Installation Inspection Guide

Retractable Grounding Assembly (RGA)

Rev A, 10/3/13

II 2 G T4

Manufactured for Lightning Eliminators & Consultants, Inc.
by Conductix, Inc. 10102 F St Omaha, NE 68127.

1.0 Introduction

The RGA is designed to create the lowest impedance connection between the roof and shell of a floating roof tank by creating the shortest possible path between the two. This connection is obtained by keeping constant tension on the wide tinned copper braided cable.

The following manual outlines the inspection procedures required to ensure that an RGA has been installed properly by verifying the mechanical functionality and electrical continuity of each installed unit. Installation inspections may be performed on a tank during maintenance shut downs or while the tank is in service. It is recommended that written records be kept for reach RGA inspected for future reference.

Note: All site safety policies and procedures MUST be followed. Obtain all necessary permits before beginning the inspection.

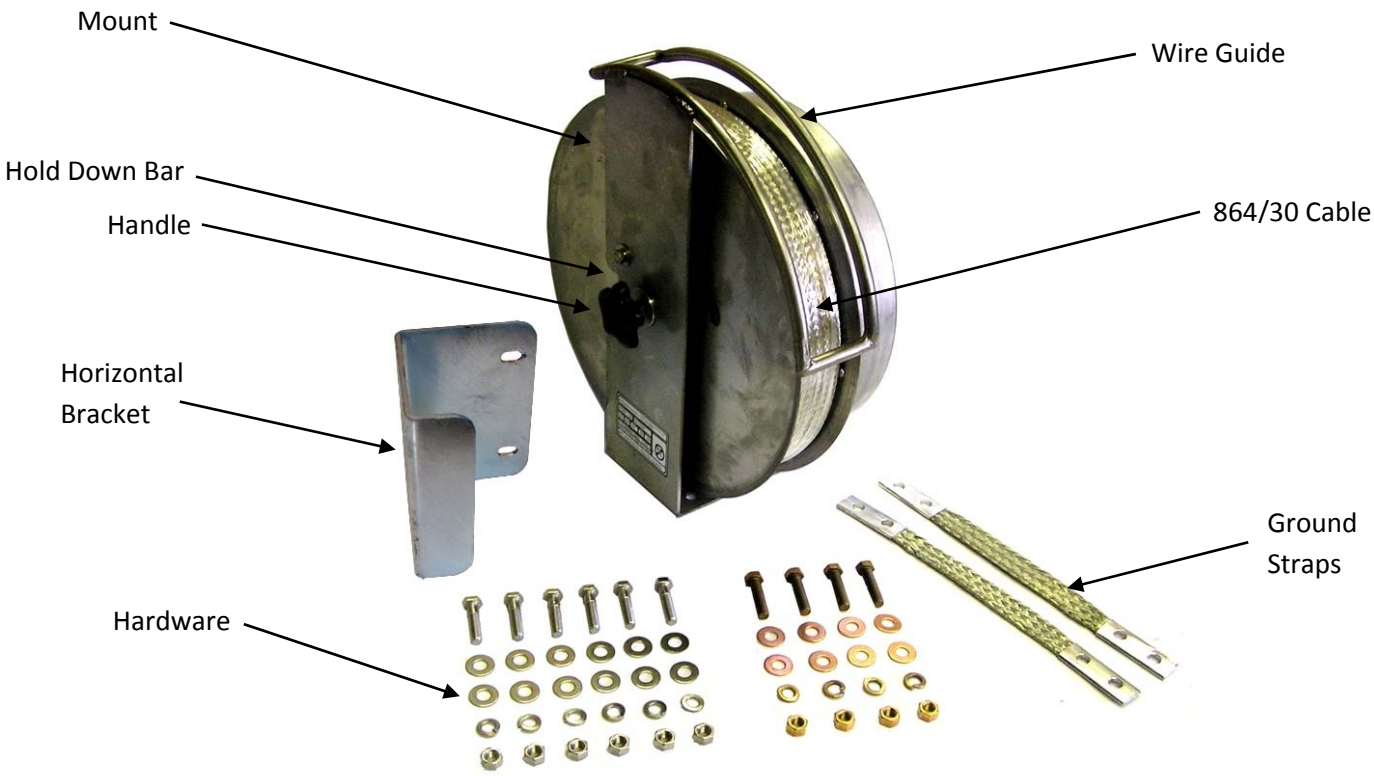

Figure 1: RGA Assembly

2.0 Equipment and Tools

RGAs may be inspected for proper installation with a minimum amount of common hand tools, as listed below. If permissible, photographs should be taken to document the method of attachment between each RGA reel and top of the tank, as well as each ground strap attachment to the foam dam or tank roof.

Required Inspection Items

Digital camera
Digital Multi-Meter (DMM)
Tape Measure (80ft [24.4m] minimum length)
0008846-Retractable Grounding Assembly Installation Manual
Pre-Tension Chart, RGA-55 and/or RGA-75 as required

3.0 Inspection Procedure

Determine the overall height of the tank where the RGAs are installed by either reviewing the tank construction drawings or the tank manufacturer's nameplate. The tank manufacturer's nameplate is typically located near the bottom of the tank access stairway, if equipped.

Obtain any RGA installation and commissioning records from site personnel. Review the records for information indicating date of install, installation procedures followed, and commissioning date. Note any discrepancies between LEC Installation Instructions and actual procedures followed, then proceed with the physical inspection procedure outlined below.

3.1 Top of Tank Inspections

3.1.1 Verify that the installed RGA's are spaced equally around the perimeter of the tank. (i.e. if 4 RGAs are installed on one 100ft [30m] diameter tank, each RGA should be located 90º apart, and approximately 78ft – 6 ½in [23.94m] around the circumference of the rim of the tank.)

3.1.2 As shown below in Figure 2, verify that all nuts and bolts fastening the RGA reel to mount and RGA mount or horizontal bracket to tank rim/wall have been securely tightened.

Note the model of RGA under inspection on the metal manufacturer's nameplate; either "RGA 55" or "RGA 75" will be listed under the "Retractable Grounding Assembly" heading.

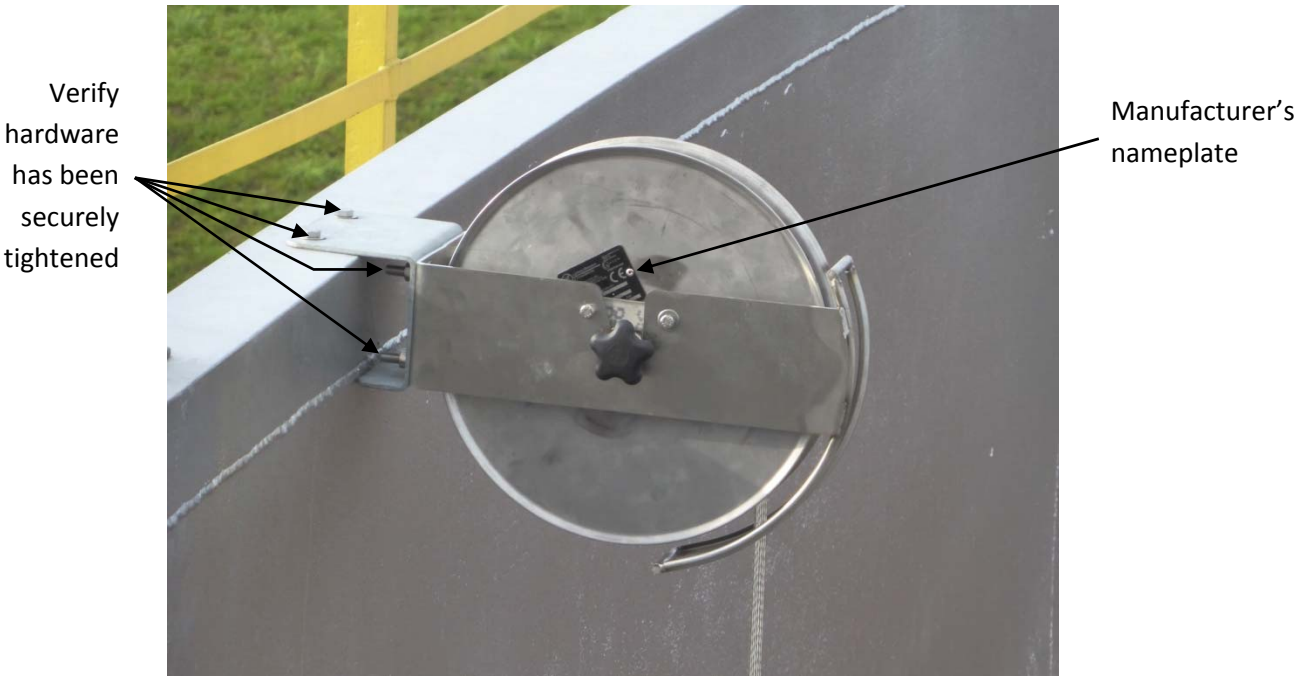

Figure 2: Secure reel attachment to the tank

3.1.3 During installation, the RGA must be pre-tensioned (rotated in the direction of cable payout) to a specific number of turns according to the height of the tank and maximum movement of the floating roof. Improper pre-tensioning of the RGA during installation is

the leading cause of premature RGA cable or strap failure. If the unit is not pre-tensioned properly in the field during installation, then the cable/strap assembly will be subjected to greater flexure and movement due to wind and the cable or straps will fail prematurely.

To determine the number of pre-tension turns placed on the unit during installation, the following steps should be followed:

A. Verify that the RGA reel rotates freely in the mount without binding and offers resistance to rotation in the direction of cable payout.

B. Using the metal manufacturer's nameplate riveted to the side of the reel as a reference point, slowly rotate the reel in the direction of cable payout, as shown below in Figure 3, while counting the number of full rotations until the reel cannot be rotated further.

Note: The springs will have reached their maximum limit of travel when the reel cannot be rotated further. Applying excessive force to rotate the reel beyond this point may damage the unit.

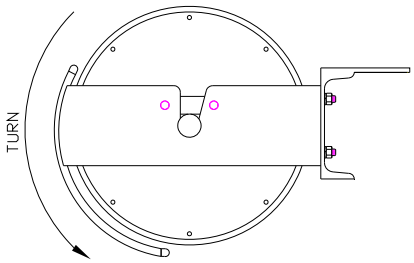

Figure 3: Pre-tension rotation direction

C. Note the total number of turns required to reach the maximum reel rotation (the reel cannot be rotated further in the direction of cable payout).

D. In a controlled fashion, carefully allow the reel to retract the strap back onto the reel until the cable is taught and the reel cannot retract further.

Note: Never allow the unit to retract in an uncontrolled manner. Uncontrolled retraction may damage the unit or result in injury to personnel.

E. Determine the total number of turns currently on the reel by subtracting the total number of turns to reach maximum reel rotation determined in steps B and C above from 46 if the unit is an RGA 55, or from 44 if the unit is an RGA 75.

For example, if the unit being inspected is an RGA 75, and 12 turns are required to reach maximum rotation, then 32 turns are currently on the reel (44 – 12 = 32).

F. Measure and note the length of cable paid out from the reel at the top of the tank down to the free end of the cable which is attached to the ground straps.

G. Depending on the model being inspected, use the appropriate chart below for either an RGA 55 or RGA 75 to determine the number of turns on the reel due to the current position of the floating roof.

RGA 55	
Cable Payout Length ft-in [m]	**Number of Turns**
3’-0” [0.92]	1
6’-0” [1.82]	2
8’-10” [2.70]	3
11’-8” [3.54]	4
14’-5” [4.38]	5
17’-1” [5.21]	6
19’-8” [6.00]	7
22’-3” [6.78]	8
24’-9” [7.54]	9
27’-2” [8.28]	10
29’-6” [9.00]	11
31’-10” [9.71]	12
34’-2” [10.40]	13
36’-4” [11.07]	14
38’-6” [11.73]	15
40’-7” [12.37]	16
42’-7” [12.99]	17
44’-7” [13.60]	18
46’-7” [14.19]	19
48’-5” [14.76]	20
50’-3” [15.32]	21
52’-0” [15.86]	22
53’-9” [16.38]	23
55’-5” [16.89]	24

RGA 75	
Cable Payout Length ft-in [m]	**Number of Turns**
3’-3” [1.00]	1
6’-5” [1.96]	2
9’-6” [2.90]	3
12’-7” [3.82]	4
15’-6” [4.73]	5
18’-5” [5.62]	6
21’-4” [6.50]	7
24’-2” [7.35]	8
26’-11” [8.20]	9
29’-8” [9.03]	10
32’-4” [9.85]	11
34’-11” [10.65]	12
37’-7” [11.44]	13
40’-1” [12.21]	14
42’-7” [12.97]	15
45’-0” [13.72]	16
47’-5” [14.44]	17
49’-9” [15.15]	18
52’-0” [15.85]	19
54’-3” [16.54]	20
56’-5” [17.21]	21
58’-7” [17.86]	22
60’-8” [18.50]	23
62’-9” [19.13]	24
64’-9” [19.73]	25
66’-8” [20.33]	26
68’-8” [20.92]	27
70’-6” [21.48]	28
72’-4” [22.03]	29
74’-0” [22.56]	30
75’-9” [23.08]	31

Figure 4: Number of turns on reel per cable payout length

For example, if the unit being inspected is an RGA 75, and 39'-7" [12.06m] of cable is paid out, then according to the RGA 75 table above in Figure 4, 14 turns have been placed on the unit as a result of the current position of the floating roof.

H. Determine the number of pre-tension turns placed on the unit during installation by subtracting the number of turns on the reel due to the current position of the floating roof, as determined in step G above, from the number of turns currently on the reel as determined in step E.

Continuing with the two previous examples, if the unit under inspection has 32 turns on the reel, and 14 of them were a result of the amount of cable paid out, then 18 turns were placed on the unit when pre-tensioned during installation (32 – 14 = 18).

I. Determine the maximum RGA cable payout length, as shown below in Figure 5, for the tank in question by subtracting the height of the floating roof support legs, floating roof thickness, and foam dam height from the overall height of the tank.

Note: If the height of the floating roof support legs and roof thickness cannot be readily determined, then an assumed combined roof height of 7ft [2.1m] may be subtracted from the overall height of the tank to determine the maximum RGA cable payout.

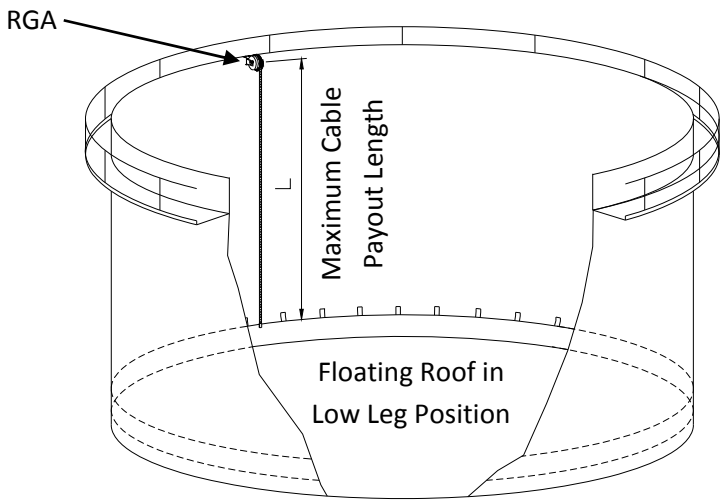

Figure 5: Maximum cable payout length

J. Compare the value computed in step H above with the number of pre-tension turns specified in the appropriate RGA 55 or RGA 75 pre-tension chart to determine if the unit is pre-tensioned properly.

To complete the example, if the tank being inspected is 65ft [19.8m] tall, and the combined roof thickness is assumed to be 7ft [2.1m], then the unit being inspected should have been pre-tensioned for a maximum cable payout length of 58ft [17.7m]. Pre-Tension Chart 0000274, to be used for an RGA 75, lists 19 pre-tension turns for a maximum cable payout length of 55ft [16.8m] and 17 pre-tension turns for a maximum cable payout length of 60ft [18.3m]. Therefore, the value of 18 pre-tension turns determined in step H above is appropriate for this tank and the inspection has revealed that the unit was, in fact, pre-tensioned properly during installation.

3.1.4 The RGA cable must be attached to the floating roof directly (plumb) below the reel. Visually verify that the RGA cable/ground strap connection to the floating roof is aligned vertically with the center of the braided RGA cable. Maintaining vertical cable alignment within +/- 12in [305mm] will minimize cable wear and maximize cable life.

3.1.5 Visually inspect the interface between the RGA mount and the tank rim/wall. During installation, paint and rust must be removed between all interfacing surfaces to ensure bare metal to bare metal contact. All mechanical connections must then be sealed with a corrosion inhibitor, which may be transparent and therefore difficult to detect.

The rust on the tank wall shown in Figure 6 below was likely not removed prior to installing the RGA mount, thereby preventing a reliable electrical connection between the RGA mount and tank wall.

Figure 6: Paint and rust must be cleaned to bare metal during installation

3.1.6 Using a Digital Multi-Meter (DMM) measure the resistance between the RGA cable and tank rim/wall at the top of the tank. Verify that there is no measureable resistance or that the measurement is less than 0.03 ohms.

3.2 Floating Roof Inspections

3.2.1 Three types of foam dams are commonly seen on floating roof tanks: welded, bolted, and angled, as illustrated below in Figures 7, 8 and 9. Each type of foam dam requires a different ground strap attachment method.

3.2.1.1 Welded Foam Dam

Figure 7 below shows a typical welded foam dam. This configuration generally consists of an approximately 1/4in [6.4mm] thick piece of steel, approximately 18-24in [457-610mm] tall that is rolled to the approximate diameter of the tank and welded directly to the floating roof. This construction allows for the RGA ground straps to be connected directly to the foam dam as good electrical conductivity is ensured between the foam dam and floating roof.

Verify that the ground straps have been mounted at the top of the foam dam so that they may flex and move along with the main cable. If the ground straps are mounted too low on the foam dam, then they will be prevented from flexing by the foam dam itself, and excessive stresses will be transferred to the main cable, resulting in premature cable failure.

Figure 7: Typical welded foam dam

3.2.1.2 Bolted Foam Dam

Figure 8 below shows a typical bolted foam dam. This configuration generally consists of a series of 18-24in [457-610mm] wide plates which are bolted to a welded portion of the floating roof. These foam dam plates are typically mounted over the primary and secondary seal fabric, as well as any gasket material, thereby resulting in unacceptably high impedance between the foam dam and floating roof. RGA ground straps may not be mounted directly to a bolted foam dam.

A custom bracket or tab must be attached directly to the floating roof in order to ensure a good electrical connection between the roof and RGA. The tab should be welded to the roof all the way around, but may be temporarily attached to the roof with at least two bolts. Verify that the bracket or tab has been located on the floating roof sufficiently inboard from the tank wall to ensure that the RGA cable and ground straps do not rub against any portion of the bolted foam dam as the roof rises and falls during normal tank operation. The RGA cable and straps will be nearest to the lip of the foam dam when the tank is at its fullest and the roof is near the top of the tank.

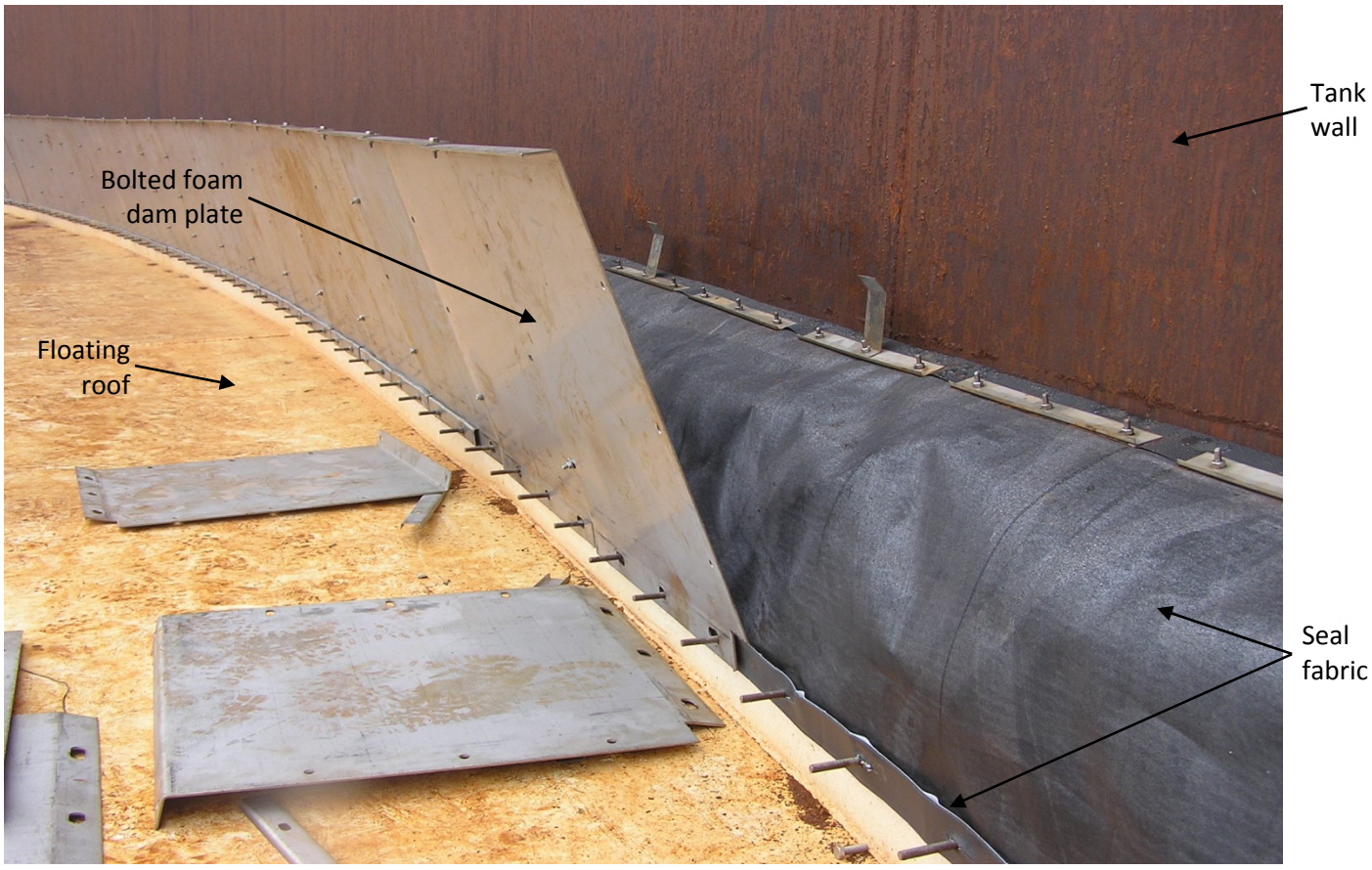

Figure 8: Typical bolted foam dam

3.2.1.3 Angled Foam Dam

Figure 9 below shows a typical angled foam dam which is welded to the floating roof. This type of foam dam rises from the floating roof either vertically or at an angle, and has a horizontal lip at the top. RGA ground straps cannot be mounted directly to this foam dam as the straps cannot be placed on either side without rubbing the horizontal lip of the foam dam, which will result in premature strap failure. A custom bracket must be used to mount ground straps to an angled foam dam. The custom bracket may be located either directly on top of the horizontal foam dam lip, or on the floating roof itself.

If the custom bracket or tab has been located directly on the floating roof, then verify that it has been welded all the way around (it may be temporarily attached to the roof with at least two bolts). Also verify that the custom bracket or tab mounted is sufficiently inboard from the tank wall to ensure that the RGA cable and ground straps do not rub against any portion of the angled foam dam as the roof rises and falls during normal tank operation. The RGA cable and straps will be nearest to the lip of the foam dam when the tank is at its fullest and the roof is near the top of the tank.

Figure 9: Typical angled foam dam

3.2.2 Regardless of the type of foam dam utilized, ensure that two straps are used to secure the main cable to the foam dam/floating roof. One strap should be used on each side of the main cable and each side of the foam dam/floating roof connection point, as shown below in Figure 10, in order to ensure sufficient electrical contact area at the connection points.

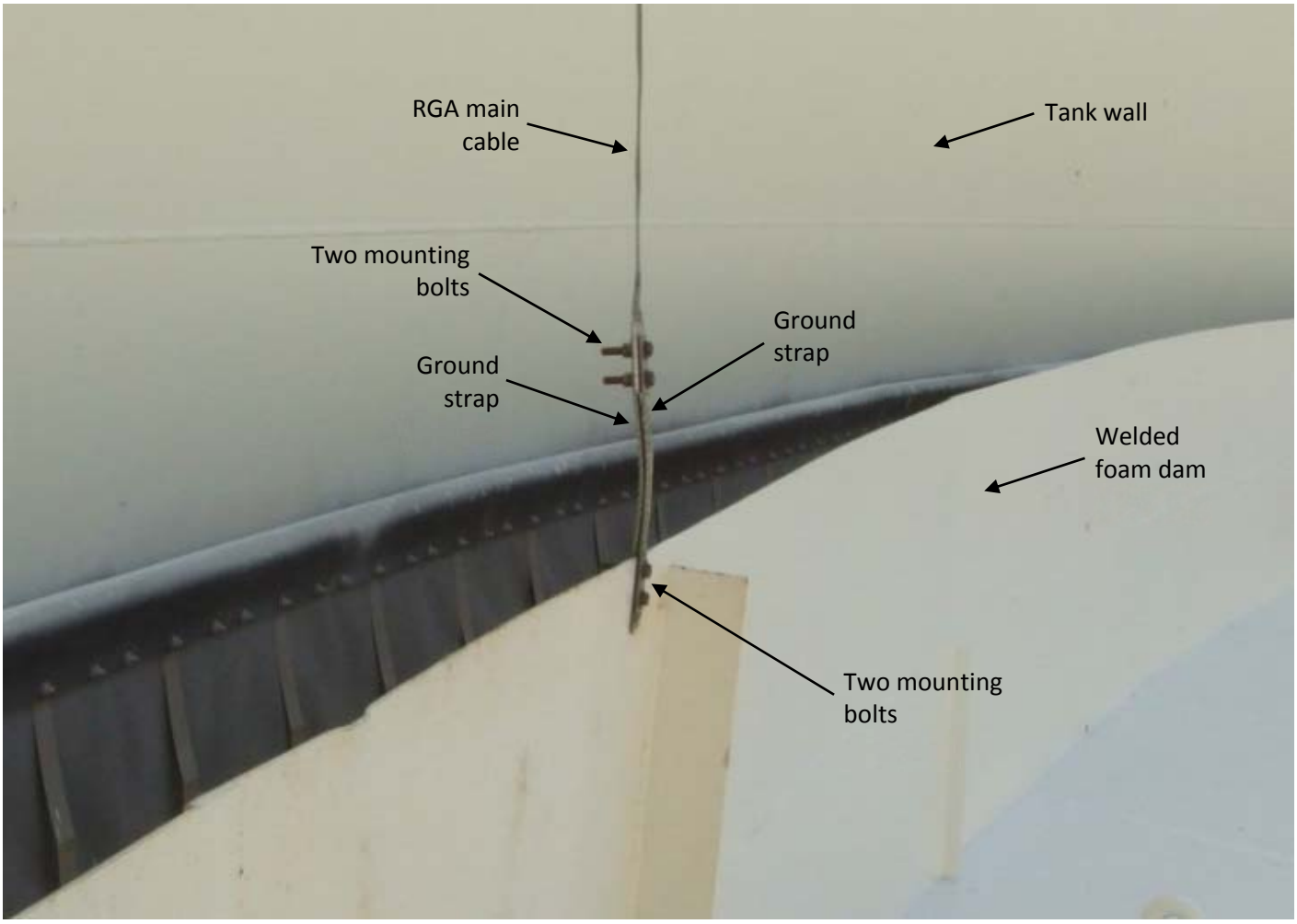

Figure 10: Ground straps on either side of welded foam dam

3.2.3 Two bolts should be used to connect the RGA main cable to the ground straps, and two bolts should be used to connect the ground straps to the foam dam/floating roof. Verify that the RGA main cable to ground strap and ground strap to foam dam/floating roof connection each uses both mounting holes at each end of the ground straps.

3.2.4 As shown below in Figure 11, verify that all nuts and bolts fastening the RGA cable to ground straps and ground straps to foam dam or tank roof have been securely tightened.

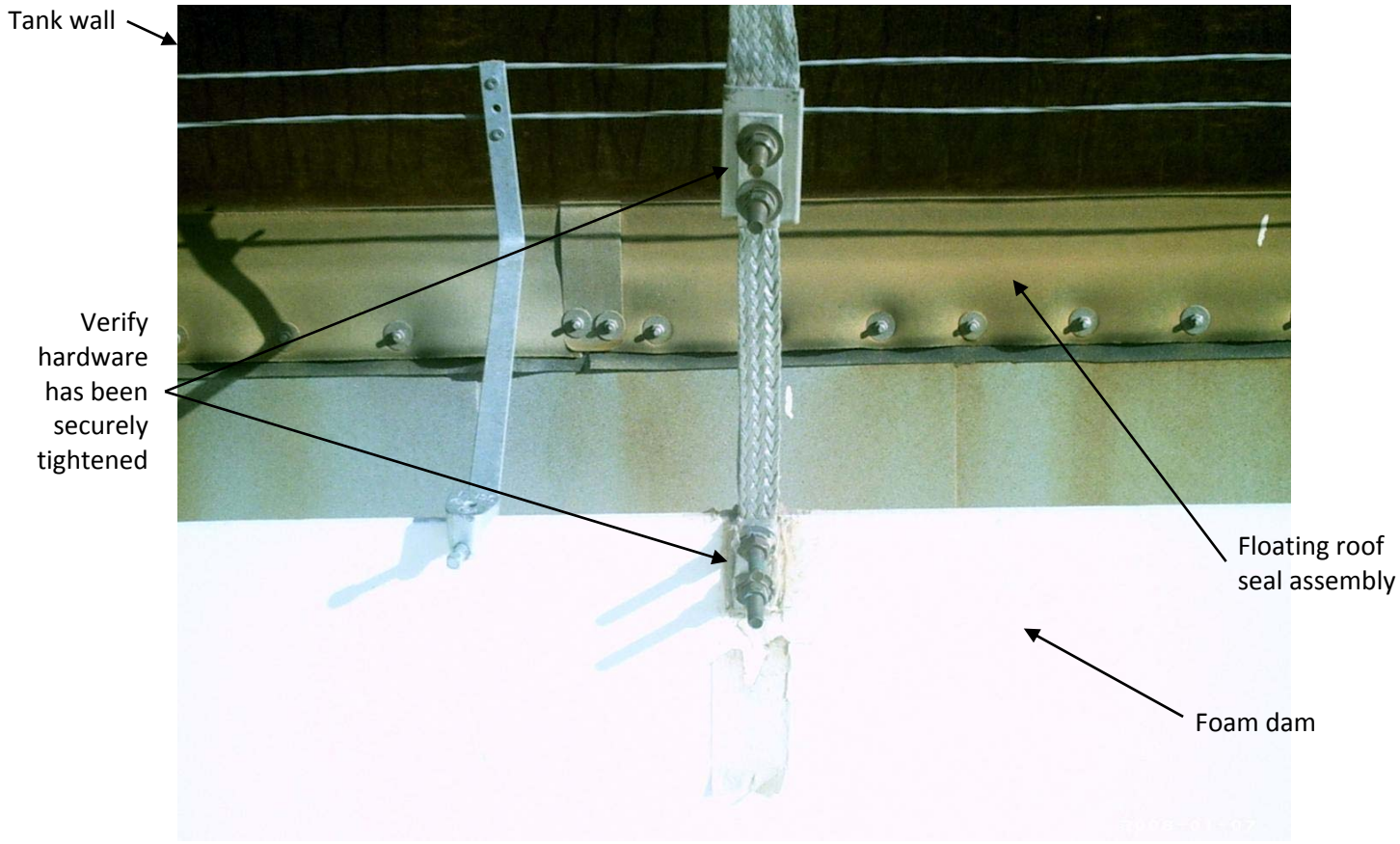

Figure 11: Secure cable and ground strap attachment to foam dam

3.2.5 Visually inspect the interface between the RGA straps and the foam dam/floating roof. During installation, paint and rust must be removed between all interfacing surfaces to ensure bare metal to bare metal contact. All mechanical connections must then be sealed with a corrosion inhibitor, which may be transparent and therefore difficult to detect.

3.2.6 Using a Digital Multi-Meter (DMM) measure the resistance between the RGA cable and floating roof. Verify that there is no measureable resistance or that the measurement is less than 0.03 ohms.

3.2.7 Verify that the combined total of the resistance measurements taken in 3.1.6 and 3.2.6 is less than 0.03 ohms.