

## OPERATING PROCEDURES FOR G-100 TUBE TESTING GUNS

### PRIOR TO TESTING:

- The tubes to be tested should be cleaned and any loose deposits or scale should be removed. If the tubes have not been cleaned, any foreign materials present may be ejected during the testing operation and may damage the test guns or injure the operators.
- The operators should always wear the appropriate personal protective equipment (PPE). At a minimum safety glasses or a face shield should be worn when testing with the G-100 test equipment.
- If the tubes have been acid cleaned please check with EST regarding the compatibility of the test gun seals with the cleaning agent. Different types of elastomer seals are available as replacements.
- Make sure the test guns have the correct size Replacement Seal and Washer Sets, shown as Items 2, 3 & 4 in Figures 1 and 2, for the tube size being tested. Two (2) Sets are required. The seals and washers are considered to be correctly sized if the OD of the seal is between 0.02" to 0.06" (0.5 mm to 1.5 mm) smaller than the actual tube ID. Using seals that are too small may cause any of the following: premature seal wear, jamming of the test gun in the tube, and / or expulsion of the test gun from the tube end. Replacement seals for the G-100 testing guns can be manufactured for any tube ID from .28" to 1.23" (7.1 mm to 31.3 mm).

### TESTING PROCEDURE:

The G-100 Tube Testing Guns are supplied as a set. This set is comprised of the following individual components: an G-100 Air Injection Gun (AIG), G-100 Plugging Gun (PG) and a G-100 / 300 Pressure Attachment (PA). These components are shown in Figures 1 through 3 respectively. The PA is connected to the AIG via a quick connect coupling. This coupling allows the PA to rotate around the axis of the AIG facilitating the use of the AIG in tight confines of a channel head or partition plate. The AIG and PG components should be fit with a Seal and Washer Set that corresponds to the tube size being tested. Seal and Washer Sets are purchased separately. Seal and Washer Set sizing is shown in Table 3 below. In very tight confines separate Support Rod Extension Assemblies are available to increase the distance between the AIG / PG and the tubesheet face.

1. Select and install the appropriate size Seal and Washer Set, refer to Table 2. One Seal element with a flanking washer on each side should be installed onto both the AIG and PG. The G-100 Seals are "stepped" so that the minor diameter will fit in the tube end and the shoulder of the major diameter will act as a face seal on the tube end. The Seal should be oriented so that the major diameter end is toward the back or operator side of the gun, refer to Figures 1 and 2.
2. Attach air supply to the PA. Connect the PA to the AIG. The G-100 test guns are operable on plant air supplies ranging from 40 to 125 psi (2.7 to 8.6 Bar) at a minimum of 5 CFM (2.36 liters per second).

Table 1. Maximum Suggested Working Pressure by Tube ID			
Tube ID Range		Test Pressure	
(in)	(mm)	(psi)	(Bar)
0.28 to 1.23	7.1 to 31.3	125	8.6



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3. One Operator inserts the AIG injection gun into one end of the tube to be tested. A second Operator inserts the PG into the opposite end of the same tube. Both operators squeeze and maintain even hand pressure on the pistol grip to expand the Seal and close the tube end. Maintain this squeeze throughout the test.

**WARNING! NEVER RELAX THE SQUEEZE ON THE PISTOL GRIP WHILE THE TUBE IS PRESSURIZED. THE GUN(S) MAYBE FORCIBLY EXPELLED FROM THE TUBE END(S) RESULTING IN INJURY OR DEATH, TO THE OPERATOR.**

**WARNING! THE OPERATOR SHOULD NEVER BE POSITIONED DIRECTLY BEHIND THE TEST GUN.**

4. The AIG operator then pressurizes the tube by squeezing the handle of the air control valve lever on the PA for several seconds. Once the pressure has stabilized within the tube the AIG Operator releases the valve and both operators observe the pressure gage on their gun for the desired test duration. If the pressure within the tube remains steady, the tube is not leaking. Any loss of pressure observed indicates that the tube is leaking. Leaking tubes should be re-tested to confirm the results.
5. To relieve pressure within the tube the AIG operator depresses the bleed valve lever on the PA.
6. Both operators release the squeeze on the pistol grip of their guns. The Seals relax and the guns may be moved to the next tube to be tested. Mark each leaking tube encountered for plugging or other repair.
7. Repeat steps 3 through 6 for each tube to be tested.

**NOTE:** The total operation cycle may be completed in as short as 10 to 15 seconds. Actual testing times may vary

## **SEAL SIZING AND SELECTION**

Individual Seal and Washer Set Part Numbers may be derived from this table using the following format: GSD-XXXX-N, where XXXX is the number listed in the table that corresponds to the appropriate tube OD and BWG. Each Seal and Washer Set contains (1) seals and (2) washers for the indicated tube size(s). Two Seal and Washer Sets are required, one set for the G-100 Injection Gun and the other for the G-100 Plugging Gun.

<b>Table 2. G-100 Seal Sizing, BWG Tubes</b>								
<b>Wall (BWG)</b>	<b>Tube OD (in)</b>							
	<b>3/8</b>	<b>1/2</b>	<b>5/8</b>	<b>3/4</b>	<b>7/8</b>	<b>1</b>	<b>1 1/8</b>	<b>1 1/4</b>
<b>8-9</b>	N/A	N/A	0030	0043	0057	0069	0081	0093
<b>10-11</b>	N/A	N/A	0035	0047	0061	0073	0088	0098
<b>12-13</b>	N/A	0028	0041	0053	0065	0078	0090	0103
<b>14-15</b>	N/A	0033	0047	0057	0073	0083	0098	0110
<b>16-17</b>	N/A	0035	0049	0061	0075	0088	0100	0113
<b>18-19</b>	0028	0041	0053	0065	0078	0090	0103	0115
<b>20-24</b>	0030	0043	0057	0069	0081	0093	0106	0118

To determine the Seal size once the Seals have been removed from their original package, use EST's Seal Sizing Template, refer to Figure 4. Seal Sizing Templates are available by contacting EST Customer Service at any of the numbers listed. To use the Seal Sizing Template simply slip the template over the minor diameter of the seal. Find the slot in the template where the seal becomes gently pinched by the template and read the corresponding tube size and wall thickness from the front side of the template. The proper size will be indicated next to the green bar that is adjacent to where the minor diameter of the seal contacts the template.

**Note:** Some Seals will fit more than one tube size.



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**INSTALLING REPLACEMENT SEALS:**

Replacement seals for the G-100 guns are supplied with the corresponding size washers. Always replace the seals and washers on both guns at the same time.

1. Remove the locknut from the end of the support tube and set it aside.
2. Remove the Seal and Washer Set from the support tube. Discard if worn. Under optimum testing conditions you should be able to test between 100 to 500 tubes per Replacement Seal and Washer Set.
3. For replacement Seal and Washer sets of the same size, install on existing support tube. If you are changing the Seal and Washer set to a different size, keep in mind that the support tube assembly may be required to change as well. To replace the support tube assembly, refer to the procedure outlined below.
4. When replacing the locknut tighten the locknut until the seal expands slightly and barely fits into the tube being tested. If this is not done there may not be enough seal expansion when the pistol grip is squeezed to adequately seal the tube end.

**REPLACING THE SUPPORT TUBE ASSEMBLY:**

The G-100 test guns are originally shipped with three sets of support tube assemblies as shown in Table 3. These support tube assemblies will allow you to test tubes with ID's from 0.28" to 0.48", 0.49" to 0.83" and 0.84" to 1.23" (7.1 mm to 12.3 mm, 12.4 mm to 21.2 mm, and 21.3 mm to 31.3 mm respectively). Support Tube Extension Assemblies are also available allowing the distance between the Seal and Operator to be increased. Each Support Tube Assembly has an NPT thread on one end of the tube and a UNF thread on the other. The NPT threaded end should always be oriented so that it is threaded into the gun body.

1. Remove the Seal and Washer Sets as outlined above.
2. Install the AIG or PG in a vise and grip the body gently. Using a pipe wrench gently unscrew the support tube from the body.
3. All three sizes of support tubes will fit into the piston of the test gun. Choose the correct size support tubes for the tube ID being tested. Use Never-Seize® or equivalent thread lubricant to lubricate and seal the NPT threads. Do not over tighten the support tube into the gun body.
4. Repeat steps 1 through 3 for the remaining gun.
5. Prior to replacing the Seal and Washer Set and the Back-up Washer Set inspect the support tube for scars left from the replacement procedure. File smooth if present.

**QUESTIONS?** Contact EST Customer Service at any of the following locations with questions.

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FIGURE 1 G-100 AIR INJECTION GUN ASSEMBLY

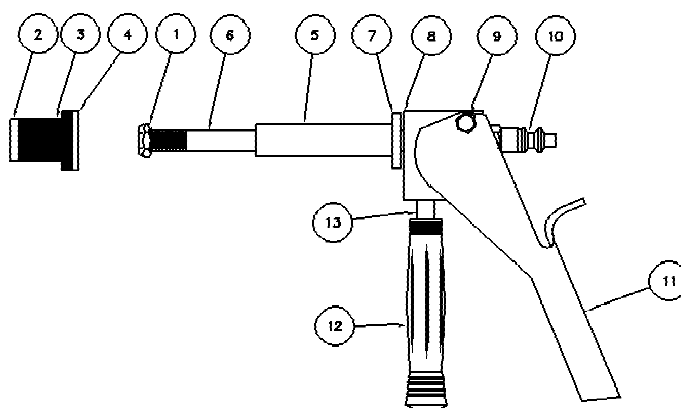


FIGURE 2 G-100 PLUGGING GUN ASSEMBLY

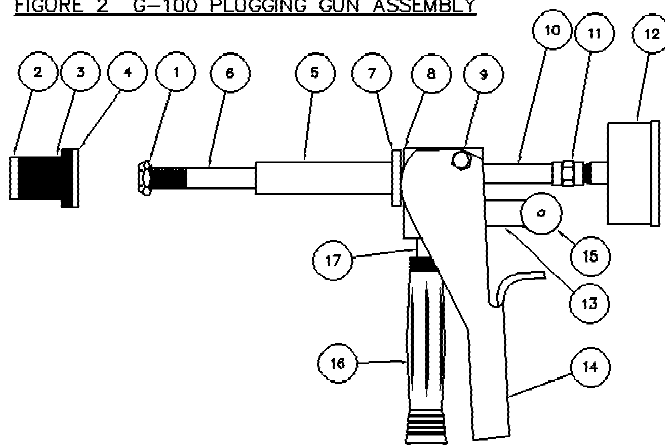
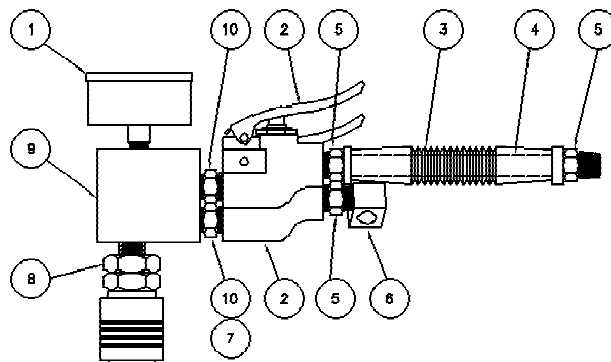


FIGURE 3 G-100/300 PRESSURE ATTACHMENT



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Table 3. G-100 Gun Set Parts List

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(Referenced Item Numbers refer to items on corresponding drawings, see Figures 1, 2 and 3 on preceding page)				
G-100 Air Injection Gun (AIG), ref: Figure 1				
Item No.	Description	Part Number By Tube ID Size		
		0.28" to 0.48	0.49" to 0.83"	0.84" to 1.23"
1	Locknut	GSA-1530 <sup>(2)</sup>	GSA-1531 <sup>(2)</sup>	GSA-1531 <sup>(2)</sup>
2	Seal Washer	GSD-XXXX-N <sup>(1)</sup>	GSD-XXXX-N <sup>(1)</sup>	GSD-XXXX-N <sup>(1)</sup>
3	Seal			
4	Seal Back-up Washer			
5	Compression Tube	GSD-1310-LL <sup>(2)</sup>	GSD-1311-LL <sup>(2)</sup>	GSD-1312-LL <sup>(2)</sup>
6	Support Tube			
7	Support Tube Assembly Washer			
8	Body	N/A	N/A	N/A
9	Handle Bolt & Nut	N/A	N/A	N/A
10	Quick Coupling, male	N/A	N/A	N/A
11	Pistol Grip Handle	N/A	N/A	N/A
12	Plastic Grip	N/A	N/A	N/A
13	Handle	N/A	N/A	N/A
G-100 Plugging Gun (PG), ref: Figure 2				
Item No.	Description	Part Number By Tube ID Size		
		0.28" to 0.48	0.49" to 0.83"	0.84" to 1.23"
1	Locknut	GSA-1530 <sup>(2)</sup>	GSA-1531 <sup>(2)</sup>	GSA-1532 <sup>(2)</sup>
2	Seal Washer	GSD-XXXX-N <sup>(1)</sup>	GSD-XXXX-N <sup>(1)</sup>	GSD-XXXX-N <sup>(1)</sup>
3	Seal			
4	Seal Back-up Washer			
5	Compression Tube	GSD-1310-LL <sup>(2)</sup>	GSD-1311-LL <sup>(2)</sup>	GSD-1312-LL <sup>(2)</sup>
6	Support Tube			
7	Support Tube Assembly Washer			
8	Body	N/A	N/A	N/A
9	Handle Bolt & Nut	N/A	N/A	N/A
10	Pipe Nipple	N/A	N/A	N/A
11	Pipe Coupling	N/A	N/A	N/A
12	Pressure Gage	GSA-1540	GSA-1540	GSA-1540
13	Body Support Handle	N/A	N/A	N/A
14	Pistol Grip Handle	N/A	N/A	N/A
15	Plastic Grip	N/A	N/A	N/A
16	Plastic Grip	N/A	N/A	N/A
17	Handle	N/A	N/A	N/A
G-100 / 300 Pressure Attachment (PA), ref: Figure 3				
Item No.	Description	Part Number By Tube ID Size		
		0.28" to 0.48	0.49" to 0.83"	0.84" to 1.23"
1	Pressure Gage	GSA-1540	GSA-1540	GSA-1540
2	Air Control Valve	GSA-1550	GSA-1550	GSA-1550
3	Plastic Grip	N/A	N/A	N/A
4	Handle	N/A	N/A	N/A
5	Reducing Bushing	N/A	N/A	N/A
6	Pipe Elbow Brass	N/A	N/A	N/A
7	Pipe Elbow CRS	N/A	N/A	N/A
8	Quick Coupling, female	N/A	N/A	N/A
9	Body	N/A	N/A	N/A
10	Reducing Nipple	N/A	N/A	N/A

**Notes:**

- (1) Refer to Table 2 for Seal and Washer Set sizing information and a description of the Part Numbering format. G-100 Gun Replacement Seal and Washer Sets should be purchased in pairs. One set for the G-100 Air Injection Gun, the other set for the G-100 Plugging Gun.
- (2) The G-100 Support Tube Assemblies are an assembly consisting of a support tube, compression tube, washer and locknut for the tube ID range identified. The Support Tubes may be purchased in standard, 1 foot (304 mm), 2 foot (609.6 mm), 3 foot (914.4 mm) and 4 foot (1,219.2 mm) lengths. Specify the Support Tube length by replacing the "LL" with 00, 01, 02, 03 or 04, to indicate the desired length in feet.

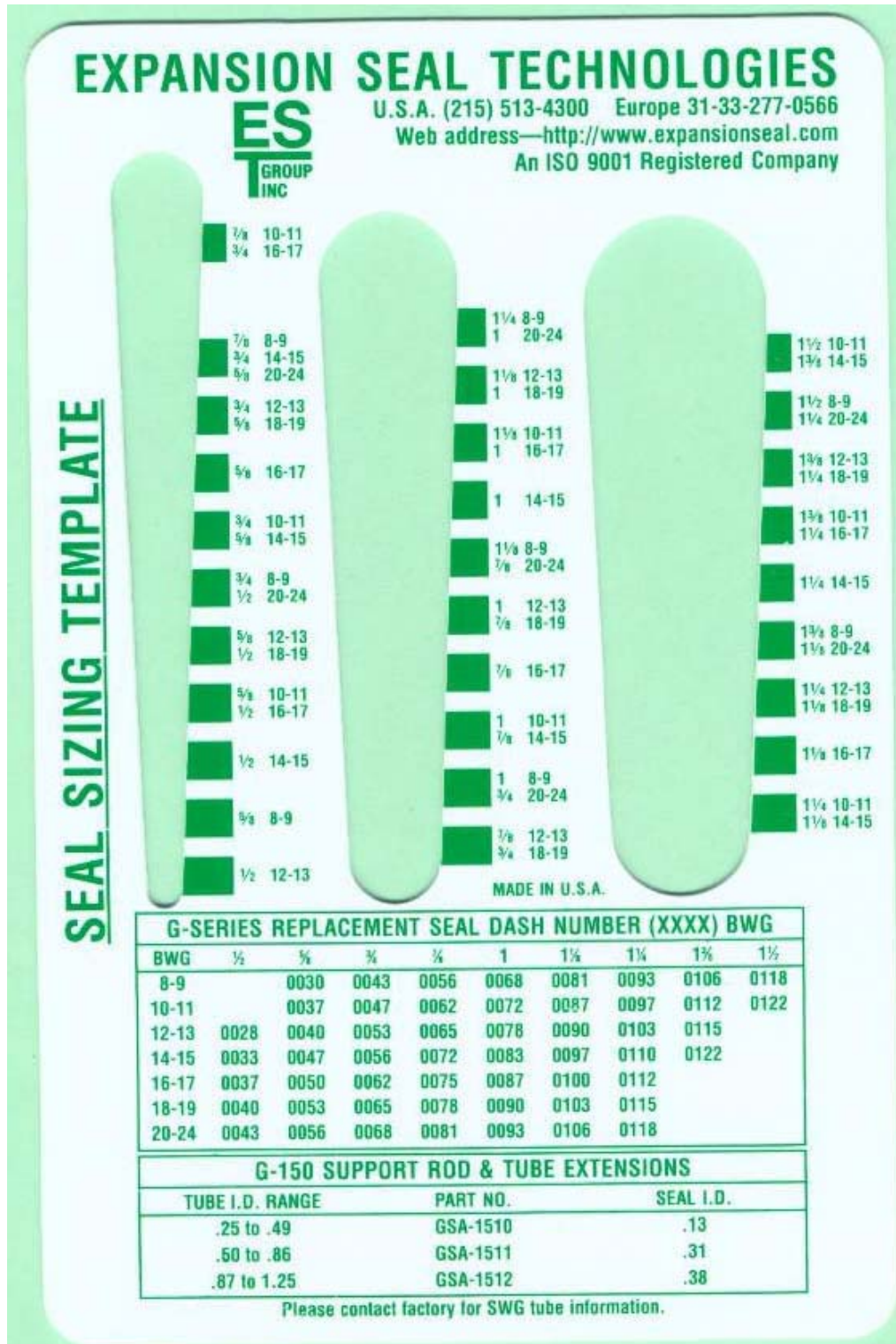


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Figure 4. Seal Sizing Template (Front View).



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