RLS®

Rapid Locking System

Introduction To Stainless Press-To-Connect System (150 bar)

Copper RLS & Aluminum RLS Update

- Our copper products – sold in aftermarket by Parker Sporlan under the brand name Zoomlock continue gain adoption. These are used primarily in VRF/HVAC systems.

- Several OEM's also using the product on their equipment, numerous other continue to trial. Total installed fittings exceed 3 million.

- Currently being tested in ASHRAE RP-1808 'Servicing and installing equipment using flammable refrigerants – assessment of field made mechanical joint systems', RLS versus flare and compression joints.

- New sku's planned for late 2017/early 2018 include 1-5/8", 2-1/8".

- Our aluminum products were developed as an option for aluminum VRF systems. Market interest in aluminum has subsided but we are getting interest from OEM's looking at Ammonia systems, several now asking for Ammonia performance data – specifically leak rates and O-ring testing.

Introduction To Stainless Rapid Locking System

- It is the worlds first press-to-connect stainless system engineered for high pressure systems.
- Has been in development for 3 years. Numerous patents pending and granted.
- Will be certified to 150 bar and have typical Rapid Locking System leak rates (several times tighter than European F-Gas Regulation definition of hermetically sealed*).
- Can be installed in under 30 seconds – no matter what size (O.D.). Low skill required.
- Well documented that initial costs *which includes piping and the installation of piping* is a major barrier to greater adoption for CO2.
- Stainless would be preferred material if not for its current high installation costs and health hazards of installation when welding.

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Product Benefits

- Significant total installed cost advantages.
- Certified labour not required.
- No hot-works.
- Clean, no contamination, eliminates need for purging.
- Repeatable, every connection has the same high quality.
- System approach: fittings, valves, tubes.
- Highly engineered valves are supplied by NDL Industries.
- Press-to-connect tools and jaw from worlds leading suppliers.

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RLS Stainless vs Copper/Copper with Impurities & Welded Stainless

- In addition to instantly clean and guaranteed leak rates the RLS stainless fittings will have a significant total installed cost advantage over copper iron and welded stainless.

	Copper Iron (120 bar)	Welding Stainless	RLS Stainless (140 bar)
Labor Cost/HR	$60.00	$95.00	$60.00
Total Time To Install a system with approx. 1000ft of process piping in man-hours (Thunder Bay Canada)	68.4 hrs	134.2 hrs	16.9 hrs
Total Labor Cost	$4,104.00	$12,749.00	$1,014.00
Total Materials Cost	$19,294.00	$14,630.00	$14,950.00*
Total Installed Cost (Labor and Base Materials Only)	$23,398.00	$27,379.00	$15,964.00

*Using Proposed Pricing

Explosive Decompression Testing (Completed)

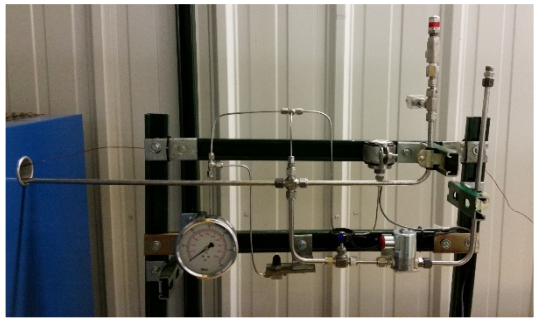
- Premise of test was small molecules of supercritical CO2 can be absorbed by common polymer materials found in O-rings.

- Rapid de-pressurization does not leave CO2 molecules enough time to move out of the polymer, resulting in splitting and blistering of O-rings as CO2 expands before escaping from O-rings.

- Vacuum system and charge appropriate amount of CO2.
- Heat oven to 150°C, allow CO2 inside oven to reach 150°C and 150 bar.
- Hold system steady at 150°C and 150 bar for ~3-4 hours.
- Open valve and allow system to discharge very rapidly.
- Repeat cycle 10 times for each set of O-rings and fittings.

- All fitting tested passed.

- Testing summary available.



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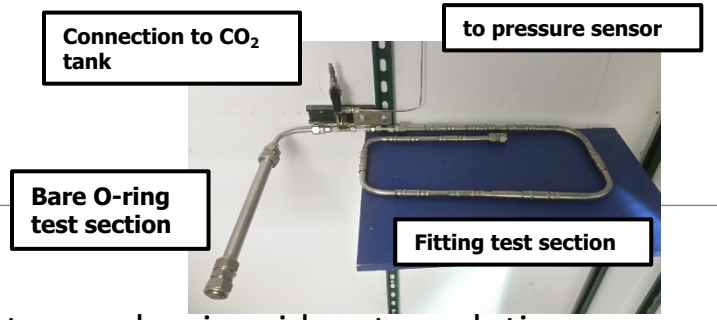
Carbonic Acid Testing (Underway)



- Premise of testing is to expose fittings and O-rings to a carbonic acid-water solution.
- Water enters systems by interaction of ambient air during system assembly. Complete removal of water is impossible due to adsorption of water to surfaces and the solubility of water in oil.
- Using CO2 as a refrigerant causes a challenge as there is a limit to how much H20 can be dissolved by CO2 and the reaction between CO2 and H20 to form a weak carbonic acid (H2CO3).
- These tests will be to prove the RLS stainless fittings can survive and operate as designed in a worse case scenario.
- Leak rate will also be determined using an infrared photoacoustic multi-gas analyzer method.

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Timeline

- CTS to conclude Carbonic Acid Testing – September 2017.
- First ‘real world’ total installed cost study versus copper with impurities and welded stainless – October 2017.
- Fittings available for OEM’s to test – November 2017.
- RLS to determine path of market/commercialization of fittings – By End 2017
- Product certifications at U.L., TUV and others Q1/Q2 2018.
- Product launch mid to late 2018.