



# SEA-CURE®

## Common Practice for Roller Expanding and Flaring Stainless Tubes into Tubesheets

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### FABRICATION DATA

#### **SCOPE**

This procedure covers the generally accepted practice for roller expansion and flaring of stainless steel tubes into a tubesheet.

#### **GENERAL**

The sheet holes should be clean and dry prior to pushing in the tubes. Heavy burrs or ridges on the tubesheet holes should be removed to prevent harmful scratching of the tubes. Deep scratches, .003"/.004", can leave paths between the tube and tubesheet after expanding.

Small clusters of tubes should be expanded in symmetric locations of the tubesheets on both ends. Such a practice will help to hold the tubesheets in the proper location, and guard against warping of the tubesheet as the tubes are expanded.

#### **TOOLING**

Torque controlled reversible drives are suggested for expanding. Torque control can be either by air pressure or by electronic torque measurement. The torque drive is set to the value determined by the method described below. By using a self-feeding expander, the tube will be pulled against the collar and rolled until the proper reduction of wall thickness is obtained. After the drive trips off, the direction is reversed and the expander can be removed. The collar design should be such that the tube end cannot be feathered by fitting into the space between the rollers and the collar. Such feathering of the end can cause splitting of the tube ends when they are flared. The collar should be flush, or when flaring will follow, be recessed approximately 1/32". Three or five roll expanders can be used. Five roll expanders are recommended for lighter wall thicknesses (.035" or less). The distance from the face of the collar to the end of the straight portion of the roll should be about 1/8" less than the tubesheet thickness. At least two expanders should be used. One can be left in the water soluble lubricant, while the other is used until it becomes warm. The rolls and mandrel should be checked periodically for pitting or buildup of foreign matter.

#### **AMOUNT OF EXPANSION**

Measurements of the amount of expansion are used to determine the percentage reduction of wall thickness in the expanded areas. Five to seven percent reduction is suggested for stainless steel. Under-rolling can leave a mechanically weak or leaking joint; over-rolling leads to excessive work-hardening and elimination of an established leak proof bond.

The following step-by-step procedure is suggested for establishing the expansion required:

1. Twenty to twenty five tubesheet holes should be measured with an I.D. micrometer to establish the average size.
2. A similar number of tube O.D.'s should be measured. The average is subtracted from #1 above to determine the average clearance.
3. The tube I.D.'s are measured with an I.D. micrometer. The average is added to the clearance to find the average tube I.D. when metal to metal contact is reached.
4. Five percent of the average wall thickness is determined and doubled. This value is then added to the value found for metal-to-metal contact, and the result is the desired average I.D. of the tubes after expansion.



2061 Young Street • East Troy, WI 53120 USA

Visit us online at <http://www.plymouth.com>

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Phone: **1-262-642-8201**

Fax: 262-642-8486

Email: [sales@plymouth.com](mailto:sales@plymouth.com)

**EXAMPLE: 3/4" O.D. x 0.035" wall**

(a) Average tube sheet hole	.757"
(b) Average tube O.D.	.751"
Average Clearance	.006"
(c) Average tube I.D.	.681"
Average I.D. at metal-to-metal contact	.687"
(d) 5% of .035" = .0018 X 2 = .0036"	
Average I.D. Desired	.6906"

The torque setting should be started at a low value and gradually adjusted upward until the proper expansion is obtained. During the setup of the torque level, each trial should be conducted on a previously unrolled tube. After the setting is established, the previous tubes can be re-rolled with the proper setting. It is important to recognize that the actual tube I.D.'s on properly expanded tubes will not all be the same value. The I.D.'s will vary dependent upon actual tubesheet hole, tube O.D. and tube I.D. sizes.

**FLARING**

If flaring is required, the following procedure is suggested to avoid splitting. Even with the use of proper tooling, some work-hardening or feathering of the tube end can be expected from the expanding operation. After the tubes are rolled, the ends should be lightly ground with 190 grit sanding discs to remove sharp edges or burrs. The flaring operation should then proceed with no splitting problems. If flaring on both ends is required the excess length must be removed. Carbide tube facing bits designed specifically for stainless are recommended for this procedure. The feed should be heavy and continuous and should stop as soon as the proper length is achieved. This will avoid work hardening the tube ends. Any cutting operations other than facing should be performed with a rotating abrasive cut-off wheel.

**RE-ROLLING**

Joints which show leak indications during a pressure fluid test can be re-rolled. They should first be re-rolled using the originally established torque setting. If this does not solve the leaking problem, re-rolling it at an increased setting should be done with extreme care. Once tubes are over-rolled the situation becomes very difficult to correct.

**FOR FURTHER ASSISTANCE:**

Plymouth Tube Co. Inside Sales is prepared to offer clarification on these procedures. Just call 262-642-8201, or FAX your questions to 262-642-8486 Attention: Inside Sales or e-mail [sales@plymouth.com](mailto:sales@plymouth.com).

