RLS™

Refrigeration Press Fittings

Product Overview
and Third Party
Testing Summaries

RLS™ Refrigeration Press Fittings Overview

Copper tube is used for a variety of refrigerants in both residential and commercial applications. When copper tube is installed, it is typically connected with brazed joints. While brazed joints are typically strong and reliable, the process of brazing is highly technical, time consuming and potentially hazardous due to the presence of an open flame.

RLS™ press fittings join refrigeration tube and withstand high-pressure systems as well as brazed joints, but can be joined in a much shorter period of time, without a flame or heat source. The fittings are joined by pressing with an approved RLS™ press tool and press jaws, which are similar to existing water press connect tools, but are based on exclusive AVA Press Technology™ which was specifically developed for refrigeration systems.

The fittings are currently available in sizes ranging from 1/4 inch through 1-1/8 inch, and the technology is also available as a connection method in certain valves and ancillary refrigeration products.

Certifications and Listings:

RLS™ fittings and connections have been tested by Underwriters Laboratories to UL 207. The fittings are listed by UL for use in high-pressure refrigeration piping systems to 700 psi. The listing applies to all sizes of RLS™ fittings and RLS™ connections in valve and ancillary refrigeration products.

Mechanical Code Approvals:

Uniform Mechanical Code: The IAPMO Uniform Mechanical Code/2012 regulates refrigerant piping in Chapter 11. Copper tube is one of the piping materials listed for refrigerant piping. Section 1110.2 requires the tube, valves, fittings and related parts to be approved for the intended use. RLS™ fittings and connections have been tested and listed by UL for refrigeration piping systems and comply with the requirements of the IAPMO Uniform Mechanical Code.

International Mechanical Code: The ICC International Mechanical Code/2012 regulates refrigerant piping in Section 1107. Copper tube is listed as an acceptable material for refrigerant piping systems. Section 1107.6 required joints in refrigerant piping systems to withstand 150 percent of the design pressure of the system. RLS™ fittings and connections comply with the requirements of the ICC International Mechanical Code.

Third Party Testing:

The following pages summarize the findings of four independent tests performed to verify the installation time savings, effectiveness and durability of RLS™ press fittings/connections in high-pressure refrigeration systems, including:

- Time and Motion (compared to brazing)
- Helium Leak
- Accelerated Durability (frost/defrost, thermal cycling and vibration)
- Salt Spray Corrosion

Time and Motion Study

Conducted by:
Jay Peters, Principal Advisor, Codes and Standards International

Methodology:

A time study was conducted in a controlled environment, with two stations set up for joining refrigeration tube: one by brazing and one by making RLS™ press connections. Two different installers were used, one very experienced in making brazed connections and one very experienced in using the RLS™ press tool.

The two installers were timed independently making connections using various sized copper tube and fittings. Before timing began, tube was cut to length and the ends were prepared for connection (as these procedures are the same for both connection methods). Three connections were timed for each size of tube/fitting for each installer, and the three times were averaged. The results are shown in the table below.

LABOR TIME FOR INSTALLING A COPPER COUPLING

Fitting Size	1/4"	5/8"	1-1/8"
Brazed Connection	35 sec	42 sec	1:51 min
RLS™ Connection	24 sec	24 sec	25 sec
% Time Savings	31%	43%	77%

Key Findings and Conclusions:

The time savings achieved while joining tube using RLS™ press fittings, compared to brazed connections, ranged from 31% on the smallest fittings timed to 77% on the largest. The average time savings over the fitting sizes timed was approximately 50%. So, on average, RLS™ connections were made in roughly half the time of brazing — and in less than one-quarter the time on the largest fitting size.

Based on the study, brazed connections take longer to complete than RLS™ fitting connections. When analyzing the installation techniques for both connections, a brazed connection requires a period of time to raise the temperature of the fitting and tube to about 1000˚F. As the tubing and fitting increases in diameter, the amount of time it takes to heat them also increases. The RLS™ fittings only require the connection of a press connect tool, which takes less than ten seconds to complete the actual pressing operation (two crimps) — and the time to connect does not increase significantly as the diameter of tubing and fittings increase in size.

In a controlled environment, such as the work station where the time study was conducted, the brazing operation takes less time than a similar joint made on a construction or repair project in the field. The controlled environment is already set up for brazing, with all necessary equipment and materials close at hand. However, using the RLS™ press tool and fittings requires approximately the same amount of time in any environment. Therefore, it can be assumed that the RLS™ time savings would be even greater outside of a controlled environment.

Helium Leak Test

Conducted by:
Jim Busch, Project Engineer, EWI

Methodology:

Six different RLS™ fitting sizes were connected to commercially available ACR tubing. Thirty union connections were chosen as a sample lot, with two connections per fitting. Each sample connected two pieces of tubing approximately nine inches long. One of the tubes was brazed shut at one end and the other tube was reduced to a ¼" tube stub.

Prior to testing each lot of samples, the Veeco MS-40 helium leak tester was calibrated. After calibration, a solid ¼" dowel was tested to verify the integrity of the seals on the helium leak test fixture. The ¼" tube stub was wiped down with methanol and connected to the leak detector via a Swagelok ¼" Ultra-Torr vacuum fitting. Each sample was pumped down to a level of approximately 500 millitorr prior to applying helium gas near the RLS™ crimp joint (at atmospheric pressure). The helium leak rate was measured and recorded for each of the 60 connections in a 30 piece sample lot.

Key Findings and Conclusions:

The maximum leak rate of all connections is summarized in the following table. The maximum leak rate detected was 5.40E-09 std.cc/sec.

Maximum Leak Rate per Lot						
Tube O.D. (inches) Maximum Helium Leak (std.cc/sec)	0.250	0.313	0.375	.750	0.875	1.125
Maximum Helium Leak	4.00E-10	6.10E-10	1.30E-09	5.20E-09	5.40E-09	3.00E-10

Test Set-up

Accelerated Durability Testing

Conducted by:
Chad Bowers, Creative Thermal Solutions, Inc.

Methodology:

Three tests were devised to accelerate mechanical fatigue on RLS™ refrigeration press fittings, to simulate real world extreme conditions and determine possible failure modes. Six different fitting sizes between 1/4" and 1 1/8" were subjected to the tests.

Accelerated Frost/Defrost Simulation
Field failures of brazed joints have been detected due to water being trapped in tight spaces and expanding during freezing, causing high stress on brazed joints and joining methods. To test RLS™ fittings in this environment, an accelerated freeze/thaw test was performed in a controlled laboratory environment. A total of 16 RLS™ fittings representing 6 different sizes were repeatedly cycled in a humid environment from 50°F down to -40°F to simulate the water freezing and thawing in the vicinity of a crimped RLS™ fitting.

Accelerated Thermal Cycling
Accelerated thermal and pressure cycling was performed in a controlled laboratory environment. A total of 16 RLS™ fittings representing 6 different sizes were repeatedly cycled from high temperature and pressure to low temperature and pressure in a working air conditioning system utilizing R410A.

Vibration Durability Testing
To ensure durability in the presence of vibration induced fatigue, a test was conceived to simulate mechanically induced field vibration in refrigerant carrying tubes. This vibration test procedure was performed in a controlled laboratory environment. A sample of pressurized RLS™ fittings were subjected to a series of 3 million cycles each.

Key Findings and Conclusions:

Accelerated Frost/Defrost Simulation
The freeze/thaw test loop was allowed to run for over 5,000 cycles (nearly 28 days), simulating approximately 10 years of field operation. During the testing, the facility was shut down once each week to check the fittings for leaks. A similar leak check was performed at the end of testing as well, to confirm that no failures were caused by the testing. All leak checks were passed, with no indications of any form of failure as a result of this accelerated test.

Accelerated Thermal Cycling
The thermal cycling test facility was allowed to run until a total of 85,000 thermal cycles were imposed on the set of 16 RLS™ fittings. Periodic leak checks were performed over the course of testing to ensure that the fittings' sealing capabilities were intact. Upon completion of thermal cycling, a final leak check was performed, using soap water, indicating that the thermal and mechanical fatigue imposed on the fittings was insufficient to cause a failure in any of the fittings.

Vibration Durability Testing
The accelerometer data showed the up and down motion from the oscillating support causes a very consistent acceleration of approximately +/- 1g on all fittings. The primary frequency occurs at the 28.5HZ provided by the motor, with a very small amount of power occurring in the second harmonic. All of the fittings tested were pressurized to 400 psi and cycled for 3 million times, as described above. All of the fittings maintained pressure over this test period, indicating resilience to vibrational loading.

Corrosion Test

Conducted by:
Jeremy L. Lewis, Touchstone Research Laboratory, Ltd.

Methodology:

In this test, 41 RLS™ refrigeration press fittings were provided to Touchstone Research Laboratory for SWAAT corrosion testing according to instructions provided in ASTM G85, Standard Practice for Modified Salt Spray (Fog) Testing, Annex A3 Acidified Synthetic Sea Water Test.

Specimens were a mixture of copper and aluminum tubes with fittings and gauges. The tubes were pressurized to 400 psi using dry nitrogen and exposed for 1000 hours. After none of the samples had failed to lose pressure before the 1000-hour mark, the decision was made to continue the test to 2000 hours. Test interruptions consisted of 1-2 minute periods every day (excluding weekends) to collect fallout.

Key Findings and Conclusions:

None of the RLS™ fittings failed. All but one of the original 41 RLS™ fittings lasted the full exposure time of 2,000 hours. One specimen lasted approximately 1,915 hours, when the aluminum tube failed.

The RLS™ fittings did not corrode despite extended exposure to the harsh acidified salt solution. The specimens not only passed the 1,000-hour test, but also did not fail after 2,000 hours. One sample was only able to complete 1,915 of the 2,000 hours, due to the failure of the tube.

Specimen placement in the test chamber at start of test.

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