



COMMERCIAL PRODUCT GUIDE



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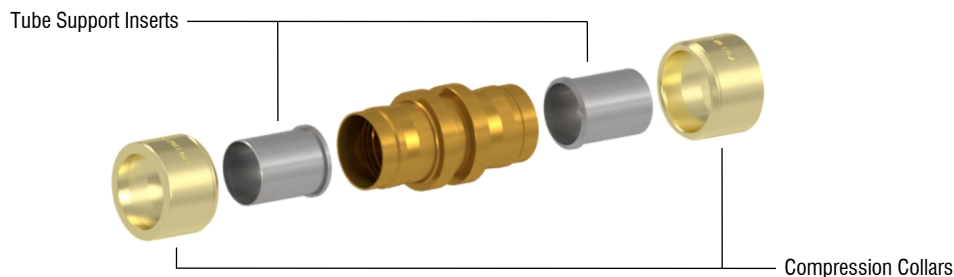
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Introduction to Refrigerant Coupling Systems

Refrigerant Coupling Systems, Inc. (RCS) couplings and reducers are permanent, flame-free, mechanically attached fittings, developed to bring modern refrigerant pipe fitting technology to the commercial refrigeration and HVAC industry. The installation of RCS couplings and reducers is a simple and repeatable process designed as a one-person operation without the use of high temperature brazing methods.

RCS's mechanically attached fittings form a tight, full perimeter seal. Each fitting consists of a brass-body sleeve, two zinc plated steel collars and two zinc plated steel tube support inserts. The steel collars compress the brass-body sleeve onto the tubing, which is supported on the inside by the steel tube support inserts. Annular grooves inside the brass body provide additional sealing effect and resist torsional loads. Micro-scratches and minor tube surface imperfection are filled and sealed with a specially formulated anaerobic retaining compound. The retaining compound also provides protection from vibration of the piping system.



The fittings are permanently connected to the copper tubing by use of a portable, battery operated hydraulic pressing tool, with specially designed, quick-change clamps and clamp inserts. The time required to produce a gas tight connection is significantly less than flame brazing. This cold connection process eliminates the need for high temperature brazing, nitrogen purge, fire watch, and hot work permits. Harmful gases and smoke produced from the brazing process are also eliminated.

To offer a completely flame-free system installation approach, RCS replaced the heat shrink process with Cold Shrink technology. Again, no heat is required to install a water-resistant silicone rubber sleeve to any fitting installed outdoors, or in wet and/or high humidity environments.

RCS's cold connection system also provides exceptional time saving benefits for complex VRF refrigerant piping system installations. The special design, flame-free Y-branch pipe kits, selector box kits, outdoor unit connection kits, and pre-flared fan coil kits provide for a complete system piping solution. Each kit is individually assembled and packaged to match the equipment manufacturers configuration, eliminating confusion and mistakes on the job. This invaluable service is free of charge to our VRF customers.

When compared to traditional pipe fitting methods, mechanically attached fittings significantly reduce the system assembly time. Time savings can be as high as 60 percent, while greatly enhancing quality and reliability of the completed connection. Safety conditions are also significantly improved. The cost of tooling and fittings is often recuperated in a single system installation. Technician/Installer training includes fully detailed, simple to follow instructions, and how-to videos.

Refrigerant Coupling Systems, Inc. provides a safe, cost-effective, and environmentally responsible method for installing any copper refrigerant piping system. Quality and service is the foundation of our product and business strategy. RCS is dedicated to working with our customers for mutual, long-term success.

Frequently Asked Questions

WHAT IS THE INTENDED APPLICATION FOR RCS FITTINGS?

RCS Mechanically attached fittings are high-pressure flame-less type fittings intended for use on refrigeration piping systems with all refrigerants and refrigerant oils except Ammonia (R717) and Methyl Chloride (R40). Do not use for Refrigerants R717 or R40.

CAN THE RCS FITTINGS BE USED ON FLUIDS OTHER THAN REFRIGERANTS, SUCH AS WATER, MEDICAL GAS, OR COMPRESSED AIR?

No, the fittings should only be used on clean, dehydrated closed refrigerant piping systems.

WHAT IS THE PRESSURE RATING FOR RCS FITTINGS?

RCS fittings are ETL listed for a maximum working pressure of 1,167 psi. The fittings are tested and rated in accordance to UL-207 Standard for use in the USA and Canada.

DO YOU NEED TO DERATE THE WORKING PRESSURE OF THE INSTALLED TUBING?

No, the copper tube working pressure does not need to be de-rated to the annealed copper working pressure (required for brazed copper piping systems). The working pressure of the installed system is equal to the working pressure rating of the tubing (based on size, wall thickness, and temper) up to a maximum working pressure of 1,167 psi.

WHAT PIPING MATERIAL IS COMPATIBLE WITH RCS FITTINGS?

RCS Mechanically Attached Fittings are compatible with copper tube and pipe. For refrigerant use, the pipe/tube should be C12200 phosphorus-deoxidized, high residual phosphor (DHP) tube.

CAN RCS FITTINGS BE USED IN HAZARDOUS ENVIRONMENT?

No. RCS fittings are intended for use on refrigeration piping system and therefore required to be insulated to prevent from moisture intrusion. All RCS fittings installed outdoors or in humid environments require the installation of a protective heat shrink, cold shrink, or other impervious covering material.

DO YOU NEED NITROGEN PURGE WHEN ASSEMBLING REFRIGERATION PIPING WITH RCS FITTINGS?

No. RCS fittings allow for the installation of refrigerant piping without the need for heat. Therefore, the tubing does not need nitrogen purge (prevents copper oxide formation during brazing).

WHAT PIPING SIZES ARE ACCOMMODATED BY RCS FITTINGS?

RCS fittings are available for standard copper tube sizes for 1/4" through 1-5/8" outside diameter with ACR Type L copper wall thickness per ASTM B280.

CAN RCS FITTINGS BE USED ON "SOFT" COPPER TUBING?

Yes, RCS fittings are suitable for use on annealed (O60), light drawn (H55), and general purpose drawn (H58) copper tubing. RCS fittings must utilize a tube support insert sized properly for the tube OD and wall thicknesses. Alternative tube support inserts must be used when RCS fittings are installed on annealed copper coil or pre-insulated line sets with tube wall thickness less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

HOW DO YOU ATTACH FLARE CONNECTIONS WITH RCS FITTINGS?

If using annealed (O60) or "annealed" copper tube, the tubing can be field flared in the normal manner. When using light drawn (H55) or general purpose drawn (H58) copper tube, use an RCS "Flare Kit". This is a factory flared copper tube and RCS coupling, that requires the installer to use the flare nut furnished with the original equipment. The flare nut is NOT furnished as part of the RCS flare kit.

HOW DO YOU MAKE CHANGES OF DIRECTION (ELLS, OFFSET, ETC.)?

If the refrigerant piping is done using annealed (O60) or light drawn (H55) copper tube, the tubing can be field bent to any desired angle and connections made with RCS couplings. Do NOT bend general purpose drawn (H58) "hard" copper. Note: Use ONLY copper tube benders sized to precisely bend imperial size OD dimensions. Do NOT use conduit benders. For light drawn (H55) copper tube, do NOT use "Press Bending" or "T-Bender" style benders. Refer to RCS detailed installation instructions for additional information.

CAN YOU REMOVE AND REUSE RCS FITTINGS?

No. Once the fitting is pressed onto the tubing, the fitting is non-removable. If the fitting is deemed not visually acceptable prior to, during, or after the installation, the fitting must be cut out from the piping system and a new one correctly reinstalled.

CAN YOU PERFORM A BRAZE NEAR A FITTING?

Keep the temperature of the RCS fitting less than 250F (121C) by directing the flame away from the fitting, using a heat conductive paste and wrapping the fitting in a clean wet rag.

Tubing Qualification

Suitable tubing selection is essential to the performance of every system. When selecting tubing for use with the RCS, Inc. fittings, the tubing material, wall thickness, and working pressure must be considered:

Tubing Material

It is critical for the performance of RCS, Inc. fittings that only the following types of tubing are used:





- ASTM B75/ASTM B280 ACR light-drawn (H55) temper, seamless copper tubing.
- ASTM B280 ACR drawn general purpose (H58) temper, seamless copper tubing.
- ASTM B280 ACR annealed (O60) temper, seamless copper tubing.

Tubing Wall Thickness

Ensure that tube utilized in refrigeration and air conditioning systems complies with all local standards and codes. Tubes manufactured per ASME B75 or ASTM B280 are acceptable.

Size Nominal OD [inches]	Nominal Wall (Wall Thickness) [inches]	WT Tolerance Average (+/-) [inches]
1/4"	0.030	0.003
3/8"	0.030	0.003
1/2"	0.035	0.004
5/8"	0.040	0.004
3/4"	0.042	0.004
7/8"	0.045	0.004
1-1/8"	0.050	0.004
1-3/8"	0.055	0.006
1-5/8"	0.060	0.006

Table 1. Wall Thickness (WT) Requirements

-  Installers using coiled copper tubing or line sets with RCS, Inc. fittings must ensure that the tubing used complies with ASME B31.5. It must also meet ASTM B75 and/or ASTM B280 standards with the required wall thickness and tolerances.
-  Annealed coiled copper tubing or line sets larger than 5/8 inch shall NOT be used with RCS, Inc. fittings.
-  Installers must use the appropriate RCS, Inc. tubing inserts for the tubing selected without exception.
-  RCS, Inc. will not be held liable for any damages, incidental and/or consequential, resulting from the use of tubing that does not meet ASME B31.5, and ASTM B280 or ASTM B75 standards, or resulting from the use of incorrect tubing inserts.

Working Pressure

RCS, Inc. components are ETL Listed to standard UL-207, and approved for use with seamless copper tubing, and working pressure of 1,167 psi (80 bar). RCS, Inc. mechanically attached fittings are installed without the use of heat; therefore, de-rating of the tube working pressure is not required as mandated by ASME B31.5.

Table 2 shows the maximum working pressures for each tube size and wall thickness for ASTM B75 and ASTM B280 Type L ACR copper.

ASME B31.5	Light Drawn (H55)		Drawn General Purpose (H58)		Annealed (O60)	
Allowable Strength [lb _f /in ²] (250°F)	10,300		9,000		4,800	
Tube OD [inches]	Nominal Wall [inches]	Max Working Pressure [psi]	Nominal Wall [inches]	Max Working Pressure [psi]	Nominal Wall [inches]	Max Working Pressure [psi]
1/4"	0.030	2735	N/A	N/A	0.030	1274
3/8"	0.030	1761	0.030	1538	0.032	879
1/2"	0.035	1528	0.035	1335	0.032	648
5/8"	0.040	1390	0.040	1214	0.035	563
3/4"	0.042	1208	0.042	1055	Do NOT use Refrigerant Coupling Systems, Inc. (RCS) fittings on these annealed copper tube sizes	
7/8"	0.045	1105	0.045	965		
1-1/8"	0.050	949	0.050	829		
1-3/8"	0.055	851	0.055	744		
1-5/8"	0.060	784	0.060	685		

Table 2. Maximum Working Pressures of Copper Tube
Based on allowable strength shown in ASME B31.5 – 2016, Table 502.3.1

Tube and Fitting Storage

All tubing and fitting parts should be inspected when received, during installation, and after installation completion, ensuring that parts with any manufacturing defects are not installed on the system. Proper handling, both in transit and onsite is critical. At a minimum, the following practices should be followed:

- Store tubing and fittings above ground in a clean, dry, indoor location.
- Ensure all tubes are capped or plugged at all times. If caps are not present, inspect, clean and re-cap.
- Cover tubes to eliminate oxidation and corrosion while allowing sufficient ventilation to avoid condensation.
- Do not store materials directly on or in contact with dissimilar metals, concrete, asphalt, or pavement.
- Never drag tubing across concrete, asphalt, or pavement.
- Never drag tubing out of a tubing rack, on the ground, or across rough surfaces.
- Protect tube and fitting ends from damage.
- Store tubing and fittings in original crates or packages.

Tube Handling Best Practices

Surface finish is very important to ensure proper sealing of mechanical connections. Tubing with any kind of surface defect may not seal properly.

- Always inspect the tube for a clean and smooth surface and concentricity.
- Only use tubing cutter with a sharp cutting wheel. Slowly advance the cutting wheel in small increments to avoid deformation of the tube end and to minimize de-burring time. Never use a hacksaw.
- Remove all burrs from the tubing ID and OD. The de-burred tube end should have a uniform edge break with no burr and the chamfer should not exceed half the wall thickness of the tubing.
- Do not put fingers inside the tool or near the cutting edges, or near sharp tube ends or burrs.
- Do not abrade the tube ends with sand cloth when connecting with RCS, Inc. mechanically attached fittings.



WARNING: Refrigerant Coupling Systems, Inc. fitting assemblies are high precision machined components. The use of any component not supplied or manufactured by RCS, Inc. may result in unreliable and/or unsafe connections, and is expressly prohibited by Refrigerant Coupling Systems, Inc.

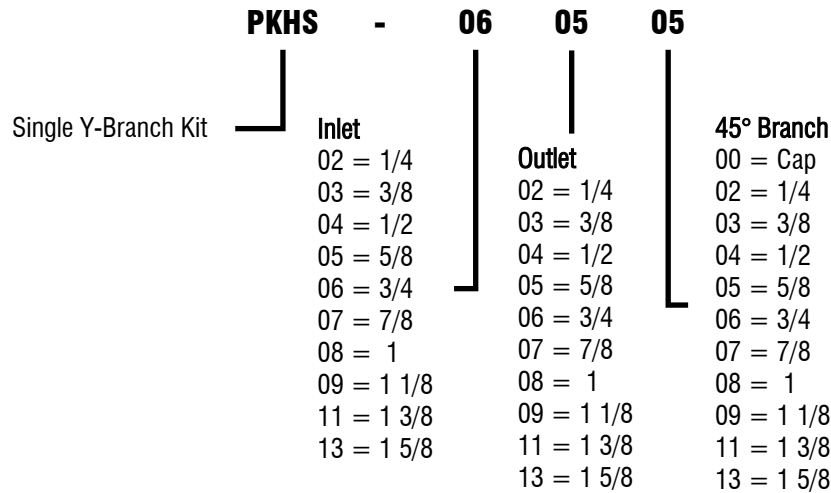
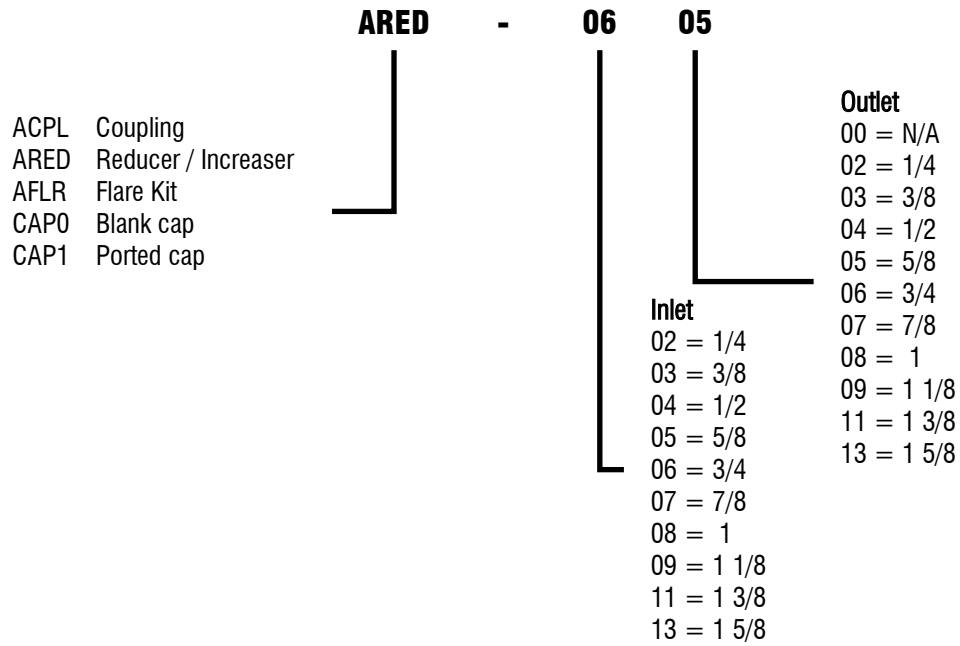


WARNING: RCS fittings are single-use permanent fittings and cannot be removed or repaired after installation. If the fitting is deemed not visually acceptable prior to, during, or after the installation, the fitting must be cut out and a new one correctly reinstalled.



WARNING: All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

Model Number Identifier



- ◆ RCS tube support inserts are identify by their finished color to designate their uses on different tubing wall-thicknesses.
- ◆ VRF specialty inserts (Green), may also be marked with identification groove(s). Appropriate tube support inserts are packaged with select fitting(s) to match to the equipment connecting tubing being installed per the customers provided drawings.

Standard ACR Type L

0 = Silver/Clear



Specialty Inserts

6 = Black - NDL Valve



Line Sets = Gold 3/8, 1/2, 5/8



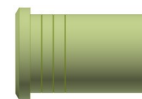
VRF Insert Series

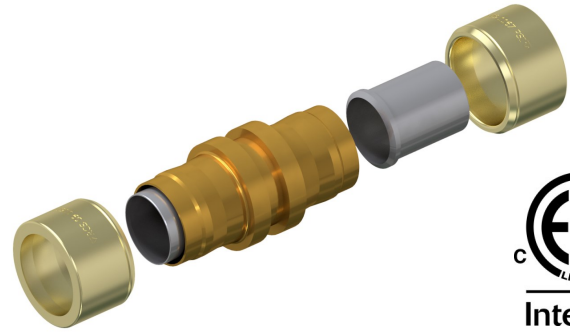
2 = Green

3 = Green, 1 groove

4 = Green, 2 grooves

5 = Green, 3 grooves



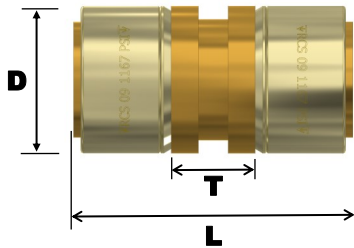


ACPL Coupling

The coupling joins equal size copper refrigeration tubing by means of a permanent mechanical seal.

The coupling is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The coupling is intended for use with C12200 Type L copper tube conforming to dimensions of ASTM B280. All tempers of copper tube may be used (O60, H55, H58). Coupling may also be used with C19400 copper alloy.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.



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TUBE SIZE Inches (mm)	PART NUMBER	L Inches (mm)	D Inches (mm)	T (Takeoff) Inches (mm)
1/4" (6.35)	ACPLS-02	1.36 (34.5)	0.63 (16.0)	0.49 (12.4)
3/8" (9.52)	ACPLS-03	1.36 (34.5)	0.63 (16.0)	0.49 (12.4)
1/2" (12.70)	ACPLS-04	1.52 (38.5)	0.75 (19.0)	0.51 (12.9)
5/8" (15.88)	ACPLT-05	1.85 (47.0)	0.91 (23.0)	0.57 (14.4)
3/4" (19.05)	ACPLT-06	2.04 (51.8)	1.04 (26.4)	0.51 (12.9)
7/8" (22.22)	ACPLT-07	2.22 (56.3)	1.22 (30.9)	0.53 (13.4)
1-1/8" (28.58)	ACPLT-09	2.94 (74.8)	1.54 (39.0)	0.92 (23.3)
1-3/8" (34.92)	ACPLT-11	3.06 (77.8)	1.81 (46.0)	0.88 (22.4)
1-5/8" (41.28)	ACPLT-13	3.07 (78.1)	2.11 (53.5)	0.89 (22.6)

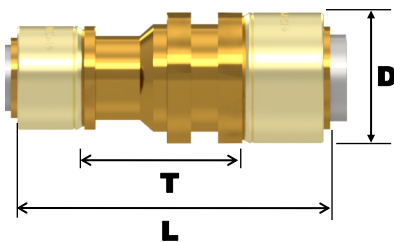
ARED Reducer



The reducer joins unequal size copper refrigeration tubing by means of a permanent mechanical seal.

The reducer is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The reducer is intended for use with C12200 Type L copper tube conforming to dimensions of ASTM B280. All tempers of copper tube may be used (O60, H55, H58). Coupling may also be used with C19400 copper alloy.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

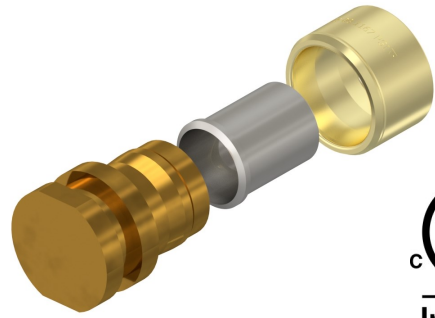


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TUBE SIZES Inches	PART NUMBER	L Inches (mm)	D Inches (mm)	T (Takeoff) Inches (mm)
3/8" to 1/4"	ARED-0302	1.36 (34.5)	0.63 (16.0)	0.49 (12.4)
1/2" to 3/8"	ARED-0403	1.92 (48.8)	0.75 (19.0)	0.98 (24.9)
5/8" to 1/2"	ARED-0504	2.23 (56.7)	0.91 (23.1)	1.08 (27.6)
3/4" to 1/2"	ARED-0604	2.44 (62.0)	1.04 (26.4)	1.17 (29.7)
3/4" to 5/8"	ARED-0605	2.51 (63.8)	1.04 (26.4)	1.10 (28.0)
7/8" to 5/8"	ARED-0705	2.75 (70.0)	1.22 (31.0)	1.27 (32.2)
7/8" to 3/4"	ARED-0706	2.87 (73.0)	1.22 (31.0)	1.26 (32.0)
1-1/8" to 3/4"	ARED-0906	3.70 (93.6)	1.54 (39.1)	1.92 (48.7)
1-1/8" to 7/8"	ARED-0907	3.74 (95.1)	1.54 (39.1)	1.88 (47.9)
1-3/8" to 1-1/8"	ARED-1109	4.24 (107.6)	1.81 (46.0)	2.11 (53.7)



CAP End Cap

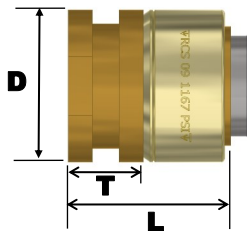


These fittings cap (blank off) copper refrigeration tubing by means of a permanent mechanical seal.

The cap is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The cap is intended for use with C12200 Type L copper tube conforming to dimensions of ASTM B280. All tempers of copper tube may be used (O60, H55, H58). Coupling may also be used with C19400 copper alloy.

Ported pressure test cap with 1/8" NPT Schrader valve available in sizes 5/8, 3/4, 7/8, and 1 1/8 inch.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO2) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.



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TUBE SIZE Inches (mm)	PART NUMBER	L Inches (mm)	D Inches (mm)	T (Takeoff) Inches (mm)
1/4" (6.35)	CAP0-02	1.12 (34.5)	0.63 (16.0)	0.67 (12.4)
3/8" (9.52)	CAP0-03	0.87 (34.5)	0.63 (16.0)	0.42 (12.4)
1/2" (12.70)	CAP0-04	0.96 (38.5)	0.75 (19.0)	0.44 (12.9)
5/8" (15.88)	CAP0-05	1.15 (47.0)	0.91 (23.0)	0.50 (14.4)
3/4" (19.05)	CAP0-06	1.26 (51.8)	1.04 (26.4)	0.48 (12.9)
7/8" (22.22)	CAP0-07	1.35 (56.3)	1.22 (30.9)	0.50 (13.4)
1-1/8" (28.58)	CAP0-09	1.92 (74.8)	1.54 (39.0)	0.90 (23.3)
1-3/8" (34.92)	CAP0-11	1.96 (77.8)	1.81 (46.0)	0.84 (22.4)
1-5/8" (41.28)	CAP0-13	1.96 (78.1)	2.11 (53.5)	0.84 (22.6)



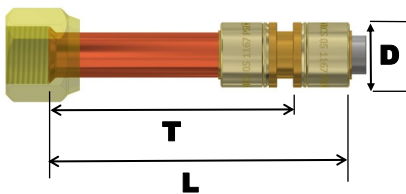
AFLR Flare Kit



These kits connect copper refrigeration tubing to the mechanical equipment by means of a permanent mechanical seal to a JIS B 8607 Class 2 Flare Stub. To ensure equipment compatibility, this kit is designed to utilize the factory Flare Nut provided with the original equipment.

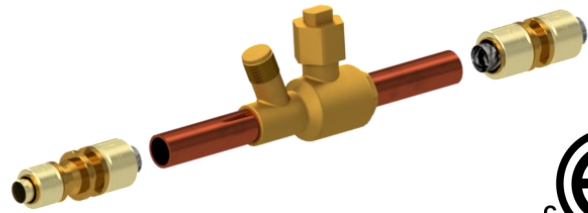
The fitting is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The copper flare stub allowable working pressure is equal to the annealed copper tube rating by tube size per ASME B31.5. The fitting is intended for use with C12200 Type L copper tube conforming to dimensions of ASTM B280. All tempers of copper tube may be used (O60, H55, H58). Fitting may also be used with C19400 copper alloy.

Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The flare nut is NOT included with the kit. The factory flare nut must be used and installed prior to final installation of the flare coupling. The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.



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TUBE SIZE Inches (mm)	PART NUMBER	L Inches (mm)	D Inches (mm)	T (Takeoff) Inches (mm)
1/4" (6.35)	AFLR-02	4.92 (124.7)	0.63 (16.0)	4.49 (114)
3/8" (9.52)	AFLR-03	4.92 (124.7)	0.63 (16.0)	4.49 (114)
1/2" (12.70)	AFLR-04	5.01 (127.3)	0.75 (19.0)	4.51 (115)
5/8" (15.88)	AFLR-05	5.21 (132.3)	0.91 (23.0)	4.57 (116)
3/4" (19.05)	AFLR-06	5.27 (133.9)	1.04 (26.4)	4.51 (115)



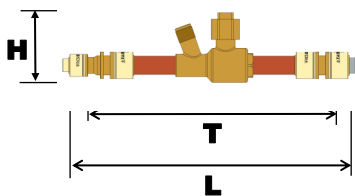
BVA Isolation Ball Valve

The full port ball valve connects to copper refrigeration tubing by means of a permanent mechanical seal.

The valve is supplied with straight ends configuration, ETL listed for U.S. and Canada with an allowable working pressure of 700 PSIG per UL-207. The valve is compatible with all Group A1 refrigerants and all refrigeration oils. The valve is internally equalized ball design, full port, bi-directional flow, with PTFE rupture-proof encapsulated stem seals.

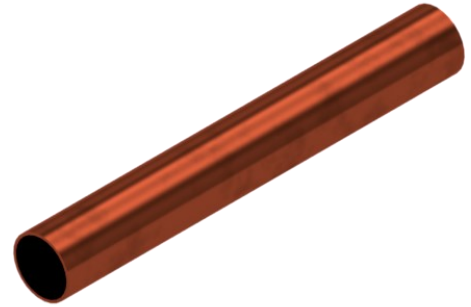
The fitting is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The fitting is intended for use with C12200 Type L copper tube conforming to dimensions of ASTM B280. All tempers of copper tube may be used (O60, H55, H58). Fitting may also be used with C19400 copper alloy.

Application	High Pressure HVAC/R
Max Rated Pressure	700 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3 and directive 2014/68EU
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The couplings are shipped loose for field installation on to the valve. The valve is supplied with line size couplings with special tube support adaptor inserts for the valve side (Black), standard inserts for the lineside (Clear/Silver), and a 3/4 inch thick insulation jacket. The valve and fittings must be installed per both RCS and NDL, Inc. installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.



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TUBE SIZE Inches (mm)	PART NUMBER	L Inches (mm)	H Inches (mm)	T (Takeoff) Inches (mm)
1/4" (6.35)	BVA-02	8.12 (206.4)	2.02 (51.3)	7.31 (185.7)
3/8" (9.52)	BVA-03	8.12 (206.4)	2.02 (51.3)	7.31 (185.7)
1/2" (12.70)	BVA-04	8.52 (216.4)	2.02 (51.3)	7.57 (192.3)
5/8" (15.88)	BVA-05	9.13 (231.8)	2.30 (58.4)	7.90 (200.8)
3/4" (19.05)	BVA-06	9.38 (238.4)	2.60 (66.0)	8.00 (203.2)
7/8" (22.22)	BVA-07	9.84 (249.8)	2.60 (66.0)	8.30 (210.7)
1-1/8" (28.58)	BVA-09	11.37 (288.8)	3.27 (83.0)	9.50 (241.2)



CT-XXXX-H55 Bendable Copper Tube

Copper is C12200, Seamless, Light Drawn (H55), Type L, ACR/MED bendable quality tubing, conforming to ASTM B75. The copper tube meets dimensional, chemical, mechanical strength, cleanliness, and eddy current testing requirements of ASTM B280 and ASTM B819 as applicable.

Light drawn (H55) tubing is a bendable quality tube in straight lengths, approved for field bending without annealing.

Tube ends are sealed with plugs to maintain cleanliness.

Allowable strength per ASME B31.5-2016 Table 502.3.1

Application	High Pressure HVAC/R
Allowable Strength*	10,300 psi (10.3 ksi) at 250°F per ASM B31.5-2016 when used with mechanically attached fittings
Standards	ASTM B75, ASTM B280, and ASTM B819
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The tubing is suitable for use with R744 (CO ₂) when used within the design pressure rating. The tubing is not suitable for use with ammonia (R 717) or Methyl Chloride (R40) refrigerants.
Installation	The tubing must be installed by skilled installers, trained in the application and installation of H55 (half hard) temper copper tubing and RCS fittings.

TUBE SIZE Inches (mm)	PART NUMBER	LENGTH Feet (m)	OUTSIDE DIAMETER Inches (mm)	WALL THICKNESS Inches (mm)	Min Bend Radius Inches (mm)	ALLOWABLE PRESSURE PSI (bar)
1/4" (6.35)	CT-0250-H55	19 (5.8)	0.250 (6.35)	0.030 (0.76)	0.69 (17.5)	2,735 (188.5)
3/8" (9.52)	CT-0375-H55	19 (5.8)	0.375 (9.52)	0.030 (0.76)	1.13 (28.6)	1,761 (121.4)
1/2" (12.70)	CT-0500-H55	19 (5.8)	0.500 (12.70)	0.035 (0.89)	1.50 (38.1)	1,528 (105.3)
5/8" (15.88)	CT-0625-H55	19 (5.8)	0.625 (15.88)	0.040 (1.02)	2.19 (55.6)	1,390 (95.8)
3/4" (19.05)	CT-0750-H55	19 (5.8)	0.750 (19.05)	0.042 (1.07)	2.63 (66.7)	1,208 (83.3)
7/8" (22.22)	CT-0875-H55	19 (5.8)	0.875 (22.22)	0.045 (1.14)	3.06 (77.8)	1,105 (76.2)
1-1/8" (28.58)	CT-1125-H55	19 (5.8)	1.125 (28.58)	0.050 (1.27)	3.94 (100.0)	949 (65.5)
1-3/8" (34.92)	CT-1375-H55	19 (5.8)	1.375 (34.92)	0.055 (1.40)	4.81 (122.2)	851 (58.7)
1-5/8" (41.28)	CT-1625-H55	19 (5.8)	1.625 (41.28)	0.060 (1.52)	5.69 (144.5)	784 (54.0)

*The allowable working pressures in the table above are based on the allowable strength value shown in ASME B31.5-2016 Table 502.3.1 for C12200, Light Drawn copper tube at 250°F, nominal wall thickness and NOT brazed.

CL-648

LOCTITE® 648™ Retaining Compound

Technology	Acrylic
Chemical Type	Urethane methacrylate
Appearance (uncured)	Green liquid
Fluorescence	Positive under UV light
Components	One component - requires no mixing
Viscosity	Low
Cure	Anaerobic
Secondary Cure	Activator
Application	Retaining
Strength	High



Application

LOCTITE® 648™ is designed for the bonding of cylindrical fitting parts. The product cures when confined in the absence of air between close fitting metal surfaces and prevents loosening and leakage from shock and vibration. LOCTITE® 648™ provides robust curing performance. It not only works on active metals (e.g. mild steel) but also on passive substrates such as stainless steel and plated surfaces. The product offers high temperature performance and oil tolerance. It tolerates minor surface contaminations from various oils, such as cutting, lubrication, anti-corrosion and protection fluids.

Limitation

- This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a sealant for chlorine or other strong oxidizing materials.
- For safe handling information on this product, consult the Safety Data Sheet (SDS).
- Where aqueous washing systems are used to clean the surfaces before bonding, it is important to check for compatibility of the washing solution with the adhesive. In some cases these aqueous washes can affect the cure and performance of the adhesive.
- This product is not normally recommended for use on plastics (particularly thermoplastic materials where stress cracking of the plastic could result). Users are recommended to confirm compatibility of the product with such substrates.

Storage

- Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.
- Optimal Storage: 8 °C to 21 °C. Storage below 8 °C or greater than 28 °C can adversely affect product properties. Material removed from containers may be contaminated during use.



CS92 Silicone Cold Shrink Sleeve

Application

The CS92 Cold Shrink Protective Sleeve is an open ended silicone rubber sleeve pre-expanded and assembled onto a plastic removable core. The plastic core is removed when the sleeve is positioned for installation over an RCS mechanically attached fitting. Silicone Cold Shrink is used to protect the steel collars used on RCS fittings from moisture when installed under thermal insulation.

This cold shrink tube is recommended for all RCS fittings installed on insulated piping located outdoors and on all RCS fittings used at the piping connection to VRF outdoor units.

These sleeves should also be installed on RCS fittings wherever the piping insulation cannot be installed per the insulation manufacturer's instructions.

Installation

- ① Locate the plastic core pull strip on the cold shrink and note the pull direction orientation.
- ② **IMPORTANT:** Slide the Cold Shrink sleeve onto the tubing section to be joined before installing the RCS mechanically attached fittings. Make sure that adequate space is available to remove the plastic core in later step.
- ③ Install the RCS fitting per the detailed installation instructions.
- ④ After pressure and leak testing has shown the fitting joint to be acceptable, center the Cold Shrink sleeve on the fitting to be covered.
- ⑤ Pull the plastic strip slowly in the direction labeled on the Cold Shrink sleeve and allow the rubber sleeve on the opposite end to shrink onto the tube at the predetermined position on the copper tube.
- ⑥ After the rubber sleeve takes firm hold of the tube, continue to pull the strip smoothly till the entire plastic core is removed and the rubber sleeve is in complete contact with the copper tube and the enclosed fitting.
- ⑦ Insulate the piping system as required following the insulation manufacturer's detailed instructions.

FITTING RANGE Inches (mm)	PART NUMBER	LENGTH inches (mm)	DIAMETER Inches (mm)	OD Maximum Inches (mm)	OD Minimum Inches (mm)	THICKNESS After Shrinkage Inches (mm)
5/8" to 1/4"	CS92-0502	5.5 (140)	0.98 (25)	0.83 (21.0)	0.25 (6.3)	0.10 (2.5)
3/4" to 3/8"	CS92-0603	6.3 (160)	1.18 (30)	0.98 (25.0)	0.34 (9.1)	0.10 (2.5)
7/8" to 1/2"	CS92-0704	7.1 (180)	1.38 (35)	1.19 (30.1)	0.41 (10.4)	0.10 (2.5)
1-1/8" to 1/2"	CS92-0904	7.9 (200)	1.77 (45)	1.57 (40.0)	0.50 (12.7)	0.12 (3.0)
1-5/8" to 7/8"	CS92-1307	9.8(250)	2.36 (60)	2.09 (53.0)	0.72 (18.2)	0.12 (3.0)

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PSP45-18

RCS Battery Powered Press Tool System

The PSP45-18 Battery Powered Press Tool package is a powerful tooling system designed for convenient, fast, and reliable pressing of linear type flame-free mechanically attached fittings. By combining a high quality powerful hydraulic tool with long lasting Lithium-Ion battery, rapid charging technology, and RCS quick-change clamps and inserts system into a total tooling packaged solution, field installation of RCS fittings can be safely, consistently, and efficiently made. This tooling system also works on most currently available linear-press type fittings in the HVAC and refrigeration market today.

The packaged tooling system consists of two specially designed kits, the hydraulic press tool kit with its companion 18 volt battery and charger, and the quick-change clamps and inserts kit with sliding clamps and tool inserts to fit 1/4 through 1 5/8 inch fittings.

KL45KN Battery Powered Press Toolkit

- 1 ea. 45 KN Hand Tool
- 1 ea. 4 Amp-HR, 18V, Li-Ion Battery
- 1 ea. Battery Rapid Charger
- 1 ea. Carrying Case with Operation Instructions

RCS18PC Quick-Change Clamps & Inserts Kit

- 1 pair Universal Press Clamps with
 - 1/4"-3/8" Clamp Inserts
 - 1/2" Clamp Inserts
 - 5/8" Clamp Inserts
 - 3/4" Clamp Inserts
 - 7/8" Clamp Inserts
 - 1-1/8" Clamp Inserts
- 1 pair 1-3/8" Dedicated Press Clamps
- 1 pair 1-5/8" Dedicated Press Clamps
- 1 ea. Carrying Case



Limitations

Not for use in hazardous, explosive, or wet environment.

The assembly of gas pipes in gas distribution line with this tool is prohibited.

For use by qualified & trained professionals only.



The tool operates at high closing pressure and can cause severe damage or injury.



For use by professionally trained technician only.



PSS45-12

RCS Selector Box Press Tool Kit

The PSS45-12 tool kit is a scaled down version of the master tool package and is intended for use in the installation of RCS fittings on to VRF Branch or Mode Selector boxes, or for small diameter copper refrigerant tubing system up to 1 1/8" Inch O.D. The rapid charger and large tube diameter dedicated press clamps are NOT included in this kit allowing for a compact, light-weight, and convenient portable toolkit. This tooling system also works on most currently available linear-press type fittings in the HVAC and refrigeration market today.

Tool Kit Components

- 1 ea. 45 KN Hand Tool
 - 1 ea. 4 Amp-HR, 18V, Li-Ion Battery
 - 1 pair Universal Press Clamps with
 - 1/4"-3/8" Clamp Inserts
 - 1/2" Clamp Inserts
 - 5/8" Clamp Inserts
 - 3/4" Clamp Inserts
 - 7/8" Clamp Inserts
 - 1-1/8" Clamp Inserts
 - 1 ea. Carrying Case
- *Rapid charger is NOT included and is sold separately



Limitations

Not for use in hazardous, explosive, or wet environment.

The assembly of gas pipes in gas distribution line with this tool is prohibited.

For use by qualified & trained professionals only.



The tool operates at high closing pressure and can cause severe damage or injury.



For use by professionally trained technician only.

KL45KN

Klauke Battery Powered Pressing Tool Kit

Characteristics

Time saved when multiple pressing by means of automatic piston return
 Very high safety factor based on "Quickstop" function
 Precise pressing force due to HPC pressure monitoring with audible signal
 Long battery and tool service life due to "Autostop" after the pressing operation
 Quick-change system for pressing clamps
 Tool information shown via LED display
 Illumination for working safely
 Compact design for optimum access to the installation
 Effortless working due to low weight and ergonomic design
 Secure grip due to innovative 2-component housing
 Easy 1-handed operation
 High-quality, powerful Makita Li-Ion technology for lasting, battery-powered pressing
 Makita i-press batteries and chargers available worldwide

Tool Kit Components

MAPAX4L hydraulic press tool
 Makita 18 volt 4Ah battery
 Makita rapid charger
 *Press Clamps & Clamp Inserts sold separately

Limitations

Not for use in hazardous, explosive, or wet environment.
 The assembly of gas pipes in gas distribution line with this tool is prohibited.
 For use by qualified & trained professionals only.

Technical data	KLAUKE® MAPAX4L
Crimping force	Linear thrust of approx. 45kN
Number of presses	Approx. 250 4.0 Ah battery
Battery capacity	4.0 Ah 18V Makita Li-Ion battery
Charging time	40 min. or less 4.0 Ah



The tool operates at high closing pressure and can cause severe damage or injury.



For use by professionally trained technician only.



DB32

Digital Tubing Bender

Characteristics

Angle Capacity: 190°

1.7kw / 2.3 HP, 120VAC / 1 phase

Dimensions: 25"L x 10"W x 7.5"D

Net Weight: 31 lb.

Digital Readout Display 0° - 180° for repetitive bends

Automatic stop at predetermined angle. Set with thumb screw. Displayed on digital readout

High reduction gear box for increased torque

Low friction guide shoe

Forward and Reverse switch

Bends made at 3.5 RPM with soft start

Tube Size Range:

5/8" OD, Bend Radius = 2.5"

3/4" OD, Bend Radius = 3.0"

7/8" OD, Bend Radius = 3.5"

1-1/8" OD, Bend Radius = 4.5"

1-3/8" OD, Bend Radius = 4.8"

Tool Kit Components

1 ea. DB32 Electric Tubing Bender

1 ea. Tripod Mounting Stand

1 ea. Back Former Mounting Post

Bending Formers and Back Formers for:

5/8" OD ACR (Bendable Quality)

3/4" OD ACR (Bendable Quality)

7/8" OD ACR (Bendable Quality)

1-1/8" OD ACR (Bendable Quality)

1-3/8" OD ACR (Bendable Quality)

1 ea. Carrying Case for Bender and Formers



CE CB

Limitations

Use ONLY with O60 annealed or H55 Light Drawn ACR copper tubing with OD as listed above.

DO NOT BEND H58 GENERAL PURPOSE DRAWN.

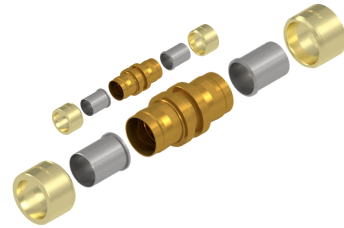
Do NOT unbend a previous bend. This will cause tube failure.



The tool operates at tremendous forces and can cause severe damage or injury.



For use by professionally trained technician only.



ODXHP-XXX Outdoor Heat Pump Unit Connector Kit

These kits provide the necessary couplings and reducers to connect VRF outdoor condensing unit to the refrigerant piping system. Each kit is custom built to match the project system selection lay-out as provided by the customer. The couplings, reducers, and silicone cold shrink sleeves are shipped loose for field installation on to the condensing unit connecting piping. Adequate tool clearance must be confirmed prior to installation. Accessory tubing and Multi-Frame Y-Branch pipe kits are NOT included and must be installed separately.

All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

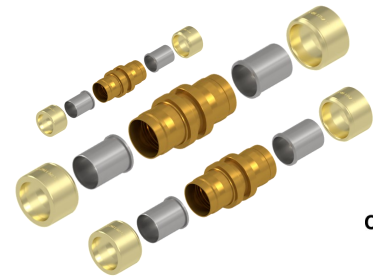
Specialty tube support inserts may be supplied with the kit for proper fit onto certain condensing unit connecting pipe. Refer to RCS installation instructions for details prior to installing these fittings.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

OUTDOOR HEAT PUMP UNIT CONNECTOR KITS

ODSHP---072	ODDHP---192	ODDHP---264	ODTHP---360
ODSHP---096	ODDHP---216	ODDHP---288	ODTHP---384
ODSHP---120	ODDHP---240	ODDHP---312	ODTHP---408
ODSHP---121	ODDHP---241	ODDHP---336	ODTHP---432
ODSHP---144			ODTHP---456
ODSHP---168			ODTHP---480
			ODTHP---504

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ODXHR-XXX Outdoor Heat Recovery Unit Connector Kit

These kits provide the necessary couplings and reducers to connect VRF outdoor condensing unit to the refrigerant piping system. Each kit is custom built to match the project system selection lay-out as provided by the customer. The couplings, reducers, and silicone cold shrink sleeves are shipped loose for field installation on to the condensing unit connecting piping. Adequate tool clearance must be confirmed prior to installation. Accessory tubing and Multi-Frame Y-Branch pipe kits are NOT included and must be installed separately.

All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

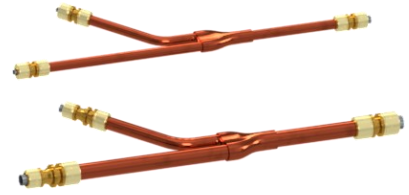
Specialty tube support inserts may be supplied with the kit for proper fit onto certain condensing unit connecting pipe. Refer to RCS installation instructions for details prior to installing these fittings.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

OUTDOOR HEAT RECOVERY UNIT CONNECTOR KITS

ODSHR---072	ODDHR---192	ODDHR---264	ODTHR---360
ODSHR---096	ODDHR---216	ODDHR---288	ODTHR---384
ODSHR---120	ODDHR---240	ODDHR---312	ODTHR---408
ODSHR---121	ODDHR---241	ODDHR---336	ODTHR---432
ODSHR---144			ODTHR---456
ODSHR---168			ODTHR---480
			ODTHR---504

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PKHPMAX

Multi-Frame Heat Pump Unit Pipe Kit

These kits are a braze-free alternative to the equipment manufacturer Outdoor Unit Multi Connection Pipe Kits. These outdoor pipe kits provide the necessary Y-Branch fittings, couplings, reducers, to field connect dual and triple frame VRF outdoor units to the refrigerant tubing system by means of permanent mechanical connection. Each kit is custom built to match the project system selection lay-out as provided by the customer.

The Y-branch, couplings, reducers, and silicone cold shrink sleeves are shipped loose for installation on to the field piping. Accessory tubing and outdoor unit connectors are NOT included and must be installed separately.

All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

Refer to RCS installation instructions for details prior to installation.

*The copper Y-Branch center fittings are not UL Listed component.

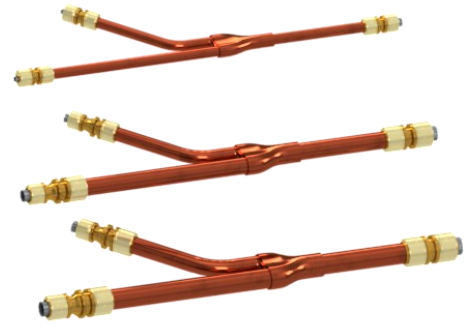
Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO2) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings.

DUAL FRAME HEAT PUMP	TRIPLE FRAME HEAT PUMP
PKHPMA2-XXX-N21	PKHPMA3-XXX-N31
PKHPMA2-XXX-P100	PKHPMA3-XXX-P151
PKHPMA2-XXX-21SA	PKHPMA3-XXX-30SA

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PKHRMAX Multi-Frame Heat Recovery Unit Pipe Kit



These kits are a braze-free alternative to the equipment manufacturer Outdoor Unit Multi Connection Pipe Kits. These outdoor pipe kits provide the necessary Y-Branch fittings, couplings, reducers, to field connect dual and triple frame VRF outdoor units to the refrigerant tubing system by means of permanent mechanical connection. Each kit is custom built to match the project system selection lay-out as provided by the customer.

The Y-branch, couplings, reducers, and silicone cold shrink sleeves are shipped loose for installation on to the field piping. Accessory tubing and outdoor unit connectors are NOT included and must be installed separately.

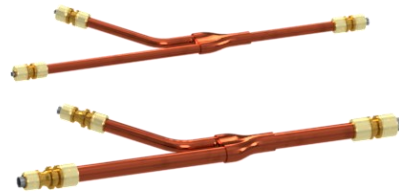
All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

Refer to RCS installation instructions for details prior to installation.

*The copper Y-Branch center fittings are not UL Listed component.

Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings.

DUAL FRAME HEAT RECOVERY	TRIPLE FRAME HEAT RECOVERY
PKHRMA2-XXX-B21	PKHRMA3-XXX-B31
PKHRMA2-XXX-P100	PKHRMA3-XXX-P151
PKHRMA2-XXX-21SX	PKHRMA3-XXX-30SX



PKHP Heat Pump Y-Branch Pipe Kit

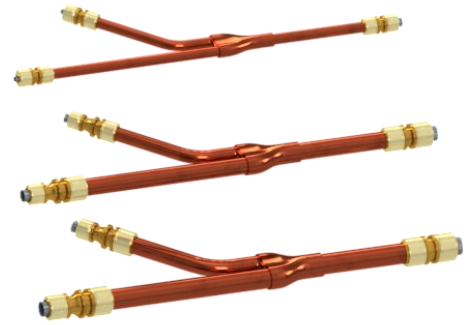
These kits provide the necessary Y-Branch fittings, couplings, reducers, and/or caps to field erect a VRF refrigerant tubing system by means of permanent mechanical connection. Each kit is custom built to match the project system selection layout as provided by the customer. The couplings and reducers are shipped loose for field installation on to the respective Y-Branched. Refer to RCS installation instructions for details prior to installation.

*The copper Y-Branch center fittings are not UL Listed component.

Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

KIT NUMBER	LIQUID	LP GAS
PKHPA16	YDP-030303	YDP-050504
PKHPA22	YDP-030303	YDP-060605
PKHPA28	YDP-030303	YDP-060605
PKHPB33	YDP-030303	YDP-060605
PKHPB45	YDP-050504	YDP-090907
PKHPC69	YDP-060605	YDP-090907
PKHPC71	YDP-060605	YDP-090907
PKHPC72	YDP-050504	YDP-090906
PKHPD73	YDP-060605	YDP-111109
PKHPD90	YDP-060605	YDP-111109
PKHPD145	YDP-060605	YDP-111109

In a continuing effort to offer the best product possible, we reserve the right to change, without notice, specifications, and/or materials. Technical specification sheets appearing on refcouplingsys.com are the most recent data available.



PKHR Heat Recovery Y-Branch Pipe Kit

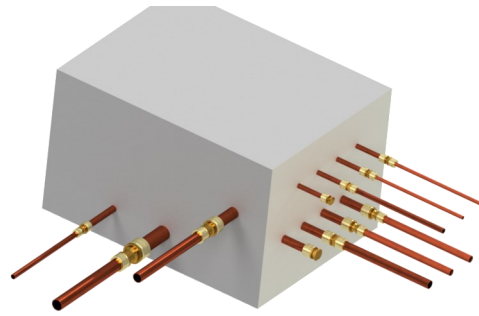
These kits provide the necessary Y-Branch fittings, couplings, reducers, and/or caps to field erect a VRF refrigerant tubing system by means of permanent mechanical connection. Each kit is custom built to match the project system selection layout as provided by the customer. The couplings and reducers are shipped loose for field installation on to the respective Y-Branches. Refer to RCS installation instructions for details prior to installation.

*The copper Y-Branch center fittings are not UL Listed component.

Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

KIT NUMBER	LIQUID	LP-GAS	HP-GAS
PKHRE14	YDP-030303	YDP-060605	YDP-050504
PKHRE16	YDP-030303	YDP-050504	YDP-050504
PKHRE22	YDP-030303	YDP-060605	YDP-050504
PKHRE28	YDP-030303	YDP-060605	YDP-060605
PKHRF33	YDP-030303	YDP-060605	YDP-060605
PKHRF45	YDP-050504	YDP-090907	YDP-060605
PKHRG56	YDP-060605	YDP-090907	YDP-060605
PKHRG71	YDP-060605	YDP-090907	YDP-090906
PKHRG72	YDP-050504	YDP-090906	YDP-060605
PKHRH73	YDP-060605	YDP-111109	YDP-090906
PKHRH90	YDP-060605	YDP-111109	YDP-090907
PKHRH145	YDP-060605	YDP-111109	YDP-090907

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SB-XXX Branch Selector Box Connection Kit

These kits provide the necessary couplings, reducers, and/or caps to connect VRF Branch Selector Boxes to outdoor unit piping and indoor unit piping. Each kit is custom built to match the project system selection lay-out as provided by the customer. The couplings, reducers, flare tube kits, or closed pipe caps are shipped loose for field installation on to the selector box.

Specialty tube support adaptor inserts may be supplied with the kit for proper fit onto certain selector box connecting pipe. Contact RCS customer service team for more details on tube inserts for your selected equipment.

Refer to RCS installation instructions for details prior to installing these fittings.

Application	High Pressure HVAC/R
Max Rated Pressure	1167 psi (80 bar)
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.
Installation	The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings. Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.
Warning	All equipment manufacturers' installation restrictions must be strictly followed. The use of RCS flame-free mechanically attached fittings does not relief the installer from following the equipment manufacturers installation requirements. Except for factory male flare ends, all factory swaged-ends must be cut off the Selector Box to provide for actual line size in order to install RCS flame-free mechanically attached fittings. A minimum of 3 1/8 inches of straight tube clearance from the selector box bulkhead and 1 5/8 inch clearance between adjacent tubes are required to engage the press tool.

SINGLE PORT	MULTI-PORT	
SBXXX01P36	SBXXX02P	SBXXX08P
SBXXX01P48	SBXXX03P	SBXXX10P
SBXXX01P60	SBXXX04P	SBXXX12P
SBXXX01P96	SBXXX06P	

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FFC & HFC Indoor Fan Coil Connection Kit



These fan coil connection kits are pre-configured combination packages of flare tube kits, couplings, or reducers to connect the liquid and suction lines of fan coils with flare connections and large horizontal outside air units to the piping system. To ensure equipment compatibility, the pre-flared kits are designed to utilize the factory Flare Nut provided with the original equipment.

The copper flare tube provided with the fitting is annealed (O60) C12200 copper tube and conforms to JIS B 8607 Class 2 dimensional requirements. The copper flared tube allowable working pressure is equal to the annealed copper tube rating by tube size per ASME B31.5.

The Coupling is ETL listed for U.S. and Canada with an allowable working pressure of 1167 PSIG per UL-207. The fitting is intended for use with C12200 Type L copper tube conforming to ASTM B280. All tempers of copper tube may be used (O60, H55, H58). The fitting may also be connected to C19400 copper alloy.

Specialty tube support inserts may be supplied with the kit for proper fit onto certain fan coil connecting tubing. Refer to RCS installation instructions for details prior to installing these fittings.

Application	High Pressure HVAC/R
Max Rated Pressure	600 psi
Compatible Tubing	Seamless Copper Tubing, Drawn H58, Light Drawn H55, or Annealed O60 made to ASTM B280 and ASTM B75 Standard.
Agency Approval	ETL Listed 5011885. Conforms to UL 207 STD. Certified to CSA STD C22.2#140.3
Refrigerants	All CFC, HCFC, HFC, HFO, and class A2L refrigerants and refrigeration oils. The product is suitable for use with R744 (CO ₂) when used within the design pressure rating. The product is not suitable for use with ammonia, methyl chloride, hazardous or flammable refrigerants from Group 2 or 3 per ASHRAE 15.

Installation The fittings must be installed per RCS installation instructions by skilled installers, trained specifically in the application and installation of RCS fittings.

Contact RCS, Inc. for alternative tube support inserts when installing fittings on annealed copper coils or pre-insulated line sets with tube wall thicknesses less than specified by ASTM B280. Do not use on annealed copper sizes larger than 5/8" O.D.

RCS KIT NUMBER	1/4" LIQUID	3/8" LIQUID	1/2" LP GAS	5/8" LP GAS	3/4" LP GAS	7/8" LP GAS
FFC-0204	AFLR-02		AFLR-04			
FFC-0305		AFLR-03		AFLR-05		
HFC-F3-0606		AFLR-03			ACPLT-06	
HFC-F3-0706		AFLR-03			ARED-0706	
HFC-F3-0707		AFLR-03				ACPLT-07
HFC-F3-0807		AFLR-03				ARED-0807

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Safety Precautions

Warnings and Caution Labels

To assure installer safety and proper installation procedures of our mechanically attached fitting system; please read, understand, and follow the contents of this document, which provides important information regarding the installation of RCS products.

When used in this document or labeled on packaging or products, the following hazard symbols and/or associated words are defined as follows.



WARNING: This symbol and/or the use of the word WARNING indicates a potential hazard associated with the use of this tool or material. It calls attention to a procedure, practice, condition, or like, which if not correctly performed or adhered to, could result in death or serious injury.



WARNING: This symbol and/or the use of the word WARNING indicates a potential hazard from electrical shock. It calls attention to a procedure, practice, condition, or like which if not correctly performed or adhered to, could result in death or serious injury.



CAUTION: This symbol and/or the use of the word CAUTION indicates a potential hazard associated with the use of this tool or material. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in minor or moderate injury.



IMPORTANT: The use of the word IMPORTANT in this manual calls attention to a procedure, practice, condition, or like, which if not correctly performed or adhered to, could result in incorrect performance of, or damage to the equipment, and may void the warranty.

Safety Precautions



WARNING: The battery operated hand tool and the electric tube bender are NOT designed to be intrinsically safe for use in areas classified as hazardous locations. For your safety, DO NOT use them in hazardous (classified) locations.



WARNING: In case of malfunction, DO NOT continue to use the tool if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply, remove the battery, and contact the nearest service center.



WARNING: The tool operates at high closing pressure and can cause severe damage or injury. Keep all body parts and foreign objects clear of the tool hydraulic ram and the clamps. Remove the battery when the tool is not in use.

Coupling Installation Guide

Tools and Supplies

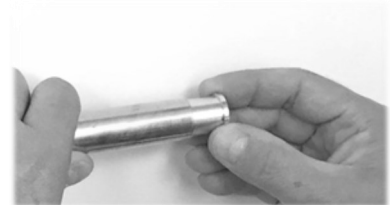
Press Tool
Loctite 648 or Loctite 603 retaining compound
Tubing cutter with sharp cutting wheel
De-burring tool
Permanent marker
Dry, clean, lint free rags or paper towels
Eye protection



Assembly

① Measure the tubing carefully and cut to the required length. Ensure the cutting wheel is sharp. Advance the cutter in small steps to minimize deformation of the tube at the cut end to reduce de-burring time.

② De-burr the end of the tube so that the RCS Inc. tubing insert will fit fully into the tube. Inspect the tubing and ensure the inside and outside of the tubing is clean and free of contamination and scratches along the entire length of the tube.



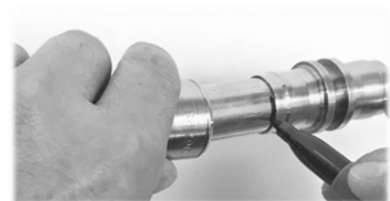
CAUTION: When installing copper tubing always use tools that are designated for exclusive use on copper. Tools that have been used on dissimilar metals may contaminate the material, which may lead to corrosion and tube failure. Always ensure tools are appropriately cleaned to avoid tubing contamination.

WARNING: Failure to abide by the proper tubing preparation procedures listed in this document may result in leaks or corrosion of materials. RCS Inc. does not assume liability for any damage caused by leaking or corroding material due to improper tubing preparation.

③ Place a tube insert of the proper size into the end of the tubing to be joined. If the tube insert does not fully fit in to the tubing with reasonable pressure, the tubing may not be adequately de-burred and will require additional de-burring. If the end of the tubing is deformed, a new square cut must be made.

④ Slide the collar over the tube with the bevel/groove of the collar facing the joint to be made.

⑤ Place the coupling body onto the end of the tube until the end of the tube insert butts against the internal stop of the coupling. With a permanent marker, mark a tube insertion depth reference line on to the tubing at the end of the coupling's body.

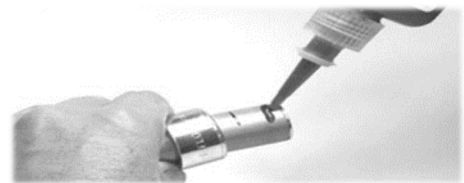


⚠ **IMPORTANT:** The tube insertion depth reference mark will be used to confirm that the tube was fully seated in to the coupling body after the compression of the joint.

⚠ **IMPORTANT:** After making the tube insertion depth reference mark is made in step (5), the proper depth can be confirmed by butting the end of the tubing with the insert in place against the shoulder of the coupling. The tube insertion depth reference mark should show to be just past the end of the coupling.

⑥ After marking the tubing, remove the coupling from the tube, leaving the tube insert and the collar in place with the bevel edge facing towards the tube end.

⑦ With the tube insert in place, apply Loctite 648 to the outside diameter of the tube end to be joined. Keep the Loctite 1mm away from the end of the tube/tube insert and distribute the Loctite completely around the perimeter of the tube. Do not extend Loctite past the tube insertion depth reference mark.



⚠ **WARNING:** Loctite 648 or Loctite 603 may cause eye and skin irritation, allergic skin reaction, respiratory tract irritation, or harmful if swallowed. Refer to the product MSDS or TDS sheet for additional information.

- ⚠ **CAUTION:** DO NOT allow Loctite on the inside of the piping. DO NOT apply Loctite to the tubing INSERT. DO NOT apply Loctite between the COLLAR and the fitting BODY. Excessive or spilled Loctite should be wiped away immediately with a dry, clean, and lint-free rag.
- ⚠ **CAUTION:** FAILURE TO PROPERLY APPLY LOCTITE AS INSTRUCTED IN THIS DOCUMENT MAY RESULT IN FUTURE LEAKS. RCS, INC. DOES NOT ASSUME LIABILITY FOR ANY DAMAGE CAUSED BY LEAKING COUPLINGS DUE TO IMPROPER OR LACK OF LOCTITE APPLICATION.

⑧ Place the coupling body over the tube end. Ensure even distribution of the Loctite completely around the outside diameter of the tube. Verify the tube insertion depth reference mark (Step 5) aligns with the end of the coupling body.

⚠ **WARNING:** Failure to fully insert the tubing into the coupling body will compromise the integrity of the connection.

⑨ While keeping the tube seated inside the coupling body, slide the collar over the tapered end of the coupling body. Ensure that the bevel/groove of the collar is facing the fitting body. The fitting is now ready to be pressed on to the tube.

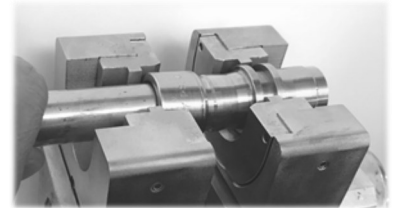


⚠ **WARNING:** Improper orientation of the collar may result in injury, or damage to the coupling, the tube, and/or the tool and its components.

⚠ **WARNING:** Failure to understand and abide by procedures as listed in this document as well as the tool manufacturer manual, battery/charger instructions, and data sheets provided by the manufacturers, may result in damage or injury. RCS, Inc. does not assume liability for any damage or injury caused by negligent handling or improper use of the hydraulic tool or any of its components.

⑩ Select the appropriate press clamps and slide into place on the hydraulic tool head until fully seated and engaged with ball detents. Secure the clamps using the clamp thumbscrews. Snap in place the selected clamp inserts on to the universal clamp as required.

⑪ With the tool in the full open position, maneuver the handheld tool into position for the connection. The tool landing area on the coupling should be fully seated on to one clamp insert, while the back of the collar is engaged with the opposite side clamp insert.



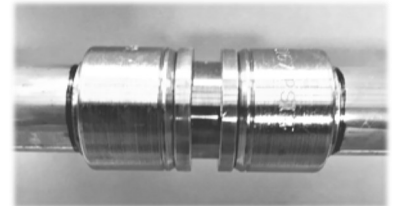
When making smaller connections, such as 1/4, 3/8, and 1/2 inch coupling, it is easier to align the tool to the coupling by reducing the distance of travel between the two clamps. To achieve this, activate the tool to pull the clamps closer together prior to mounting the coupling, collar, and tubing within the clamps. Keep all body parts and foreign objects clear of the tool head. All safety precautions must be followed to avoid damage or injury.

⚠ **WARNING:** Failure to ensure the fitting is aligned and fully seated in between the tool compression clamps may result in damage to the coupling, the tool, or injury to the operator.

⑫ While ensuring the tube remains fully seated within the coupling, press the tool trigger and allow the tool to compress the collar onto the coupling body. Keep the trigger pressed until the tool auto-retracts.

Final Inspection

- ☑ The collar is in the correct orientation and is fully seated and adjacent to the coupling shoulder on the body.
- ☑ Any gap between the collar and coupling shoulders are within 1mm.
- ☑ Verify that the tube insertion depth reference mark is visible and closely aligned with the end of the coupling body.



⚠ **CAUTION:** The maximum allowable distance between the collar and the coupling shoulder is 1mm. After compression, if the gap is wider than 1mm, immediately repress the coupling with the tool from a different angle.

⚠ **CAUTION:** Do not twist or bend the tubing after any coupling installation. Dry fit all elbows and connections prior to installation.

⚠ **CAUTION:** If the coupling is not visually acceptable, the coupling must be cut out and replaced with a new coupling.

⚠ **CAUTION:** If the collar is not oriented horizontally inline and flush against the coupling shoulder, the coupling must be cut out and replaced with a new coupling.

Reducer Installation Guide

The installation process of reducer/increaser is identical in sequence as the coupling, with the only difference being a different size of tool clamp or clamp insert is required to make the connection on the reducing end of the fitting.

All warnings and precautions stated in the coupling installation section are to be followed when making a reducer/increaser connection.

- ⚠ **WARNING:** The reducing side of the fitting only has one sided tool landing. Tool alignment is critical during the compression process of reducers/increasers. Care must be taken to ensure the fitting collar is in linear alignment throughout the compression process.

Flare Kit Installation Guide

Flare kits are time saving option providing a precision factory flare alternative to field made flare. The kits are designed to incorporate the factory flare nuts provided with the equipment to form a complete, reliable, and installer friendly assembly.

The flared copper stubs are materially compatible with all refrigerants and refrigerant oils.

- ⚠ **WARNING:** Flares may not be used in application where the operating or non-operating pressure exceeds 600 PSI.

① Remove the flare nut from the equipment to be incorporated with the RCS Flare kit. Be sure to use a back-up wrench on the factory male flare end to avoid damage to the equipment.

② Inspect the kit contents. The kit include: one class II pre-flared copper stub, one standard coupling body, two inserts, and two collars; the flare nut is from the original equipment and is not included with the kit.

③ Ensure that the tube insert fits into the line size end of the copper flare stub without interference. If necessary, de-burr and clean the non-flared end.

④ Inspect all flare mating surfaces to ensure they are smooth, clean, and free of debris.

⑤ Center the flared copper stub onto the threaded male port and slide the flare nut over the copper stub, hand-tightening the flare nut onto the threaded male port until it is snug and centered.

- ⚠ **WARNING:** Leaks may occur if the flared copper stub does not remain centered and aligned.

⑥ Engage the hex surface of the threaded male port with a back-up wrench and with a properly sized and calibrated torque wrench engaging the hex surface of the flare nut, tighten the flare nut until the equipment manufacturer's specified torque value is reached.

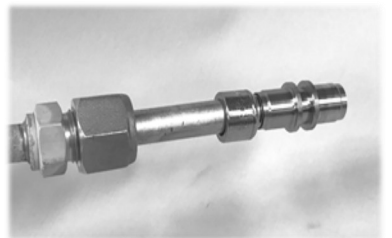
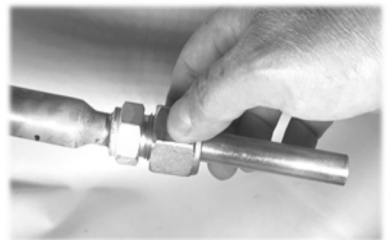
- ⚠ **WARNING:** A back-up wrench must be used to prevent damage to the unit during tightening.

- ⚠ **WARNING:** Leaks may occur if the specified torque value is not reached.

- ⚠ **WARNING:** Damage to the flare nut and leaks may occur if the torque value is exceeded.

⑦ After a few seconds, re-torque the flare nut to the same torque value to take up any joint relaxation.

⑧ Connect the system tubing to the flare stub by following RCS, Inc.'s coupling installation procedures.



Outdoor Unit Connector Kit Installation Guide

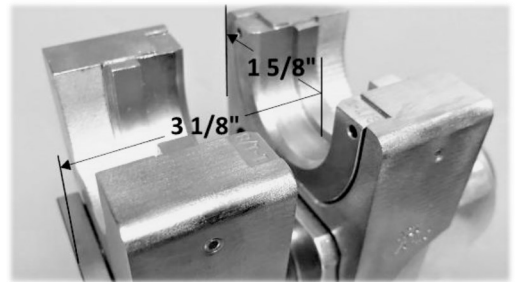
The ODXHP and ODXHR kits provide a flame-free connection solution to connect VRF heat pump and heat recovery outdoor units to the refrigerant piping system. Each kit contains appropriately sized couplings or reducers with companion Cold Shrink protective sleeves.

The couplings, reducers, and silicone cold shrink sleeves are shipped loose for field installation on to the condensing unit connecting piping. Adequate tool clearance must be confirmed prior to installation. Accessory tubing and Multi-Frame pipe kits are NOT included and must be purchased separately.

Specialty tube adaptor inserts may be supplied with the kit for proper fit onto certain condensing unit connecting pipe. Contact RCS customer service team for more details on tube inserts for your selected equipment.

⚠ WARNING: All factory swaged or capped ends at the service valves must be cut back to provide for actual line size in order to install RCS flame-free mechanically attached fittings.

⚠ WARNING: A minimum of 3 1/8 inches of straight tube clearance from the service valve body and 1 5/8 inch clearance between adjacent tubes are required to engage the press tool. Measure carefully and ensure that adequate tube lengths are available and there is clearance to operate the press tool without obstruction.



⚠ WARNING: To avoid injury to the operator, damage to the tool, damage to the fitting, or damage to the surrounding property, ensure there is a minimum of 6 inches of unobstructed clearance behind the press tool.

⚠ WARNING: All VRF equipment manufacturers' installation restrictions must be strictly followed. The use of RCS flame-free mechanically attached fittings does not relieve the installer from following the equipment manufacturers installation requirements.

⚠ WARNING: RCS fittings are single-use permanent fittings and cannot be repaired after installation. The fitting must be completely removed and a new one installed.

⚠ WARNING: Tool operates at high closing pressure and can cause severe damage or injury. Keep all bodily parts and foreign objects clear of tool head. For use by professionally trained technician only.

1 Inspect the kit contents and verify against the factory equipment selection documents for the correct fitting size and quantity required.

2 Confirm the service valves are shut off by following the equipment manufacturer's detailed instructions.

⚠ WARNING: Refrigerant gas or oil may be present between the service valve and the pipe cap. Failure to follow the equipment manufacturers' service valves handling instructions to ensure the services valves are shut prior to doing pipe work may result in property damage or personal injury.

3 Measure the service valves copper tube stubs for available tool clearance and mark the cut off locations.

4 Carefully cut off all factory swaged or capped end connections at the marked location with a sharp tubing cutter. Advance the cutter in small steps to minimize deformation of the tube at the cut end to reduce de-burring time.


5 De-burr the end of each tube so that the appropriate tubing insert will fit fully into the tube. Inspect the tubing and ensure the inside and outside of the tubing is clean and free of contamination and scratches along the entire length of the tube.


6 Confirm that the type and size of fitting being installed matches against the equipment selection document for accuracy before connecting the fitting to the outdoor unit by following standard RCS, Inc.'s coupling and reducer installation procedures.

⚠ WARNING: Specialty tube support adaptor inserts may be supplied with the kit for proper fit onto certain condensing unit connecting pipe. Only use RCS tube support inserts and compression collars provided with the fitting. The use of tube inserts or compression collars from other manufacturers with RCS fittings is strictly prohibited.




7 After confirming that adequate clearance is available to safely operate the press tool, install the fittings on to the Liquid, LP Gas, and or the HP Gas service valve connecting tubing by following standard RCS, Inc.'s coupling and reducer installation procedures.

 **WARNING:** Failure to ensure the fitting is aligned and fully seated in between the tool compression clamps may result in damage to the coupling, the tool, or injury to the operator.

 **IMPORTANT:** Place the compression clamps in the horizontal position on the press tool to make connections where tight or limited space is encountered.



8 Prior to connecting the outdoor unit to the refrigerant piping system, slip the matching Cold Shrink sleeve on to the connecting tube or elbow to be connected to the fitting. Ensure that the plastic core pull strip is in the correct orientation and adequate space is available for the removal of the plastic core in later steps.

 **WARNING:** All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.



9 Dry-fit the prepared connecting tube or elbow to the fitting to ensure proper fit and that adequate clearance is available for the press tool operation prior to making the final connection.

10 Connect the system tubing to the Outdoor unit by following RCS, Inc.'s coupling installation procedures.

11 After pressure and leak testing has shown the fitting joint to be acceptable, center the Cold Shrink sleeve on the fitting to be covered.

12 Pull and unwind the plastic strip slowly in the direction labeled on the Cold Shrink sleeve and allow the silicone sleeve on the opposite end to shrink onto the tube at the predetermined position on the copper tube.

13 After the silicone sleeve takes firm hold of the tube, continue to pull the strip smoothly till the entire plastic core is removed and the silicone sleeve is in complete contact with the copper tube and the enclosed fitting.






14 Insulate the piping system as required following the equipment and the insulation manufacturer's detailed instructions.

Y-Branch Pipe Kit Installation Guide



PKHS Single Y-Branch, PKHP Heat Pump, and PKHR Heat Recovery, Y-Branch Pipe Kits provide a flame-free alternative to traditional VRF piping system refrigerant Y-splitters. RCS, Inc.'s copper Y-Branch splitters are designed to be used with standard RCS fittings and tube inserts and also provides for a 45° take-off for added versatility in field pipe fitting option.

Each kit is individually packaged and tagged to match the equipment manufacturers 2-Pipe or 3-Pipe system configuration for each project.

The kit contains loose Y-Branch copper disperse pipe fittings, couplings, reducers, and insulation jackets for field installation.

-  **WARNING:** All VRF equipment manufacturers' Y-Branch installation position requirement and rules must be strictly followed. The use of RCS Y-Branch fittings does not relieve the installer from following the equipment manufacturers installation requirements.
-  **WARNING:** To avoid injury to the operator, damage to the tool, damage to the fitting, or damage to the surrounding property, ensure there is a minimum of 6 inches of unobstructed clearance at the back of the press tool.
-  **WARNING:** RCS fittings are single-use permanent fittings and cannot be repaired after installation. The fitting must be completely removed and a new one installed.



- 1** Inspect the kit contents and verify they match the equipment selection documents for the correct fitting size and quantity required for the system.
 - 2** Inspect the Y-Branch copper tube ends for any damage and ensure the inside and outside of the tube is clean and free of contamination and scratches along the entire length of the tube.
 - 3** De-burr the tube end of the Y-Branch if necessary so that the tubing insert will fit fully into the tube.
 - 4** Confirm the type and size of fitting being installed matches the equipment selection document for accuracy before connecting the fittings to the Y-Branch by following standard RCS, Inc.'s coupling and reducer installation procedures.
-  **WARNING:** Only use RCS tube inserts and compression collars provided with the fitting. The use of tube inserts or compression collars from other manufacturers with RCS fittings is strictly prohibited.
- 5** Connect the remaining fittings to the Y-Branch for each connection of the Liquid, LP Gas, and HP Gas Y-Branch fittings as necessary by following RCS, Inc.'s coupling installation procedures.
 - 6** Connect each completed Y-Branch assembly to the system tubing by following RCS, Inc.'s coupling installation procedures.
 - 7** After pressure and leak testing has shown the fitting joint to be acceptable, secure the insulation jackets to the Y-Branch and insulate the complete piping system as required, following the equipment and the insulation manufacturer's detailed instructions.
-  **Warning:** All RCS fittings installed outdoors, at the outdoor units, on insulated piping located outdoors, in wet/humid environments, or wherever the thermal insulation cannot be installed per the insulation manufacturer's instructions, must be protected from possible corrosion via the use of cold shrink, heat shrink, or other suitable impervious protective cover.

Selector Box Kit Installation Guide

The Selector Box kits provide a flame-free connection solution to VRF heat recovery systems where numerous connections can be safely and systematically installed without the use of high temperature brazing methods. Each kit is individually assembled and packaged to match the equipment manufacturers configuration.

The couplings, reducers, or flared tube kits are shipped loose for field installation on to the selector box connecting piping. Adequate tool clearance must be confirmed prior to installation.

Specialty tube support adaptor inserts may be supplied with the kit for proper fit onto certain selector box connecting pipe. Contact RCS customer service team for more details on tube inserts for your selected equipment.

⚠ WARNING: Except for factory male flare ends, all factory swaged-ends must be cut off the Selector Box to provide for actual line size in order to install RCS flame-free mechanically attached fittings.

⚠ WARNING: A minimum of 3 1/8 inches of straight tube clearance from the selector box bulkhead and 1 5/8 inch clearance between adjacent tubes are required to engage the press tool. Measure carefully and ensure that adequate tube lengths remain on the box and there is clearance for the press tool without obstruction.

⚠ WARNING: RCS fittings are single-use permanent fittings and cannot be repaired after installation. The fitting must be completely removed and a new one installed.

1 Inspect the kit contents and verify against the factory equipment selection documents for the correct fitting size and quantity required.

2 Measure the Selector Box copper tube ends for available tool clearance and mark the cut off locations.

3 Carefully cut off all factory swaged-end connections at the marked location with a sharp tubing cutter. Advance the cutter in small steps to minimize deformation of the tube at the cut end to reduce de-burring time.

4 De-burr the end of each tube so that the appropriate tubing insert will fit fully into the tube. Inspect the tubing and ensure the inside and outside of the tubing is clean and free of contamination and scratches along the entire length of the tube.

⚠ WARNING: Only use RCS tube inserts and compression collars provided with the fitting. The use of tube inserts or compression collars from other manufacturers with RCS fittings is strictly prohibited.

5 Confirm that the type and size of fitting being installed matches against the equipment selection document for accuracy before connecting the fitting to the Selector Box by following standard RCS, Inc.'s coupling and reducer installation procedures.

⚠ IMPORTANT: Place the compression clamps in the horizontal position on the press tool to make connections where tight or low overhead space is encountered.

6 Connect the system tubing to the Selector Box fittings by following RCS, Inc.'s coupling installation procedures.

7 Where the selector box connecting tube end is a male flare connection, connect piping system to the selector box by using the RCS flared tube connection kit together with the flare nut from the equipment by following RCS, Inc.'s flare connection procedures.

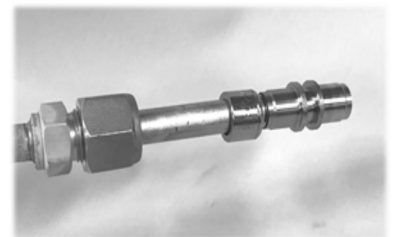
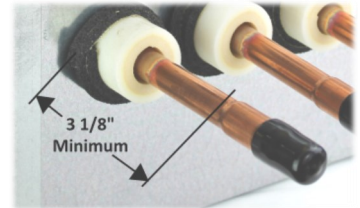
⚠ WARNING: Refer to the equipment manufacturer's specified flare torque value. Leaks may occur if the manufacturers' specified torque value is not reached.

⚠ WARNING: Use back-up wrench to prevent damage to the unit during tightening.

⚠ WARNING: Leaks may occur if the flared copper tube does not remain centered and aligned.

⚠ WARNING: Damage to the flare nut and leaks may occur if the torque value is exceeded.

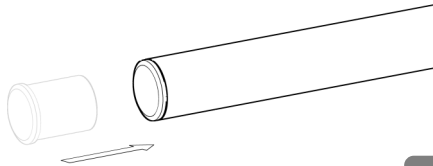
8 After pressure and leak testing has shown the fitting joint to be acceptable, insulate the piping system as required following the equipment and the insulation manufacturer's detailed instructions.



Assembly Guide

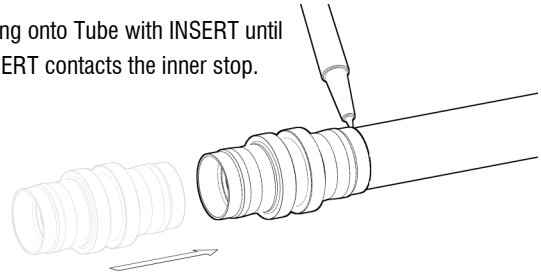
Tube surface must be clean, free from scratches or any surface imperfections, and de-burred inside and out.

Place tube support INSERT in to clean and de-burred tube.



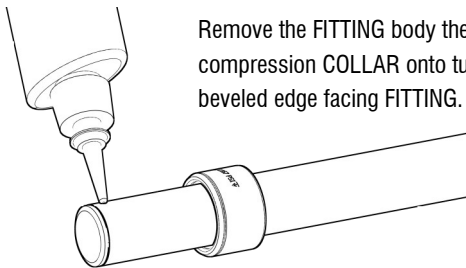
1

Place Fitting onto Tube with INSERT until TUBE/INSERT contacts the inner stop.



Mark Tube at end of FITTING with permanent felt tip marker.

2

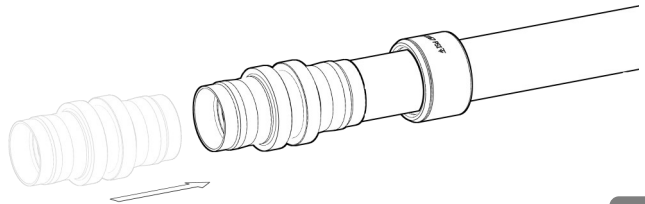


Remove the FITTING body then slide the compression COLLAR onto tube with the beveled edge facing FITTING.

Apply LocTite® to full circumference of tube end.
Keep LocTite® 1/8" from end of TUBE and INSERT.

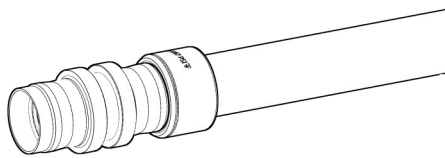
3

Slide the FITTING body back onto the TUBE with INSERT in place until TUBE/INSERT contacts the fitting inner stop.



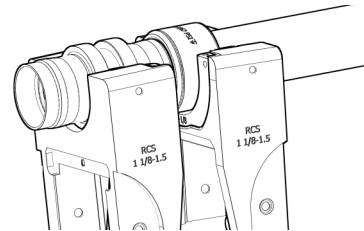
4

Keeping the TUBE/INSERT against the FITTING inner stop, slide the COLLAR against the FITTING. Collar should overlap the FITTING body.



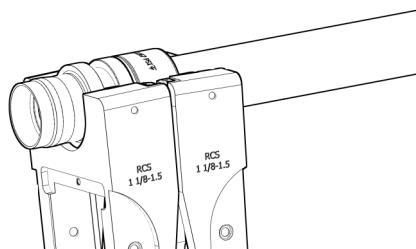
5

Place the FITTING and COLLAR into correct size press clamps. The assembly **MUST** be fully seated on the lower circumference of the clamps. Do not change the insertion depth of the TUBE/INSERT and the connecting joint.



6

Using the press tool, press the COLLAR onto the FITTING body until it is fully seated against FITTING stop. TUBE/INSERT must be maintained against the FITTING inner stop during the pressing operation.



7



That the tube insert depth reference mark is visible and closely aligned with the end of the FITTING body.



That the COLLAR is in the correct orientation, fully seated, and is flush against the shoulder of the FITTING body.






That any gap between the COLLAR and the FITTING shoulders are less than 1mm.

8

Troubleshooting Guide

Problems	Possible Causes	Remedy
<p>The tube insert does not fit inside the tubing</p> <p>The insert appears to be too loose</p>	<p>The tube end was not de-burred</p> <p>The tube end is out-of-round</p> <p>Incorrect tube type or wall thickness</p> <p>Incorrect size or type of tube insert</p>	<p>De-burr the tube ID</p> <p>Make a new square cut and de-burr</p> <p>Ensure that tube wall thickness is within tolerance for ACR Type L copper tubing</p> <p>Use a correct sized insert</p>
<p>The tube does not fit inside the fitting body</p>	<p>Incorrect size or type of tubing</p> <p>Incorrect size or type of fitting</p> <p>Burrs on the tube OD</p> <p>Tube is out of round</p> <p>Fitting inlet is damaged</p>	<p>Check size and type of tubing</p> <p>Check size and type of fitting</p> <p>De-burr the tube OD</p> <p>Make a new square cut and de-burr</p> <p>Use a new fitting</p>
<p>The compression collar does not engage over the fitting starting end</p>	<p>Incorrect size compression collar</p> <p>Incorrect type or size of fitting</p> <p>The compression collar is installed in the wrong direction</p> <p>Loctite is applied to or collected between the compression collar and the fitting body</p> <p>The tube is not completely inserted inside the fitting</p>	<p>Use the correct size of compression collar</p> <p>Use the correct type or size of fitting</p> <p>Install the compression collar with the beveled edge facing the fitting</p> <p>Do not apply Loctite to the OD of the fitting</p> <p>Wipe off excess Loctite before compressing the compression collar on to the fitting</p> <p>Mark the tube insertion depth reference line and confirm it is visible before and after compression</p>
<p>Excessive gap of more than 1mm between the compression collar and the fitting shoulder</p> <p>The collar is not on flush</p> <p>The compression collar cracked or split</p> <p>The shoulder of the fitting body is broken</p> <p>The fitting body is deformed</p>	<p>The fitting was not fully seated inside the tool compression clamps or the clamp inserts</p> <p>The tool was not held in square alignment with the fitting during compression</p> <p>Incorrect size of tool clamp or clamp insert was used</p> <p>The tool clamps were not completely seated in the tool alignment slots</p> <p>When retracted, the tool hydraulic ram, backed against an adjacent obstruction</p> <p>The tool clamp insert dislodged from the universal clamp</p>	<p>Completely seat the entire fitting assembly into the tool clamp or tool insert landing before compressing</p> <p>Ensure proper and square alignment between the fitting and the tool during compression</p> <p>Use a correct size clamp or clamp insert</p> <p>Fully seat the clamps on to the tool and tighten the thumb screws</p> <p>Position the hand tool so that there is no obstruction in the area at the back of the tool when the hydraulic ram is retracted</p> <p>Inspect the clamp and clamp insert. Adjust the clamp ball detent screws to secure the insert or replace the universal clamp</p>

-  **WARNING:** Only RSC tube inserts are allowed. Use of tube inserts from other manufacturers is prohibited.
-  **WARNING:** Only RSC compression collars are allowed. Use of collars from other manufacturers is prohibited.
-  **WARNING:** RCS fittings are single-use permanent fittings and cannot be removed or repaired after installation. If the fitting is deemed not visually acceptable prior to, during, or after the installation, the fitting must be cut out and a new one correctly reinstalled.

TERMS AND CONDITIONS OF SALE

1. AGREEMENTS AND ACCEPTANCE. The terms and conditions of Sale set forth herein, in credit application, the order, and the order acknowledgement shall constitute the entire Agreement between Refrigerant Coupling System, Inc. (known as Seller) and Buyer and supersedes all other agreements and understandings, whether written or oral, between the parties with respect to the subject matter hereof. Seller's acceptance of any offer by Buyer is expressly made conditional upon Buyer's assent to the terms and conditions hereof, and none of Buyer's additional or different terms shall apply. Acceptance of Seller's offer to sell is expressly limited to acceptance of the terms and conditions hereof, and no other terms or conditions shall apply, unless expressly agreed to by Seller in writing.

2. PRICE. All prices exclude federal, state, or local taxes, customs, duties, charges, consular fees, permit and license fees and any other taxes, fees or expenses which shall be added to the price or billed separately to Buyer where Seller has the legal obligation to collect or pay such taxes, fees, or expenses. Buyer shall pay all taxes. Prices quoted are firm for thirty (30) days unless extended in writing by Seller. Prices are firm provided release to manufacturing and Seller completes shipment within one hundred and twenty (120) days of acceptance of purchase order by Seller. However, prices may increase as a result of delays due to changes requested by Buyer or Buyer's failure to furnish information requested. Seller reserves the right to change this policy at any time without written notice.

3. PAYMENT TERMS. If Seller has extended credit to Buyer, payment shall be due net (15) days from date of invoice. On any order on which credit is not extended by Seller, shipment or delivery shall only be made, at Seller's election after payment in cash with order (in whole or in part), C.O.D., or by a signed draft upon presentation of bill of lading or other appropriate shipping documents covering each shipment. All costs of collection shall be borne by Buyer. If Buyer delays shipment or delivery, payment shall be due when Seller is ready to make the shipment or delivery. Unless otherwise set forth on the face of this Agreement, all payments shall be made in U.S. Dollars. Seller reserves the right to charge at any time a monthly service charge of one and one-half percent (1½%) or the highest rate allowed by law, on outstanding balances aged forty five (45) days from the due date of Seller's invoice. The account may be put on hold until payment is received. Payment due to Seller is not contingent upon receipt of any other third party payment. The amount of credit may be changed and/or credit withdrawn by Seller, at any time.

If Buyer fails to fulfill the terms of payment or if Seller shall have any doubt at any time as to Buyer's financial condition, Seller may decline to make further deliveries except upon prompt receipt of cash or satisfactory security, as decided by Seller. This requirement will not release Buyer from any previous obligation. Seller's rights under this Section shall be in addition to all other rights and remedies provided by law or in equity upon Buyer's default. In addition, if reasonably requested by Seller, Buyer shall furnish an irrevocable letter of credit in favor of Seller, in an amount sufficient to cover the price of products and all related expenses which are for Buyer's account, and which includes such other terms and conditions as may be agreed upon and issued or confirmed by a U.S. bank, as may be acceptable to Seller.

4. ORDERS. No order shall be valid until accepted by Seller at its office in Rocklin, California. U.S.A.

5. FORCE MAJEURE. Seller shall not be liable for any delays in the delivery of orders or any other failure to perform, due in whole or in part, directly or indirectly, to fire, storm, flood, earthquake, war, insurrection, labor disputes or shortages, act of God, strike, shortage of raw materials, supplies or components, retooling, upgrading of technology, delays of carriers, embargo, government order or directive, or any other circumstance beyond Seller's reasonable control. Buyer agrees that Seller shall not be liable for any direct, indirect, consequential, or special damages, which may result from any such delays.

6. DELIVERY TERMS AND RISK OF LOSS. Unless otherwise stated on the face of this Agreement, all deliveries shall be F.O.B. Seller's factory. Seller will attempt to meet the requirements of Buyer's delivery schedule but shall be obligated only to the delivery schedule shown on the order acknowledgment and Seller shall not be in default of performance due to a delay of reasonable duration resulting from any cause. All delivery expenses, including transportation, freight, insurance, and any other shipping costs, and risk of loss during delivery and transportation, shall be for the account of Buyer. Claims for damages in transit must be assessed against the carrier. Unless otherwise instructed, selection of carrier and routing of all shipments shall be at Seller's discretion. When special packaging is specified for domestic or export sales involving greater expense than that customarily supplied, a charge may be made to cover such extra expense. Shipment dates are approximate and are subject to receipt of all necessary Buyer information, letter of credit, if required, and all necessary licenses, permits and other documents.

7. INSPECTION AND ACCEPTANCE. Buyer must inspect delivered products and report claims for damages or shortages in writing within ten (10) days of delivery or the products shall be deemed irrevocably accepted and such claims are hereby waived.

8. USER RESPONSIBILITY. All products and documents provided by RCS, Inc. are for further investigation by Buyers and Users having technical expertise. The Buyer and User, through their own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from RCS, Inc. All clerical errors are subject to correction. Many states and localities have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While RCS attempts to assure that its Products ("Product") comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the Product is installed or used. As these Products are dynamic and versatile, RCS shall not be responsible for how Products are used or installed and the Product's conformance to local or regional codes or regulations. Review the Product materials and application, relevant code, regulations or ordinances, to be certain that the Product, its installation, and use will satisfy these requirements. In no event will RCS be responsible for any loss or damage arising out of Purchaser's improper selection, misapplication or misuse of a Product.

9. LIMITED WARRANTY AND REMEDY. Seller warrants to the original purchaser that the products sold hereunder shall be free from defects in workmanship and material upon delivery under normal use and service for a period of ten (10) year from the date of shipment. The liability of Seller under this warranty is limited to replacing, repairing, or issuing credit (at cost, FOB factory and at Seller's discretion) for any part or parts which are returned by Buyer during such period provided that (a) Seller is notified in writing within ten (10) days following discovery of such defects by Buyer, or within ten (10) days after such defects should reasonably have been discovered, whichever is less, (b) the defective unit is returned to Seller, transportation charges prepaid by Buyer, (c) payment in full has been received by Seller for said products, (d) Seller's examination of such unit shall disclose to Seller's satisfaction that such defects have not been caused by misuse, neglect, improper installation, repair, unauthorized modification, Buyer's design, alteration, act of God, or accident. Seller makes no warranty, expressed or implied with respect to the specific application for which Seller's products are used or with respect to the design or operation of an entire system, in which Seller's products sold hereunder are mere components, nor does Seller make any warranty, expressed or implied, with respect to other components of Seller's product, where such components are warranted separately by their respective manufacturers. Repair or replacement of the products sold hereunder, or refund of the purchase price as provided in this warranty, is the Buyer's exclusive remedy. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty shall be borne by Buyer unless accepted in writing by Seller. This exclusive remedy will not be deemed to have failed its essential purpose so long as Seller is willing and able to repair or replace any defective product or refund the purchase price, in the prescribed manner. THIS LIMITED WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY WARRANTY OF MERCHANTABILITY, INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE. BUYER'S FAILURE TO PAY THE FULL AMOUNT DUE WITHIN SIXTY (60) DAYS OF DATE OF INVOICE SHALL OPERATE TO RELEASE SELLER FROM ANY AND ALL LIABILITY OR OBLIGATION ARISING PURSUANT TO ANY WARRANTY, EXPRESSED OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY WARRANTY OF MERCHANTABILITY, INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE, MADE IN CONNECTION WITH ANY CONTRACT FORMED HEREUNDER. BUYER AGREES THAT SUCH FAILURE TO PAY SHALL CONSTITUTE A VOLUNTARY WAIVER OF ANY AND ALL SUCH WARRANTIES ARISING PURSUANT TO SUCH CONTRACT. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND AND ANY REPAIR OR ATTEMPT TO REPAIR PRODUCTS BY ANYONE OTHER THAN AN AUTHORIZED REPRESENTATIVE OF SELLER AUTOMATICALLY VOIDS ANY WARRANTY OF THOSE PRODUCTS. ANY ORAL OR WRITTEN STATEMENT CONCERNING THE PRODUCTS INCONSISTENT WITH THE WARRANTY CONTAINED HEREIN SHALL BE OF NO FORCE OR EFFECT.

10. LIMITATIONS ON LIABILITY. Under no circumstances shall Seller be liable for any indirect, consequential, collateral, special or incidental damages (including without limitation, increased manufacturing costs, loss of profits, or goodwill) whether such claim is based on contract, negligence, strict tort, warranty or any other basis. Seller's liability shall, in no event, exceed the purchase price of the particular products with respect to which a claim is made. Seller does not insure Buyer under any of its insurance policies, including liability or workers' compensation. Seller will not provide Buyer with indemnification for any matter nor does Seller agree to provide Buyer with contribution for any damages. Seller has no obligation to Buyer to direct Seller's insurance companies to waive their right of subrogation against Buyer in the event of an insured loss.

11. LIMITATION OF ACTIONS. Any actions or claims by Buyer under this Agreement shall be brought within 120 months after shipment of the products sold by Seller hereunder or shall be deemed barred by waiver.

12. PATENTS. Seller, at its own expense will defend any suit against Buyer for infringement of United States patents by any product purchased from Seller when used or sold for its normal purpose and in any such suit will satisfy any final award of damages for such infringement, but Seller assumes no liability, consequential or otherwise, for infringement or patent claims covering any components purchased by Seller from third parties or covering any other product, or any assembly, combination, method or process, in which, or in the manufacture or testing of which, any such product may be used. This covenant by Seller is upon the condition that Buyer shall give Seller a prompt notice in writing of such suit or infringement, full opportunity to conduct the defense thereof and full assistance and cooperation in said defense. No cost or expense shall be incurred for the account of Seller without its written consent.

13. CHANGES. After acceptance by Seller, Buyer's order shall not be subject to cancellation, change or reduction in amount nor to any suspension by Buyer of deliveries without Seller's prior written consent. Buyer acknowledges that Seller engages in continuous product improvement and makes changes to its products from time to time. The Seller reserves the right to make reasonable changes and use substitute parts or products as long as such substitutions perform equal to, or better than the original product or part thereof, and shall have the right to deliver revised designs or models and such substitute products or parts against any order. Seller may subcontract the furnishing of any products sold hereunder and any portion thereof.

14. NON-WAIVER OF DEFAULT. Each shipment made under any order shall be treated as a separate transaction, but in the event of any default by Buyer, Seller may decline to make further shipments without in any way affect its rights under such order. If, despite any default by Buyer, Seller elects to continue to make shipments, its actions shall not constitute a waiver of any default by Buyer or in any way affect Seller's legal remedy for such default and Seller's failure to deliver, or nonconformity of, any installment of this Agreement after a Buyer default shall not be a breach of the entire Agreement.

15. TERMINATION. No termination by Buyer for default shall be effective unless Seller shall have failed to correct such alleged default within fifteen (15) days after receipt by Seller of a written notice specifying such default.

16. ASSIGNS. This Agreement shall be binding upon and inure to the benefit of the successors and assigns of the entire business and good will of either Seller or Buyer or of that part of the business of either used in the performance of this Agreement but shall not be otherwise assignable.

17. MODIFICATION OF STANDARD TERMS AND CONDITIONS. No addition to or modification of any of the provisions upon the face or reverse of this form shall be binding upon Seller, unless made in writing and signed by a duly authorized employee of Seller.

18. ARBITRATION. Buyer agrees that all claims, demands, disputes, controversies, and differences arising under any contract made hereunder shall be settled exclusively in arbitration in accordance with the rules then prevailing of the American Arbitration Association. Judgment on the award thus rendered shall be binding on the Buyer and may be entered in any court having jurisdiction thereof. Unless the parties agree otherwise in writing, such arbitration will be conducted in Rocklin, California, U.S.A.

19. EXPORT REGULATIONS AND PERMITS. Buyer will comply with the provisions of the United States Government's Export Administration regulations and related documentation requirements and internal control procedures. Buyer shall be responsible for obtaining any necessary export or import licenses and permits.

20. APPLICABLE LAW. This Agreement shall be governed by and construed in accordance with the internal laws (and not the laws of conflicts) of the State of California, U.S.A. and the Buyer submits to the personal jurisdiction of courts located in California, U.S.A. The United Nations Convention on Contracts for the International Sale of Products shall not apply to this Agreement. Buyer shall comply with all laws, regulations, treaties, directives, and orders, including, but not limited to, any import, export, health, safety, security and environmental laws, regulations, treaties, directives, and orders of any jurisdiction (whether international, country, region, state, province or local) applicable to this Agreement and the products sold hereunder. Buyer agrees to release, defend, indemnify, and hold harmless Seller from and against all claims, liabilities, costs and expenses arising out of or resulting from the failure to comply with the requirements of this paragraph, including, but not limited to, claims arising from or connected with the possession, handling, processing or use of the products by Buyer or others.

21. VALIDITY. If any provision of this Agreement is found to be invalid or unenforceable in any respect, the validity and enforceability of the remaining provisions shall not be affected.

22. NUCLEAR LIMITATION OF USE. Unless otherwise agreed in writing by a duly authorized representative of Seller, products provided hereunder are not sold or intended for use in any nuclear or nuclear related applications. Buyer (i) accepts the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from the use of products in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability.

LIMITED WARRANTY

LIMITED WARRANTY AND REMEDY

Seller warrants to the original purchaser that the products sold hereunder shall be free from defects in workmanship and material upon delivery under normal use and service for a period of ten (10) year from the date of shipment. The liability of Seller under this warranty is limited to replacing, repairing, or issuing credit (at cost, FOB factory and at Seller's discretion) for any part or parts which are returned by Buyer during such period provided that (a) Seller is notified in writing within ten (10) days following discovery of such defects by Buyer, or within ten (10) days after such defects should reasonably have been discovered, whichever is less, (b) the defective unit is returned to Seller, transportation charges prepaid by Buyer, (c) payment in full has been received by Seller for said products, (d) Seller's examination of such unit shall disclose to Seller's satisfaction that such defects have not been caused by misuse, neglect, improper installation, repair, unauthorized modification, Buyer's design, alteration, act of God, or accident. Seller makes no warranty, expressed or implied with respect to the specific application for which Seller's products are used or with respect to the design or operation of an entire system, in which Seller's products sold hereunder are mere components, nor does Seller make any warranty, expressed or implied, with respect to other components of Seller's product, where such components are warranted separately by their respective manufacturers. Repair or replacement of the products sold hereunder, or refund of the purchase price as provided in this warranty, is the Buyer's exclusive remedy. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty shall be borne by Buyer unless accepted in writing by Seller. This exclusive remedy will not be deemed to have failed its essential purpose so long as Seller is willing and able to repair or replace any defective product or refund the purchase price, in the prescribed manner. THIS LIMITED WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY WARRANTY OF MERCHANTABILITY, INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE. BUYER'S FAILURE TO PAY THE FULL AMOUNT DUE WITHIN SIXTY (60) DAYS OF DATE OF INVOICE SHALL OPERATE TO RELEASE SELLER FROM ANY AND ALL LIABILITY OR OBLIGATION ARISING PURSUANT TO ANY WARRANTY, EXPRESSED OR IMPLIED, WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY WARRANTY OF MERCHANTABILITY, INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE, MADE IN CONNECTION WITH ANY CONTRACT FORMED HEREUNDER. BUYER AGREES THAT SUCH FAILURE TO PAY SHALL CONSTITUTE A VOLUNTARY WAIVER OF ANY AND ALL SUCH WARRANTIES ARISING PURSUANT TO SUCH CONTRACT. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND AND ANY REPAIR OR ATTEMPT TO REPAIR PRODUCTS BY ANYONE OTHER THAN AN AUTHORIZED REPRESENTATIVE OF SELLER AUTOMATICALLY VOIDS ANY WARRANTY OF THOSE PRODUCTS. ANY ORAL OR WRITTEN STATEMENT CONCERNING THE PRODUCTS INCONSISTENT WITH THE WARRANTY CONTAINED HEREIN SHALL BE OF NO FORCE OR EFFECT.

LIMITATIONS ON LIABILITY

Under no circumstances shall Seller be liable for any indirect, consequential, collateral, special or incidental damages (including without limitation, increased manufacturing costs, loss of profits, or goodwill) whether such claim is based on contract, negligence, strict tort, warranty or any other basis. Seller's liability shall, in no event, exceed the purchase price of the particular products with respect to which a claim is made. Seller does not insure Buyer under any of its insurance policies, including liability or workers' compensation. Seller will not provide Buyer with indemnification for any matter nor does Seller agree to provide Buyer with contribution for any damages. Seller has no obligation to Buyer to direct Seller's insurance companies to waive their right of subrogation against Buyer in the event of an insured loss.

LIMITATION OF ACTIONS

Any actions or claims by Buyer under this Agreement shall be brought within 120 months after shipment of the products sold by Seller hereunder or shall be deemed barred by waiver.



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