

# Flaretek® Tube Fitting Heated Flare and Assembly Procedures

*Insert installation instructions for  
1/4", 3/8", 1/2", 3/4" and 1" sizes*

## SPECIFICATIONS

Maximum pressure rating chart

Size (X)	Temperature	FluoroLine® 4300, 4200 PFA tubing reference	PVDF nut FL(X)-1	PFA nut FL(X)-3	CPFA nut FL(X)-6
1/4" (4)	24°C (75°F)	1882 kPa (273 psig)	1551 kPa (225 psig)	1551 kPa (225 psig)	1551 kPa (225 psig)
	93°C (200°F)	938 kPa (136 psig)	917 kPa (133 psig)	917 kPa (133 psig)	917 kPa (133 psig)
	121°C (250°F)	586 kPa (85 psig)	689 kPa (100 psig)	689 kPa (100 psig)	689 kPa (100 psig)
	150°C (300°F)	421 kPa (61 psig)	517 kPa (75 psig)	517 kPa (75 psig)	517 kPa (75 psig)
	175°C (350°F)	248 kPa (36 psig)	N/R	345 kPa (50 psig)	345 kPa (50 psig)
	200°C (400°F)	N/R	N/R	N/R	103 kPa (15 psig)
3/8" (6)	24°C (75°F)	1613 kPa (234 psig)	1551 kPa (225 psig)	1551 kPa (225 psig)	1551 kPa (225 psig)
	93°C (200°F)	800 kPa (116 psig)	917 kPa (133 psig)	917 kPa (133 psig)	917 kPa (133 psig)
	121°C (250°F)	503 kPa (73 psig)	689 kPa (100 psig)	689 kPa (100 psig)	689 kPa (100 psig)
	150°C (300°F)	359 kPa (52 psig)	517 kPa (75 psig)	517 kPa (75 psig)	517 kPa (75 psig)
	175°C (350°F)	214 kPa (31 psig)	N/R	345 kPa (50 psig)	345 kPa (50 psig)
	200°C (400°F)	N/R	N/R	N/R	103 kPa (15 psig)
1/2" (8)	24°C (75°F)	1158 kPa (168 psig)	1310 kPa (190 psig)	1310 kPa (190 psig)	1310 kPa (190 psig)
	93°C (200°F)	572 kPa (83 psig)	689 kPa (100 psig)	689 kPa (100 psig)	689 kPa (100 psig)
	121°C (250°F)	359 kPa (52 psig)	517 kPa (75 psig)	517 kPa (75 psig)	517 kPa (75 psig)
	150°C (300°F)	255 kPa (37 psig)	345 kPa (50 psig)	345 kPa (50 psig)	345 kPa (50 psig)
	175°C (350°F)	152 kPa (22 psig)	N/R	276 kPa (40 psig)	276 kPa (40 psig)
	200°C (400°F)	N/R	N/R	N/R	103 kPa (15 psig)
3/4" (12)	24°C (75°F)	738 kPa (107 psig)	758 kPa (110 psig)	758 kPa (110 psig)	758 kPa (110 psig)
	93°C (200°F)	365 kPa (53 psig)	524 kPa (76 psig)	524 kPa (76 psig)	524 kPa (76 psig)
	121°C (250°F)	228 kPa (33 psig)	241 kPa (35 psig)	241 kPa (35 psig)	241 kPa (35 psig)
	150°C (300°F)	165 kPa (24 psig)	186 kPa (27 psig)	186 kPa (27 psig)	186 kPa (27 psig)
	175°C (350°F)	95.5 kPa (14 psig)	N/R	138 kPa (20 psig)	138 kPa (20 psig)
	200°C (400°F)	N/R	N/R	N/R	103 kPa (15 psig)

N/R = Not recommended

## SPECIFICATIONS (CONTINUED)

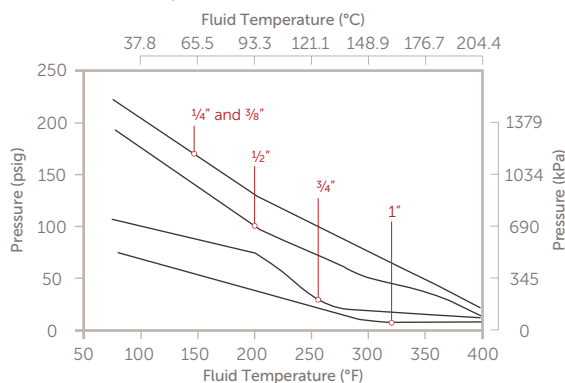
Maximum pressure rating chart (continued)

Size (X)	Temperature	FluoroLine 4300, 4200 PFA tubing reference	PVDF nut FL(X)-1	PFA nut FL(X)-3	CPFA nut FL(X)-6
1" (16)	24°C (75°F)	531 kPa (77 psig)	517 kPa (75 psig)	517 kPa (75 psig)	517 kPa (75 psig)
	93°C (200°F)	262 kPa (38 psig)	276 kPa (40 psig)	276 kPa (40 psig)	276 kPa (40 psig)
	121°C (250°F)	165 kPa (24 psig)	193 kPa (28 psig)	193 kPa (28 psig)	193 kPa (28 psig)
	150°C (300°F)	117 kPa (17 psig)	103 kPa (15 psig)	103 kPa (15 psig)	117 kPa (17 psig)
	175°C (350°F)	68.9 kPa (10 psig)	N/R	103 kPa (15 psig)	103 kPa (15 psig)
	200°C (400°F)	N/R	N/R	N/R	103 kPa (15 psig)

N/R = Not recommended

## PERFORMANCE DATA

Pressure vs. Temperature



## CHEMICAL COMPATIBILITY

Refer to Entegris' *Fluid Handling Systems* catalog or web site for chemical compatibility information.

## FLARETEK® FITTING CONNECTION

The hot flaring process provides a permanent expansion (flare) of the tubing end, allowing insertion of the Flaretek fitting body. Proper tube flaring and Flaretek fitting assembly results in a secure tubing connection.

Entegris recommends these procedures for flaring standard wall Entegris PFA tubing only (0.062" wall thickness for 3/8", 1/2", 3/4" and 1" OD, 0.047" wall thickness for 1/4").

**NOTE: The tubing cools rapidly so please read and understand all instructions before flaring.**

## TUBING PREPARATION

1. Cut the tubing end squarely (0.070" maximum squareness tolerance) using an Entegris tubing cutter (part number 213-14, 213-16 or 213-30).
2. Insert the cut end of the tubing through the nonthreaded end of the nut.

**WARNING:** If you do not put the nut on the tube now you will not be able to put it on after you complete the flare.

Flaretek® fittings are specifically designed, tested and characterized to work together with specific Flaretek fitting components manufactured by Entegris. Customer assumes the risk of connection integrity if Flaretek fittings, body and/or nut components are attached to components manufactured by third parties.

## HEAT FLARING INSTRUCTIONS

1. If using an Entegris hot air gun, set the hot air gun (see Figure 1) on "high." Hold the PFA tubing end flush with the heater edge and 1/2" to 3/4" above the heater and slowly rotate the tubing 360° for the approximate time specified in Table 1 or until a fine, clear line appears around the tubing.

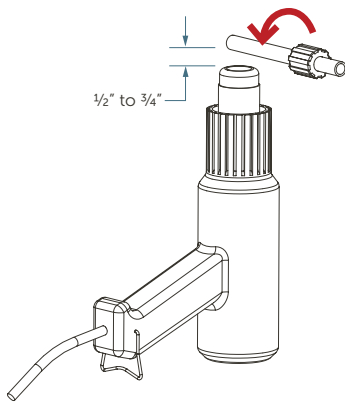


Figure 1.

**NOTE:** It is very important to fully rotate the tubing over the heat source so all surface areas receive an equal amount of heat. Uniform heating is essential to making a good flare.

If using an Entegris infrared heating tool, turn on heating tool (see Figure 2). Center 1/2" to 3/4" of the PFA tubing between the heat rings. While slowly rotating the PFA tubing back and forth between your forefinger and thumb, heat for the approximate time specified in Table 1 or until a fine, clear line appears around the tubing.

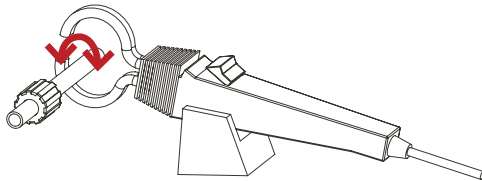


Figure 2.

**NOTE:** To flare 1" tubing with an Entegris infrared heating tool, a larger heat ring (part number 213-91 or 213-92) is needed.

**NOTE:** It is very important to rotate the tubing through the heat source so all surface areas receive an equal amount of heat. Uniform heating is essential to making a good flare.

- Remove the PFA tubing from the heat source. Immediately push the flaring mandrel (see Figure 3) into the tubing until the end of the tubing reaches the tube stop. Refer to Entegris' *Fluid Handling Systems* catalog or web site for available mandrel configurations.

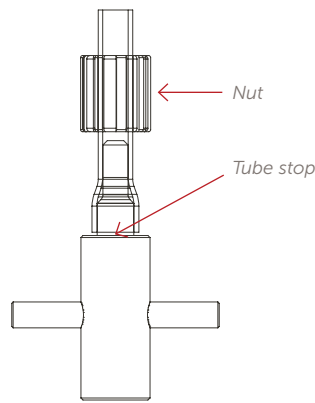


Figure 3.

**NOTE:** Flaring 1/4" tubing is the most challenging because of its small size. To get a firm grip on the small tube diameter, we recommend using the grip pad that is included in the mandrel kit (for additional grip pad, part number 213-73).

- Firmly hold the tubing onto the mandrel for the time specified in Table 1.
- Let the flared tubing continue to cool on the mandrel for the time specified in Table 1.

**NOTE:** A water bath may be used to cool the tubing. If bath is used:

- Hold tubing on mandrel for 20 seconds after heating.
  - Place tubing on mandrel in bath for one minute.
- The flaring process is now complete and the mandrel may be removed from the tube.

**NOTE:** An automatic bench top flaring tool is also available by Entegris (part number 213-95, 213-96, 213-95R).

## FLARETEK FITTING ASSEMBLY INSTRUCTIONS

1. Push the flared tubing end onto the Flaretek fitting body until the end of the fitting body contacts the flare shoulder of the tube (see Figure 4). The maximum gap between the tube end and fitting shoulder should be 2.03–3.81 mm (0.08–0.15”).

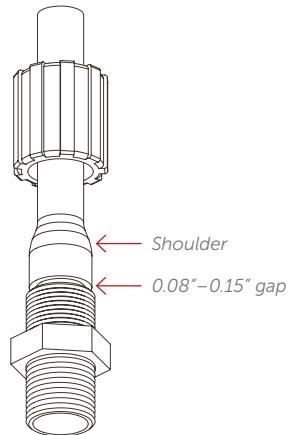


Figure 4.

2. Tighten the nut onto the fitting body until handtight (see Table 1 for recommended minimum torque values).

Table 1.

Tubing and fitting size		¼"	⅜"	½"	¾"	1"
<b>Heating time for PFA</b>	Air gun	15 sec	25 sec	25 sec	25 sec	25 sec
	Infrared heater	40 sec	50 sec	50 sec	50 sec	50 sec
<b>Hold tubing on flare mandrel</b>		20 sec	20 sec	20 sec	20 sec	20 sec
<b>Minimum cooling time on mandrel</b>		2 min	2 min	3 min	3 min	3 min
<b>Minimum nut torque</b>	PFA fitting/PVDF nut	0.57 N•m (5 in•lbs)	0.90 N•m (8 in•lbs)	1.24 N•m (11 in•lbs)	1.58 N•m (14 in•lbs)	3.39 N•m (30 in•lbs)
	PFA fitting/PFA nut	0.57 N•m (5 in•lbs)	0.90 N•m (8 in•lbs)	1.24 N•m (11 in•lbs)	1.58 N•m (14 in•lbs)	3.39 N•m (30 in•lbs)
	PFA fitting/CPFA nut	0.57 N•m (5 in•lbs)	0.90 N•m (8 in•lbs)	1.24 N•m (11 in•lbs)	1.58 N•m (14 in•lbs)	3.39 N•m (30 in•lbs)
	PVDF fitting/PVDF nut	0.57 N•m (5 in•lbs)	0.90 N•m (8 in•lbs)	1.24 N•m (11 in•lbs)	2.14 N•m (19 in•lbs)	4.51 N•m (40 in•lbs)

## RETIGHTENING

After exposing the connection to operating conditions for a minimum of one hour, all fitting connections assembled using the Room Temperature flaring technique should be retightened to the minimum nut torque values identified in Table 1.

After initial exposure to temperatures >74°C (>165°F), all "SpaceSaver" fitting connections should be retightened to the minimum nut torque values identified in Table 1 (fitting must be returned to room temperature before retightening).

## TROUBLESHOOTING

### Flaretek tube fitting assembly

Problem	Possible cause	Solution
After flaring the tubing, one side of the expanded portion of the tubing is wrinkled and shorter than its original length.	The tubing was not heated evenly. The wrinkled areas were overheated.	The wrinkles can be avoided by rotating and moving the tubing through the heat source with more uniformity. Cut off the flared tubing end and reflare.
The tubing kinks when pushing it onto the flaring mandrel.	The tubing was not heated properly before flaring.	½" to ¾" of the tubing needs to be heated. Closely follow the recommended heating times in Table 1. Cut off the flared tubing end and reflare.
When the flared tubing is pushed onto the fitting body, the tubing is more than 0.150" away from the threaded area of the fitting body.	The tubing was not pushed onto the flaring mandrel all the way or the tubing was removed from the mandrel before it was cool.	Tubing may need longer heating time or longer cooling time on the flaring mandrel. Cut off the flared tubing end and reflare.
The flared tubing will not fit onto the fitting body.	The tubing was removed from the mandrel before it was cool.	Reheat and reflare the undersized flared tubing end. Allow adequate cooling time prior to removing from the flare mandrel. <b>Or</b> Cut off the flared tubing end and reflare. Be sure the tubing is cool before removing it from the mandrel.
Changes need to be made to a line after chemical has been run through the system. There is potential for vapor explosion in the line or hazard to the operator.		Heated flaring should <b>only</b> be attempted with tubing that has not been exposed to chemical. We recommend using the Entegris Room Temperature Flaring Tool (part number 213-112) if the tubing has been exposed to chemical.
Tube connection leaks.	Inadequate torque on fitting nut.	Retighten according to the torque value in Table 1.
	Possibly damaged flare mandrel.	Replace mandrel. Cut off the flared tubing and reflare.

## TORQUE WRENCH CALCULATION

When using an Entegris flare fitting wrench, the torque reading must be adjusted on the torque wrench to compensate for the wrench extension length (see Figure 5 for reference).

$$G = (L \times T) \div (L + E)$$

**G** = Torque wrench reading (in•lbs)

**L** = Torque wrench length (inches)

**T** = Torque desired (in•lbs)

**E** = Extension length (e.g. 3.10")

*Example:*

*Wrench length = 12.0"*

*Extension length = 3.10"*

*Torque desired = 80 in•lbs*

$$(12 \times 80) \div (12 + 3.1) = 63.58 \text{ in}\cdot\text{lbs}$$

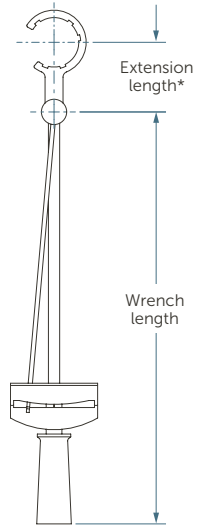


Figure 5.

## FOR MORE INFORMATION

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