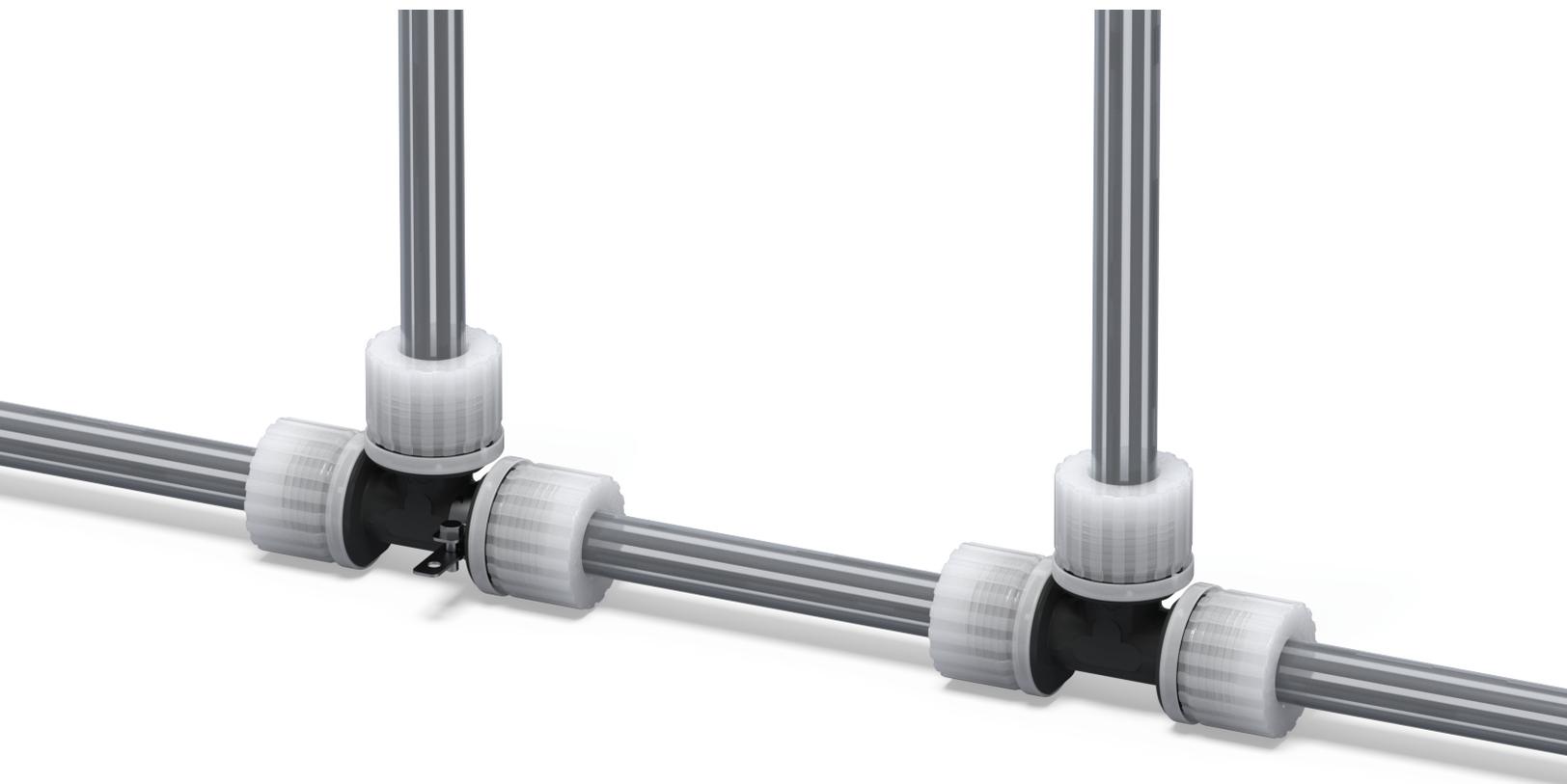


# ESD Fluid Handling Systems

*User guide*



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## INTRODUCTION

Entegris offers an ideal solution for minimizing potential issues related to electrostatic discharge (ESD) in a fab, maintaining chemical purity, ensuring safety, and improving process yields. The following instructions detail proper ESD fitting and ESD tubing installation, proper grounding methods, and means of testing the conductivity of an ESD system.

## ESD SYSTEM

Typical systems will consist of FluoroLine Plus ESD tubing and PrimeLock ESD fittings. As detailed in Figure 1, the ground is made at the fitting seal point at the interface of the fitting and tube. It is grounded through the attached grounding strap which requires a grounding wire secured to ground.

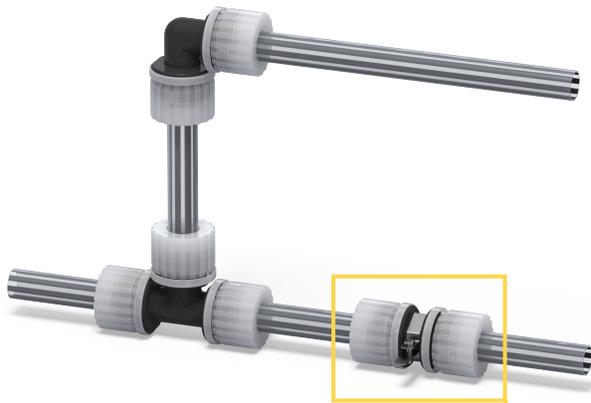
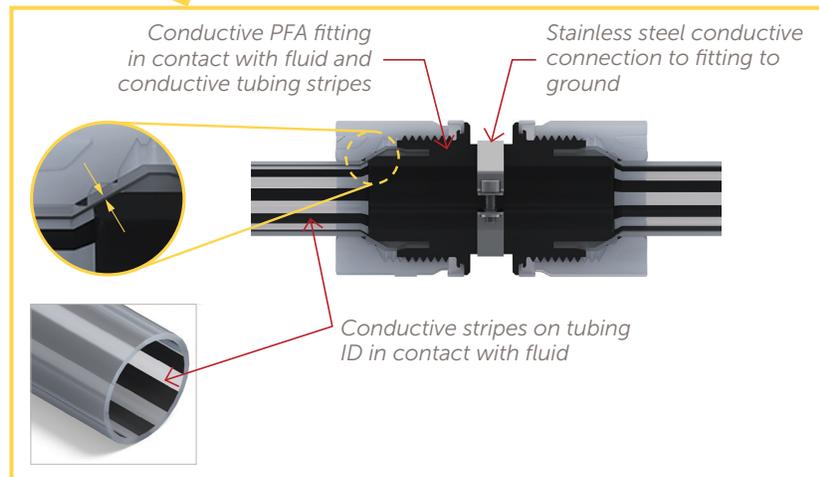


Figure 1.



## FLUOROLINE PLUS ESD TUBING

FluoroLine Plus ESD tubing has conductive stripes on the ID of the tube and when assembled to a PrimeLock ESD fitting and properly grounded, the electrical charge accumulation in the tube and in the media will be grounded.

**⚠ WARNING: Exceeding the ESD tubing maximum pull force limits listed in Table 1 could result in increased resistance and potential tubing damage.**

1. After the PrimeLock fitting connection is fully tightened, conductivity between the fitting and tubing will be established.

**NOTE: Reference the various PrimeLock fitting instruction sheets on page 4.**

2. The grounding strap can be used to provide a ground point and a means to check system resistance.
3. The resistance between two grounding straps separated by fully conductive tubing and fittings can be measured with a precision ohmmeter (capability of  $10^{13}$  ohms). The measured resistance must be less than the resistance per length value in Table 1 for the specific tube size multiplied by the length between the ground straps.

Example calculation:

- 250 foot run of  $\frac{3}{4}$ " tubing (ESDT750-062)
- Max resistance per length (ohms/foot)  $\times$  Number of feet in installation
- $1.3E+06$  ohms/foot  $\times$  250 feet =  $3.25E+08$  ohm (measured resistance must be below this reading).

4. The maximum distance tested between ground points is 400 feet.



Table 1.

Tubing part number	OD	Wall thickness	ID	Minimum bend radius	Maximum reel length	Maximum resistance per length	Maximum resistance per length	Tubing size	Tubing pull limits	Tubing weight*
ESDT250-047	0.250"	0.047"	0.156"	1.5"	2500'	3.1E+08 ohms/m	9.5E+07 ohms/ft	$\frac{1}{4}$ "	45 lbs	0.03 lbs/ft
ESDT375-062	0.375"	0.062"	0.251"	2.0"	5000'	7.0E+07 ohms/m	2.1E+07 ohms/ft	$\frac{3}{8}$ "	91 lbs	0.06 lbs/ft
ESDT500-062	0.500"	0.062"	0.376"	2.3"	4000'	6.9E+06 ohms/m	2.1E+06 ohms/ft	$\frac{1}{2}$ "	127 lbs	0.08 lbs/ft
ESDT750-062	0.750"	0.062"	0.626"	9.0"	1500'	4.2E+06 ohms/m	1.3E+06 ohms/ft	$\frac{3}{4}$ "	200 lbs	0.13 lbs/ft
ESDT1000-062	1.000"	0.062"	0.876"	11.0"	750'	6.0E+06 ohms/m	1.8E+06 ohms/ft	1"	273 lbs	0.17 lbs/ft
ESDT1250-075	1.250"	0.075"	1.100"	12.5"	500'	3.3E+06 ohms/m	1.0E+06 ohms/ft	1 $\frac{1}{4}$ "	413 lbs	0.26 lbs/ft

\*Tubing weight factors into total load if tubing is vertical.

## PRIMELOCK ESD FITTINGS



PrimeLock ESD fittings are molded from conductive PFA material and are designed to be assembled with FluoroLine Plus ESD tubing.

To assemble PrimeLock fittings, please see the PrimeLock fitting instructions found on our web site:

- Bench top tool, 1/4" – 1"  
<https://www.entegris.com/content/dam/shared-product-assets/primelock-shared/instsheet-primelock-bench-6128.pdf>
- Bench top tool, 1 1/4", 1 1/2", and 40 mm  
<https://www.entegris.com/content/dam/shared-product-assets/primelock-shared/instsheet-primelock-bench-7241.pdf>
- Handheld insertion tool, 1/4" – 1 1/2", and 40 mm  
<https://www.entegris.com/content/dam/shared-product-assets/primelock-shared/instsheet-primelock-handheld-6218.pdf>

## GROUNDING STRAP TO FITTING INSTALLATION INSTRUCTIONS



Specially designed PrimeLock ESD fitting grounding straps provide a secure grounding connection point to the ESD fittings, ensuring an effective charge dissipation path from the tube ID to equipment or facility ground.

1. Select correct grounding strap size and style for fitting connection. Clean grounding strap surfaces and fitting surface where strap will be installed with IPA.
2. Remove the screw from the grounding strap and spread it to fit over the fitting. Some manipulation of the strap will be required to properly install it onto the fitting. For elbow and tee configurations, be sure to orient the flat edge of the grounding strap against the flange of end connection, Figure 2.



Figure 2.

**⚠ WARNING:** For tee configurations, the grounding strap can only be installed on the run legs, not on the branch, Figure 3.

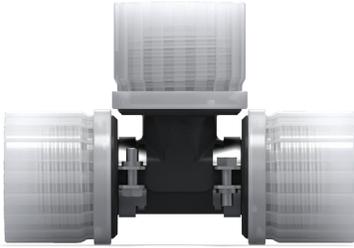


Figure 3.

- Once installed, manually close the strap and install screw. For round clamps, verify the flat edge is placed up against the fitting shoulder. Tighten the screw to 160 in•oz or until the two sides of the grounding strap are completely touching one another, Figure 4.



Figure 4.

- Grounding straps do not need to be installed on every fitting. Having a single grounding strap installed and grounded on a fitting will ground an entire system up to 400 feet. Additional grounding straps may be assembled throughout the system for use of measuring resistance.

**NOTE:** Nonconductive components within the system need to be grounded on either side of the component, Figure 5.

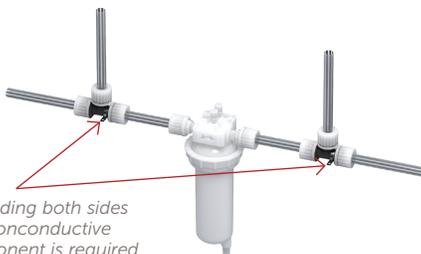


Figure 5.

## CONTINUITY TESTING

Continuity should be tested between ground straps installed on fittings using alligator clamps to ensure a solid connection, Figure 6.

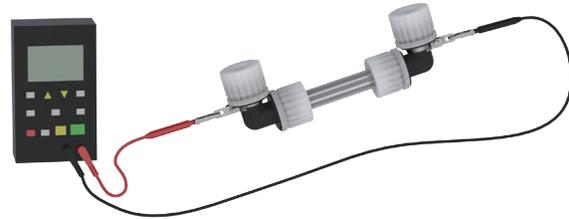


Figure 6.

**⚠ WARNING:** It is not recommended to use probes or alligator clamps directly on the tubing for continuity testing. Figure 7.

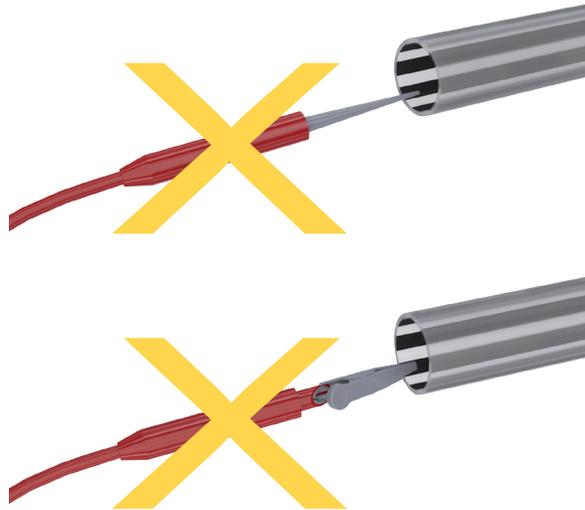


Figure 7.

Testing continuity using one of these two setup methods is recommended.

### SETUP METHOD 1

Test setup method 1 (Figure 8) requires:

1. Extra-low resistance wire (<1000 ohms) to connect meter to far connection
2. Maximum measured distance less than 400 feet
3. Resistance meter with  $10^{13}$ -ohm capability

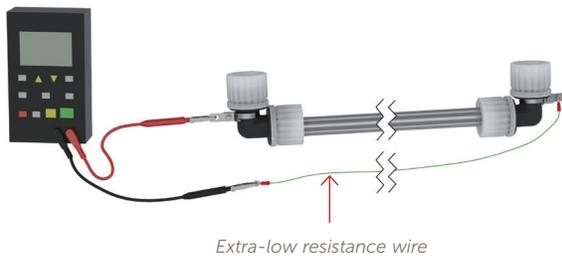


Figure 8.

### SETUP METHOD 2

Test setup method 2 (Figure 9) requires:

1. Common facilities ground
2. Extra-low resistance wire (<1000 ohms) resistance between ground points
3. Maximum measured distance less than 400 feet
4. Resistance meter with  $10^{13}$ -ohm capability

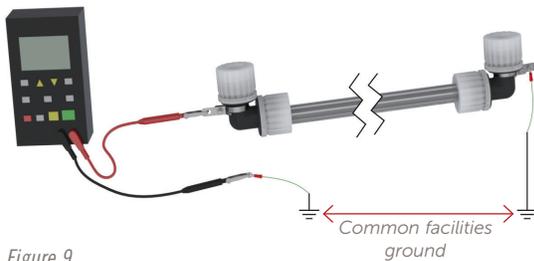


Figure 9.

### SYSTEM INSPECTION

Identifying conductive equipment and objects within a process is critical for successful grounding. Periodic inspection and testing of grounding systems are equally important to minimize static charge accumulation.

In grounding installations that are prone to corrosion, movement, or insulating surface coatings, self-testing ground clamps and systems can be used to continuously test the resistance to ground and verify acceptable levels.

Resistance to ground is measured with an ohmmeter. Care should always be taken to avoid ignition by using appropriate instruments and procedures based on the area classification.

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