Application Guide

Split System Air Conditioners Odyssey™

Tube Size and Component Selection TTA and TWA (6-25 Tons)

(TTA Models)
TTA0724*A/D****B
TTA0904*A/D****B
TTA1204*C/D****B
TTA1504*D****B
TTA1804*C/D****B
TTA2404*C/D****B
TTA3004*C****B

(TWA Models)
TWA0724*A/D****B
TWA0904*A/D****B
TWA1204*A/D****B
TWA1804*D****B
TWA2404*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.

June 2022

SS-APG008H-EN

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-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

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

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

- Updated the TTA and TWA model numbers.
- Updated Component selection for TTA cooling microchannel units 6–25 tons and Component selection for TWA heat pump units 6–20 tons tables in Parts chapter.

Table of Contents

Overview

Trane's TTA and TWA, 6 – 25 ton condensing unit product line (specific model numbers are listed on the cover) has been designed for use only with R-410A and POE oil. R-410A 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.

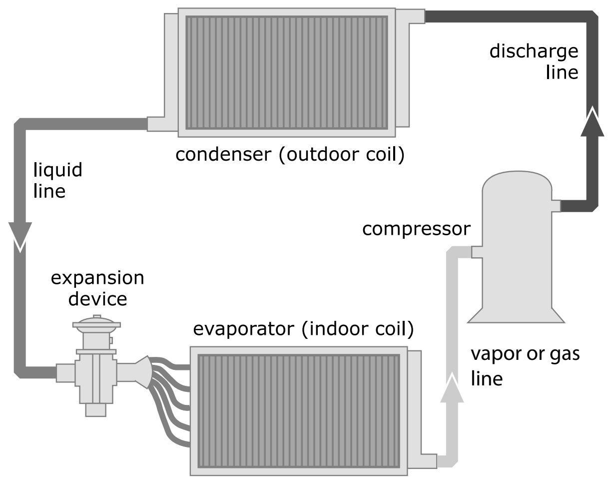
These piping practices remain the same. However, because of the different mass flows and pressures, the line diameter required to carry the oil and refrigerant may not be the same as a similar tonnage R-22 unit. Also, the allowable pressure drop may be greater for R-410A than R-22.

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 required 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 required velocity for oil entrainment is not constant.

Updated Guidelines

Liquid Lines

Historically, liquid lines were sized to minimize the pressure losses within the piping circuit. Oil movement through the piping wasn't a concern (nor is it today) because oil is miscible in liquid refrigerant at normal liquid-line temperatures. The historic and traditional 6 psid liquid line pressure drop had the unintended consequence of requiring line sizes with large internal refrigerant volumes. With R-410A refrigerant and POE oil, this pressure drop can be as high as 50 psid. Within these guidelines, refrigeration operation is maintained while minimizing the refrigerant charge. It is still required to limit the liquid line velocity to 600 ft/min to help avoid issues with water hammer.

Suction Lines

R-410A is a high-pressure refrigerant and allows higher-pressure drops in the suction lines. With R-410A refrigerant, that a 2°F loss is equivalent to a 5 psi drop. Additional pressure drop may be tolerated in certain applications.

R-410A refrigerant suction lines must be sized to maintain oil-entrainment velocities in both the horizontal lines and vertical risers. Oil entrainment for R-410A is based on suction temperature as well as tube diameter. At the time of this writing, no known direct oil-entrainment tests have been published. Trane has used ASHRAE data to create equation-based formulas to predict the entrainment velocities of R-410A refrigerant and POE oil. These minimum velocities are reflected in the line sizes listed in the component selection summary tables, see Parts chapter.

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 150 lineal ft (45.7 m) or less do not require Trane review, but only a limited amount may be in a riser, see allowable elevation difference figures in the following Refrigerant Piping Guidelines.

Refrigerant Piping Guidelines

Figure 2. Allowable elevation difference: TTA *above* indoor unit

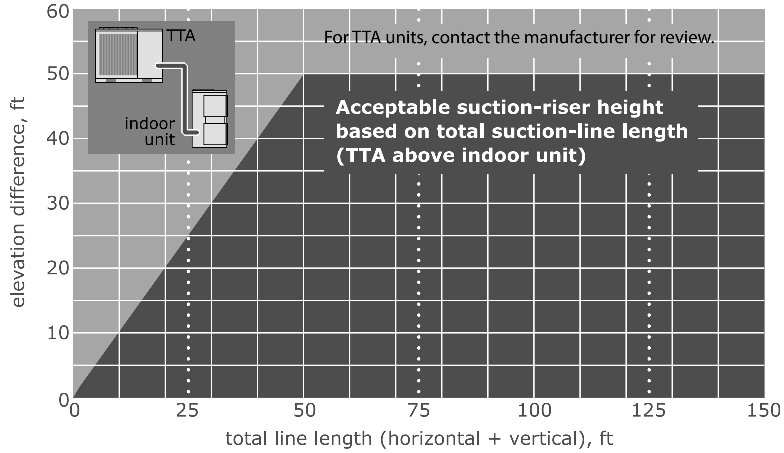
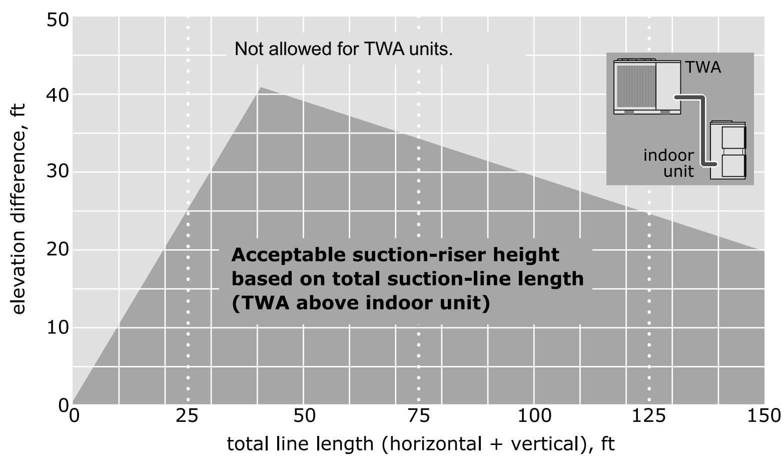
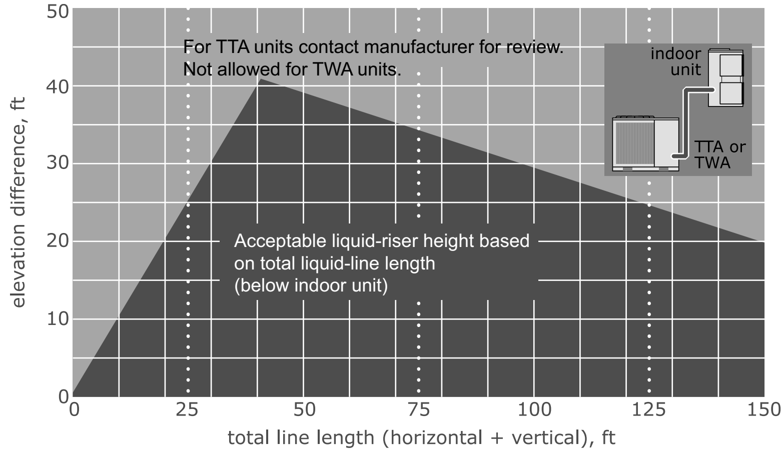


Figure 3. Allowable elevation difference: TWA *above* indoor unit



Note: *Regardless of orientation, hot gas bypass (HGBP) lines are limited to 75 feet. See Hot Gas Bypass Installation Guideline for Direct Expansion (DX) Equipment APP-APG017*-EN for more details*

Figure 4. Allowable elevation difference: TTA or TWA *below* indoor unit



Note: *Route refrigerant piping for minimum linear length, minimum number of bends and fittings.*

Important: *Read Application Guide SS-APG008*–EN thoroughly before installing this unit.*

Note: *All liquid piping rises are cumulative and all liquid and suction drops are treated as a horizontal run. For example: Liquid pipe rises 10 feet, drops 20 feet, and then rises 10 feet. In this example this would be a 20 foot vertical elevation.*

Line Sizing, Routing, and Component Selection

"Refrigerant Piping Examples," p. 17 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-410A machines and all the selected components installed in the field must also be rated for use with R-410A.

Liquid Lines

Line Sizing

Properly sizing the liquid line is critical to a reliable split system application. The Component Selection tables, found in "Parts," p. 25, show the recommended liquid-line sizing for each TTA/TWA model based on its nominal capacity. Using the preselected tube diameter to uniformly size the liquid line will maintain operating requirements and is the line size around which the TTA/TWA installation literature charging charts were generated (see IOM). 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. A height limitation exist for liquid lines that include a liquid riser due to the normal force of gravity. As the liquid riser grows in height this normal force create a pressure drop. If the riser is high enough, this pressure drop results in a loss of subcooling.Figure 3, p. 7 and Figure 4, p. 8 depict the permissible rise in the liquid line (without excessive loss of subcooling). Again, 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. In fact, heat loss from the liquid line improves system capacity because it provides additional subcooling. If the liquid line is routed through a high temperature area, 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. 17, 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. 25, 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 4, p. 26 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. 25. 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 9, p. 18 and Figure 10, p. 19).*

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. See Note 1 on Table 2, p. 25 and Table 3, p. 26 for more details.

Solenoid Valve

For TTA split systems, solenoid valves are not required to isolate the refrigerant from the evaporator during the off cycles. The exception is when the suction line is above the evaporator and is outside piping guidelines. Even then the use of solenoids is rare and should only be installed when recommended by the manufacturer. If a solenoid is required, the installer should use a drop solenoid—open when the compressor is on, and off when the compressor is off. If used, the solenoid requires code compliant wiring to the TTA condensing unit. (The solenoid is not shown on the unit wiring diagram.)

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. 25.*

⚠ 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.*

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 4, p. 26, identifies the part number of the valve recommended for TTA/TWA systems. The tonnage of the valve should represent the 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 4, p. 26.

The TWE air handler ships with a factory installed expansion device and heat pump check valve. If an alternate device is required, 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 4, p. 26.

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.

TTA: Because of the limited holding capacity of the microchannel heat exchanger, if more than 50 ft of liquid line is above a TTA unit, a check valve should be installed in the liquid line at the TTA unit to prevent backflow during the off condition. The check valve should be one size larger than the liquid line to reduce pressure drop and should be located at the TTA unit. A solenoid valve should never be used in the liquid line when using this check valve.

Gas Line

Line Sizing

Proper line sizing is required 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 run and for the vertical drops, and another for the vertical lifts (risers).

Note: *Preselected suction-line diameters shown in the Component Selection tables found in "Parts," p. 25, are independent of total line length for properly charged 6 – 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 ¼ to 1 inch per 10 feet of run (1 cm per 3 m) toward the indoor coil.

Do not install riser traps. With field-supplied air-handler coils, what appears to be a riser trap is located at the coil outlet; see Figure 5, p. 11 for an example. This piping arrangement, which isn't a riser trap, is the result of two requirements:

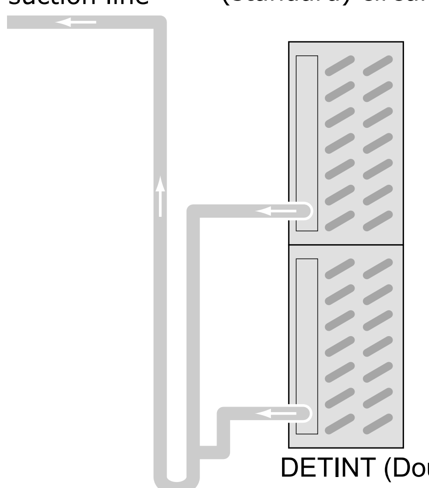
- Drain the coil to the common low point.

- Rise at least 1 ft (30 cm) from the common low point to prevent any off-cycle condensed refrigerant in the coil from attempting to flow to the compressor.

Double risers **MUST NOT** be installed. All 6 – 25 ton TTA and TWA units unload such that a single gas line size, preselected in the Component Selection tables found in“Parts,” p. 25, provide sufficient velocity to push entrained 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.*

Figure 5. Gas-line arrangement at the outlet of a field-supplied indoor coil



DETINT

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.

Avoid Underground Refrigerant Lines

Underground lines create risk due to refrigerant condensation during the off cycle, installation debris inside the line (including condensed ambient moisture), service access, and abrasion/corrosion. These hazards can quickly impair reliability.

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. See Note 1 in Table 2, p. 25 and Table 3, p. 26 for more details.

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 slug 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 4, p. 26, 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 1: 10-ton coil (one refrigerant circuit) with two equal distributors

10 / 2 = 5

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.

Example 2: 10-ton coil (one refrigerant circuit) with two distributors and a 60/40 coil split

10 x .6 = 6 and 10 x .4 = 4

One TXV should be sized for 6 tons, and one TXV should be sized for 4 tons. However, care should be taken to ensure the condensing unit is capable of operating at these conditions.

If the coil or distributors have a difference of only one circuit tube, 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 1, p. 12 to adjust them to the correct 18°F superheat.

Table 1. Expansion valves

Sporlan					
Standard off-the-shelf nominal valve settings (90 PSIG air test setting)					Field adjust for 18°F
Valve	**Superheat, °F**	**CW turns available**	**CCW turns available**	**Superheat change per turn**	
ERZE[a] or RCZE	12	4.5	4.5	2.4°F	2 1/2 CW
OZE				3.4°F	1 3/4 CW

(a) May also be called BBIZE

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, the 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

Many years ago, hot gas bypass (HGBP) was added to HVAC systems to correct a number of operational problems. Hoping to avoid such problems altogether, it eventually became common practice for designers to specify hot gas bypass in systems. Unfortunately, the practice often degraded rather than improved reliability.

Hot gas bypass increases the minimum refrigerant charge; it also inflates the first cost of the system. Besides adding more paths for potential refrigerant leaks, hot gas bypass increases the likelihood of refrigerant distribution and oil return problems. Finally, hot gas bypass uses excessive amounts of energy by preventing the compressors from cycling with fluctuating loads.

Trane now has more than 15 years experience in the successful use of packaged rooftop equipment *without hot gas bypass* in commercial comfort-cooling applications. To prevent evaporator freeze-up, our equipment typically includes Trane® Frostat™ coil frost protection.

Like hot gas bypass, the Frostat system protects the coil from freezing, but it does so by turning off compressors at 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.

Systems should be designed to avoid HGBP whenever possible. However, HGBP is necessary for some appreciations such as 100% OA.

When using HGBP or a Rawal APR valve, the total "linear" line length should be limited to 75 feet.

Additional Resources

- Refer to the *Trane Application Guide* Hot Gas Bypass Installation Guideline for Direct Expansion (DX) Equipment (APP-APG017*- EN) for more information such as design, pipe size, and maximum hot gas bypass length.
- Refer to 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-410A will need to be upgraded. Due to the phase-out of many of these older refrigerants, the major components for those older condensing unit/evaporator systems may no longer be available. The only option will be to convert the system to R-410A, POE oil, and R-410A components.

When upgrading an existing refrigerant split system due to remodel, retrofit, or replacement, the entire system must be reviewed for compatibility with R-410A and POE oil. Each and every part of the split HVAC system MUST be compatible with the properties of R-410A refrigerant and POE oil. In addition, ensure the existing electrical service and protection are correct for the product being installed.

⚠ WARNING

R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage.

The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Trane representative.

Every part of an existing split system needs to be analyzed to determine if it can be reused in an R-410A and POE oil system:

- R-22 condensing units will not work with R-410A.
- Per EPA rulings, it is not acceptable to replace R-410A refrigerant with any A2L refrigerant.
- Most older evaporator coils were not pressure and cycle rated for R-410A pressures. If they weren't, they will need to be replaced. Check with the manufacturer.
- Suction lines 2-5/8 OD and smaller of type L copper are suitable for use with R-410A. Suction lines 3-1/8 OD 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-410A. These same lines sized at 1-5/8 OD or 2-1/8 OD must use type K or thicker wall.
- R-410A refrigerant line sizes may be different than the existing line sizes. The lines need to be re-sized and compared to existing lines for reusability.
- Expansion valves need to be reselected. Expansion valves are refrigerant specific.
- Any gasket or o-ring should be replaced. Shrinkage of the original seal may occur after an HFC conversion, potentially causing a refrigerant leak. Components commonly affected are Schraeder cores, solenoid valves, ball valves, and flange seals. But all external seals in contact with refrigerant should be viewed as potential leak sources after a retrofit.
- All other valves, filters, valve packing, pressure controls, and refrigeration accessories must be researched through their manufacturer for compatibility with the pressures of an R-410A system, and for their compatibility with the newer POE oil.
- For the best performance and operation, the original mineral oil should be removed from the components of the system that are not being replaced. Any component of the system that is suspected of trapping oil (piping, traps, and coil), should be dismantled, drained, and reassembled. After all components have been drained, the amount of residual mineral oil will have a negligible effect on performance and reliability.

Important: *The system should not be open for longer than necessary, dry nitrogen should flow in the system while brazing, and only new containers of oil should be used for service and maintenance.*

NOTICE

Equipment Damage!

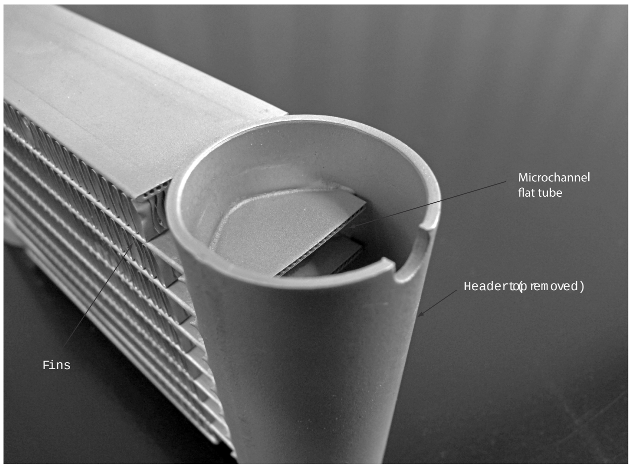
This is POE oil, which readily absorbs moisture. Always use new oil and never leave containers open to atmosphere while not in use.

All Codes take precedence over anything written here.

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 6, p. 16.

Figure 6. MCHE Condenser

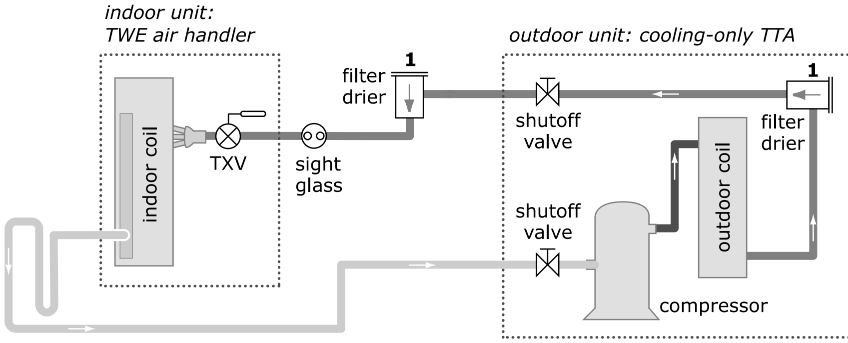


This design improves heat transfer and the refrigerant that enters the coil quickly turns to liquid. The MCHE tube volume holds very little refrigerant, so the refrigerant charge of the system is reduced. However, the tube volume is so small that if the flow of refrigerant out of the MCHE condenser is 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 won’t support pump-down.
- No trim solenoid: The storage capacity of the MCHE won’t support partial shut-off of the evaporator coil.

Refrigerant Piping Examples

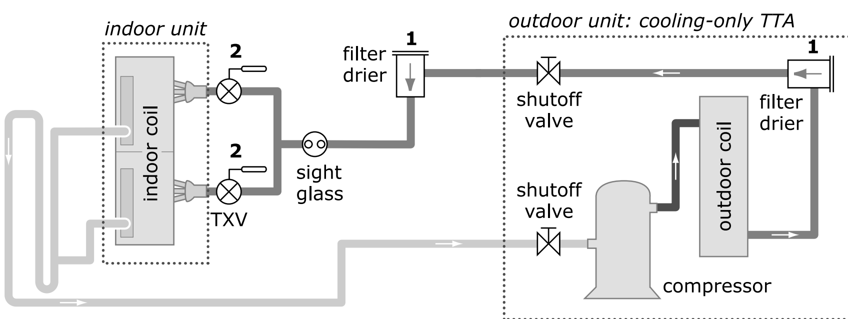
Figure 7. TTA cooling-only unit and TWE air handler



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 2, p. 25) at the TWE air handler.*
2. *Shutoff valves are a field installed option and no longer come standard from the factory.*

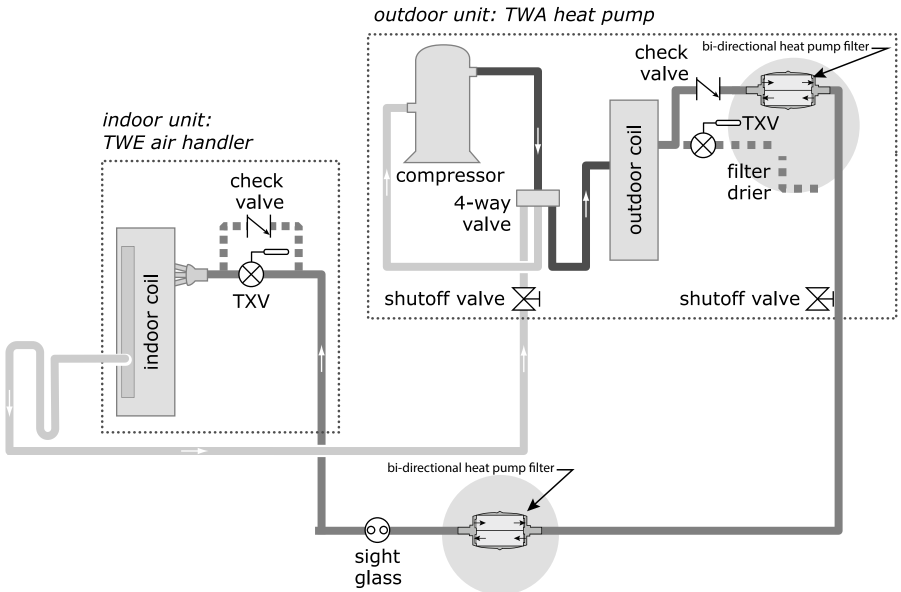
Figure 8. TTA cooling-only unit and matched indoor coil (typical arrangement)



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 2, p. 25) at the TWE air handler.*
2. *Provide one expansion valve (TXV) per distributor; see for recommendations.*
3. *Shutoff valves are a field installed option and no longer come standard from the factory.*

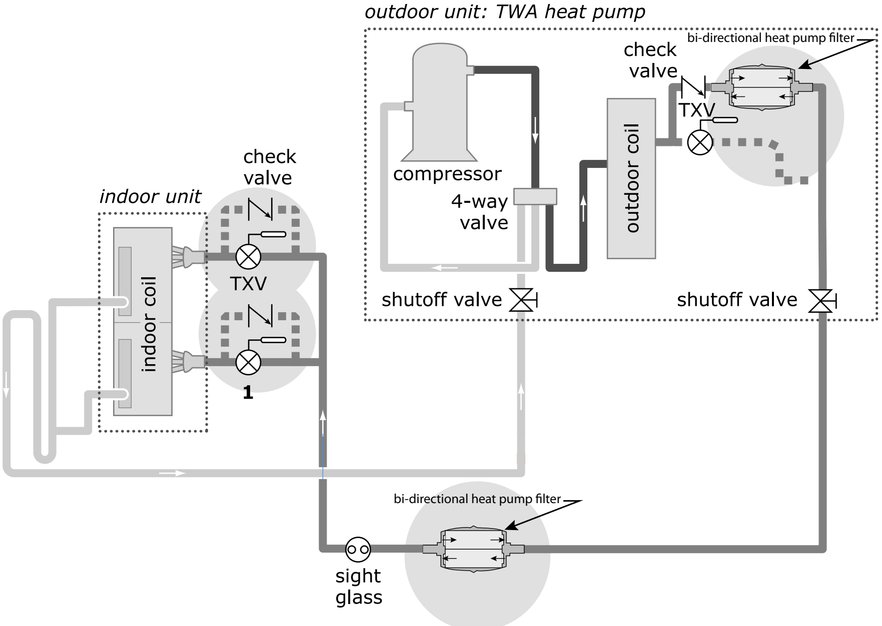
Figure 9. TWA heat pump and TWE air handler (typical arrangement shown in cooling mode)



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 and check valves at the TWE air handler.*
2. *Shutoff valves are a field installed option and no longer come standard from the factory.*

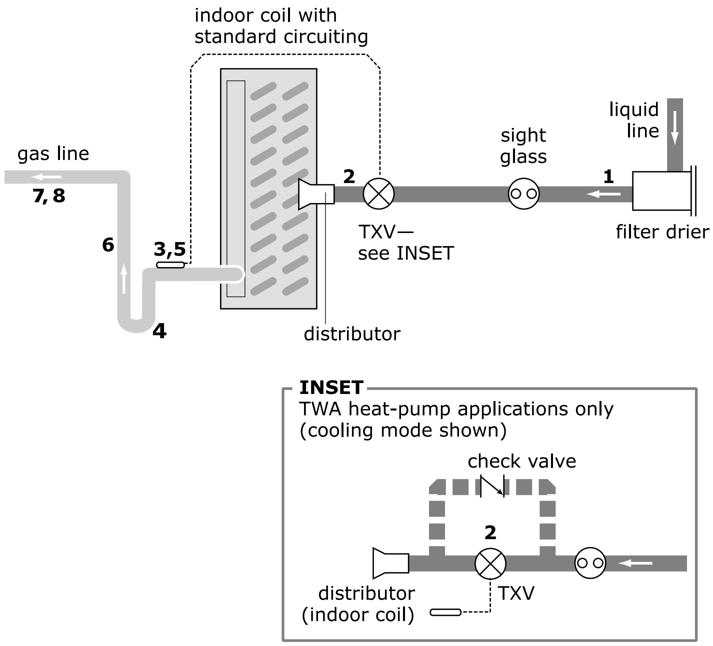
Figure 10. TWA heat pump and matched indoor coil (typical arrangement shown in cooling mode)



Notes:

1. *Each coil distributor requires one thermal expansion valve (TXV) and one check valve. See Table 3, p. 26, and , for recommendations.*
2. *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 and check valves (Table 3, p. 26) at the indoor unit.*
3. *Shutoff valves are a field installed option and no longer come standard from the factory.*

Figure 11. Indoor coil (non-TWE) with one distributor (single-circuit TTA/TWA units)



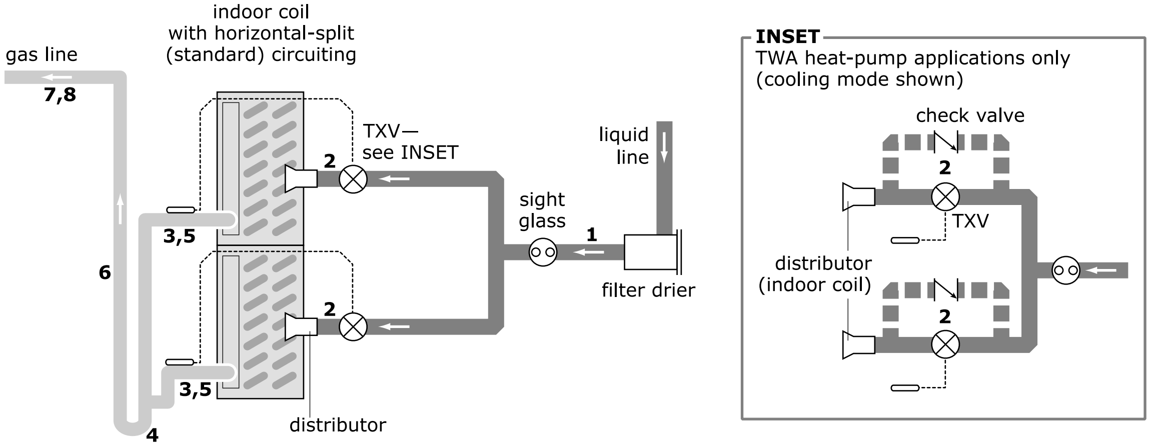
Notes:

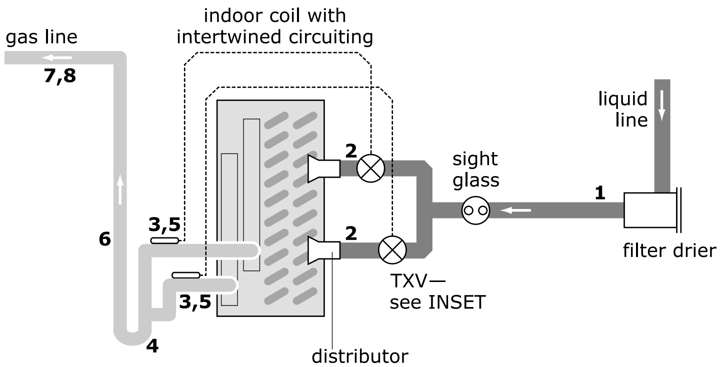
1. *Pitch the liquid line 1 inch per 10 feet (1 cm per 3 m) so that the liquid refrigerant drains toward the indoor coil. Use the liquid-line size recommended in Table 2, p. 25 or Table 3, p. 26.*
2. *Provide one expansion valve (TXV) per distributor.*

***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. 9.*
5. *Use the “horizontal” tube diameter identified in the Component selection tables, found in “Parts,” p. 25.*
6. *For vertical risers, use the tube diameter recommended in Table 2, p. 25 or Table 3, p. 26. 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. Indoor coil with two distributors (single-circuit TTA/TWA units)



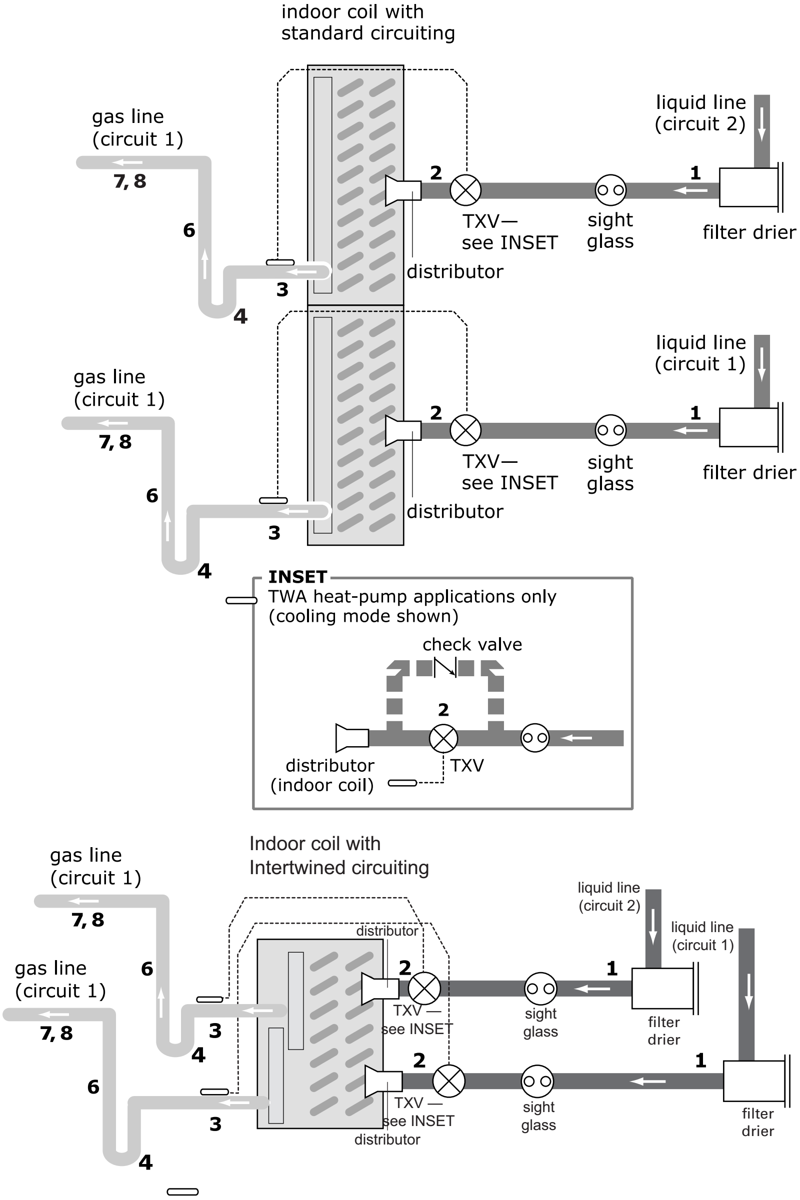


Notes:

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 Table 2, p. 25, or Table 3, p. 26.*
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. 9.*
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 2, p. 25 or Table 3, p. 26.*
6. *For vertical risers, use the tube diameter recommended in Table 2, p. 25 or Table 3, p. 26. 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 13. Indoor coil with two distributors (dual-circuit TTA/TWA units)



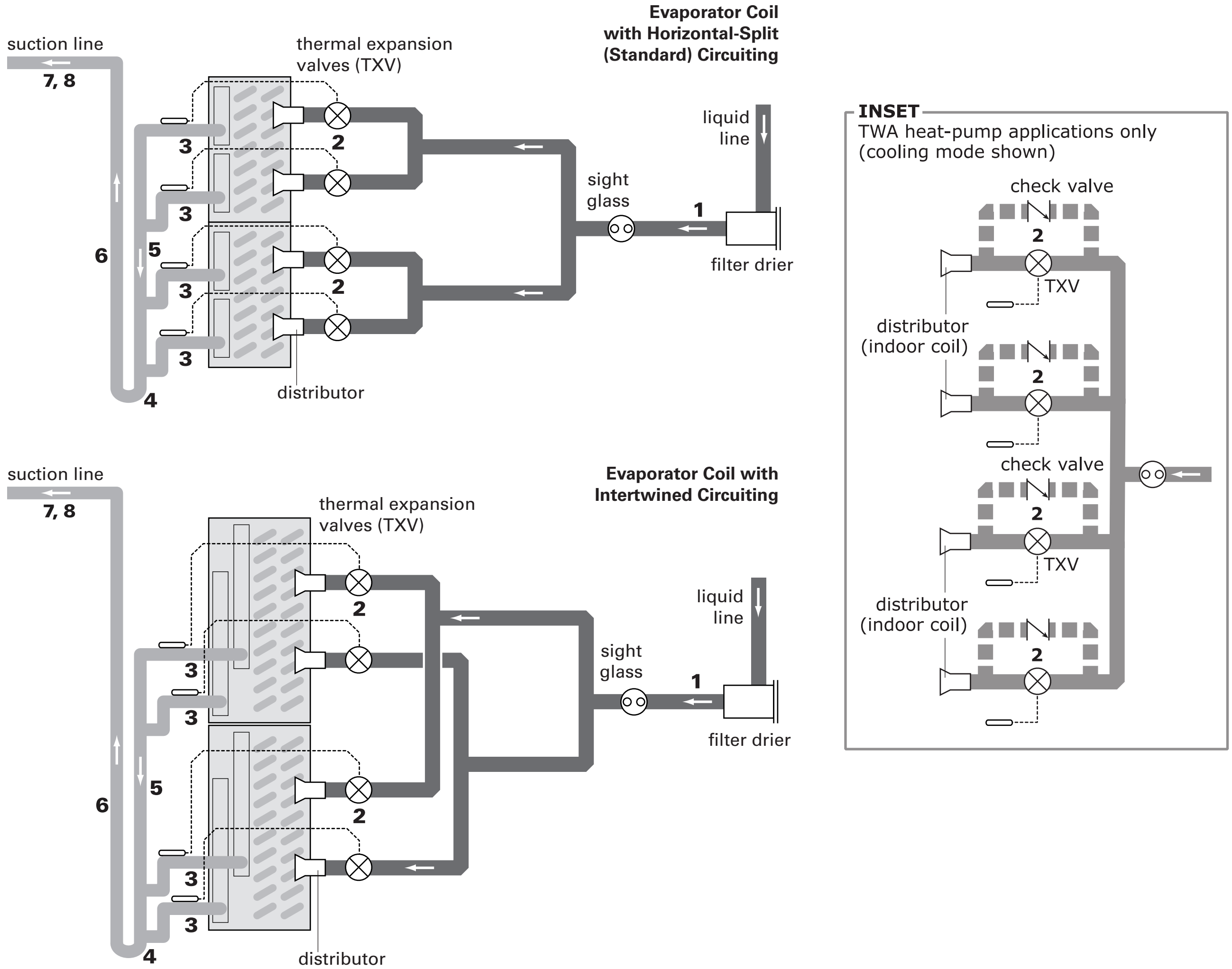
Notes:

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 Table 2, p. 25, or Table 3, p. 26.*
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. 9.*
5. *Use the “horizontal” tube diameter identified in the Component selection tables, found in “Parts,” p. 25.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in Table 2, p. 25, or Table 3, p. 26. 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 14. Type UF evaporator coil with four distributors



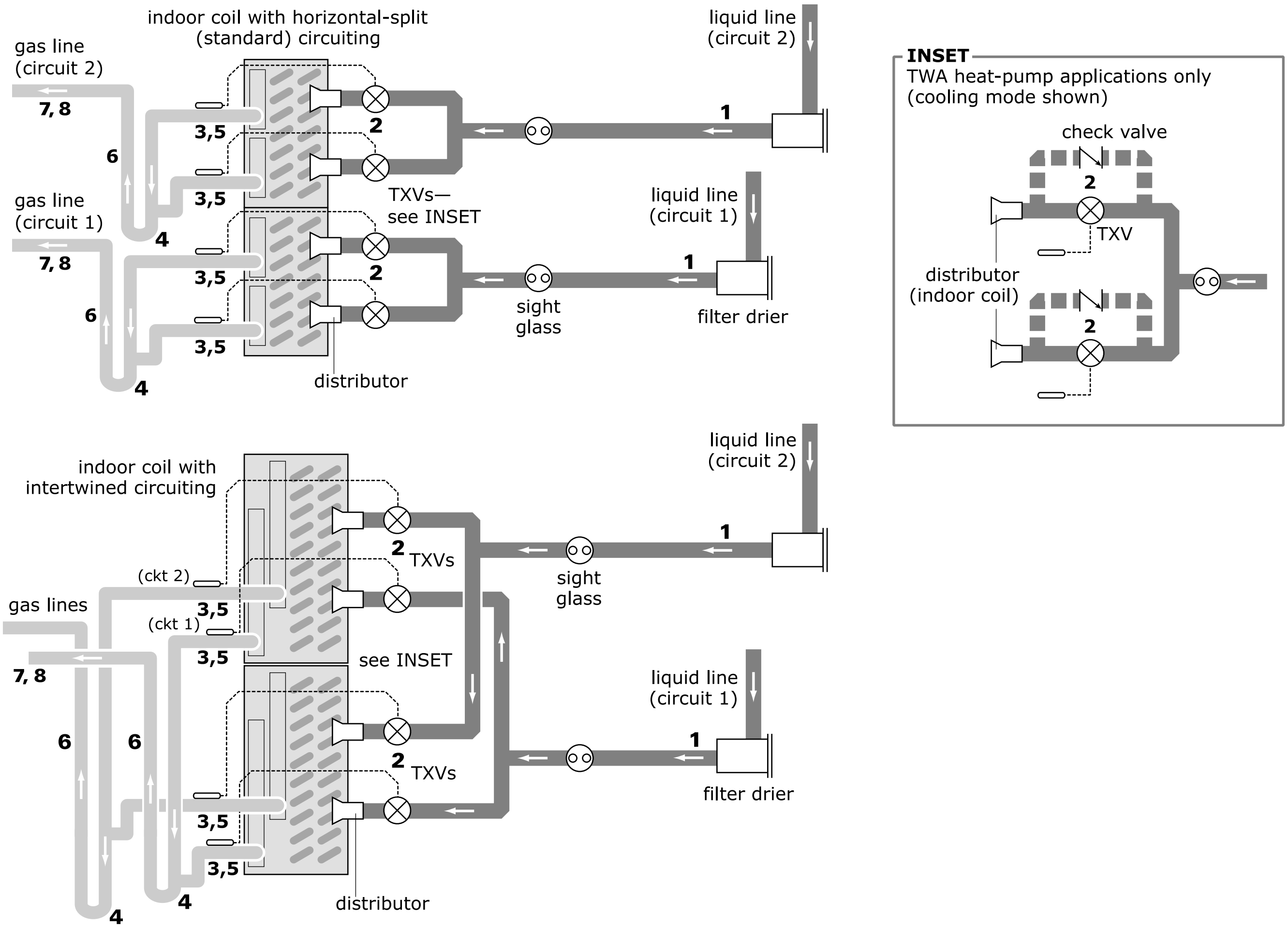
Notes:

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 Table 2, p. 25, or Table 3, p. 26.*
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. 9.*
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 2, p. 25 or Table 3, p. 26.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in Table 2, p. 25, or Table 3, p. 26. 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 15. 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 Table 2, p. 25, or Table 3, p. 26.*
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. 9.*
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 2, p. 25 or Table 3, p. 26.*
6. *For vertical risers, use the tube diameter recommended in the Component selection tables, found in Table 2, p. 25, or Table 3, p. 26. 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 2. Component selection for TTA cooling microchannel units 6–25 tons

Unit	TTA0724*A	TTA0724*D	TTA0904*A	TTA0904*D	TTA1204*D	TTA1204*C	TTA1504*D
Refrigerant ckts	1	2	1	2	2	1 (Manifold)	2
Minimum step (tons)	6	3	5	5	6.7	5	8.4
GAS LINE							
Tube diameter (in.)							
Horizontal (& drops)	1 1/8	3/4	1 1/8	7/8	1 1/8	1 3/8	1 1/8
Vertical (up)	1 1/8	3/4	1 1/8	7/8	1 1/8	1 1/8	1 1/8
Access port 3/ckt	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
LIQUID LINE							
Tube diameter (in.)	1/2	3/8	1/2	3/8	1/2	1/2	1/2
Filter drier	DHY01123	DHY01122	DHY01123	DHY01122	DHY01123	DHY01123	DHY01123
Sight glass 1/ckt	GLS00853	GLS00852	GLS00853	GLS00852	GLS00853	GLS00853	GLS00853
Access port 2/ckt	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
Additional oil charge	0 oz	0 oz	0 oz	0 oz	0 oz	1 oz/50 ft	0.4 oz/50 ft

Unit	TTA1804*D	TTA1804*C	TTA2404*D	TTA2404*C	TTA3004*C
Refrigerant ckts	2	1 (Manifold)	2	1 (Manifold)	1 (Manifold)
Minimum step (tons)	7.5	8.6	13.4	10	12.5
GAS LINE					
Tube diameter (in.)					
Horizontal (& drops)	1 1/8	1 5/8	1 3/8	1 5/8	2 1/8
Vertical (up)	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8
Access port 3/ckt	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	5/8	1/2	3/4	3/4
Filter drier	DHY01123	DHY01232	DHY01123	DHY01233 (a)	DHY01233 (a)
Sight glass 1/ckt	GLS00853	GLS00830	GLS00853	GLS00830 (b)	GLS00830 (b)
Access port 2/ckt	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core	Schraeder valve w/core
Additional oil charge	0 oz	=3oz+1oz/30ft	0 oz	0 oz	= 8 oz+1oz/30 ft

Notes:

1. On Access ports 2/ or 3/ckt: Valve body VAL01483, valve core COR00006, valve cap CAP00072Schraeder
2. On 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."
3. Check valve selections: 3/8 - VAL08459, 1/2 - VAL08460, 5/8 - VAL01722, 7/8 - VAL07030. (See “Check Valves").

(a) 7/8" connections
(b) 5/8" connections

Table 3. Component selection for TWA heat pump units 6–20 tons

Unit	TWA0724*A	TWA0724*D	TWA0904*A	TWA0904*D	TWA1204*A	TWA1204*D	TWA1804*D	TWA2404*D
Refrigerant ckts	1	2	1	2	1	2	2	2
Minimum step (tons)	6	3	5	3.75	6.7	6.7	7.5	10
GAS LINE								
Tube diameter (in.)								
Horizontal (& drops)	1 1/8	3/4	1 1/8	7/8	1-3/8	1 1/8	1 1/8	1 3/8
Vertical (up)	7/8	3/4	1 1/8	7/8	1 1/8	7/8	1 1/8	1 1/8
Access port 3/ckt[a]	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
LIQUID LINE								
Tube diameter (in.)	1/2	3/8	1/2	3/8	1/2	1/2	1/2	1/2
Filter drier[b]	DHY01608	DHY01467 (Qty 2)	DHY01608	DHY01467 (Qty 2)	DHY01608	DHY01467 (Qty 2)	DHY01608 (Qty 2)	DHY01608 (Qty 2)
Sight glass 1/ckt	GLS00853	GLS00852	GLS00853	GLS00852	GLS00853	GLS00853	GLS00853	GLS00853
Access port 2/ckt[a]	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
Additional oil charge	0 oz	0 oz	0 oz	0 oz	0 oz	0 oz	0 oz	0 oz

Notes:

1. On Access ports 2/ or 3/ckt: Valve body VAL01483, valve core COR00006, valve cap CAP00072
2. On 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. Check valve selections: 3/8 - VAL08459, 1/2 - VAL08460, 5/8 - VAL01722, 7/8 - VAL07030. (see "Check Valves")

Table 4. Expansion valves for TTA/TWA applications 6–20 tons

Refrigerant	Manufacturer	Tonnage Range	Model Number	Trane Part	Model Number w/ Check Valve	Trane Part
R-410A	Sporlan	2-3	RZE-2-GA	VAL09476	RCZE-2-GA	VAL08085
R-410A	Sporlan	3-4	RZE-3-GA	VAL09477	RCZE-3-GA	VAL08086
R-410A	Sporlan	4-5	RZE-4-GA	VAL09478	RCZE-4-GA	VAL08087
R-410A	Sporlan	5-6	RZE-5-GA	VAL09479	RCZE-5-GA	VAL08088
R-410A	Sporlan	6-8	RZE-6-GA	VAL09480	RCZE-6-GA	VAL08089
R-410A	Sporlan	8-11	RZE-8-GA	VAL09481	_____	_____
R-410A	Sporlan	11-14	RZE-12-1/2-GA	VAL09482	_____	_____
R-410A	Sporlan	14-17	RZE-15-GA	VAL09483	_____	_____
R-410A	Sporlan	17-23	OZE-20-GA	VAL09585	_____	_____
R-410A	Sporlan	23-28	OZE-25-GA	VAL09583	_____	_____

Notes:

1. See Expansion Valves
2. The RZE valves may also be called BBIZE.
3. 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 5. R-410A lbs charge per 100 ft

OD	Suction	Liquid	Discharge
1/4	0.04	1.25	0.18
5/16	0.07	2.15	0.31
3/8	0.12	3.45	0.51
1/2	0.22	6.43	0.94
5/8	0.36	10.33	1.51
3/4	0.53	15.42	2.26
7/8	0.74	21.42	3.14
1 1/8	1.26	36.52	5.36
1 3/8	1.93	55.63	8.16
1 5/8	2.73	78.74	11.55
2 1/8	4.74	136.97	20.08
2 5/8	7.32	211.22	30.97

Note: Type L or ACR tube. Suction: Saturated at 40°F, Liquid: Saturated at 90°F, Discharge: Saturated at 125°F

Note: *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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