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1. INTRODUCTION

The os3510 Surface Mount Strain Sensor measures average strain over the length of the sensor while providing integrated temperature compensation. It is based on fiber Bragg grating (FBG) technology. The os3510 is intended exclusively for surface mounting. Each end of an os3510 is attached to a structure via rigid brackets that are either welded, bolted, epoxied, or grouted to the surface of a concrete, rock, steel, composite, or other structure. The os3510 strain sensor measures the relative movement of the two mounting brackets along the axis of the sensor. It is important that the mounting brackets be securely attached to the surface to be tested if accurate results are to be obtained. Several installation tools are available from Micron Optics to aid in installation. Note that tools are available for Grout-in and Bolt-on applications.

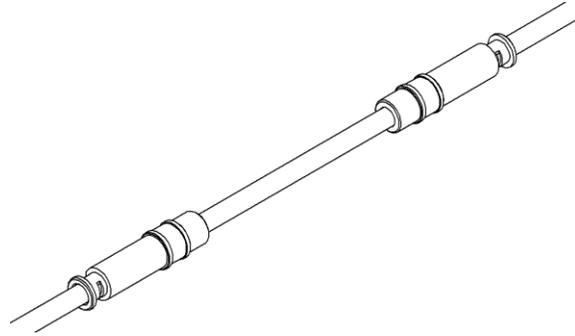


Figure 1

1.1. Installation Tools:

When mounting the os3510, it is important to properly align the mounting brackets. The following tools are helpful in maintaining bracket alignment during installation:

- os3510 Grout-in Drill Guide
- os3510 Bolt-on Drill Guide
- os3510 Setting Bar
- 3 mm Hex-Key
- Torque wrench with 3 mm Hex-Bit

2. Mounting To Steel (Weld-on Brackets):

The first step for installing the os3510 strain sensor is welding the two mounting brackets to the surface to be measured. The end brackets are made of 316 stainless steel. Each mounting bracket has two M6 x 1 set screws installed as shown in Figure 2. Use a 3 mm Hex-Key to tighten set screws.

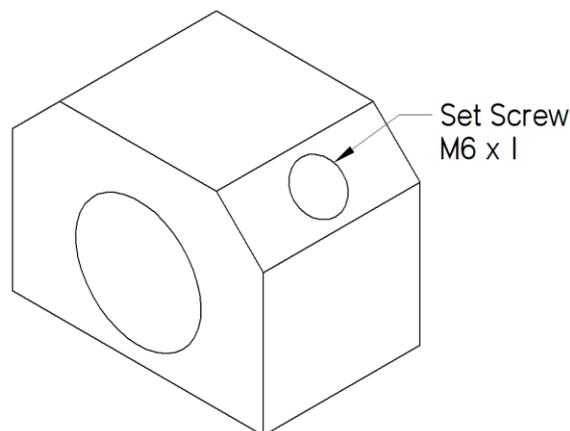


Figure 2



It is important that mounting brackets are properly spaced and axially aligned prior to welding. If axial alignment is not maintained, the sensor may bind leading to reduced sensor accuracy. The setting bar shown in Figure 3 is used to hold the mounting brackets in alignment and properly spaced during welding. The Setting Bar has annular grooves cut into each end that properly position the end brackets.

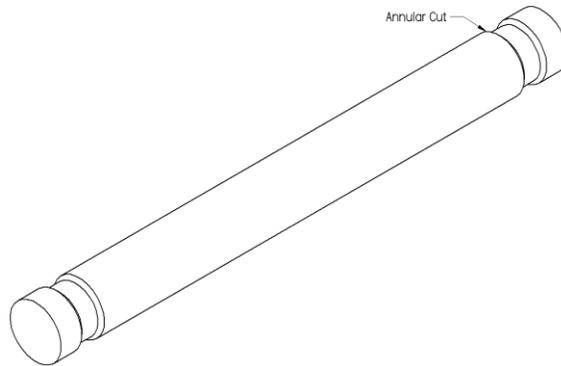


Figure 3

The Setting Bar is inserted in both mounting bracket and held in place with the set screws shown in Figure 4. The set screws should be positioned in the annular grooves to maintain the proper spacing between the mounting brackets.

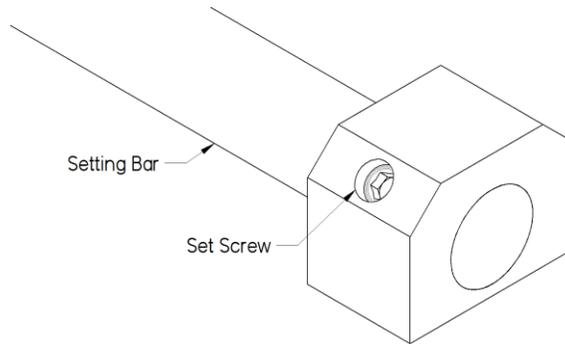


Figure 4

The steel surface should be cleaned to remove scale, rust, dirt, and oil. Position the Setting Bar with the attached mounting brackets on the steel surface to be measured. Align the axis of the Setting Bar with the axis of strain to be measured. While holding the mounting brackets firmly against the surface, weld the edges shown in Figure 5 in the indicated sequence.

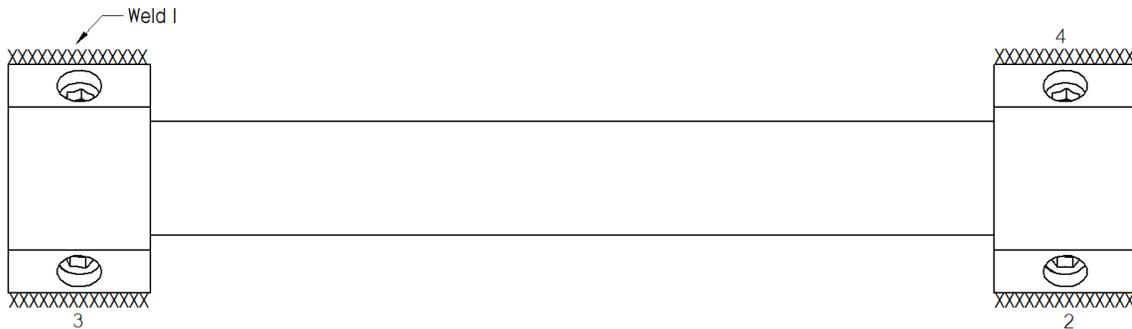


Figure 5

Allow the weld to cool and remove the Setting Bar. Clean off welding slag and inspect weld.

3. Mounting To Steel (Bold-On Brackets):



An alternative mounting bracket shown in Figure 6 is available as an option that can be fastened to the test specimen using two ¼ inch or M6 screws. It is important that mounting brackets are properly spaced and axially aligned prior to mounting sensor. If axial alignment is not maintained, the sensor may bind leading to reduced sensor accuracy. The Setting Bar shown in Figure 3 is available to hold the mounting brackets in alignment and properly spaced while the mounting holes are transferred to the specimen surface. The Setting Bar has annular grooves cut into each end that properly position the end brackets. The set screws should be positioned in the annular grooves to maintain the proper spacing between the mounting brackets. Alternatively, the Bolt-on drill guide listed in the “Installation Tools” section can be used to properly space and align the mounting holes. To use the Drill Guide, securely clamp it to the surface. Drill the four holes using the Drill Guide to guide the drill bit. After both brackets are bolted securely to the surface, check the alignment by verifying that the Setting Bar will slide into the brackets. The set screws in the bracket are M6 x 1 and can be tightened with 3 mm Hex-Key.

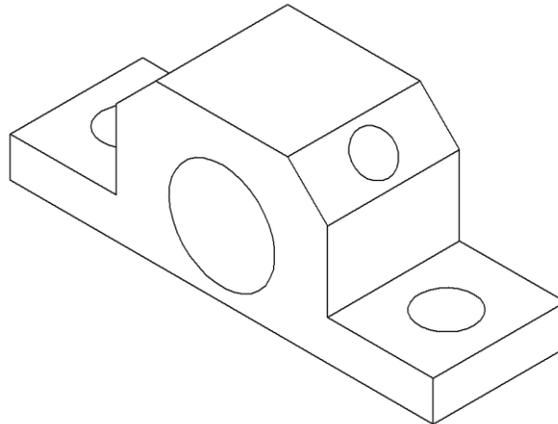


Figure 6

4. Mounting To Concrete:

The concrete mounting brackets shown in Figure 7 may be attached to concrete by inserting the concrete mounting bracket stud into a drilled hole and securing with anchoring cement or epoxy.

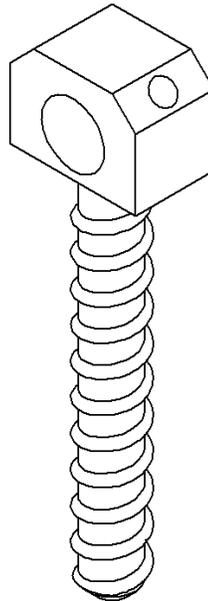


Figure 7

Prepare the test surface by drilling two ½ inch [13mm] diameter holes properly spaced. To maintain hole spacing and alignment it is necessary to use the Grout-in Drill Guide listed in the “Installation Tools” section. The distance between the holes is 110 mm. The holes should be a minimum of 3 ½ inches [64 mm] deep. To use the Drill Guide, clamp it to the surface. Place hammer-



drill in hole on one end of drill guide and drill hole. Place 1/2 inch round bar through drill guide into hole just drilled. This will help hold Drill Guide in place while second hole is drilled. Now Place hammer-drill in hole on other end of Drill Guide and drill hole. Clean out holes with vacuum or compressed air. Attach the mounting brackets to the Setting Bar as shown in Figure 4 to maintain proper alignment and spacing. The set screws should be positioned in the annular grooves to maintain the proper spacing between the mounting brackets. Grout the mounting bracket studs into place in the drilled holes using an anchoring cement or high strength epoxy. Allow the grout or epoxy to cure before removing the Setting Bar.

5. Sensor Placement:

Once the mounting brackets are attached to the surface to be studied, the sensor may be set in place and pre-tension adjusted. An interrogation unit attached to the sensor may be helpful in adjusting pre-tension.

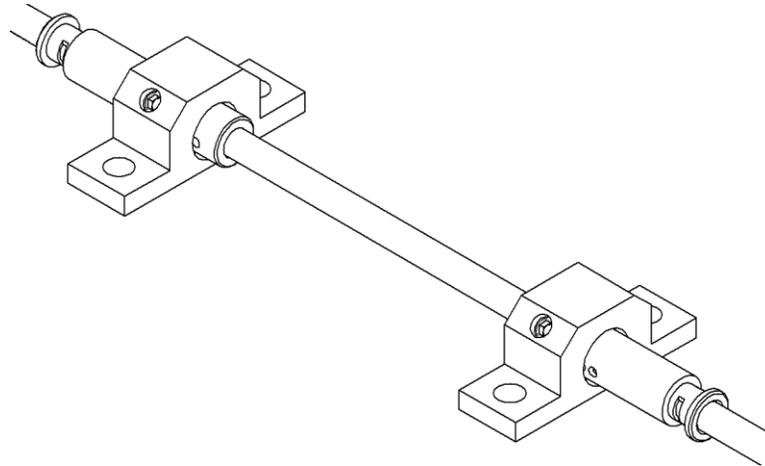


Figure 8

Using a torque wrench fitted with a 3 mm Hex-Key, torque the two set screws on one end of the sensor. Tighten the two screws to a torque of 75 inch-pounds [8.5 Nm]. The two set screws on the other end of the sensor should remain loose.

If desired, the sensor can be connected to an interrogator and adjusted while observing the interrogated wavelength. The wavelength should increase as the sensor is extended. The wavelength should decrease as the sensor is compressed. Adjust pretension as required for the particular application. For example, if the application requires the sensor to operate equally in tension and compression, the sensor should be installed centered within its range. The sensor can be centered or biased to one side of its range.

The sensor pretension and corresponding wavelength can be adjusted by gently grasping the end of the sensor near the bracket with loose set screws and sliding it in the mounting bracket. For example to center the sensor, adjust the loose end until the wavelength is halfway between the minimum and maximum wavelength value.

While holding the sensor in position, tighten the remaining two set screws. Continue tightening the two screws to a torque of 75 inch-pounds [8.5 Nm].

6. Sensor Protection:

When installing a strain sensor it is important to consider how to insulate and physically protect the sensor in order to improve the accuracy and longevity of the sensor. There are many ways to insulate and protect a sensor depending on the particular installation. One method that may be applicable to civil structures is detailed here. This method utilizes expanded polystyrene (EPS) foam insulation and a stainless steel cover shown in Figure 9.

This method may not be applicable to all installations due to size or other considerations; however, the general principles demonstrated here can be adapted for the particular installation. Figure 9 also shows a Non-metallic conduit and fitting. (Hubbell Part Numbers: G1050, P050NGYA)



Figure 9

Figure 10 show how EPS foam insulation can be used inside the cover. The insulation is designed to thermally insulate the sensor from the effects of wind and sun exposure. Notice the “stepped” interior of the foam insulator. The insulation is designed so that the fiber can be spliced and excess fiber coiled and stored above the sensor.

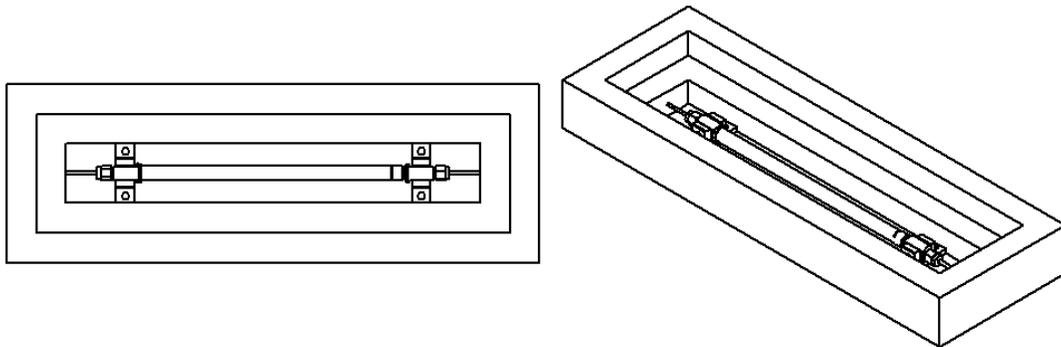


Figure 10

Plan ahead and determine where the fiber will enter and exit the stainless steel cover shown in Figure 13. The foam insulation can be cut with a knife as needed to provide fiber access. The EPS foam insulation can be attached to a variety of surface materials using a silicone sealant (such as 3M Super Silicone Sealant, Part No. 08663), or other compatible adhesive. Complete the insulation assembly by attaching an EPS foam cover to the base using silicone sealant or other compatible adhesive. The completed foam insulation is shown in Figure 11.

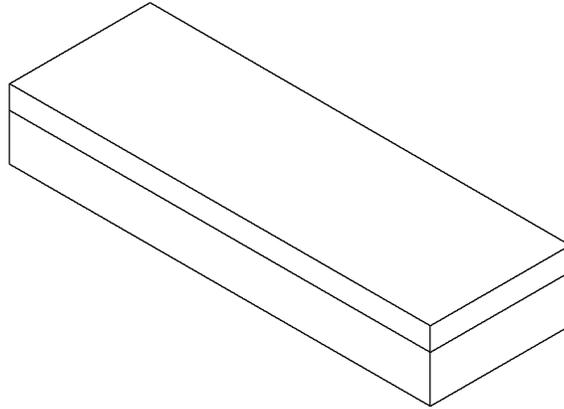


Figure 11