flow to the compressor.

Double suction risers **MUST NOT** be installed. All 6 to 25 ton TTA and TWA units unload such that a single gas line size, preselected in the Component Selection tables found in "Parts," p. 28, provide sufficient velocity to return oil up the permissible riser height.

Note: *If a gas riser is properly sized, oil will return to the compressor regardless of whether a trap is present. If a gas riser is oversized, adding a trap will not restore proper oil entrainment, and may damage the compressor.*

Figure 3. Gas-line arrangement at the outlet of a field-supplied indoor coil



DETINT

With the advent of Microchannel Heat Exchangers it is no longer possible to use refrigerant pump down. However there is still a need to capture liquid refrigerant in the evaporator when the unit is off. The riser DETINT (Double-Elbow That Is Not a Trap) does not retain oil during unit operation. When the unit is off, the DETINT prevents liquid oil or refrigerant from draining in either direction. It also allows sub-cooled oil and liquid refrigerant to drain past the TXV bulb. This promotes stable TXV operation. The DETINT riser should be extended above the AHU. It may then continue up, down, or side to side in any direction.

Avoid Underground Refrigerant Lines

Underground lines create risk due to refrigerant condensing during the off cycle, ground water migration, damage from wildlife, expansion and contraction, service access, and abrasion/corrosion. These hazards can quickly impair reliability. Installation of underground refrigerant lines is deemed an installation error. It is difficult to separate underground piping installation damage from manufacturing defects. Compressor damage may not be covered under the manufacturers defect warranty.

Insulation

Any heat that transfers from the surrounding air to the cooler gas lines increases the load on the condenser (reducing the system's air-conditioning capacity) and promotes condensate formation. After operating the system and testing all fittings and joints to verify that the system is leak-free, insulate the gas lines per local code requirements. This will prevent heat gain and unwanted condensation.

Components

Adding a gas line filter is unnecessary—provided that good refrigerant practices (including nitrogen sweeping during brazing and proper system evacuation) are followed.

Access Port

Providing an access port in the gas line at the coil permits the servicer to check refrigerant pressure and determine superheat at the evaporator/indoor coil. This port is usually a Schraeder valve with a core. Field installed access ports are recommended at each evaporator suction connection to determine evaporator coil pressure and temperatures. See Note 1 in Table 4, p. 28 and Table 5, p. 28 for more details.

Service Valve

Service Valves may be convenient for servicing the condensing unit. However, they may not be used for pump down refrigerate isolation. If a field installed service valve is added to the system, it must be full port and should have a factory installed access port.

Refrigerant Charging

System charge is dependent on actual installed interconnecting line lengths and coil sizes. See Table 7, p. 29 for estimating interconnecting line charge. It is common for the final line charge to vary from the estimated charge. This is due to variations in the actual installation. It is recommended to trim final charge for superheat and subcooling following the manufacturer's IOM and unit charging charts.

Expansion Valves

Expansion valves meter refrigerant into the evaporator under controlled conditions. If there is too much refrigerant, the refrigerant will not completely vaporize and the remaining liquid will flood back to the compressor. If there is too little refrigerant, the system won't make capacity and there may not be enough cooling for the compressor.

Note: *Expansion valves are pre-installed on the TWE product and the superheat has been set properly.*

When using air handling units beside the TWE, Table 6, p. 29, lists expansion valves. Each evaporator distributor requires a dedicated expansion valve in order to maintain proper coil distribution. The expansion valve should be selected to match the capacity of the coil that the distributor feeds.

Example: 10-ton coil (one refrigerant circuit) with two equal distributors

10-tons divided by 2 equals 5-tons.

Each TXV should be selected for 5 tons. However, care should be taken to ensure the condensing unit is capable of operating at these conditions.

It is not uncommon for non-TWE AHUs to have one liquid and suction connection that is smaller sized. This is due to one coil have one less internal circuit due to manufacturing process. If the installer verifies that distributor tonnage is evenly sized, then the difference should be ignored.

The proper balance for feeding refrigerant for a TTA/TWA system is to provide 18°F of superheat— the difference between the saturated and actual refrigerant temperature leaving the evaporator. Expansion valve superheat is preset from the factory, but it isn't set to 18°F. Use the turns listed in Table 3, p. 14 to adjust them to the correct 18°F superheat.

Table 3. Expansion valves

Sporlan					
Standard off-the-shell nominal valve setting (85 psig air test setting)					Field adjust for 18°F
Valve	**Superheat, °F**	**CW turns available**	**CCW turns available**	**Superheat change per turn**	
ERYE[a] or HXCAE	12	4.5	4.5	2.4°F	2 1/2 CW
OYE				3.4°F	1 3/4 CW

Notes:

- *'CW and CCW turns available' denotes the maximum possible number of turns from nominal setting.*
- *Superheat change per turn is for reference and may not be precisely achieved.*

(a) May also be called BBIYE

Controls

The TTA/TWA unit is available with either Symbio™ or thermostat control. It is important to understand that if the staging of compressors is turned over to a third party, the compressor protection, provided through system stability, is also turned over to the third party. Simply stated, this means that when a compressor turns on, it shouldn't turn off until the expansion valve comes under control. And, once the compressor turns off, it should be allowed to stay off until the crank case heater has warmed up.

System stability must be programmed in the third party system control. To accomplish this, third-party system controls must incorporate a **5-minute-on**, a **5-minute-off**, and a **5-minute-interstage** differential on each compressor stage.

Hot Gas Bypass

Hot gas bypass (HGBP) is added to HVAC systems to correct a number of operational problems. Unfortunately, the practice will increase energy consumption and may decrease reliability.

Trane has more than 15 years experience in the successful use of unitary equipment *without hot gas bypass* in commercial comfort-cooling applications. To prevent evaporator freeze-up, TWE AHUs include a Trane Frostat™ coil frost protection. If the system is used with a non-TWE AHU, a Trane Frostat should be field installed.

Like hot gas bypass, the Frostat system protects the coil from freezing, but it does so by turning off compressors when the Frostat sensor detects the conditions suitable for evaporator coil frosting. The compressor is released to operate when the coil temperature rises a few degrees above the frost threshold. The Frostat control strategy reduces the overall energy consumption of the system while maintaining system control. This method is often sufficient for standard comfort cooling.

Similar to hot gas bypass, the Frostat system protects the compressor. When the Frostat detects conditions that are suitable for evaporator coil frosting, it disables the compressor while leaving the supply fan enabled. The supply fan will continue to operate providing sensible cooling and warming the evaporator. After the refrigerant temperature rises to a safe condition, the compressor is enabled.

The Frostat control strategy reduces the overall system energy consumption, while maintaining system control. This method is often all that is required for standard comfort cooling.

The amount of HGBP allowed is limited by Energy Codes such as ASHRAE 90.1, the IEEC, and California Title 24. Units less than 20 tons may use up to 10% HGBP. Units 20 tons and larger may use up to 15% HGBP.

Because of the lower entering air conditions, HGBP is almost always recommended for 100% OA systems. HGBP may also be beneficial for systems with tighter humidity or discharge air requirements.

When using HGBP, the total "linear" line length should be limited to 75 feet. Field installed oil separator are not 100% efficient and may not have an oil recovery cycle. An oil separator may not be used to extend HGBP lines beyond 75 feet.

Liquid line bypass mixed with hot gas and routed to the suction line is an alternative form of HGBP. This goes by various trade names, such as "APR". While these devices may offer a lower cost installation, theoretical performance is the same as traditional HGBP. These devices are also limited to 75 feet of total system line length.

Additional Resources

- See the *Hot Gas Bypass Installation Guidelines for R-454B Direct Expansion (DX) Split Systems Application Guide* (APP-APG017*- EN) for more information such as design, pipe size, and maximum hot gas bypass length.
- See the Engineers Newsletter, “Hot Gas Bypass – Blessing or a Curse?” (ADM-APM007-EN).

Remodel, Retrofit, or Replacement

Inevitably, older condensing unit/evaporator systems that are designed for use with a refrigerant other than R-454B will need to be upgraded. As of this document, current building codes and EPA regulations do not permit mixing and matching any components designed for an A1 refrigerant, such as R-410A with any components designed for an A2L refrigerant such as R-454B. This includes air handling unit components. Should the installer replace any A1 containing condensing unit with one containing A2Ls, the installer must also confirm that all connected air handler components are also certified and listed for use with the specific A2L refrigerant. Failure to do so will create a hazardous and unsafe condition.

Every part of an existing split system needs to be analyzed to determine if it can be reused in an R-454B and POE oil system:

- Suction lines 2-5/8 OD and smaller of type L copper are suitable for use with R-454B. Suction lines 3-1/8 OD or larger must use type K or thicker wall.
- Discharge lines, liquid lines, heat pump vapor lines, and hot gas bypass lines 1-3/8 OD and smaller of type L copper are suitable for use with R-454B. If the liquid lines are larger than 1 3/8" OD they must use type K or thicker wall.
- The installer is responsibly for confirming recycled refrigerant lines are clean of any contaminants that may impact compressor reliability.

NOTICE

Equipment Damage!

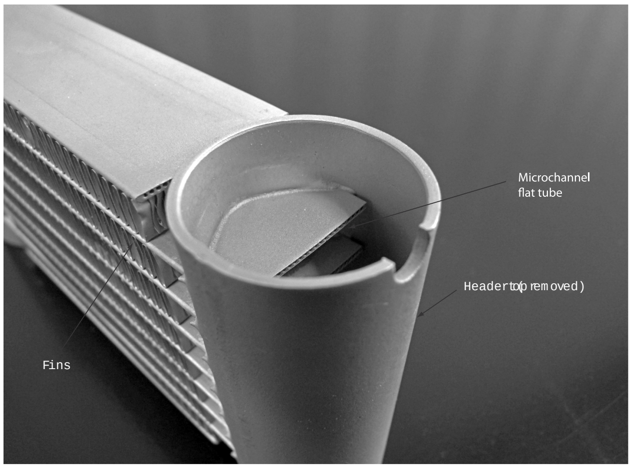
This is POE oil, which readily absorbs moisture. Always use new oil and never leave containers open to atmosphere while not in use.

All Codes take precedence over document content.

Microchannel Heat Exchanger Condensers (MCHE)

The microchannel heat exchanger (MCHE) condenser design is quite similar to the design of an automobile radiator. Refrigerant is distributed to very small channels in a thin plate. There are any number of thin plates, one above the other, separated by fins as shown in Figure 4, p. 18.

Figure 4. MCHE Condenser

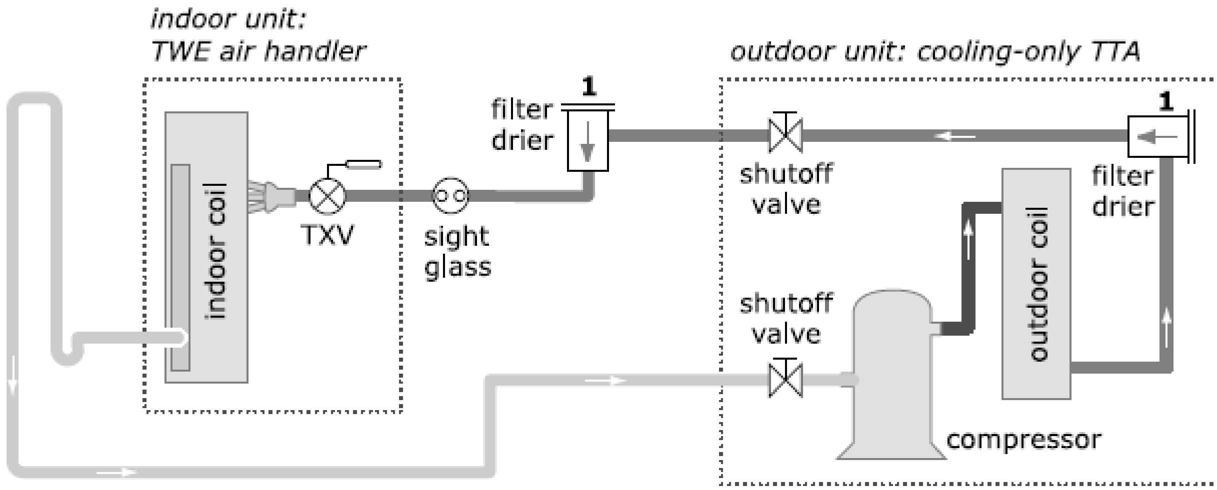


This design improves heat transfer and the refrigerant that enters the coil quickly turns to liquid. The MCHE tube volume holds very little refrigerant, so the refrigerant charge of the system is reduced. However, the tube volume is so small that if the flow of refrigerant out of the MCHE condenser is slowed much more than the flow of refrigerant into the MCHE condenser, the condenser may quickly fill with liquid and cause a high-pressure control trip. To avoid this condition, the designer or servicer should not include the following:

- No pump-down: The storage capacity of the MCHE will not support pump-down.
- No trim solenoid: The storage capacity of the MCHE will not support partial shut-off of the evaporator coil.

Refrigerant Piping Examples

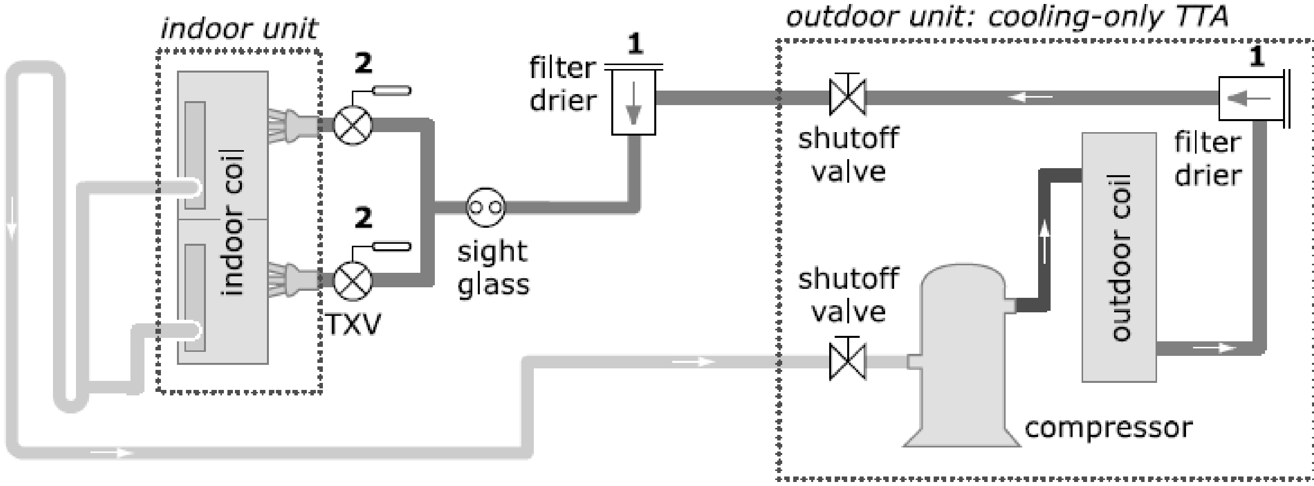
Figure 5. TTA cooling-only unit and TWE air handler



Notes:

1. *If the total length of the liquid line exceeds 80 ft (24 m), remove the liquid-line filter drier from the TTA and install a new one (Table 4, p. 28) at the TWE air handler. If the filter drier is relocated it requires an access port to service the drier.*
2. *Shutoff valves are a field installed option and no longer come standard from the factory. Field installed shutoff valves should have an integral access port.*
3. *The TTA/TWA condensing unit ships with three integral access ports. Each TXV requires an additional field installed access port installed between the TXV and sight glass.*
4. *A field installed access port is recommended at any location that a technician may need to read temperature or pressure.*

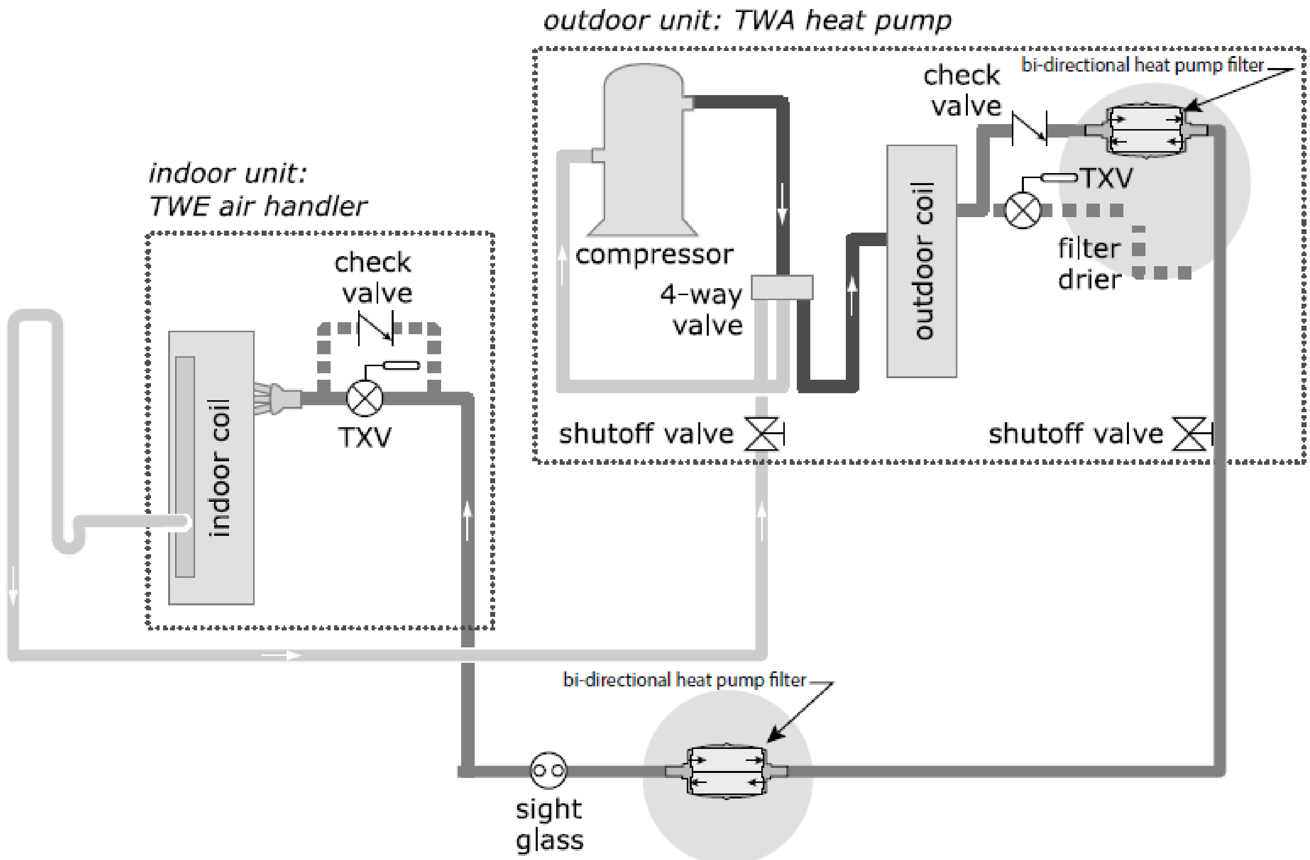
Figure 6. TTA cooling-only unit and matched indoor coil (typical arrangement)



Notes:

1. *If the total length of the liquid line exceeds 80 ft (24 m), remove the liquid-line filter drier from the TTA and install a new one (Table 4, p. 28) at the TWE air handler. If the filter drier is relocated it requires an access port to service the drier.*
2. *Provide one expansion valve (TXV) per distributor. The TTA/TWA condensing unit ships with 3 integral access ports. Each TXV requires an additional field installed access port installed between the TXV and sight glass. See Table 6, p. 29 for recommendations.*
3. *Shutoff valves are a field installed option and no longer come standard from the factory. Field installed shutoff valves should have an integral access port.*
4. *A field installed access port is recommended at any location that a technician may need to read temperature or pressure.*

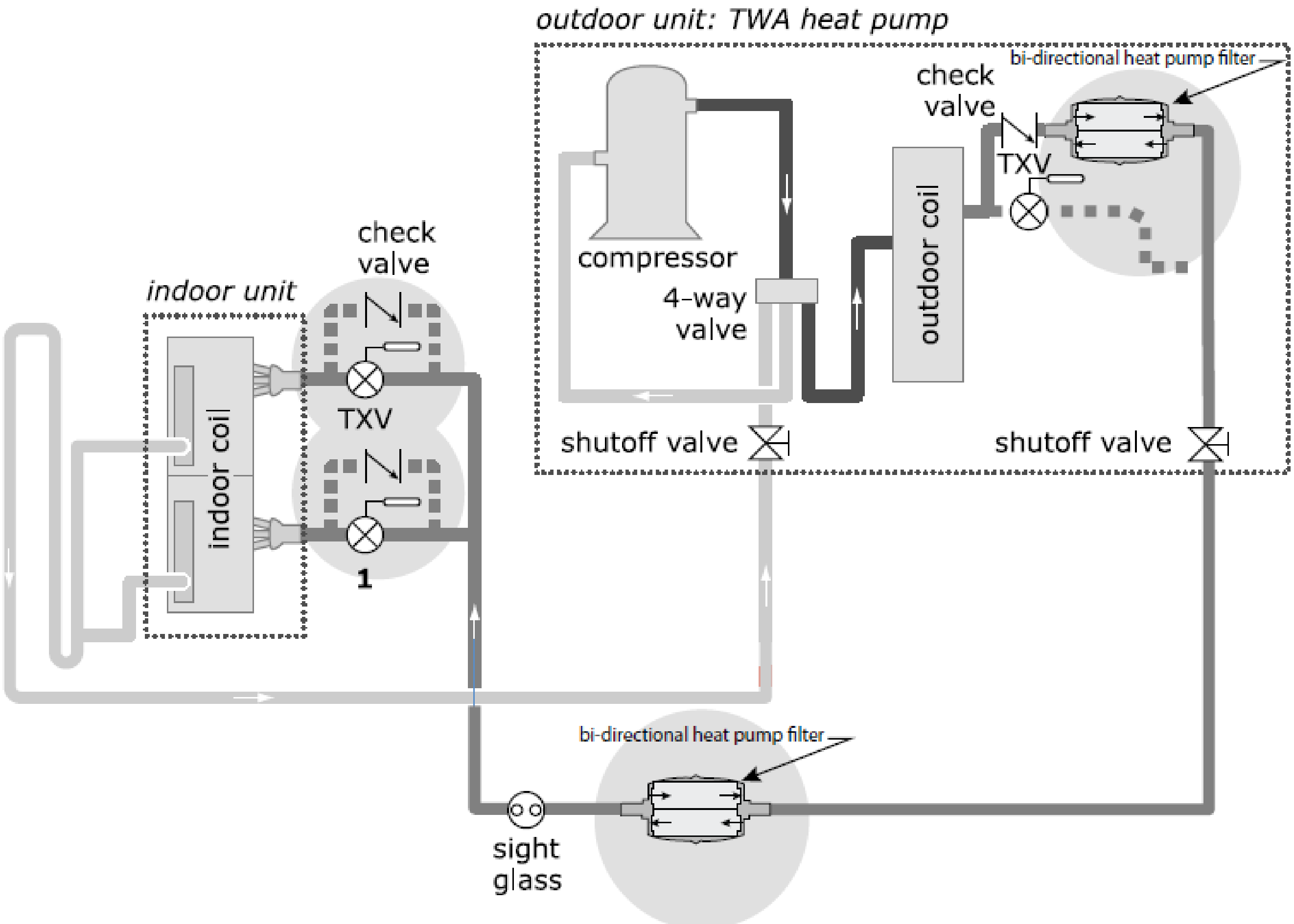
Figure 7. TWA heat pump and TWE air handler (typical arrangement shown in cooling mode)



Notes:

1. *For applications where the length of the liquid line exceeds 80 ft (24 m) and the heat pump will start in the cooling mode, remove the liquid-line filter driers from the TWA heat pump and install new filter driers (**Table 5, p. 28**) and check valves at the TWE air handler. If the filter drier is relocated it requires an access port to service the drier.*
2. *Shutoff valves are a field installed option and no longer come standard from the factory. Field installed shutoff valves should have an integral access port.*
3. *The TTA/TWA condensing unit ships with three integral access ports. Each TXV requires an additional field installed access port installed between the TXV and sight glass.*
4. *A field installed access port is recommended at any location that a technician may need to read temperature or pressure.*

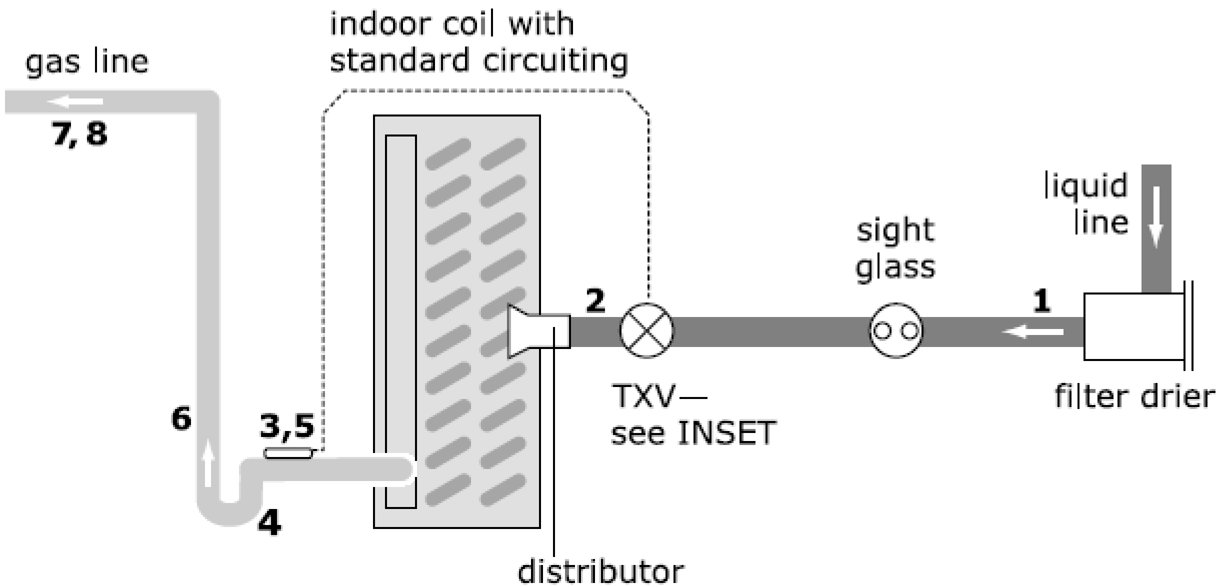
Figure 8. TWA heat pump and matched indoor coil (typical arrangement shown in cooling mode)



Notes:

1. *If the total length of the liquid line exceeds 80 ft (24 m), remove the liquid-line filter drier from the TTA and install a new one (Table 5, p. 28) at the TWE air handler. If the filter drier is relocated it requires an access port to service the drier.*
2. *Provide one expansion valve (TXV) per distributor. The TTA/TWA condensing unit ships with 3 integral access ports. Each TXV requires an additional field installed access port installed between the TXV and sight glass. See Table 6, p. 29 for recommendations.*
3. *Shutoff valves are a field installed option and no longer come standard from the factory. Field installed shutoff valves should have an integral access port.*
4. *A field installed access port is recommended at any location that a technician may need to read temperature or pressure.*

Figure 9. Indoor coil (non-TWE) with one distributor (single-circuit TTA/TWA units)

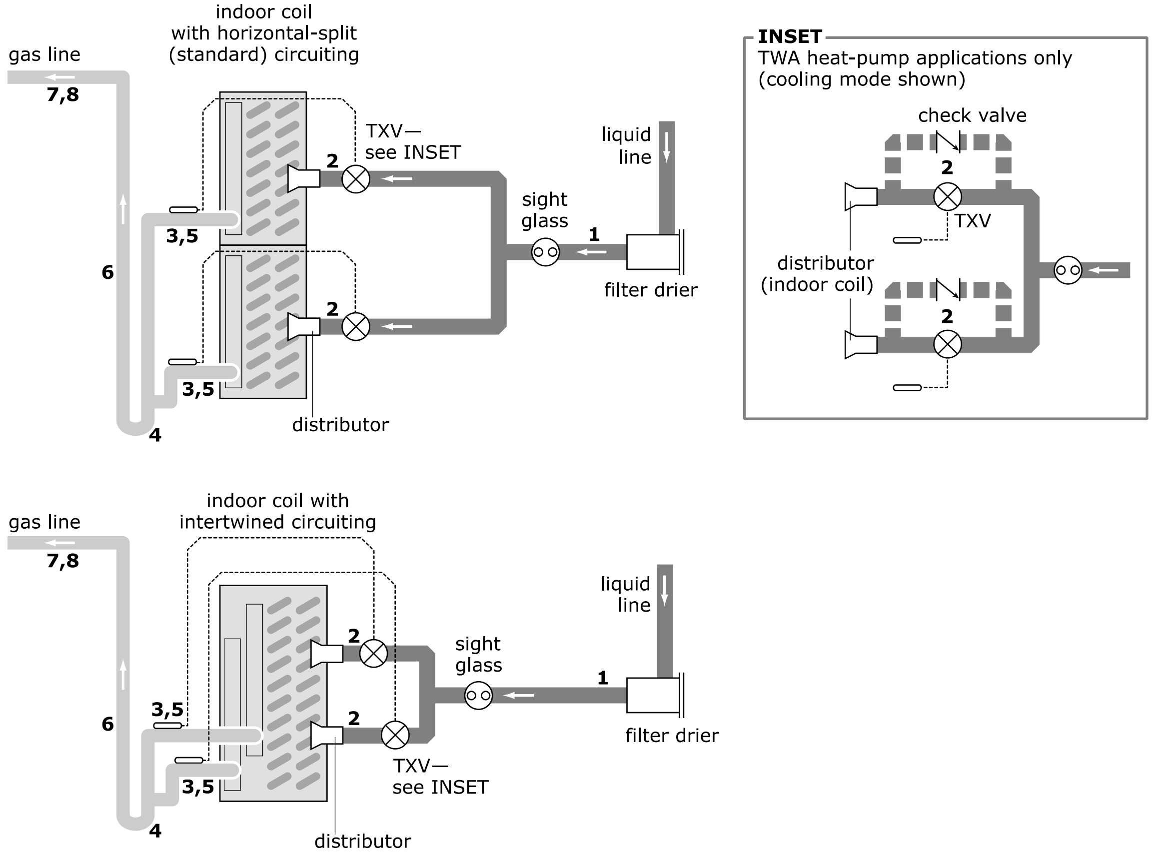


Notes:

1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in “Parts,” p. 28.*
2. *Provide one expansion valve (TXV) per distributor.*

   ***TWA heat pumps only**: Provide one check valve for each expansion valve.*
3. *Pitch the gas line leaving the coil so that it slopes away from the coil by 1 inch per 10 feet (1 cm per 3 m).*
4. *Use the DETINT to prevent oil and refrigerant migration when the unit is off. The DETINT also serves to isolate the TXV bulb from suction-header conditions. See “Line Sizing, Routing, and Component Selection,” p. 11.*
5. *Use the “horizontal” tube diameter identified in the Component selection tables, found in “Parts,” p. 28.*
6. *For vertical risers, use the tube diameter recommended in “Parts,” p. 28. Ensure that the top of the riser is at least 1 foot (30 cm) above the lowest point.*
7. *Pitch the gas line 1 inch per 10 feet (1 cm per 3 m) toward the indoor coil.*
8. *Insulate the gas line.*

Figure 10. Indoor coil with two distributors (single-circuit TTA/TWA units)

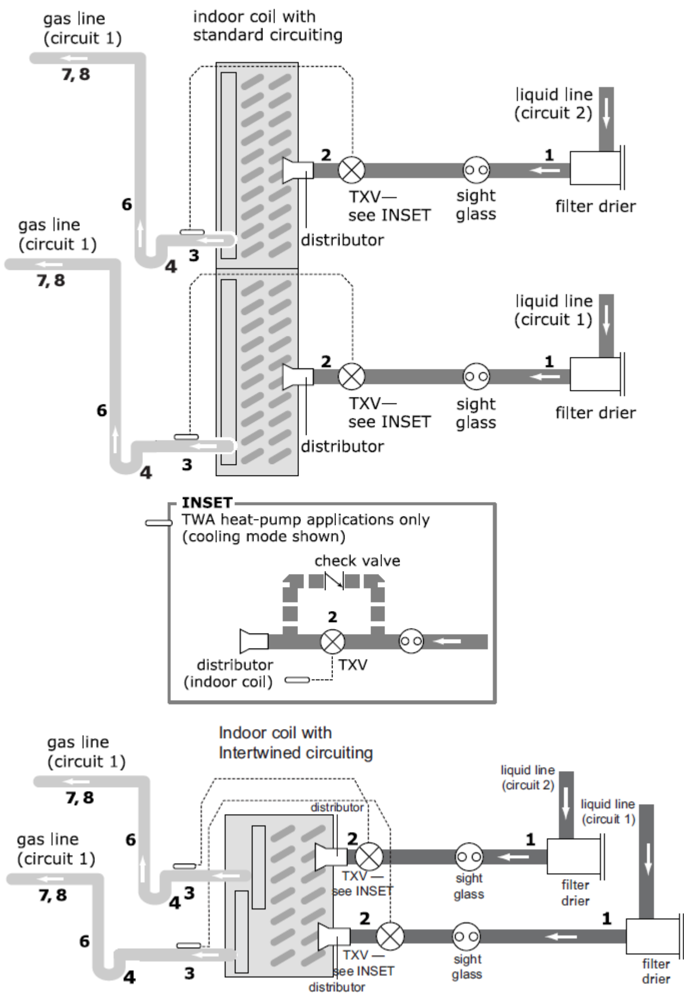


Notes:

1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in “Parts,” p. 28.*
2. *Provide one expansion valve (TXV) per distributor.*

   ***TWA heat pumps only**: Provide one check valve for each expansion valve.*
3. *Pitch the gas line leaving the coil so that it slopes away from the coil by 1 inch per 10 feet (1 cm per 3 m).*
4. *Use the DETINT to prevent oil and refrigerant migration when the unit is off. The DETINT also serves to isolate the TXV bulb from suction-header conditions. See “Line Sizing, Routing, and Component Selection,” p. 11.*
5. *For all coil branch circuits in the gas line, use a tube diameter that is one size smaller than the gas-line size recommended in Table 4, p. 28 or Table 5, p. 28.*
6. *For vertical risers, use the tube diameter recommended in “Parts,” p. 28. Ensure that the top of the riser is at least 1 foot (30 cm) above the lowest point.*
7. *Pitch the gas line by 1 inch per 10 feet (1 cm per 3 m) toward the indoor coil.*
8. *Insulate the gas line.*

Figure 11. Indoor coil with two distributors (dual-circuit TTA/TWA units)

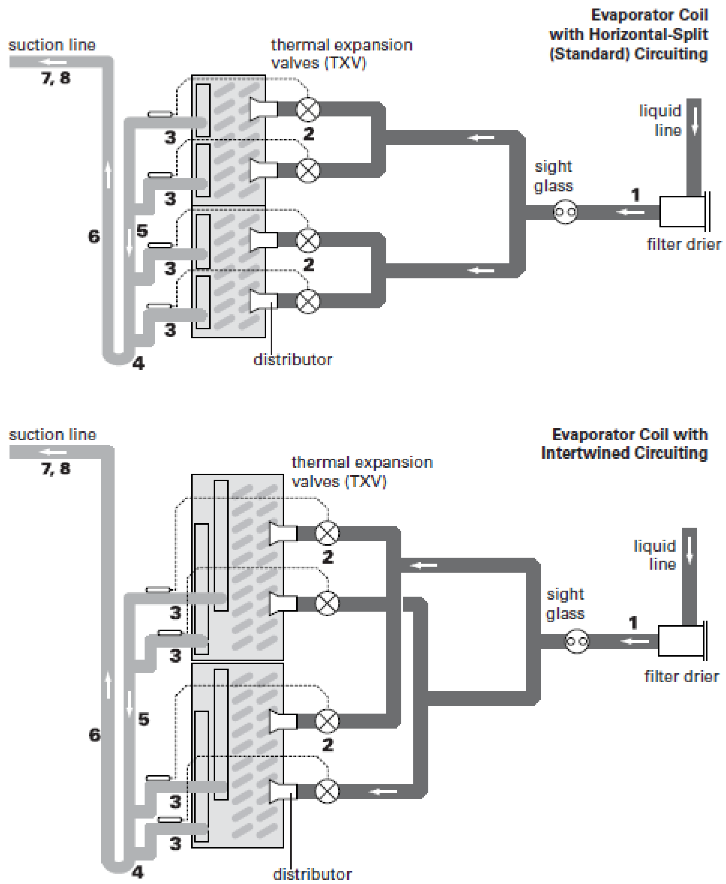


Notes:

1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in “Parts,” p. 28.*
2. *Provide one expansion valve (TXV) per distributor.*

   ***TWA heat pumps only**: Provide one check valve for each expansion valve.*
3. *Pitch the gas line leaving the coil so that it slopes away from the coil by 1 inch per 10 feet (1 cm per 3 m).*
4. *Use the DETINT to prevent oil and refrigerant migration when the unit is off. The DETINT also serves to isolate the TXV bulb from suction-header conditions. See “Line Sizing, Routing, and Component Selection,” p. 11.*
5. *Use the “horizontal” tube diameter identified in the Component selection tables, found in “Parts,” p. 28.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in “Parts,” p. 28. Ensure that the top of the riser is at least 1 foot (30 cm) above the lowest point.*
7. *Pitch the gas line 1 inch per 10 feet (1 cm per 3 m) toward the indoor coil.*
8. *Insulate the gas line.*

Figure 12. Type UF evaporator coil with four distributors

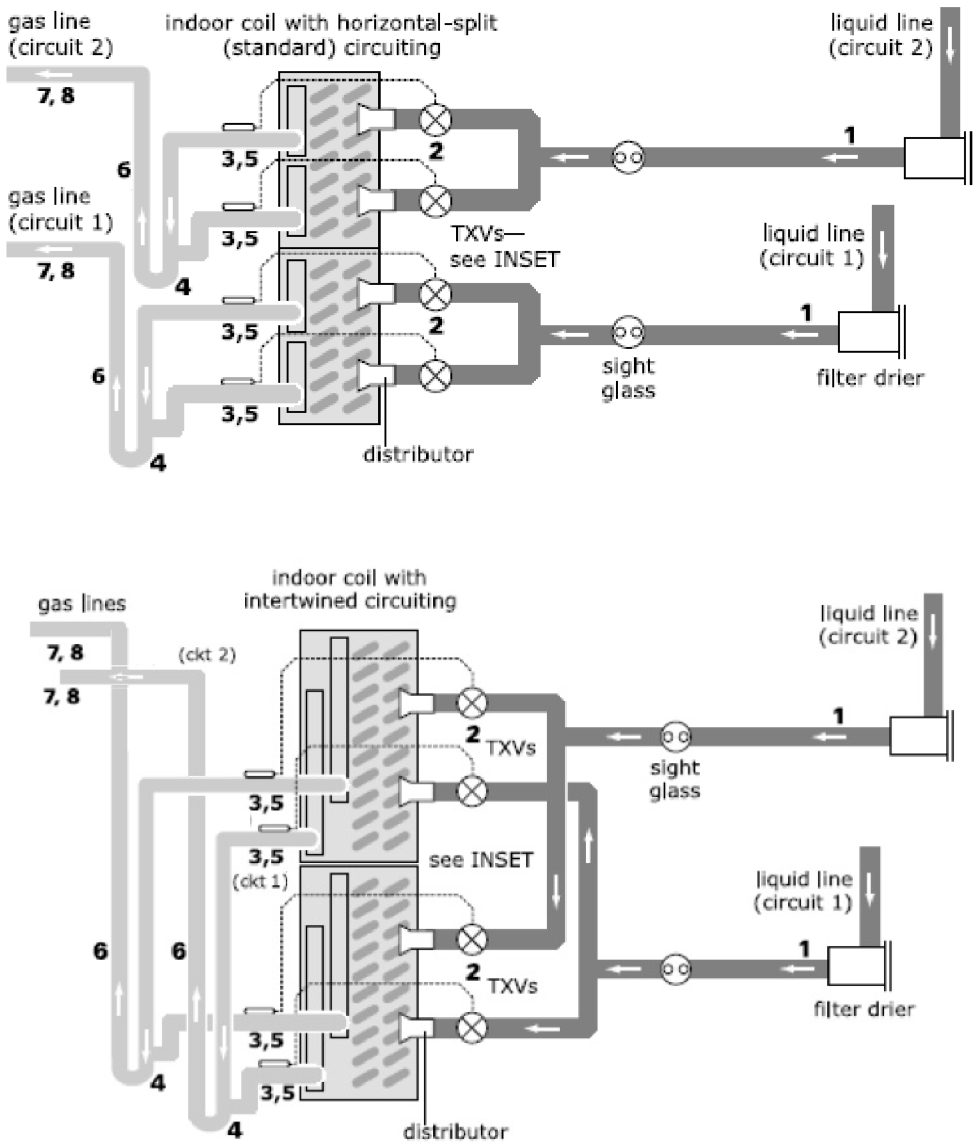


Notes:

1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in* *"Parts," p. 28**.*
2. *Provide one expansion valve (TXV) per distributor.*

   TWA heat pumps only*: Provide one check valve for each expansion valve.*
3. *Pitch the gas line leaving the coil so that it slopes away from the coil by 1 inch per 10 feet (1 cm per 3 m).*
4. *Use the DETINT to prevent oil and refrigerant migration when the unit is off. The DETINT also serves to isolate the TXV bulb from suction-header conditions. See* *"Line Sizing, Routing, and Component Selection," p. 11**.*
5. *For all coil branch circuits in the gas line, use a tube diameter that is one size smaller than the gas-line size recommended in* *"Parts," p. 28**.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in* *"Parts," p. 28**. Ensure that the top of the riser is at least 1 foot (30 cm) above the lowest point.*
7. *Pitch the gas line 1 inch per 10 feet (1 cm per 3 m) toward the indoor coil.*
8. *Insulate the gas line.*

Figure 13. Indoor coil with four distributors (dual-circuit TTA/TWA units)



Notes:

1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in “Parts,” p. 28.*
2. *Provide one expansion valve (TXV) per distributor.*

   ***TWA heat pumps only**: Provide one check valve for each expansion valve.*
3. *Pitch the gas line leaving the coil so that it slopes away from the coil by 1 inch per 10 feet (1 cm per 3 m).*
4. *Use the DETINT to prevent oil and refrigerant migration when the unit is off. The DETINT also serves to isolate the TXV bulb from suction-header conditions. See “Line Sizing, Routing, and Component Selection,” p. 11.*
5. *For all coil branch circuits in the gas line, use a tube diameter that is one size smaller than the gas-line size recommended in “Parts,” p. 28.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in “Parts,” p. 28. Ensure that the top of the riser is at least 1 foot (30 cm) above the lowest point.*
7. *Pitch the gas line 1 inch per 10 feet (1 cm per 3 m) toward the indoor coil.*
8. *Insulate the gas line.*

Parts

Table 4. Component selection for TTA cooling microchannel units 6 to 25 tons

Unit	TTA072K*A	TTA072K*D	TTA090K*A	TTA090K*D	TTA120K*D	TTA120K*C
Refrigerant ckts	1	2	1	2	2	1 (Manifold)
Minimum step (tons)	6	3	5	5	6.7	5
GAS LINE						
Tube diameter (in.)						
Horizontal (& downflow)	1 1/8	3/4	1 1/8	7/8	1 1/8	1 3/8
Vertical Return (upflow)	1 1/8	3/4	1 1/8	7/8	1 1/8	1 1/8
Access port	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core
LIQUID LINE						
Tube diameter (in.)	1/2	3/8	1/2	3/8	1/2	1/2
Filter drier	DHY01123	DHY01122	DHY01123	DHY01122	DHY01123	DHY01123
Sight glass 1/ckt	GLS00853	GLS00852	GLS00853	GLS00852	GLS00853	GLS00853
Access port	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core
Unit	**TTA150K*D**	**TTA180K*D**	**TTA180K*C**	**TTA240K*D**	**TTA240K*C**	**TTA300K*C**
Refrigerant ckts	2	2	1 (Manifold)	2	1 (Manifold)	1 (Manifold)
Minimum step (tons)	8.4	7.5	8.6	13.4	10	12.5
GAS LINE						
Tube diameter (in.)						
Horizontal (& downflow)	1 1/8	1 1/8	1 5/8	1 3/8	1 5/8	2 1/8
Vertical Return (upflow)	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8
Access port	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core
LIQUID LINE						
Tube diameter (in.)	1/2	1/2	5/8	1/2	3/4	3/4
Filter drier	DHY01123	DHY01123	DHY01232	DHY01123	DHY01233 [a]	DHY01233 [a]
Sight glass 1/ckt	GLS00853	GLS00853	GLS00830	GLS00853	GLS00830 [b]	GLS00830 [b]
Access port	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core	Schraeder valve w/ core

Notes:

1. Per ASHRAE 90.1 HGBP may not be more than 10 % for units less than 20 tons, and may not be more than 15% for units 20 tons and larger.
2. Access ports: Valve body VAL01483, valve core COR00006, valve cap CAP00072Schraeder
3. Filter drier: For units with line lengths in excess of 80 ft, the unit included filter must be removed and discarded, and a filter from the table must be installed close to the air handler. See “Liquid Filter Drier."
4. Check valve selections: 3/8 - VAL08459, 1/2 - VAL08460, 5/8 - VAL01722, 7/8 - VAL07030. (See “Check Valves").
5. For additional oil charge recommendations see Table 1.

(a) 7/8-in. connections
(b) 5/8-in. connections

Table 5. Component selection for TWA heat pump units 6 to 25 tons

Unit	TWA072-K*A	TWA072K*-D	TWA090-K*A	TWA090K*-D	TWA120-K*A	TWA120K*-D	TWA150K*-D	TWA180K*-D	TWA240K*-D	TWA300K*-D
Refrigerant ckts	1	2	1	2	1	2	2	2	2	2
Minimum step (tons)	6	3	5	3.75	6.7	6.7	6.25	7.5	10	12.5
GAS LINE										
Tube diameter (in.)										
Horizontal (and downflow)	1 1/8	3/4	1 1/8	7/8	1-3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8
Vertical Return (upflow)	1 1/8	3/4	1 1/8	7/8	1 3/8	1 1/8	1 1/8	1 1/8	1 3/8	1 3/8
Access port	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core

Table 5. Component selection for TWA heat pump units 6 to 25 tons (continued)

Unit	TWA072-K*A	TWA072K*-D	TWA090-K*A	TWA090K*-D	TWA120-K*A	TWA120K*-D	TWA150K*-D	TWA180K*-D	TWA240K*-D	TWA300K*-D
LIQUID LINE										
Tube diameter (in.)	1/2	3/8	1/2	3/8	1/2	1/2	1/2	1/2	1/2	1/2
Filter drier	DHY01608	DHY01467 (Qty 2)	DHY01608	DHY01467 (Qty 2)	DHY01608	DHY01467 (Qty 2)	DHY01467 (Qty 2)	DHY01608 (Qty 2)	DHY01608 (Qty 2)	DHY01608 (Qty 2)
Sight glass 1/ckt	GLS00853	GLS00852	GLS00853	GLS00852	GLS00853	GLS00853	GLS00854	GLS00853	GLS00853	GLS00853
Access port	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core

Notes:

1. Access ports: Valve body VAL01483, valve core COR00006, valve cap CAP00072.
2. Filter drier: The heat pump products require two filters and two check valves: one set-oriented for liquid in the cooling direction, and one set-oriented for liquid in the heating direction. For units with line lengths in excess of 80 ft, the included filters must be removed and filters from the table must be installed close to the air handler. See “Liquid Filter Drier.".
3. For additional oil charge recommendations see Table 2.
4. Check valve selections: 3/8 - VAL08459, 1/2 - VAL08460, 5/8 - VAL01722, 7/8 - VAL07030. (see “Check Valves”)
5. Direction of gas line flow (horizontal, upflow, downflow) is determined by direction of the gas, in the pipe while in cooling mode.

Table 6. Expansion valves for TTA/TWA applications 6 to 25 tons

Refrigerant	Manufacturer	Tonnage Range	Model Number	Trane Part	Model Number w/ Check Valve	Trane Part
R-454B	Sporlan	2-3	ERYE-3-CP	VAL21180	HXCAE-2-ZXB	VAL21190
R-454B	Sporlan	3-4	ERYE-4.5-CP	VAL21181	HXCAE-3-ZXB	VAL21191
R-454B	Sporlan	4-5	ERYE-6-CP	VAL21182	HXCAE-5-ZXB	VAL21192
R-454B	Sporlan	5-6	ERYE-7-CP	VAL21183	HXCAE-5-ZXB	VAL21192
R-454B	Sporlan	6-8	ERYE-8.5-CP	VAL21184	HXCAE-6-ZXB	VAL21193
R-454B	Sporlan	8-11	ERYE-11.5-CP	VAL21185	—	—
R-454B	Sporlan	11-14	ERYE-15.5-CP	VAL21186	—	—
R-454B	Sporlan	14-17	ERYE-18-CP	VAL21187	—	—
R-454B	Sporlan	17-23	OYE-20-CP	VAL21188	—	—
R-454B	Sporlan	23-28	OYE-25-CP	VAL21189	—	—

Notes:

1. See Expansion Valves
2. The tonnage range is the maximum design tonnage for the system. The TXV is capable of additional turn down below the maximum capacity. Contact your local Trane office for questions on TXV turndown. When sizing TXVs, select the TXV where the design tonnage is close to the middle of the device.

Table 7. R-454B lbs charge per 100 ft

OD	Suction	Liquid	Discharge
1/4	0.04	1.23	0.16
5/16	0.06	2.13	0.28
3/8	0.09	3.30	0.43
1/2	0.18	6.40	0.84
5/8	0.29	9.99	1.31
3/4	0.43	15.00	1.97
7/8	0.57	19.99	2.62
1 1/8	0.98	34.08	4.47
1 3/8	1.49	51.91	6.82
1 5/8	2.11	73.48	9.65
2 1/8	3.67	127.83	16.78

Table 7. R-454B lbs charge per 100 ft (continued)

OD	Suction	Liquid	Discharge
2 5/8	5.65	197.11	25.88

Notes:

1. Type L or ACR tube. Suction: Saturated at 40°F, Liquid: Saturated at 90°F, Discharge: Saturated at 125°F
2. When calculating refrigerant charge, the first step is to determine the unit charge, and if the unit charge includes the first 25 foot of pipe. This information may be located in the catalog and IOM. If the unit charge does include 25 foot of pipe, the field installed refrigerant line calculations should be reduced accordingly. The discharge line need not be calculated unless it is a remote evaporator application. The unit charge, suction charge, liquid charge, and discharge line (if required) may then be summed for a refrigerant charge estimate.

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