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# ZoomLock™

## BRAZE-FREE FITTINGS

# ZoomLock™ Braze-Free Fittings

Catalog K-1, Engineering Submittal, May 2016



ENGINEERING YOUR SUCCESS.

# ZoomLock Braze-Free Fittings

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**ATTENTION!**  
**WARRANTY COULD BE VOID IF ZOOMLOCK IS NOT APPLIED PER USER INSTRUCTIONS!**  
Please read user instructions enclosed. It is recommended that you also watch the videos.



<http://mailserver.parker.com/zoomvid>

### ⚠ WARNING – USER RESPONSIBILITY

Failure or improper selection or improper use of the products described herein or related items can cause death, personal injury and property damage.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its 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 Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

### OFFER OF SALE

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the detailed "Offer of Sale" available at [www.parker.com](http://www.parker.com).

Catalog K-1, May 2016 supersedes Catalog K-1, January 2016 and all prior publications.



ZoomLock™ fittings are specially designed to work without brazing, which automatically makes your job simpler and faster when joining copper tubes. In addition, the one-piece fittings are reliably secure, leak-proof and more repeatable than brazed connections — so there's no compromise on quality or performance. Professionals who have tried ZoomLock braze-free

couplings report that their time and labor costs on tube connections are typically reduced 40 – 60% on average by eliminating the need for brazing. The biggest benefit of that improved efficiency is more productivity and increased profit potential, but there are also many other exciting advantages to braze-free tube connecting.

### The ZoomLock Advantage

- Less equipment and no gas needed
- Safer conditions, no fire hazards
- No hot work permits required
- More environment-friendly
- No solder-related quality issues
- More flexible access to job sites
- No need to nitrogen-purge



# ZoomLock Braze-Free Fittings



## Applications

- High Pressure HVAC/R
- Glycol
- Non-Potable Water

## Product Parameters

- **Continuous Operating Temperature (COT):**  
250°F / 121°C
- **O-Ring Temperature Rating:**  
-40°F to +300°F  
-40°C to +148.9°C
- **Maximum Rated Pressure (MRP):**  
700 psi / 48 bar
- **Maximum Burst Pressure:**  
3000 psi / 207 bar+
- **Vacuum Pressure Capability:**  
20 Microns
- **External Leak Rate:**  
<0.1 Ounces of Helium per Year at Operating Pressure Range
- **Vibration Resistance:**  
Conforms to UL109
- **Size Availability (Inches):**  
1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8, 1-3/8

## Fitting Materials

- **Fitting Body:**  
Refrigerant Grade Copper, per ASTM-B280
- **O-Ring:**  
HNBR

## Fitting Warranty

- 12 months from date of install. Read page 22 for more details.

## Compatibility

- **Approved Oils:**  
Mineral Oil, POE, PVE, PAG
- **Approved Tubing Materials:**  
Copper to Copper Connections
- **Approved Copper Tubing Types for Use with Klauke® Compatible Jaws:**  
Hard Copper (Drawn)
  - 1/4" – 1-1/8" Type ACR, M, L
  - Type K only up to 7/8"
 Soft Copper (Annealed)
  - 1/4" – 1-1/8" Type ACR, L
  - Type K only up to 7/8"
- **Approved Copper Tubing Types for Use with RIDGID® Compatible Jaws:**  
Hard Copper (Drawn)
  - 1/4" – 1-3/8" Type ACR, M, L
  - Type K only up to 1-1/8"
 Soft Copper (Annealed)
  - 1/4" – 1-3/8" Type ACR, L
  - Type K only up to 1-1/8"

## Approved Refrigerants

- |          |        |
|----------|--------|
| ■ 1234yf | ■ 417A |
| ■ 1234ze | ■ 422D |
| ■ 125    | ■ 438A |
| ■ 32     | ■ 447A |
| ■ 134a   | ■ 448A |
| ■ 143A   | ■ 449A |
| ■ 404A   | ■ 450A |
| ■ 407A   | ■ 452A |
| ■ 407C   | ■ 507  |
| ■ 407F   | ■ 513A |
| ■ 410A   | ■ 718  |

## Agency Approvals and Certifications

- UL 207, SA#33958, SDTW(7)
- ICC-ES, PMG-1296
  - 2015 IMC (International Mechanical Code)
  - 2015 IRC (International Residential Code)
  - 2012 UMC (Uniform Mechanical Code)
- CRN (Canadian Registration Number)



RIDGID is a registered trademark of RIDGID, Inc.

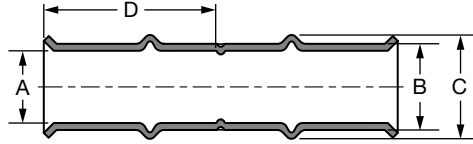


# ZoomLock Braze-Free Fittings

## Couplings



### Dimensions

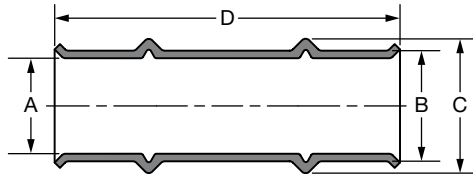


Size	Part Number	Description	Dimensions							
			A		B		C		D	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/4	770500	PZK-C4-HNBR	0.26	6.6	0.34	8.6	0.45	11.5	0.95	24.1
5/16	770501	PZK-C5-HNBR	0.32	8.2	0.40	10.2	0.52	13.1	0.93	23.6
3/8	770502	PZK-C6-HNBR	0.39	9.8	0.47	11.8	0.59	14.9	0.98	24.9
1/2	770503	PZK-C8-HNBR	0.51	13.0	0.59	15.0	0.73	18.6	1.25	31.8
5/8	770504	PZK-C10-HNBR	0.64	16.1	0.74	18.7	0.89	22.5	1.24	31.5
3/4	770505	PZK-C12-HNBR	0.76	19.3	0.88	22.4	1.07	27.2	1.29	32.8
7/8	770506	PZK-C14-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	1.31	33.3
1-1/8	770507	PZK-C18-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	1.29	32.8
1-3/8*	770508	PZK-C22-HNBR	1.39	35.3	1.54	39.1	1.57	39.9	1.75	44.5

## Slip Couplings



### Dimensions



Size	Part Number	Description	Dimensions							
			A		B		C		D	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/4	770550	PZK-RC4-HNBR	0.26	6.6	0.34	8.6	0.45	11.5	2.00	50.8
3/8	770552	PZK-RC6-HNBR	0.39	9.8	0.47	11.8	0.59	14.9	2.05	52.1
1/2	770553	PZK-RC8-HNBR	0.51	13.0	0.59	15.0	0.73	18.6	2.74	69.6
5/8	770554	PZK-RC10-HNBR	0.64	16.1	0.74	18.7	0.89	22.5	2.75	69.9
3/4	770555	PZK-RC12-HNBR	0.76	19.3	0.88	22.4	1.07	27.2	2.75	69.9
7/8	770556	PZK-RC14-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	2.74	69.9
1-1/8	770557	PZK-RC18-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	2.77	70.4
1-3/8*	770558	PZK-RC22-HNBR	1.39	35.3	1.54	39.1	1.57	39.9	1.75	44.5

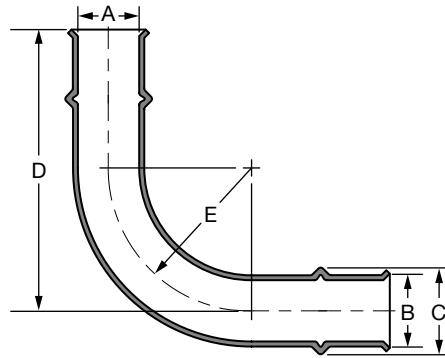
\*ZoomLock 1-3/8" jaws are not available for the Klauke® tool at this time.

# ZoomLock Braze-Free Fittings

## Elbows



### Dimensions

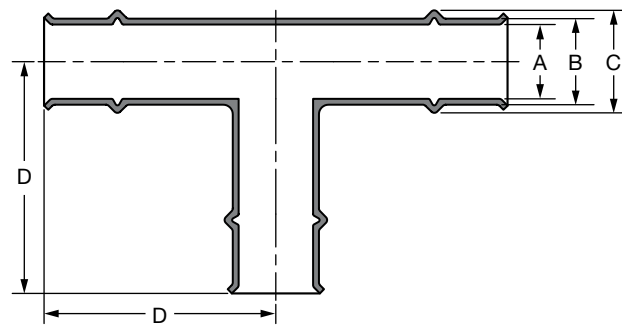


Size	Part Number	Description	Dimensions									
			A		B		C		D		E (Ref.)	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/4	770600	PZK-90E4-HNBR	0.26	6.6	0.34	8.6	0.45	11.5	2.01	51.1	0.50	12.7
5/16	770601	PZK-90E5-HNBR	0.32	8.2	0.40	10.2	0.52	13.1	2.13	54.1	0.60	15.2
3/8	770602	PZK-90E6-HNBR	0.39	9.8	0.47	11.8	0.59	14.9	2.27	57.7	0.65	16.5
1/2	770603	PZK-90E8-HNBR	0.51	13.0	0.59	15.0	0.73	18.6	2.88	73.2	0.90	22.9
5/8	770604	PZK-90E10-HNBR	0.64	16.1	0.74	18.7	0.89	22.5	3.21	81.4	1.13	28.7
3/4	770605	PZK-90E12-HNBR	0.76	19.3	0.88	22.4	1.07	27.2	3.47	88.0	1.50	38.1
7/8	770606	PZK-90E14-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	3.75	95.3	2.25	57.2
1-1/8	770607	PZK-90E18-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	4.29	108.8	2.85	72.4
1-3/8*	770608	PZK-90E22-HNBR	1.39	35.3	1.54	39.1	1.75	44.5	4.54	115.3	3.05	77.5

## Tees



### Dimensions



Size	Part Number	Description	Dimensions							
			A		B		C		D	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm
3/8	770702	PZK-T6-HNBR	0.39	9.8	0.47	11.8	0.59	14.9	1.63	41.4
1/2	770703	PZK-T8-HNBR	0.51	13.0	0.59	15.0	0.72	18.2	2.23	56.6
5/8	770704	PZK-T10-HNBR	0.64	16.1	0.74	18.7	0.87	22.0	2.29	58.2
3/4	770705	PZK-T12-HNBR	0.76	19.3	0.88	22.4	1.05	26.6	2.37	60.2
7/8	770706	PZK-T14-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	2.44	62.0
1-1/8	770707	PZK-T18-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	2.56	65.0
1-3/8*	770708	PZK-T22-HNBR	1.39	35.2	1.54	39.0	1.75	44.4	2.75	69.9

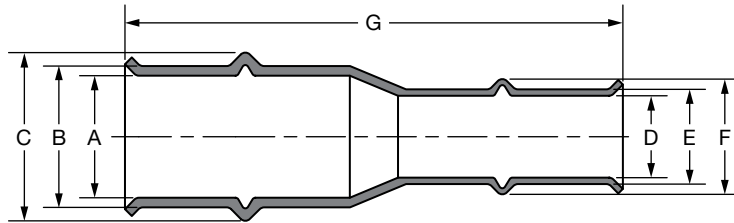
\*ZoomLock 1-3/8" jaws are not available for the Klauke® tool at this time.

# ZoomLock Braze-Free Fittings

## Reducers



### Dimensions

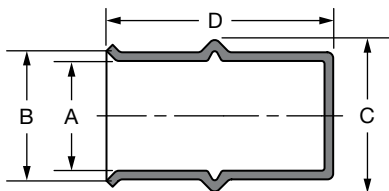


Size	Part Number	Description	Dimensions															
			A		B		C		D		E		F		G			
			Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm		
3/8 in to 1/4	770800	PZK-R64-HNBR	0.39	9.8	0.47	11.8	0.59	14.9	0.26	6.6	0.34	8.6	0.45	11.5	2.20	55.9		
1/2 in to 1/4	770808	PZK-R84-HNBR	0.51	13.0	0.59	15.0	0.73	18.6	0.26	6.6	0.34	8.6	0.45	11.5	2.63	66.8		
1/2 in to 3/8	770801	PZK-R86-HNBR	0.51	13.0	0.59	15.0	0.73	18.6	0.39	9.8	0.47	11.8	0.59	14.9	2.63	66.8		
5/8 in to 1/4	770809	PZK-R104-HNBR	0.64	16.1	0.74	18.7	0.89	22.5	0.26	6.6	0.34	8.6	0.45	11.5	2.70	68.6		
5/8 in to 3/8	770810	PZK-R106-HNBR	0.64	16.1	0.74	18.7	0.89	22.5	0.39	9.8	0.47	11.8	0.59	14.9	2.70	68.6		
5/8 in to 1/2	770802	PZK-R108-HNBR	0.64	16.1	0.74	18.7	0.87	22.0	0.51	13.0	0.59	15.0	0.72	18.2	3.00	76.2		
3/4 in to 1/2	770811	PZK-R128-HNBR	0.76	19.3	0.88	22.4	1.05	26.6	0.51	13.0	0.59	15.0	0.72	18.2	3.10	78.7		
3/4 in to 5/8	770803	PZK-R1210-HNBR	0.76	19.3	0.88	22.4	1.05	26.6	0.64	16.1	0.74	18.7	0.87	22.0	3.00	76.2		
7/8 in to 1/2	770812	PZK-R148-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	0.51	13.0	0.59	15.0	0.72	18.2	3.05	77.5		
7/8 in to 5/8	770804	PZK-R1410-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	0.64	16.1	0.74	18.7	0.87	22.0	3.05	77.5		
7/8 in to 3/4	770805	PZK-R1412-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	0.76	19.3	0.88	22.4	1.05	26.6	3.11	79.0		
1-1/8 in to 1/2	770813	PZK-R188-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	0.51	13.0	0.60	15.0	0.72	18.2	3.25	82.6		
1-1/8 in to 5/8	770814	PZK-R1810-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	0.64	16.1	0.74	18.7	0.87	22.0	3.25	82.6		
1-1/8 in to 3/4	770806	PZK-R1812-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	0.76	19.3	0.88	22.4	1.05	26.6	3.25	82.6		
1-1/8 in to 7/8	770807	PZK-R1814-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	0.89	22.5	1.02	25.8	1.12	28.4	3.11	79.0		

## Caps



### Dimensions



Size	Part Number	Description	Dimensions							
			A		B		C		D	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/4	770900	PZK-CP4-HNBR	0.26	6.6	0.34	8.6	0.45	11.5	1.11	28.2
5/16	770901	PZK-CP5-HNBR	0.32	8.2	0.40	10.2	0.52	13.1	1.11	28.2
3/8	770902	PZK-CP6-HNBR	0.39	9.8	0.47	11.8	0.57	14.5	1.13	28.7
1/2	770903	PZK-CP8-HNBR	0.51	13.0	0.59	15.0	0.72	18.2	1.47	37.3
5/8	770904	PZK-CP10-HNBR	0.64	16.1	0.74	18.7	0.87	22.0	1.56	39.6
3/4	770905	PZK-CP12-HNBR	0.76	19.3	0.88	22.4	1.05	26.6	1.57	39.9
7/8	770906	PZK-CP14-HNBR	0.89	22.5	1.02	25.8	1.19	30.2	1.60	40.6
1-1/8	770907	PZK-CP18-HNBR	1.14	28.8	1.29	32.6	1.44	36.7	2.05	52.1
1-3/8*	770908	PZK-CP22-HNBR	1.39	35.2	1.54	39.0	1.75	44.4	2.11	53.6

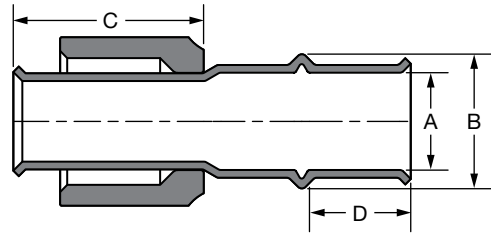
\*ZoomLock 1-3/8" jaws are not available for the Klauke® tool at this time.

# ZoomLock Braze-Free Fittings

## SAE Flare



### Dimensions



Size	Part Number	Description	Dimensions							
			A		B		C		D	
			Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/4	771000	PZK-F4-HNBR	0.26	6.6	0.45	11.5	1.38	35.1	0.56	14.2
3/8	771002	PZK-F6-HNBR	0.39	9.8	0.59	14.9	1.38	35.1	0.58	14.7
1/2	771003	PZK-F8-HNBR	0.51	13.0	0.72	18.2	1.13	28.7	0.75	19.1
5/8	771004	PZK-F10-HNBR	0.64	16.1	0.87	22.1	1.48	37.6	0.75	19.1
3/4	771005	PZK-F12-HNBR	0.76	19.3	1.05	26.7	1.48	37.6	0.80	20.3



# Tool Kits



## 0 Jaw Tool Kit

Includes the crimping tool and the tool kit contents, listed below.

- **Description:** PZK-TK0
- **Part Number:** 770000



## 3 Jaw Tool Kit

Includes the crimping tool, 3 jaws, and tool kit contents, listed below.

- **Description:** PZK-TK3
- **Part Number:** 770001
- **Jaw Sizes:** 3/8", 1/2", 7/8"



## 5 Jaw Tool Kit

Includes the crimping tool, 5 jaws and tool kit contents, listed below.

- **Description:** PZK-TK5
- **Part Number:** 770002
- **Jaw Sizes:** 3/8", 1/2", 5/8", 7/8", 1-1/8"

### Tool Kit Contents:

- Klauke® Crimping Tool
- Tubing Cutter
- Deburring Tool
- RLS Crimp Gauge
- Stainless Steel Brush
- Abrasive Pad
- Permanent Marker
- Battery Charger
- (2) Lithium-Ion Rechargeable Batteries



## Crimping Tool

- **Available in Tool Kits:**  
PZK-TK0, Part Number 770000  
PZK-TK3, Part Number 770001  
PZK-TK5, Part Number 770002
- **Not Sold Separately**

- Short pressing cycle, 5-7 seconds
- Compact design and 350° jaw rotation allows technician to install in tight spaces
- Lightweight design increases productivity
- Tool service indicated via imbedded LEDs, illuminates at 10,000 cycles
- Automatic piston return
- Safety feature that allows crimp cycle to be interrupted
  - Feature allows manual release of piston, if needed
- High-quality, powerful Makita Li-Ion technology for lasting, battery-powered pressing
  - 100-150 Crimps per Charge
  - Extremely short charging time of just 15 minutes (1.5 Ah)
  - Makita i-Press batteries and chargers available worldwide.

## Tool Specifications

- **Crimping Force:**  
Linear thrust of approx. 15 kN
- **Number of Crimps:**  
1.5 Ah approx. 150 (for NS20)
- **Battery Capacity:**  
High-power Makita 1.5 Ah Li-Ion battery
- **Charging Time:**  
1.5 Ah 15 min.
- **Weight including Battery:**  
Without jaw 1.7 kg  
Including jaw 2.3 kg
- **Dimensions:**  
377 x 75 x 116 mm
- **Revolving/Rotatable:**  
Approx. 350° rotating pressing jaw holder
- **Tool Warranty:**  
24 months from date of purchase

# Replacement Parts and Accessories



**Klauke®  
Compatible  
Jaw**



**RIDGID®  
Compatible  
Jaw**

## Pressing Jaw Kits

8 piece Klauke jaw kit in rigid plastic carrying case. Includes jaw sizes 1/4" through 1-1/8".

- **Description:** J4-J18 Klauke
- **Part Number:** 770208

9 piece RIDGID compatible jaw kit in hard plastic carrying case. Includes jaw sizes 1/4" through 1-3/8". Jaws are designed for use with the RIDGID RP 200-B, RP 210-B, and RP 100-B compact press tools.

- **Description:** RJ4-RJ22 RIDGID
- **Part Number:** 770219

## Pressing Jaws

Pressing jaws, ranging in sizes from 1/4" through 1-3/8", may be purchased individually.

Size (Inches)	Klauke Compatible Jaw		RIDGID Compatible Jaw*	
	Part Number	Description	Part Number	Description
1/4	770200	PZK-J4	770210	PZK-RJ4
5/16	770201	PZK-J5	770211	PZK-RJ5
3/8	770202	PZK-J6	770212	PZK-RJ6
1/2	770203	PZK-J8	770213	PZK-RJ8
5/8	770204	PZK-J10	770214	PZK-RJ10
3/4	770205	PZK-J12	770215	PZK-RJ12
7/8	770206	PZK-J14	770216	PZK-RJ14
1-1/8	770207	PZK-J18	770217	PZK-RJ18
1-3/8	—	—	770218	PZK-RJ22



## Jaw Carrying Case

Empty rigid carrying case with firm foam insert. Holds up to 8 Klauke jaws.

- **Description:** Jaw Carrying Case Only
- **Part Number:** 770209



## Battery Charger

110V AC battery charger for 18V Li-Ion batteries.

- **Description:** DC18RC
- **Part Number:** 770003

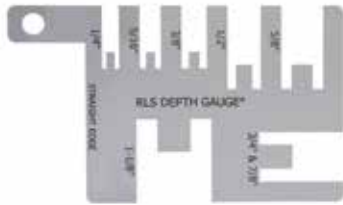


## Rechargeable Battery

High performance, 1.5 Ah, 18V Li-Ion battery with high capacity and extremely short charging time of just 15 minutes.

- **Description:** BL1815
- **Part Number:** 770004

# Replacement Parts and Accessories



## Standard RLS Depth Gauge

Metal depth gauge confirms the proper insertion depth of the tubing.

- **Description:** PZK-IDGM
- **Part Number:** 770014



## Optional Depth Gauge

Plastic depth gauge confirms the proper insertion depth of the tubing.

- **Description:** PZK-IDGP
- **Part Number:** 770015



## Diagnostic Tool

Adaptor tool for crimping tool diagnostics. Easily connect to PC via USB-Interface. Provides statistical evaluation of average crimping process of tool. Free downloading of Software "iPress" via [www.klauke.com](http://www.klauke.com).

- **Description:** PGA1
- **Part Number:** 770008



## RLS Crimp Gauge

Confirms the measurement of the finished crimp band diameter.

- **Description:** PZK-GNG1
- **Part Number:** 770005



## Tubing Cutter

ZoomLock approved tubing cutter.

- **Description:** Tubing Cutter
- **Part Number:** 770006

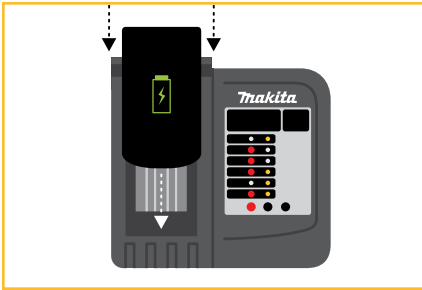


## Deburring Tool

ZoomLock approved deburring tool.

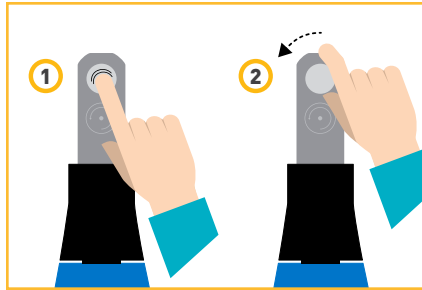
- **Description:** Tube Deburring Tool
- **Part Number:** 770007

# Installation Instructions



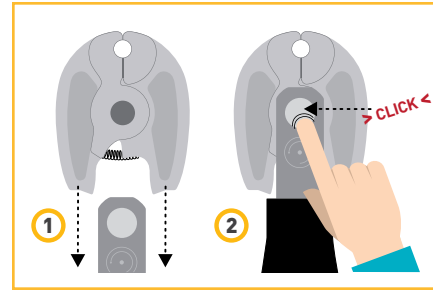
## STEP 1

Slide battery into charger. Plug charger into a power source. Check to see that the charging light is on. When red light turns off and green light turns on, battery is fully charged ~ 20 minutes.



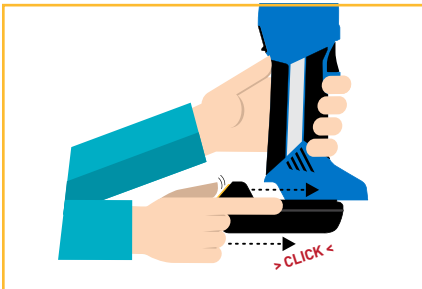
## STEP 2

Press the locking pin, then rotate 45° to release.



## STEP 3

Slide jaws over Crimping Tool head, then depress locking pin until it clicks.



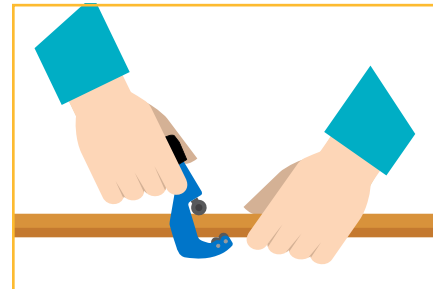
## STEP 4

Slide charged battery into base of Crimping Tool.



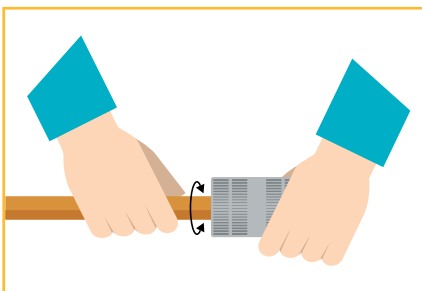
## STEP 5

Press and hold the trigger on Crimping Tool to calibrate. **Calibration is recommended daily, prior to use.**



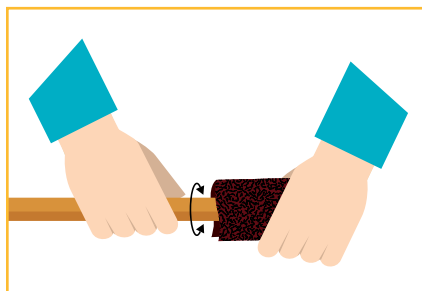
## STEP 6

Cut the copper tube using the **supplied** tube cutter. Do **NOT** use a hacksaw or reciprocating saw as this creates a rough surface that may damage the o-ring.



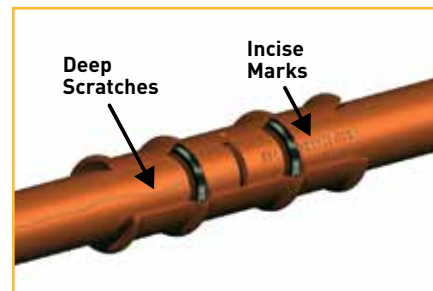
## STEP 7

Use the **supplied** deburring tool to remove any residual burrs from the outside and inside of the copper tube.



## STEP 8

Use a heavy duty scouring pad to clean the ends of the copper tubes to be joined. Tube ends should be free and clear of oxidation, dirt or debris.

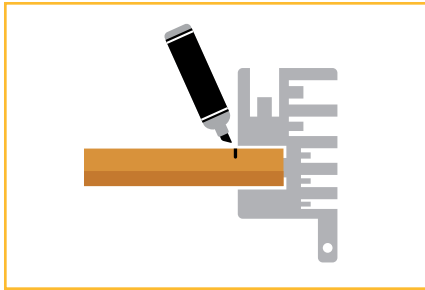


## STEP 9

Inspect the copper tube for imperfections such as deep surface scratches and incise marks within the o-ring sealing area that may provide a leak path for refrigerant. If scratches are present, cut off the affected area or sand thoroughly to remove.

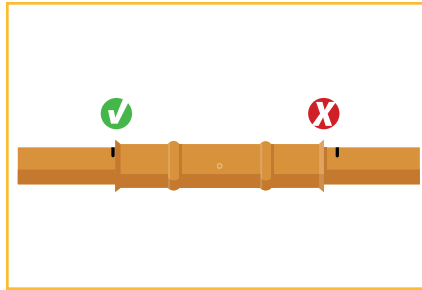
**WARNING: COPPER TUBE ENDS SHOULD BE INSPECTED AND ANY SHARP EDGES SHOULD BE ADDRESSED. SHARP EDGES MAY CAUSE DAMAGE TO THE O-RING.**

# Installation Instructions



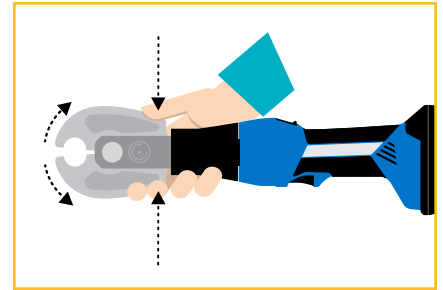
## STEP 10

Using the depth gauge provided or the chart on page 19 to determine the minimum insertion depth. Mark the tubing with a permanent marker to indicate proper insertion depth on every tube.



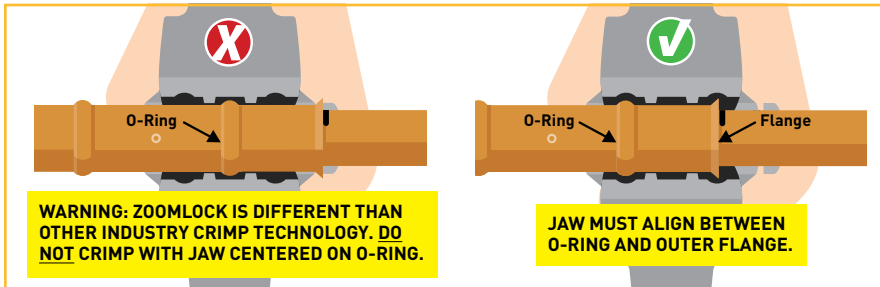
## STEP 11

Push the fitting onto the tube. Use the mark to assure insertion depth and secure fit.



## STEP 12

Open the jaws of the ZoomLock Crimping Tool.



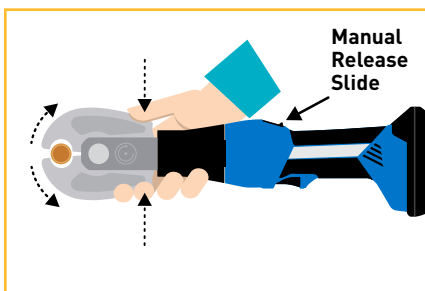
## STEP 13

Properly place the crimping jaws onto the fitting. Grooves in the jaws make it easy to align. See illustration at above right for proper crimping alignment.



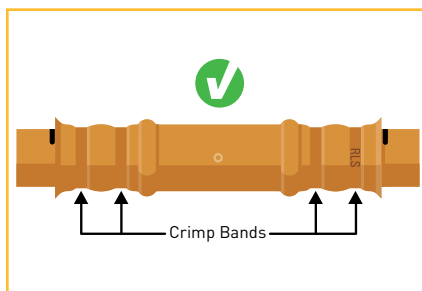
## STEP 14

Press and hold the trigger on the ZoomLock Crimping Tool to begin the crimping process. Continue to hold the trigger until the ZoomLock Crimping Tool completes its cycle.



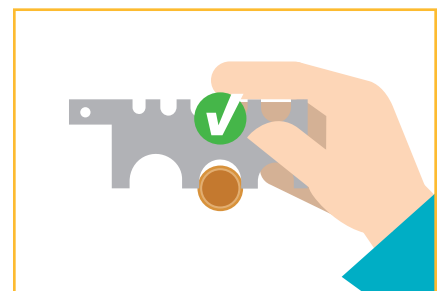
## STEP 15

Open the jaws of the ZoomLock Crimping Tool and remove from the fitting. If the jaws do not open, the crimping cycle was not completed. For manual override, slide the manual release button down to open the jaw in case of emergency.



## STEP 16

A special "RLS" mark will be displayed on the tube to let you know the connection is crimped properly.



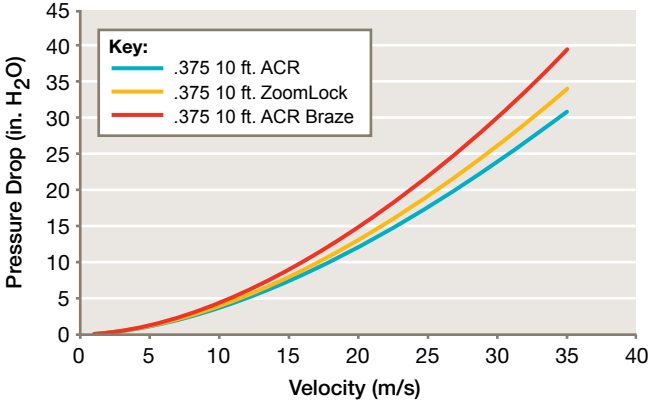
## STEP 17

The supplied RLS Crimp Gauge will confirm the measurement of the finished crimp band diameter. See crimp band locations noted in Step 16. It may be necessary to rotate the gauge in order to not interfere with the copper tube flashing left from the crimping process.

# Performance Data

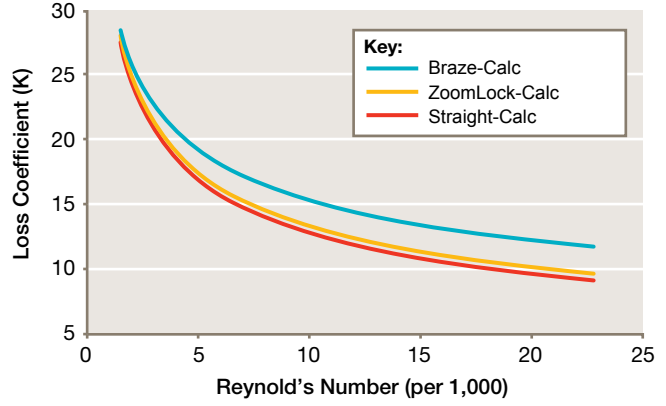
## ACR Pressure Drop (10 ft. long)

3/8" ACR Tube Pressure Drop vs. Velocity

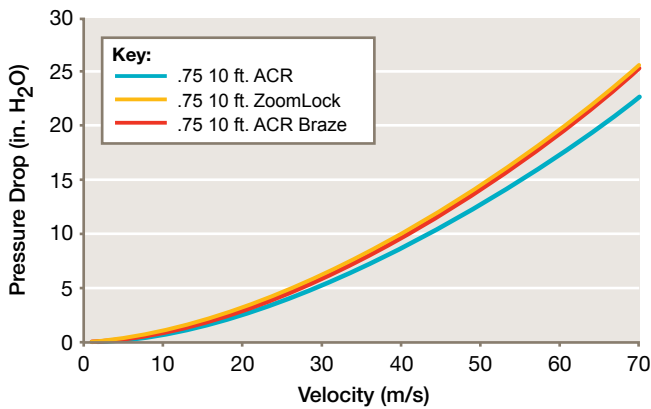


## ACR Loss Coefficient

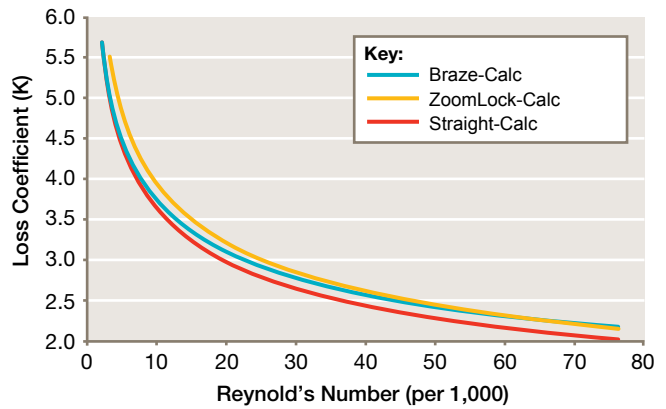
3/8" ACR Tube Loss Coefficient vs. Reynolds Number



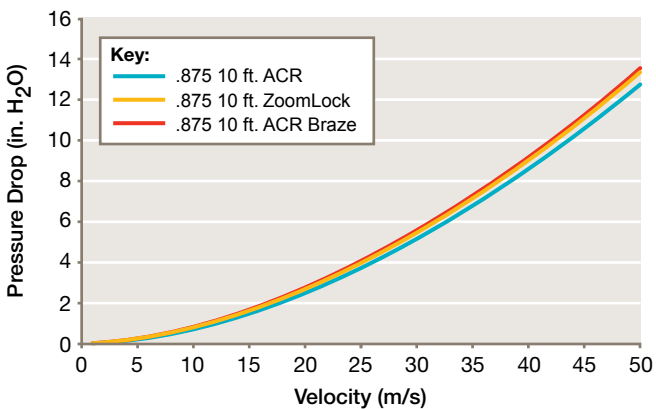
3/4" ACR Tube Pressure Drop vs. Velocity



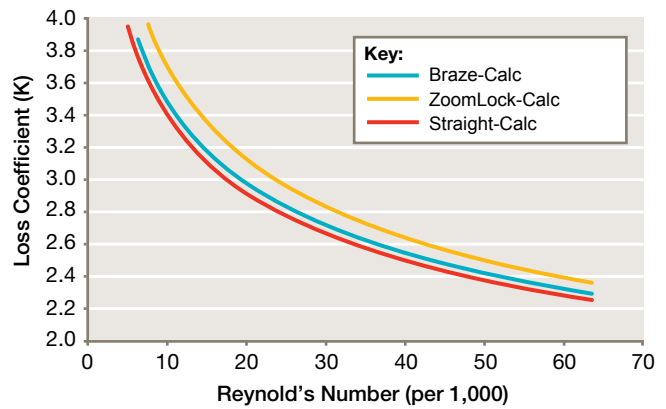
3/4" ACR Tube Loss Coefficient vs. Reynolds Number



7/8" ACR Tube Pressure Drop vs. Velocity



7/8" ACR Tube Loss Coefficient vs. Reynolds Number



# ICC-ES Evaluation Report



Effective Date: January 2015

Revision Date: January 20, 2016

This report subject to renewal in January 2017.

## PMG-1296

CSI: DIVISION: 23 00 00—HEATING, VENTILATING AND AIR CONDITIONING (HVAC)  
Section: 23 20 00—HVAC Pipe and Fittings

### Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: Refrigeration Tubing Connectors

Listee: RLS, LLC  
101 S. Douglas Street  
Shelbina, MO 63468  
www.rlspressfittings.com

### Additional Listee:

Parker Sporlan  
206 Lange Drive  
Washington, MO 63090  
www.parker.com

### Compliance with the following codes:

2015, 2012, 2009 and 2006 *International Mechanical Code*® (IMC)  
2015, 2012, 2009 and 2006 *International Residential Code*® (IRC)  
2015, 2012, 2009 and 2006 *Uniform Mechanical Code*® (UMC)\*

\*Copyrighted publication of the International Association of Plumbing and Mechanical Officials.

### Compliance with the following standards:

UL 207 (Edition 8), Standard for Refrigerant-Containing Components and Accessories, Nonelectrical

### Identification:

The refrigerant tubing connectors shall be legibly and permanently marked with the manufacturer's name, trade name, trademark, or identifying symbol or other descriptive marking by which the organization responsible for the product may be identified.

The shipping carton, a separate instruction sheet included with the shipping carton or a tag attached to the component shall include a distinctive model, part number, or type designation for the connector and include information for each refrigerant type for which the connector is intended and the ICC-ES PMG listing mark.

### Installation:

The refrigerant tubing connectors must be installed in accordance with the manufacturer's published installation instructions, the applicable codes and this listing.

Mechanical joints shall not be used on annealed temper copper tube in sizes larger than 7/8-inch (22.2 mm) OD size per IMC and 3/4" of an inch nominal size per UMC.

### Models:

The refrigerant tubing connectors are intended for connection of copper, aluminum, titanium and other types of tubing approved by the manufacturer. The connection is accomplished by

# ICC-ES Evaluation Report

compressing (solder-free) the fitting to a pipe. The refrigerant tubing connectors are only suitable for type A1 refrigerants (R-32, R-125, R-134a, R-143A, R-402, R-404A, R-407A, R-410A, R-447A, R-448A, R-449A, R-450, R-452, R-507, R-513A, R-718, R-1234yf, R-1234ze).

Serial Model Name: RLS™ Cu

Type of Connector	Sizes (Inches)
Couplings	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8
Slip Couplings	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8
Long Radius 90°	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8
Stubs	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8
Reducers	1/4 x 5/16, 5/16 x 3/8, 3/8 x 1/2, 1/2 x 5/8, 5/8 x 3/4, 3/4 x 7/8, 7/8 x 1-1/8
Tees	1/2, 3/4, 7/8, 1-1/8
Reducing Tees	5/8 x 5/8 x 7/8, 3/4 x 3/4 x 7/8, 7/8 x 7/8 x 1-1/8
Cap	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8
Return Bend	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1-1/8

Ratings:

Sizes	Design Pressure, psig	Maximum Abnormal Pressure, psi	Continuous Operating Temperature
1/4" RLS	700	700	250°F (121°C)
5/16" RLS	700	700	250°F (121°C)
3/8" RLS	700	700	250°F (121°C)
1/2" RLS	700	700	250°F (121°C)
3/4" RLS	700	700	250°F (121°C)
5/8" RLS	700	700	250°F (121°C)
7/8" RLS	700	700	250°F (121°C)
1-1/8" RLS	700	700	250°F (121°C)

Conditions of Listing:

1. The refrigerant tubing connectors must be used with only the following refrigerants (R-32, R-125, R-134a, R-143A, R-402, R-404A, R-407A, R-410A, R-447A, R-448A, R-449A, R-450, R-452, R-507, R-513A, R-718, R-1234yf, R-1234ze).
2. Mechanical joints shall not be used on annealed temper copper tube in sizes larger than 7/8 inch (22.2 mm) OD size per IMC and 3/4 inch (19 mm) nominal size per UMC.
3. The installation must be pressure-tested for leaks in the presence of the code official of the code official's designated representative.
4. When installation is in fire-resistance-rated assemblies, evidence must be provided to the code official of compliance with International Building Code® (IBC) Section 713 (penetrations), *Uniform Building Code* (UBC) Section 709 (walls and partitions) or UBC Section 710 (floor/ceiling or roof/ceiling), as applicable.
5. The connectors must be used as a source of electrical ground.
6. When the system is embedded in concrete, tubing must be covered a minimum of 3/4 inch (19.1 mm) and installation must comply with IBC Section 1906.3 or UBC Section 1906.3, as applicable.
7. The refrigerant tubing connectors is manufactured by Cerro Flow Products, LLC in Shelbina, Missouri, under a quality control program with surveillance inspectors annually by ICC-ES.



# Helium Leak Test Report



1250 Arthur E Adams Dr., Columbus, OH 43221

LAB SERVICES

## Helium Leak Test Report

page 1 of 2

**Customer:** Marmon Refrigeration Technologies

**Project No.:** 12866CSL-01

**Equipment:** Veeco MS-40

**Date Reported:** January 10, 2013

**Project Engineer:** Jim Busch

**Principal Tech:** Barb Christel

**Scope:** To test and report the leak rate of RLS press connections.

**Background:** Marmon Refrigeration Technologies (MRT) submitted RLS™ press connection samples for helium leak testing. Six (6) different RLS™ sizes were chosen to connect commercially available ACR tubing (see Table 1). Thirty (30) union connections were chosen as a sample lot with two (2) connections per fitting. Each sample connected two pieces of tubing approximately nine (9) inches long. One of the tubes was brazed shut at one end and the other tube was reduced to a ¼" tube stub.

**Table 1. Tube Diameters Tested**

Tube O.D. (in)	# of Samples	Total # of Tested Connections	Notes
0.250	30	60	Samples were made from commercially available ACR tubing (soft)
0.313	30	60	
0.375	30	60	
0.750	30	60	
0.875	30	60	
1.125	30	60	

**EWI Leak Testing Approach:** 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 (see Figure 1). 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 sixty (60) connections in a thirty (30) piece sample lot.

# Helium Leak Test Report



1250 Arthur E Adams Dr., Columbus, OH 43221

LAB SERVICES

## Helium Leak Test Report

page 2 of 2

Customer: Marmon Refrigeration Technologies

Project No.: 12866CSL-01

Equipment: Veeco MS-40

Date Reported: January 10, 2013

Project Engineer: Jim Busch

Principal Tech: Barb Christel



Figure 1. Test Set-up

**Results:** The maximum leak rate of all connections is summarized in Table 2. The maximum leak rate detected was 5.40E-09 std.cc/sec.

**Table 2.** Maximum Leak Rate per Lot

Tube O.D. (in)	Maximum Helium Leak std.cc/sec
0.250	4.00E-10
0.313	6.10E-10
0.375	1.30E-09
0.750	5.20E-09
0.875	5.40E-09
1.125	3.00E-10

Reported by: Brad NagySignature: Brad NagyTitle: Manager, Weld & Test Labs

# 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 using ZoomLock braze-free fittings. Two different installers were used, one very experienced in making brazed connections and one very experienced in using the ZoomLock 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 seconds	42 seconds	1:15 minutes
ZoomLock Braze-Free Fitting	24 seconds	24 seconds	25 seconds
% Time Savings	31%	43%	77%

## Key Findings and Conclusions

The time savings achieved while joining tube using ZoomLock braze-free 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, ZoomLock braze-free fittings 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 ZoomLock braze-free fittings. 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 (538°C). As the tubing and fitting increases in diameter, the amount of time it takes to heat them also increases. The ZoomLock braze-free 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 ZoomLock press tool and fittings require approximately the same amount of time in any environment. Therefore, it can be assumed that the ZoomLock time savings would be even greater outside of a controlled environment.



# Frequently Asked Questions

## 1. How many crimps can you complete on a complete battery charge?

On average you can achieve 100-150 crimps per charge depending on the size fittings being crimped. Each kit comes with 2 Makita Lithium-ion batteries and a rapid charge charging system. To prevent any downtime, it is recommended that you have both batteries charged before going to the jobsite and to have one charging while the other is in use.



## 2. Can you use ZoomLock to crimp to aluminum, steel, or stainless steel?

No, ZoomLock is specifically designed for copper to copper connections. Connecting to dissimilar metals can cause formicary corrosion issues that could cause a failure.

## 3. What material is the o-ring made of?

The o-ring is a highly engineered HNBR Parker o-ring that has been used in HVAC applications by OEMs and suppliers for many years with no issues.

## 4. What is the expected life of the o-ring in the system?

The expected life of the o-ring that stays within the product specifications for temperature and pressure should be 30 years.

## 5. Are there any shelf life concerns?

No, the shelf life of the product is estimated at or above 30 years.

## 6. Is there a concern about ice building up and then thawing under fitting in a horizontal or vertical configuration?

No, ZoomLock has been thoroughly tested in freeze/thaw applications with over 10,000 cycles completed in both vertical and horizontal configurations with no leakage concerns.

## 7. If a fitting does leak, can you braze the fitting in rather than cutting out the fitting and having to make up for lost pipe?

If you find a fitting that has a refrigerant leak, try re-crimping the connection first. If that does not work, the fitting must be cut out and replaced. Trying to braze the fitting will very likely melt the o-ring material and thus introduce contaminants into the system that could cause other system issues.

## 8. Are there any concerns with corrosion due to coastal applications, cleaning agents, or off-gassing of produce/vegetables?

No, ZoomLock has gone through a battery of corrosion testing, completing over 2,000 hours of salt spray testing without failure, which proves the resilience of the product.

## 9. How do you slide insulation over these fittings (the flare will grab insulation).

If the flare of the fitting tends to be a problem, you can smooth the transition over the fitting by adding duct tape around the flared edge of the fitting to the tube.

## 10. How do you know when the tool needs to be serviced?

The tool has a red LED on the back of the tool that will blink for 20 seconds after a crimp. When this occurs, take the tool back to an authorized dealer to have the tool analyzed. They will be able to verify if the tool needs to be sent in for service.

## 11. What is the expected life of the jaws?

Each jaw has an expected life of 10,000 to 12,000 crimps.

## 12. How do you know when the jaw needs to be replaced?

You will know when the jaw needs to be replaced when the contact point between the upper and lower jaw starts to open up/widen. A good indication of failure is when the crimp gauge no longer engages.

## 13. Do you have a solution for crimping onto flared tubing like that coming out of the condenser and evaporator on residential units?

No, we do not have a specific product designed to crimp over the flared tubing. However, if there is at least 2 inches of straight copper tubing after the flared end and is accessible with the jaws, we suggest that you cut the flared end off and crimp directly to the tube.

# Frequently Asked Questions

## 14. Is ZoomLock approved by state and city building codes?

ZoomLock has been approved by UL-207, ASHRAE 15, International Code Council – Evaluation Service (ICC-ES), International Mechanical Code (IMC), Universal Mechanical Code (UMC), and International Residential Code (IRC). These approvals are all that is needed in most areas. Please contact your local building inspector with questions prior to install.

## 15. How do I know the correct insertion depth when pushing the ZoomLock fitting onto the copper tube?

Use the depth gauge provided or the chart below to determine the minimum insertion depth. Mark the tubing with a permanent marker to indicate proper insertion depth on every tube.

### Minimum Insertion Depth

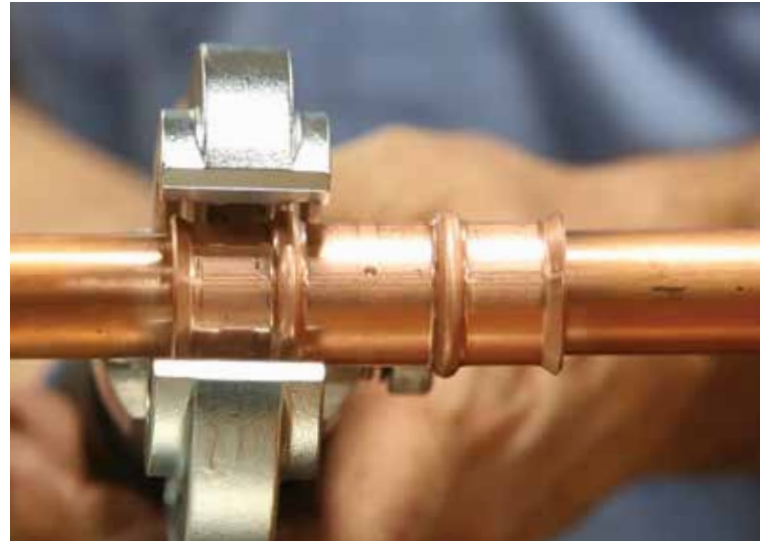
Fitting Size	Inches	mm
1/4	15/16	23.8
5/16	15/16	23.8
3/8	15/16	23.8
1/2	1-1/4	31.8
5/8	1-1/4	31.8
3/4	1-1/4	31.8
7/8	1-1/4	31.8
1-1/8	1-1/4	31.8
1-3/8	1-1/2	38.1

## 16. How much tolerance can the ZoomLock handle on the pipe being crimped?

We know that not all copper tubing is the same, but we have tested ZoomLock with most copper tube manufacturers with no issues. The tolerance for each tube to ensure a good leak-free joint is +.002/-.007.

## 17. Does the o-ring compensate for imperfections in the piping to make a tight seal?

Yes, the o-ring does compensate for small/minor scratches on the surface of the tube; however, the tubing needs to be inspected prior to use per ASTM B280 and the Copper Tube Handbook published by the Copper Development Association (CDA) specifications. Imperfections in and adjacent to the crimp area could inhibit the joint integrity. These imperfections may include surface scratches, incise marks, and tubing out of round.



## 18. The product specifications state that the application temperature limits are -40°F to +300°F / -40°C to -150°C. What happens if we go beyond that limit?

If the application that the fitting is being used in goes beyond the specified limits of the o-ring (-40°F to +300°F / -40°C to -150°C) then there will be an increased likelihood that a leak can occur.

## 19. Can I use ZoomLock in a transportation application where fitting vibration is high?

Yes, ZoomLock has gone through extensive vibration testing and results are actually better than that of a braze joint. Please review the vibration testing procedure and conclusion for more information.

## 20. What is the minimum brazing distance?

### Minimum Distance from ZoomLock Fitting to Braze

Tube Diameter	Inches	Millimeters
1/4, 5/16, 3/8, 1/2	5.00	127.0
5/8	6.25	158.8
3/4	7.50	190.5
7/8	8.75	222.3
1-1/8	13.75	349.3

## OFFER OF SALE

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

1. **Terms and Conditions.** Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is expressly conditioned on Buyer's assent to these Terms and Conditions and to the terms and conditions found on-line at [www.parker.com/saleterms/](http://www.parker.com/saleterms/). Seller objects to any contrary or additional term or condition of Buyer's order or any other document issued by Buyer.
2. **Price Adjustments; Payments.** Prices stated on the reverse side or preceding pages of this document are valid for 30 days. After 30 days, Seller may change prices to reflect any increase in its costs resulting from state, federal or local legislation, price increases from its suppliers, or any change in the rate, charge, or classification of any carrier. The prices stated on the reverse or preceding pages of this document do not include any sales, use, or other taxes unless so stated specifically. Unless otherwise specified by Seller, all prices are F.O.B. Seller's facility, and payment is due 30 days from the date of invoice. After 30 days, Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.
3. **Delivery Dates; Title and Risk; Shipment.** All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon tender to the carrier at Seller's facility (i.e., when it's on the truck, it's yours). Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferral of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.
4. **Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. This warranty is made only to Buyer and does not extend to anyone to whom Products are sold after purchased from Seller. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**
5. **Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 60 days after delivery or, in the case of an alleged breach of warranty, within 30 days after the date within the warranty period on which the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for any amount due to Seller from Buyer) must be commenced within thirteen months from the date of tender of delivery by Seller or, for a cause of action based upon an alleged breach of warranty, within thirteen months from the date within the warranty period on which the defect is or should have been discovered by Buyer.
6. **LIMITATION OF LIABILITY.** UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT**

**SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. **Contingencies.** Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.
8. **User Responsibility.** The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product 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 and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.
9. **Loss to Buyer's Property.** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.
10. **Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.
11. **Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.
12. **Improper use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.
13. **Cancellations and Changes.** Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.
14. **Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.
15. **Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive

expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. **Waiver and Severability.** Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.
17. **Termination.** This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.
18. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.
19. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.
20. **Taxes.** Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.
21. **Equal Opportunity Clause.** For the performance of government contracts and where dollar value of the Products exceed \$10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.





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