

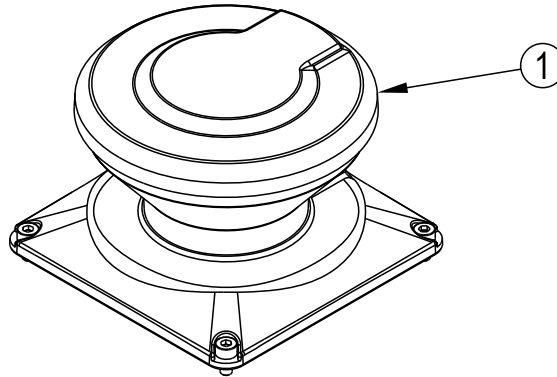
56122804 SAFETY SENSOR LENS KIT

Liberty SC50 Models: All

CONTENTS OF KIT

ITEM	PART NO.	QTY	DESCRIPTION
[]	56090416	1	Instruction Sheet
1		1	Lens-Safety Sensor

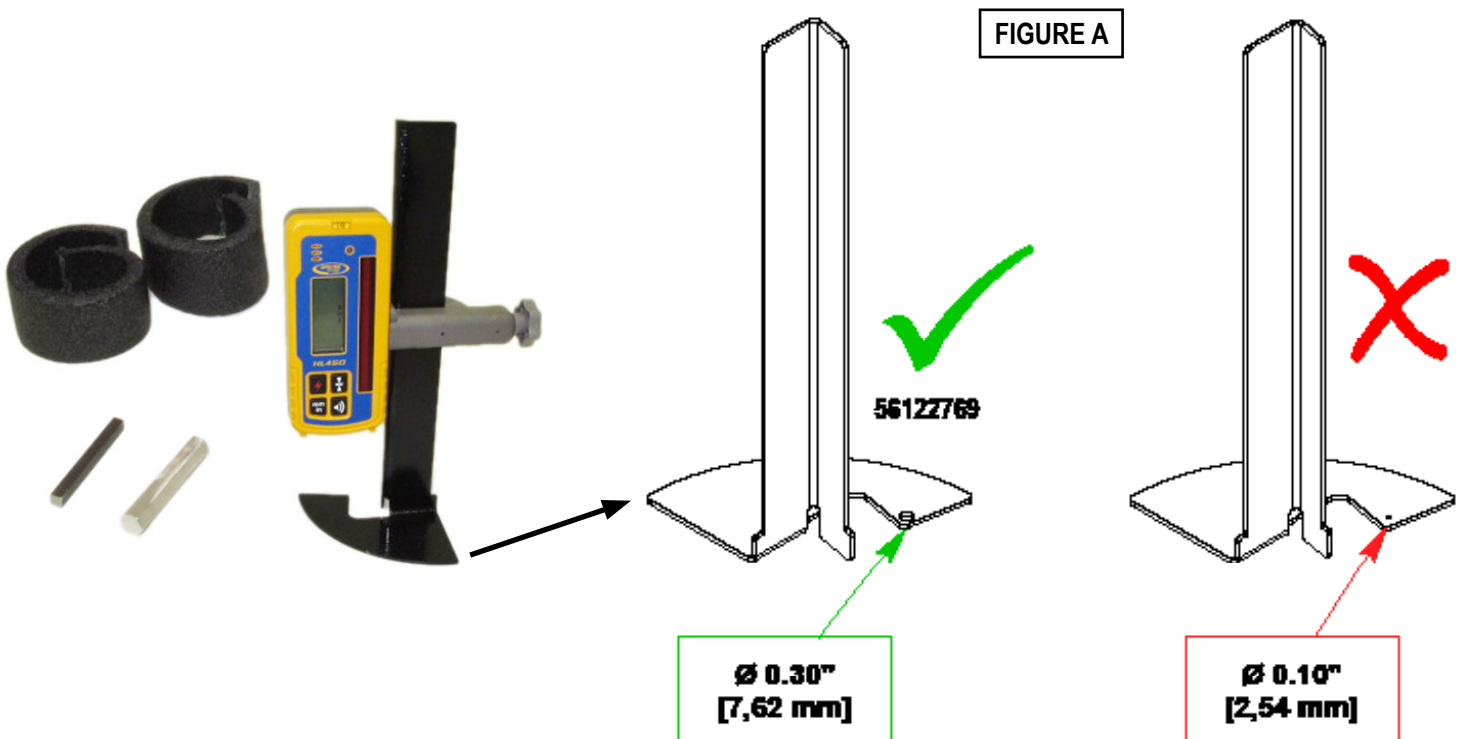
[] = Not Shown



The purpose of this kit is to install a new lens to either the left or right safety sensor on the Liberty SC50. The procedure involves removing the safety sensor from the machine to access the lens. After the lens is replaced and the safety sensor reinstalled the rotation and leveling adjustments will have to be checked/adjusted. Then perform the static and dynamic safety tests of the safety sensor.

SPECIAL TOOLS REQUIRED

- Laser Alignment Kit part number **56122718**. **NOTE:** The Detector Stand which is part of the laser alignment kit has been recently changed. Make sure your detector stand is the most recent (part no. 56122769). It can be identified by the hole in the base which is $\varnothing 0.30"$ [7,62 mm] **SEE FIGURE A.**

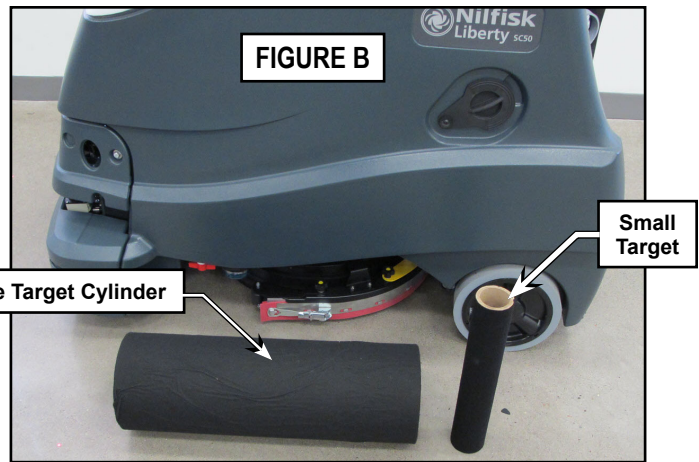


SPECIAL TOOLS REQUIRED - CONTINUED

- Target Cylinders Small p/n 56122722 & Large p/n 56122723.
SEE FIGURE B.

TOOLS REQUIRED

- Metric hex wrenches (2.5mm, 4mm & 5mm)
- Metric ratchet and sockets (10mm, 13mm)



INSTALLATION INSTRUCTIONS

PREPARING THE MACHINE

⚠ IMPORTANT!

This procedure should be done in a dust free environment so that no dust enters into the safety sensor (laser).

⚠ CAUTION!

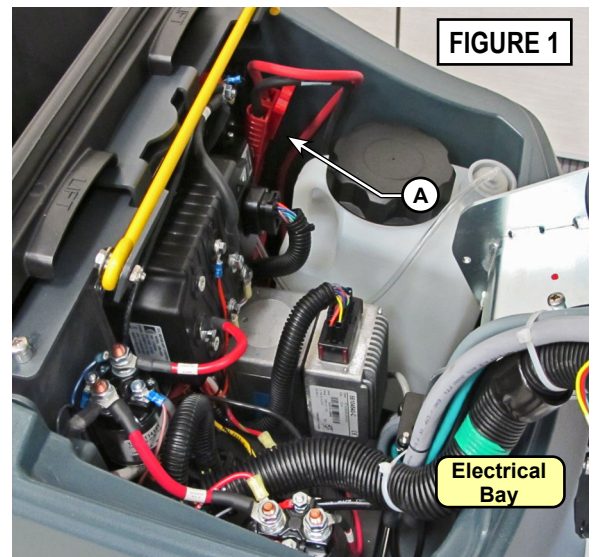
When working on an SC50 and a battery disconnect is needed, ensure that the Autonomy Module is completely powered off before the power is pulled from the system. To verify that the Autonomy Module is completely powered down simply wait for both the safety LiDAR's and Dropoff lasers to power off, plus an additional 15 seconds after that. If this procedure is not followed when disconnecting the battery, there is a chance that the Autonomy Module could be permanently damaged and would need replacement.

DISCONNECT THE BATTERIES

⚠ WARNING!

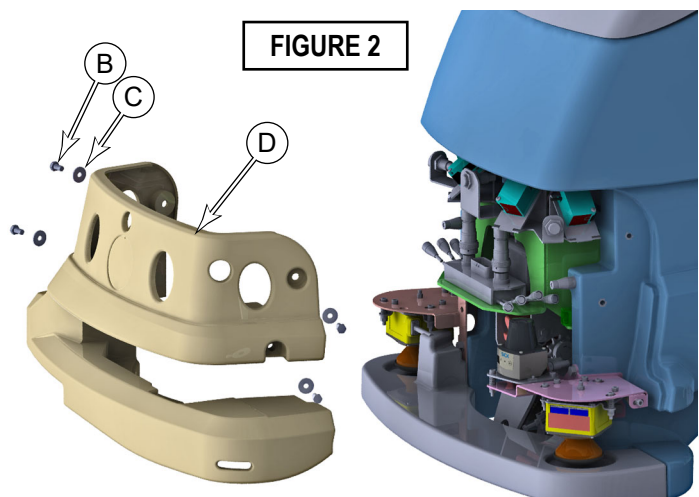
Disconnect the main Battery connector (A) before removing or installing any machine components.

1. Unlatch and open the Control Panel Housing and set the prop rod.
2. **SEE FIGURE 1.** Locate and disconnect the Machine Battery Connector (A).



REMOVE THE FRONT NOSE

3. Ensure the main battery connector is disconnected.
4. **SEE FIGURE 2.** Remove the 4 screws (B) and washers (C) that secure the front nose (D) to the solution tank, and remove the front nose.



REPLACE THE LENS

5. To replace the lens on the right side safety sensor go to page 3.
6. To replace the lens on the left side safety sensor go to page 4.

REMOVE RIGHT SIDE SAFETY SENSOR

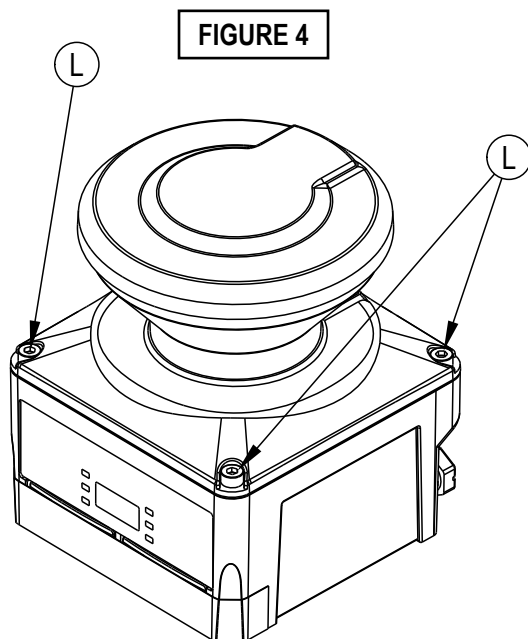
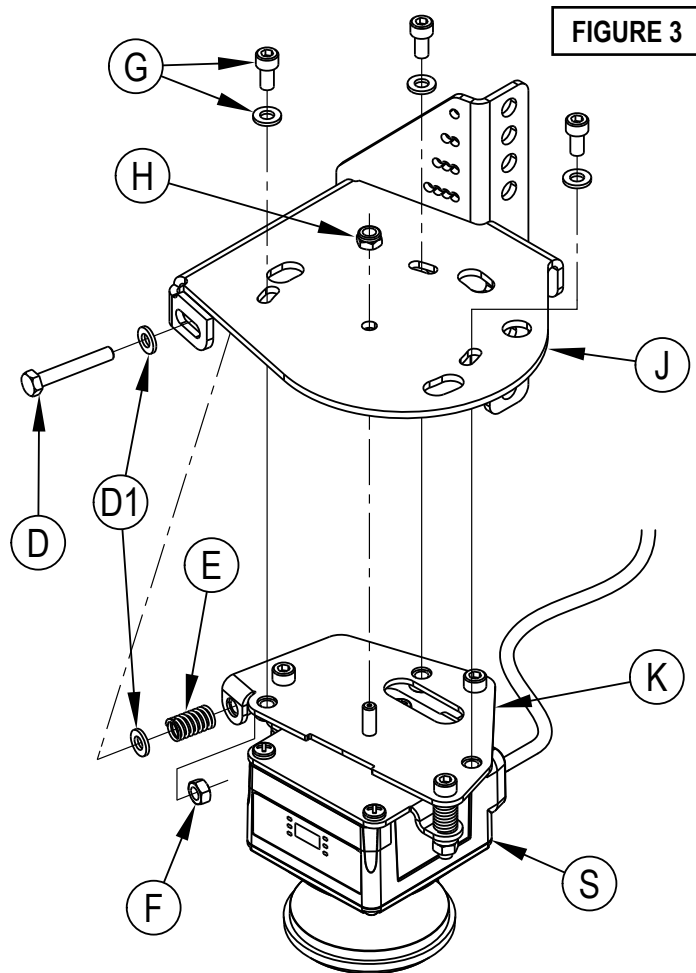
1. **SEE FIGURE 3.** Remove the adjusting screw (D), washers (D1), jam nut (F), and spring (E) from the mount bracket weldment (J).
2. Remove the center pivot nut (H).
3. Remove the 3 mounting screws (G) and washers that secure the sensor mount bracket (K) to the mount bracket weldment (J). Carefully rest the sensor on the bumper.

INSTALL THE NEW LENS

4. **SEE FIGURES 4 & 5.** Use a 2.5mm hex wrench to remove the 4 Screws (L) that secure the lens to the safety sensor.
5. Install the new Lens (1) onto the safety sensor be sure the Gasket (1A) is properly in place. Hand-tighten the screws (L) being careful not to over tighten. **NOTE:** There is only one way the lens can go on to the sensor.

REINSTALL THE RIGHT SIDE SAFETY SENSOR

6. **SEE FIGURE 3.** Install the safety sensor (S) onto the mount bracket (J) and loosely secure it in place with the center pivot nut (H).
7. Install the adjusting screw (D) with washers (D1) through the mount bracket weldment (J), through the compression spring (E), and into the sensor mount bracket (K). Secure the jam nut (F).
8. Install the 3 mounting screws and washers (G) to the sensor mount bracket (K).
9. After the safety sensor has been reassembled to the machine the two settings (rotation and level) should be checked and adjusted if necessary for proper machine operation.
 - Proceed to the ["SAFETY SENSOR ROTATIONAL POSITION CHECK \(RIGHT and LEFT\)"](#) on page 5.



REMOVE LEFT SIDE SAFETY SENSOR

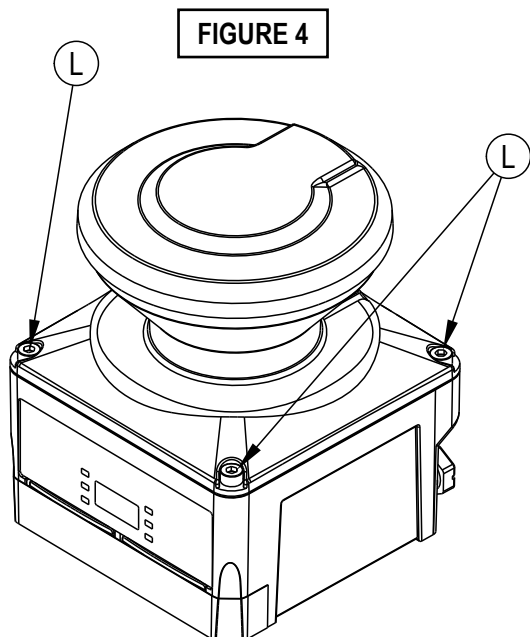
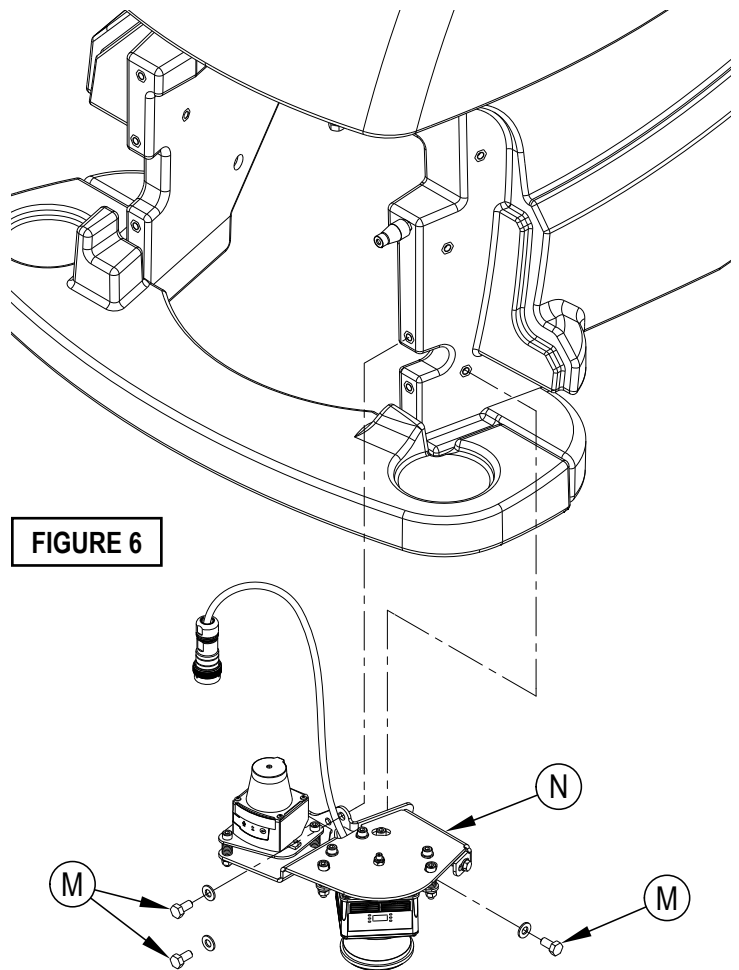
1. **SEE FIGURE 6.** Use a 13mm socket or wrench to remove the 3 screws and washers (M) and carefully rest the sensor assembly (N) on the bumper.

INSTALL THE NEW LENS

2. **SEE FIGURES 4 & 5.** Use a 2.5mm hex wrench to remove the 4 Screws (L) that secure the lens to the safety sensor.
3. Install the new Lens (1) onto the safety sensor be sure the gasket (1A) is properly in place. Hand-tighten the screws (L) being careful not to over tighten. **NOTE:** There is only one way the lens can go on to the sensor.

REINSTALL THE LEFT SIDE SAFETY SENSOR

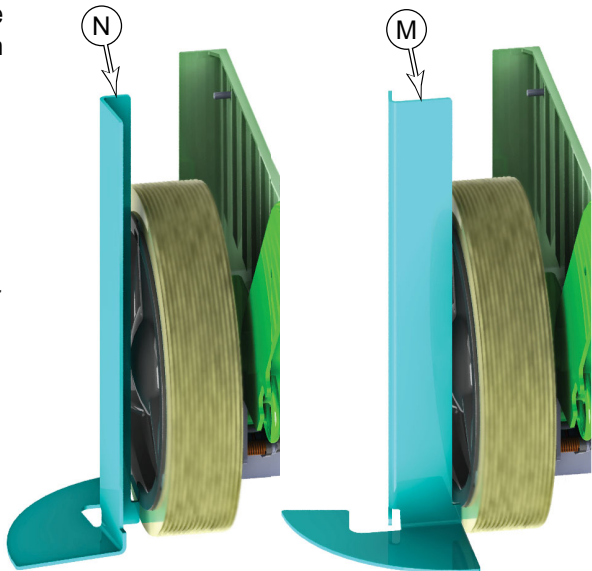
4. **SEE FIGURE 6.** Reinstall the 3 mounting screws and washers (M) to secure the safety sensor assembly to the solution tank.
5. After the safety sensor has been reassembled to the machine the two settings (rotation and level) should be checked and adjusted if necessary for proper machine operation.
 - Proceed to the ["SAFETY SENSOR ROTATIONAL POSITION CHECK \(RIGHT and LEFT\)"](#) on page 5.



NOTE: The following steps regarding safety sensor level and rotation adjustment are provided here for convenience but the latest most up-to-date set of instructions can always be found in the service manual 56043177.

SAFETY SENSOR ROTATIONAL POSITION CHECK (RIGHT and LEFT)

- 1. Connect the main battery disconnect. Power the machine and make sure the safety sensors are active.
- 2. Turn the steering wheel toward the straight ahead position.
- 3. Place the laser detector stand (from laser kit 56122718) against the applicable rear wheel with the stand in the **narrow** direction (**D**) at the center line of the axle. Note the warning 1 LED status.
- 4. Place the stand in the **wide** direction (**E**) at the center line of the axle. Note the warning 1 LED status.
- 5. The warning 1 LED should be off and the OSSD 1/2 illuminated green with the stand in the narrow direction (**D**). The warning 1 LED should be illuminated orange and the OSSD 1/2 illuminated red with the stand in the wide direction (**E**).
 - If this is not true, proceed to the ["SAFETY SENSOR ROTATIONAL POSITION ADJUSTMENT"](#) on page 6
 - If this is true, the rotational position is correct and does not require adjustment. Proceed to check if the sensor is level.
 - ["RIGHT SAFETY SENSOR LEVEL CHECK AND ADJUSTMENT"](#) on page 10 or
 - ["LEFT SAFETY SENSOR LEVEL CHECK AND ADJUSTMENT"](#) on page 13



Condition	Expected LED States
Stand in narrow position (Or no stand) 	 Warning 1 = Off OSSD 1/2 = Green
Stand in wide position 	 Warning 1 = Orange OSSD 1/2 = Red

SAFETY SENSOR ROTATIONAL POSITION ADJUSTMENT

Because the safety sensors utilize pre-programmed zones to determine where they should be scanning as the machine travels, it is important that they be oriented correctly with respect to the machine. To ensure that the zones are pointing in the right direction, each zone looks back toward the rear corner of the machine. If the rear wheel of the machine is seen in the area of warning zone 2, Warning 2 is triggered as a confirmation for the Autonomous controller to see and the warning 2 LED on the sensor is illuminated orange.

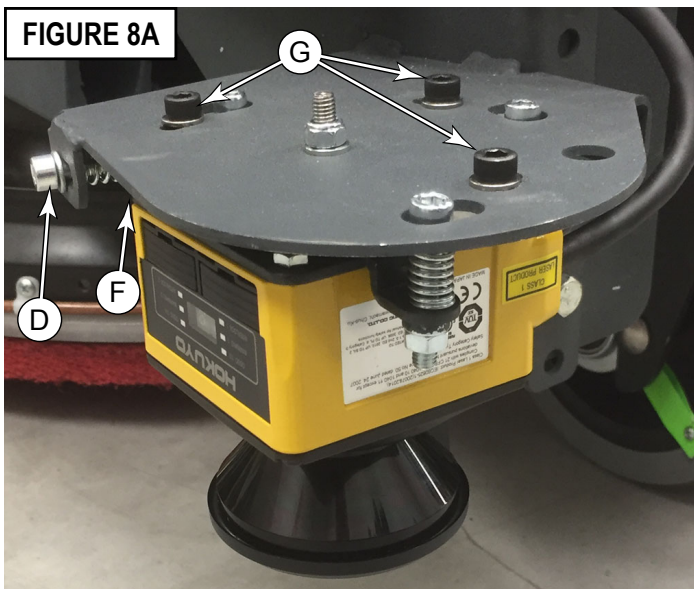
This adjustment is accomplished by using the laser detector stand as a gauge and monitoring the LED states on the sensor. It must be done if the rotation position is out of adjustment (based on the "position check" that was done on the previous page).

1. Power the machine and make sure the safety sensors are active.
2. Turn the steering wheel toward the straight ahead position. **SEE FIGURE 7.** Area address 08 should be displayed on each safety sensor.
3. **SEE FIGURES 8A & 8B.** For the sensor being adjusted, make sure the following hardware items are slightly loose; 3 mounting screws (**G**), the center pivot nut (**H**) and the adjustment lock nut (**F**).

FIGURE 7

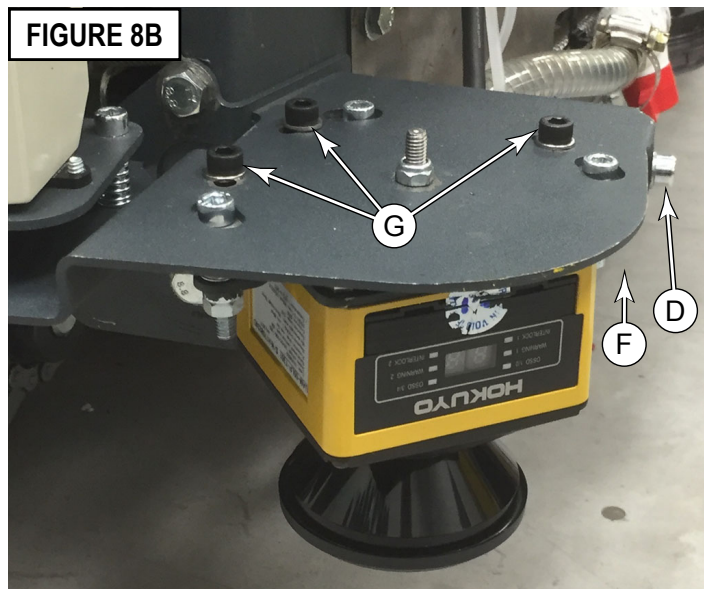


FIGURE 8A



Right Side

FIGURE 8B

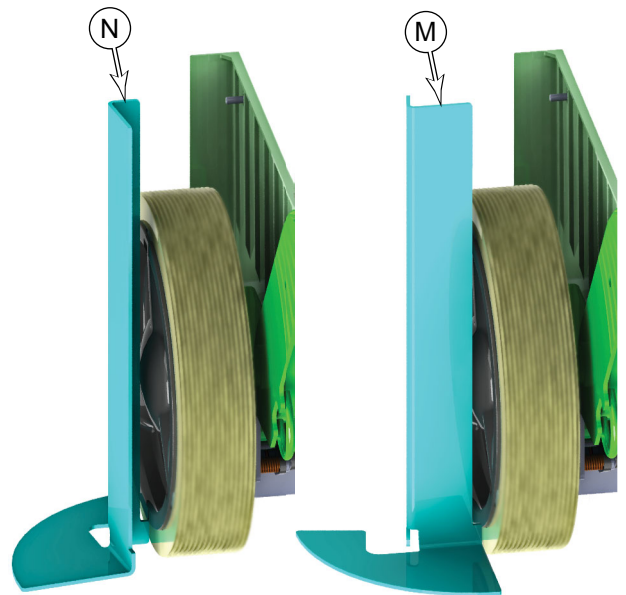


Left Side

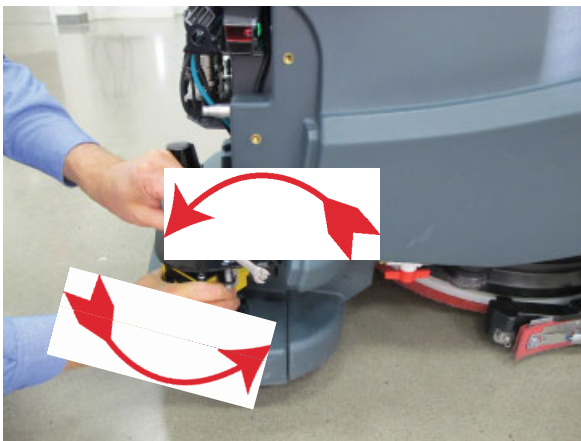
ADJUST SAFETY SENSOR ROTATIONAL POSITION - CONTINUED

- Place the laser detector stand (from laser kit 56122718) against the applicable rear wheel with the stand in the **narrow** direction (N) at the center line of the axle.

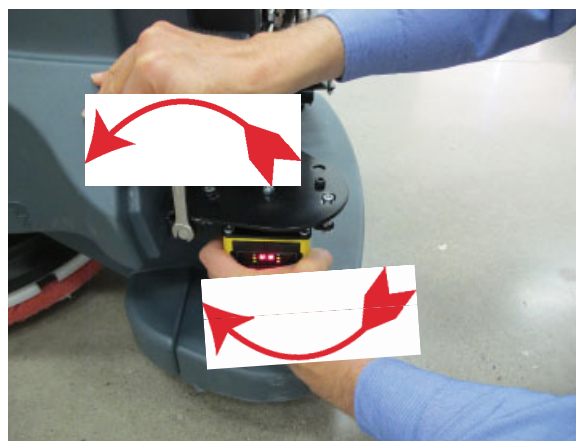
Note: For these next steps, keep your body and tools away from the sensor laser when observing the LED status to prevent false triggering of the LEDs.



- Turn the adjustment screw (D) counterclockwise until the Warning 1 LED illuminates orange and the OSSD 1/2 LED illuminates red. (You may have to help the sensor rotate using hand pressure.) Give the screw at least 1-full turn more so it's past the transition.



Left Side



Right Side



ADJUST SAFETY SENSOR ROTATIONAL POSITION - CONTINUED

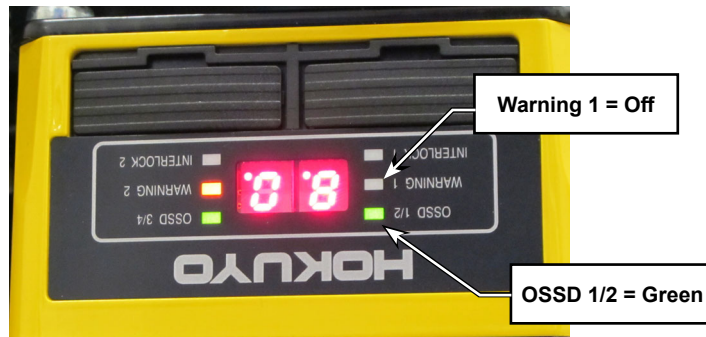
6. Slowly turn the adjustment screw (D) clockwise until the Warning 1 LED turns off and the OSSD 1/2 LED illuminates green, and then another 1/2-turn.



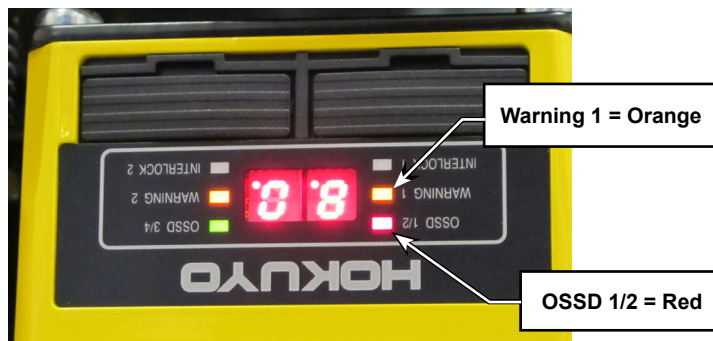
Left Side



Right Side



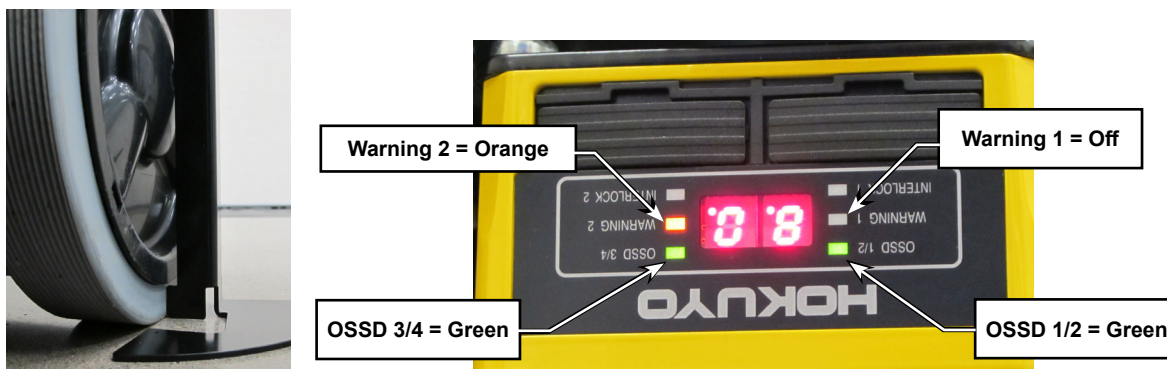
7. Rotate the laser detector stand to the **wide** position (**M**), and verify that the Warning 1 LED illuminates orange and the OSSD 1/2 illuminates red.



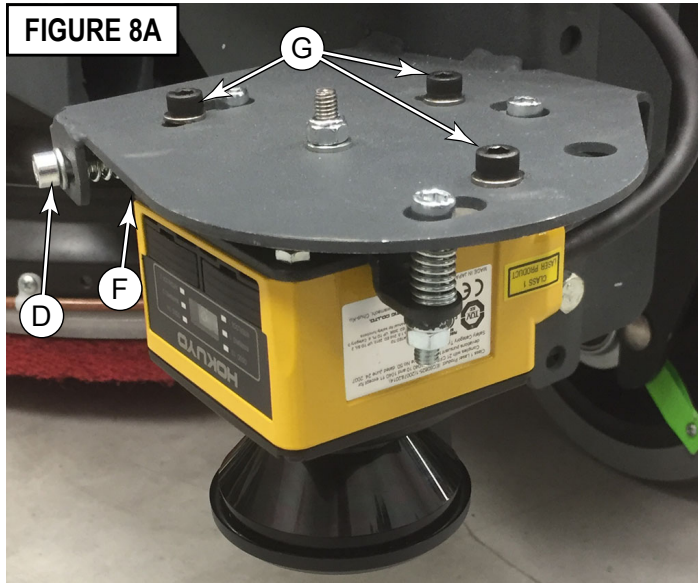
ADJUST SAFETY SENSOR ROTATIONAL POSITION - CONTINUED

8. Remove the laser detector stand, and verify that the Warning 2 LED illuminates orange, Warning 1 LED is off. (both OSSD 1/2 and 3/4 LEDs illuminate green).

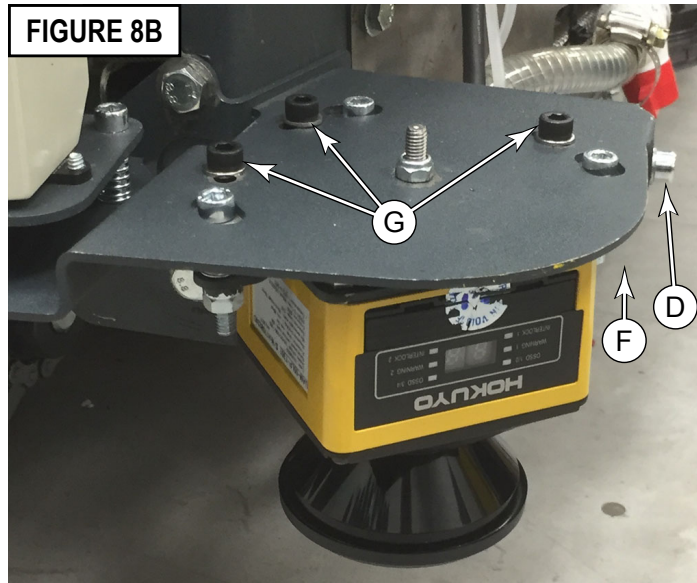
That is, Warning 1 sees the stand in the wide position, but not the narrow position, and Warning 2 always detects the rear wheel.



9. Retighten the 3 mounting screws (G) and the adjustment lock nut (F) torque to 62 in/lb (7 Nm). Retighten the center pivot nut (H).



Right Side



Left Side

RIGHT SAFETY SENSOR LEVEL CHECK AND ADJUSTMENT

CHECKING LASER LEVEL

For proper operation, the laser must be accurately leveled with respect to the machine. This is accomplished by placing the machine on a flat floor surface, and measuring the height of the laser beam at 3 positions around the machine.

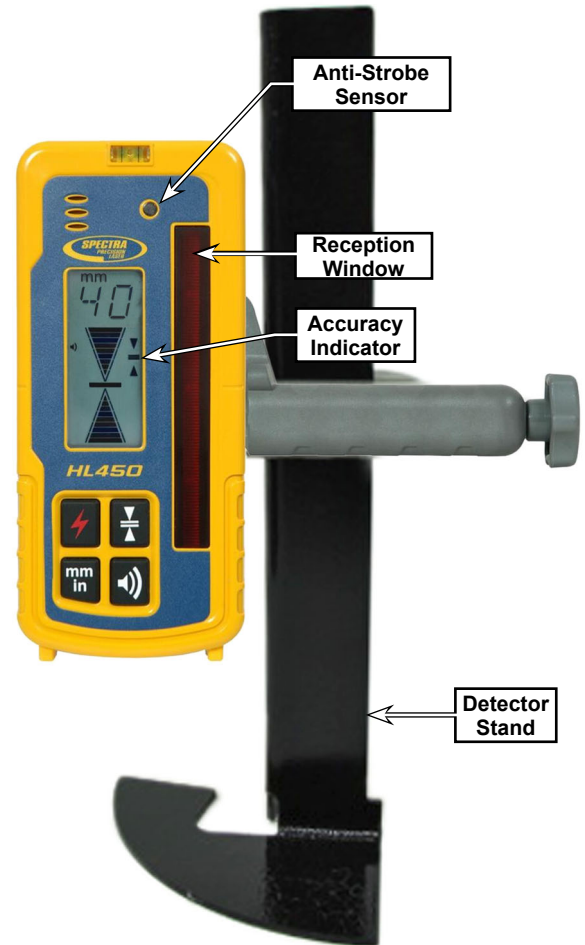
After the safety sensor is removed/reinstalled onto the machine, both the level and rotational adjustments must be performed.

This procedure requires the laser calibration kit (56122718).

1. Perform the steps to **Check and then Adjust Safety Sensor Rotational Position** on **pages 5-9** before completing this procedure.
2. Setup the laser detector on the stand, as shown.
 - Adjust the initial height of the detector on the stand so that the laser beam from the sensor should strike the detector in the middle of the red reception window. It is not necessary to place the detector at any specific height, as long as the laser beam strikes the detector in the reception window on the right side.
 - Cover the anti-strobe sensor with a piece of tape

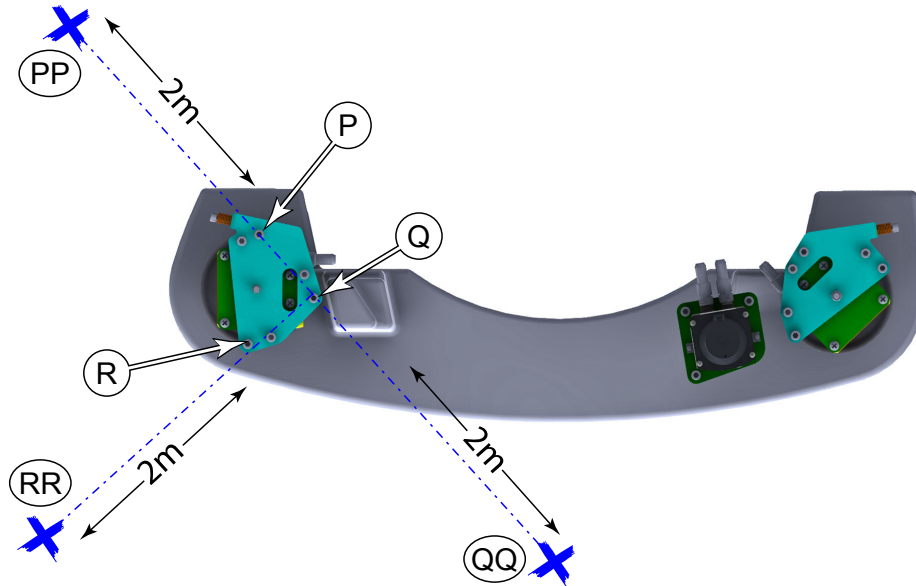


3. Press the power button on the detector to turn the detector on. Make sure the detector cannot see any laser beam when first turned on, or it will display an error message.
4. Press the units button as necessary to set the units to "mm" (millimeter).
5. Press the accuracy button as necessary to set the accuracy to the 1-mm range. (3 bars are displayed between the accuracy arrows.)
6. Cover the left safety sensor and mapping sensor to avoid interference with the laser detector. **NOTE:** The laser calibration kit includes laser covers.



CHECKING LASER LEVEL - CONTINUED

7. Mark the measurement positions (PP), (QQ), (RR) on the floor as shown, 2 meters from the center of the laser, in a line parallel to the line established by the adjustment screws.



8. Move the detector stand to each of the three positions, and record the height of the laser beam from each position. It is recommended that you draw a diagram of the 3 positions and write down the measurements.
 - a. The measurement value shown on the detector is how far above or below the on-grade mark the laser beam is striking the reception window. When accompanied by a downward arrow, it means the beam is below the on-grade mark. When accompanied by an upward arrow, it means the beam is above the on-grade mark. The image below means that the laser is striking the reception window 2mm above the on grade mark.

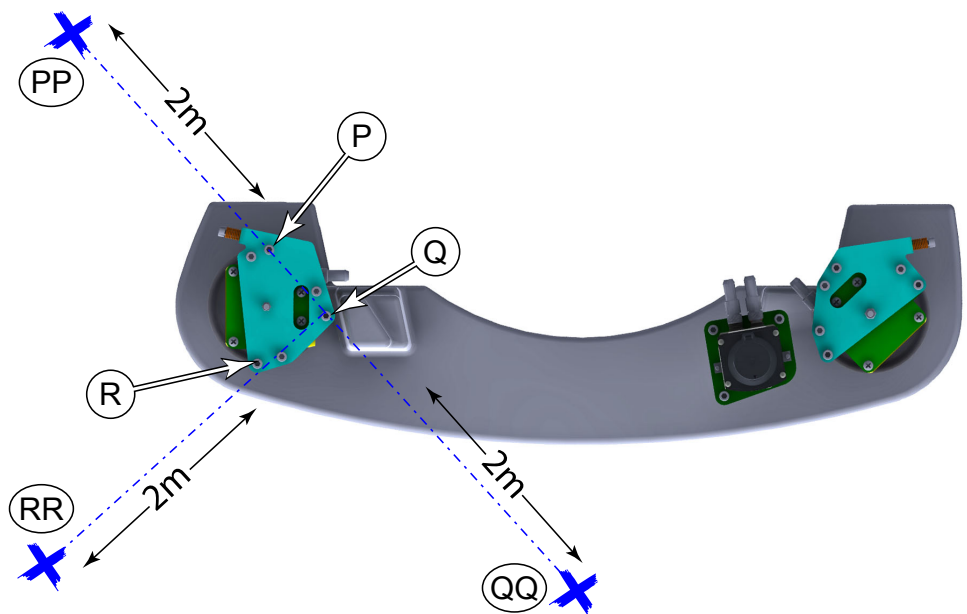
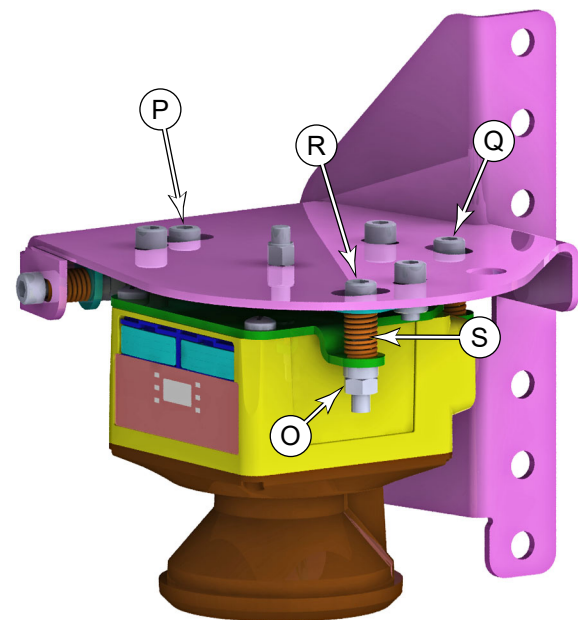
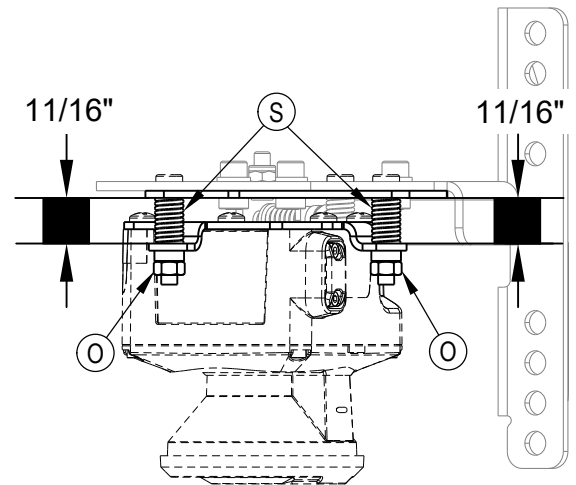


9. If the laser heights at all 3 positions are within $\pm 3\text{mm}$ of each other, then no adjustment is necessary and installation is complete. If adjustment is necessary, proceed to the ["RIGHT SAFETY SENSOR LEVEL ADJUSTMENT" on page 12.](#)

RIGHT SAFETY SENSOR LEVEL ADJUSTMENT

ADJUSTING LASER LEVEL

1. Before making adjustments, use the 11/16" gauge block to verify/set each of the 3 adjustment screws to their neutral position.
 - a. Loosen the 3 jamb nuts (**O**) at the bottom of the laser adjustment screws.
 - b. Loosen the adjustment screw as needed and place the gauge block adjacent to each of the 3 tension springs (**S**).
 - c. Temporarily tighten the adjustment screw until the gauge block is slightly snug between the brackets.
 2. Adjust the **(PP)**-to-**(QQ)** level first.
 - a. Compare the height readings from the **(PP)** and **(QQ)** locations of the laser detector.
 - If the **(PP)** position is higher than the **(QQ)** position, tighten screw **(P)**.
 - If the **(PP)** position is lower than the **(QQ)** position, loosen screw **(P)**.
 3. Adjust the **(RR)** position to match the **(PP)** and **(QQ)** heights.
 - If the **(RR)** position is lower than (and not between) the **(PP/QQ)** positions, loosen screw **(R)**.
 - If the **(RR)** position is higher than (and not between) the **(PP/QQ)** positions, tighten screw **(R)**.
- NOTE:** If adjusting the **(RR)** position causes screw **(R)** to exceed its adjustability limit, you will need to raise or lower both **(Q)** and **(R)** screws equally to compensate, and repeat the **P** to **Q** level adjustment.
4. Make sure that none of the 3 suspension springs are loose enough (too extended) to permit excessive vibration as the machine travels.
 - If any suspension spring is too loose, equally tighten all 3 adjustment screws, and repeat the leveling procedure.
 5. While holding each respective adjustment screw from turning, re-tighten the 3 jam nuts. This may affect the level adjustment so, recheck the level and adjust as necessary.
 6. Reinstall the front nose (**D**) onto the machine (removed in step 4 on page 2).
 7. Perform the static and dynamic safety tests of the safety sensors found on pages 16 - 23.



LEFT SAFETY SENSOR LEVEL CHECK AND ADJUSTMENT

CHECKING LASER LEVEL

For proper operation, the laser must be accurately leveled with respect to the machine. This is accomplished by placing the machine on a flat floor surface, and measuring the height of the laser beam at 3 positions around the machine.

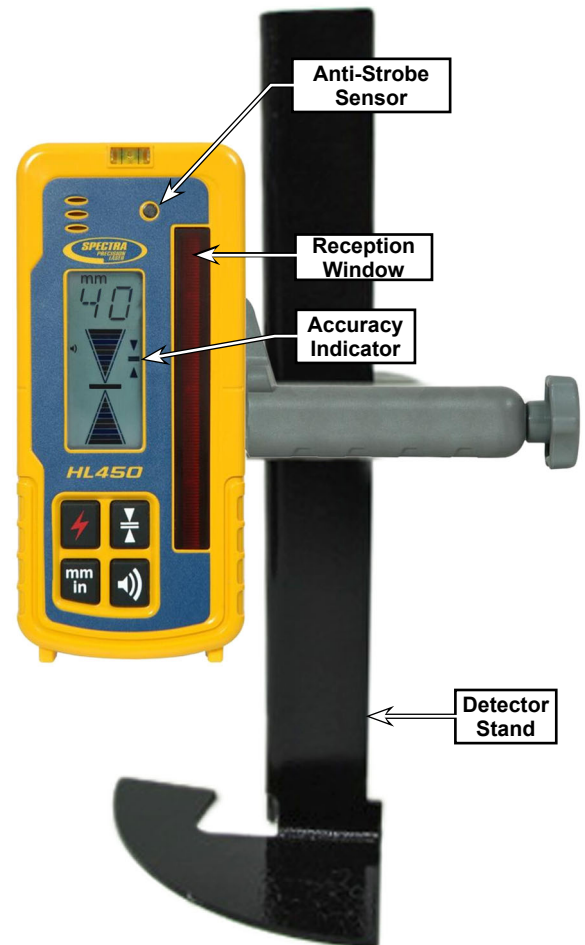
After the safety sensor is removed/reinstalled onto the machine, both the level and rotational adjustments must be performed.

This procedure requires the laser calibration kit (56122718).

1. Perform the steps to **Check and then Adjust Safety Sensor Rotational Position** on pages 5-9 before completing this procedure.
2. Setup the laser detector on the stand, as shown.
 - Adjust the initial height of the detector on the stand so that the laser beam from the sensor should strike the detector in the middle of the red reception window. It is not necessary to place the detector at any specific height, as long as the laser beam strikes the detector in the reception window on the right side.
 - Cover the anti-strobe sensor with a piece of tape.

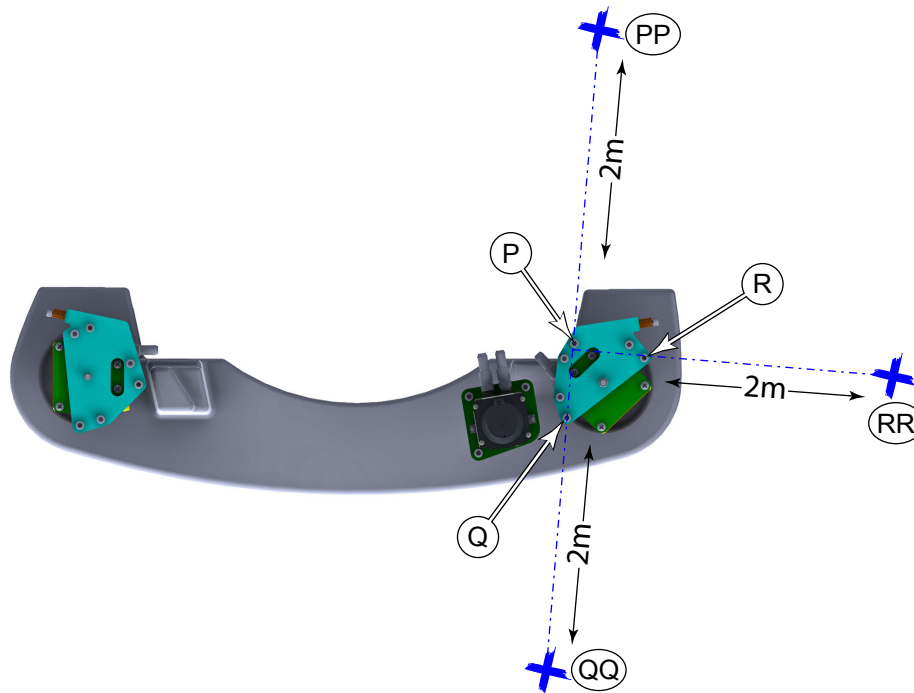


3. Press the power button on the detector to turn the detector on. Make sure the detector cannot see any laser beam when first turned on, or it will display an error message.
4. Press the units button as necessary to set the units to "mm" (millimeter).
5. Press the accuracy button as necessary to set the accuracy to the 1-mm range. (3 bars are displayed between the accuracy arrows.)
6. Cover the left safety sensor and mapping sensor to avoid interference with the laser detector.

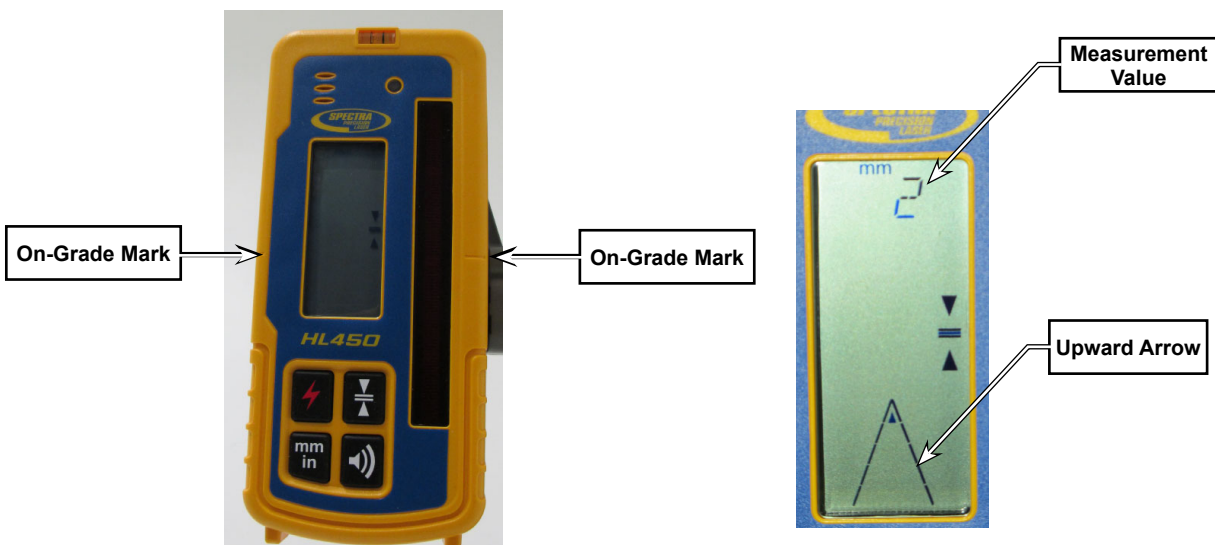


CHECKING LASER LEVEL - CONTINUED

7. Mark the measurement positions (PP), (QQ), (RR) on the floor as shown, 2 meters from the center of the laser, in a line parallel to the line established by the adjustment screws.



8. Move the detector stand to each of the three positions, and record the height of the laser beam from each position. It is recommended that you draw a diagram of the 3 positions and write down the measurements.
- b. The measurement value shown on the detector is how far above or below the on-grade mark the laser beam is striking the reception window. When accompanied by a downward arrow, it means the beam is below the on-grade mark. When accompanied by an upward arrow, it means the beam is above the on-grade mark. The image below means that the laser is striking the reception window 2mm above the on grade mark.

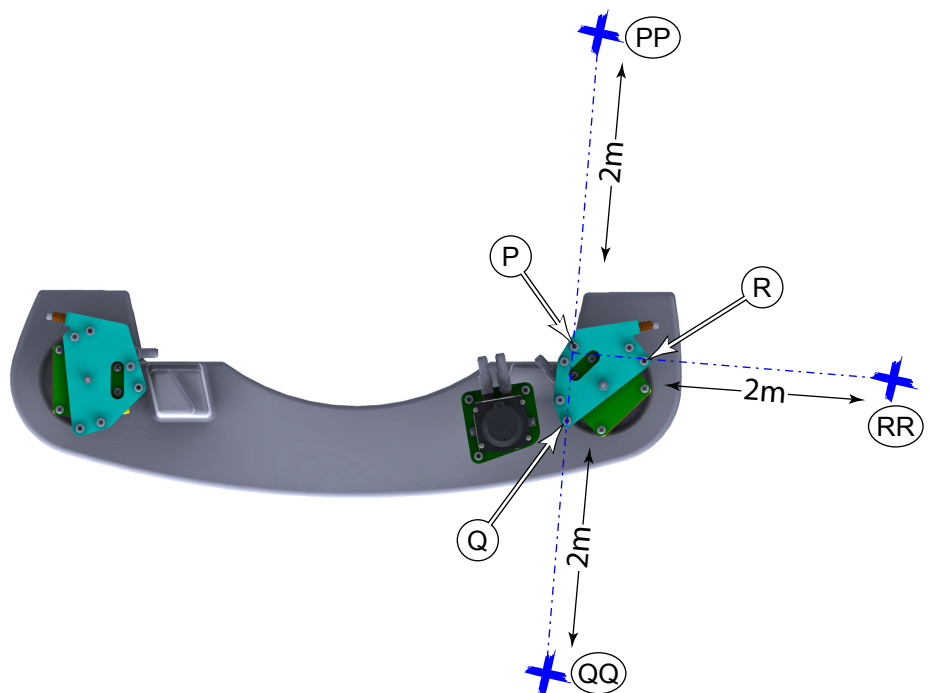
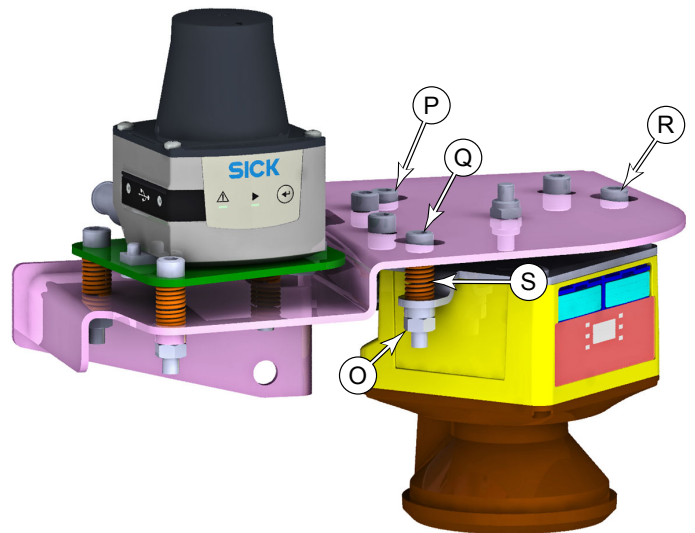
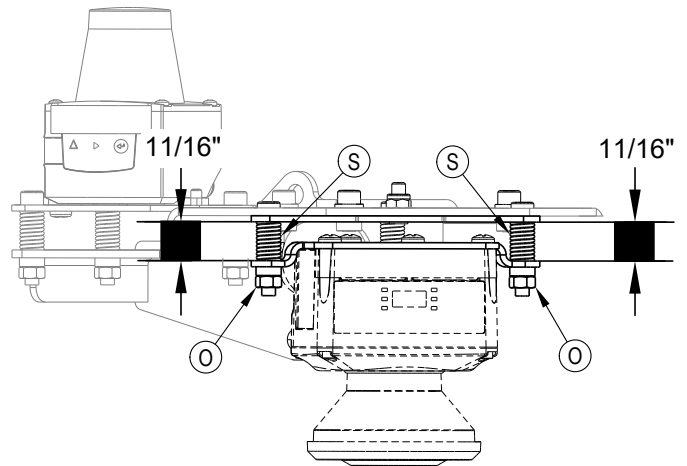


9. If the laser heights at all 3 positions are within ± 3 mm of each other, then no adjustment is necessary and installation is complete. If adjustment is necessary, proceed to the [“LEFT SAFETY SENSOR LEVEL ADJUSTMENT” on page 15.](#)

LEFT SAFETY SENSOR LEVEL ADJUSTMENT

ADJUSTING LASER LEVEL

1. Before making adjustments, use the 11/16" gauge block to verify/set each of the 3 adjustment screws to their neutral position.
 - a. Loosen the 3 jamb nuts (**O**) at the bottom of the laser adjustment screws.
 - b. Loosen the adjustment screw as needed and place the gauge block adjacent to each of the 3 tension springs (**S**).
 - c. Temporarily tighten the adjustment screw until the gauge block is slightly snug between the brackets.
 2. Adjust the (**PP**)-to-(**QQ**) level first.
 - a. Compare the height readings from the (**PP**) and (**QQ**) locations of the laser detector.
 - If the (**PP**) position is higher than the (**QQ**) position, tighten screw (**P**).
 - If the (**PP**) position is lower than the (**QQ**) position, loosen screw (**P**).
 3. Adjust the (**RR**) position to match the (**PP**) and (**QQ**) heights.
 - If the (**RR**) position is lower than (and not between) the (**PP/QQ**) positions, loosen screw (**R**).
 - If the (**RR**) position is higher than (and not between) the (**PP/QQ**) positions, tighten screw (**R**).
- NOTE:** If adjusting the (**RR**) position causes screw (**R**) to exceed its adjustability limit, you will need to raise or lower both (**Q**) and (**R**) screws equally to compensate, and repeat the P to Q level adjustment.
4. Make sure that none of the 3 suspension springs are loose enough (too extended) to permit excessive vibration as the machine travels.
 - If any suspension spring is too loose, equally tighten all 3 adjustment screws, and repeat the leveling procedure.



5. While holding each respective adjustment screw from turning, re-tighten the 3 jam nuts and torque to 62 in/lbs. This may affect the level adjustment so, recheck the level and adjust as necessary.
6. Reinstall the front nose (**D**) onto the machine (removed in step 4 on page 2).
7. Perform the static and dynamic safety tests of the safety sensors found on pages 16 - 23.

STATIC TEST OF SAFETY SENSORS

This procedure checks the right and left safety sensor operation but it does not prove that the sensors are able to send “warning” information about a detected obstacle to the autonomous controller. The static test must be completed before performing the “dynamic safety system test of the safety sensors.”

1. With the machine powered on, the autonomous system fully booted up, and the drive wheel pointing straight ahead, area address 08 should be displayed on the sensor. Warning 2 LED should be orange, Warning 1 LED should be off and OSSD 1/2 LED should be green.



Figure 9: Normal State

2. From the front of the machine, move your hand toward the sensor at a height which is level with the sensor lens. When your hand breaches the warning 1 zone, the Warning 1 should be orange. As you move your hand closer to the sensor to breach protection zone 1, the OSSD 1/2 LED should be red. If you get the expected response the sensor passes the static test.

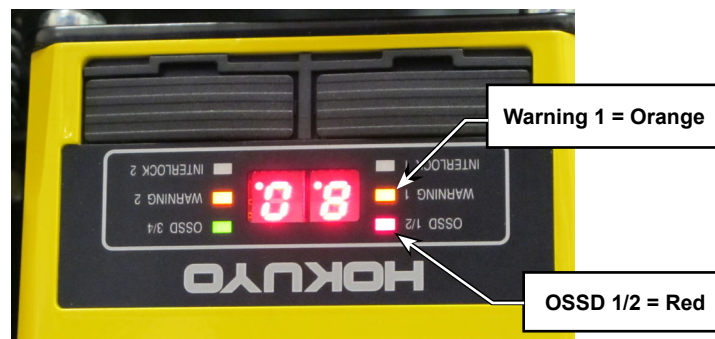


Figure 10: Warning 1 and Protection 1 breached

DYNAMIC SAFETY SYSTEM TEST OF SAFETY SENSORS



Note: Perform the Static Test of Safety Sensors before proceeding to the Dynamic Safety System Test of Safety Sensors .

You must perform **all** of the test procedures in this section

- Test Procedure - Maximum Speed Stop and “kick-out” time
- Test Procedure - Low Speed Stop, Forward
- Test Procedure - Low Speed Stop, Turning Right
- Test Procedure - Low Speed Stop, Turning Left
- Test Procedure - Stay Put

If the machine fails ANY of the tests, it must be taken out of autonomous service. Contact your local Nilfisk Technical Support center for assistance.

TEST SUMMARY

Whenever a safety sensor is replaced and/or adjusted, it is necessary to verify that the sensors are working properly and that the machine stops when a safety sensor reports an obstacle to the autonomous controller. This is done by placing the machine in a special operational mode along with using cylinder shaped “obstacles” of a specific size and material which are placed in the path of the machine during playback. The machine should stop before contacting the obstacle.

The obstacles are called “Target-Cylinders.” They are shaped like a cylinder and covered with a black felt-like cloth. There are two sizes. The large cylinder is 60 cm long and 20 cm wide. The small cylinder is 40 cm long and 7 cm wide. When in use, the small target cylinder is placed so that it stands up vertically, while the large target cylinder is laid down on its side horizontally.

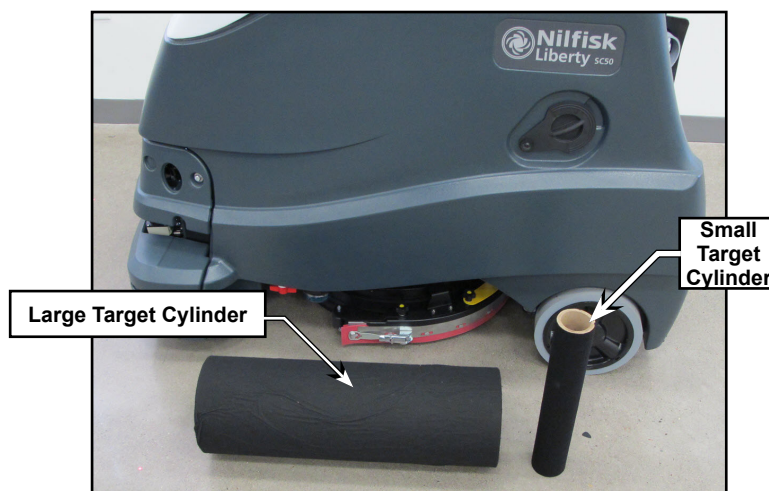


Figure 11: Target-Cylinders

Most of the tests are to ensure that the machine stops without contacting the obstacle when the obstacle is placed in several different positions and orientations, however there are also tests to ensure that the autonomous system will quit playback mode (kick out) within 20 seconds when the obstacle remains in place and tests to make sure that machine will refuse to move when playback is started if the object is directly in front of the machine.

TEST PROCEDURE - MAXIMUM SPEED STOP AND “KICK-OUT” TIME

Test Preparation:

Record a copy-cat plan for transport only following a straight, predictable line (~15m+) that you can reference during playback. There should be at least 1 meter (3 feet) of clearance on either side of the machine. You may want to place some easily removable tape on the floor as reference markers to help guide you.

Power on the machine in service mode. Navigate to Service, A3 Drive Controller so that you can monitor the machine speed during play back. Remove the key before pressing the play button. (If you fail to do this, you will not be able to monitor the machine speed.) Play back the plan while walking behind the machine so that you can note (or mark with tape) where the machine speed exceeds 1.8 mph (2.9 kph).

Navigate to Service/A5 Autonomy/Send Any System Command. Press the up navigation arrow 50 times to select command #50, **then press the right navigation arrow to select**. You should see the value for 50 be momentarily highlighted. This puts the machine into a special operation mode, where it will no longer try to go around obstacles, which is required for the test procedure. If the machine is powered off it will automatically return to normal operation. If you are not finished testing and the machine has powered off, you will need to go back and send command #50 again.

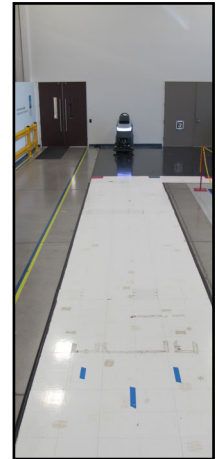


Figure 12: Straight Copy-cat Plan

1. Place the large cylinder as shown in [Figure 13: Traveling Toward Target Cylinder](#) at the place where the machine speed exceeded 1.8 mph (2.9 kph).
2. Drive to the start area. Remove the key before pressing the play button. (If you fail to do this, you will not be able to monitor the machine speed.) Play back the plan while walking behind the machine so that you can monitor the machine speed to make sure it exceeds 1.8 mph (2.9 kph) before reaching the target cylinder area. The machine should stop before contacting the cylinder. If it touches the cylinder it fails the test.



Figure 13: Traveling Toward Target Cylinder

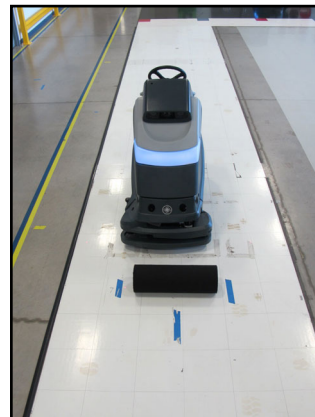


Figure 14: Machine Stopped

3. Move the cylinder towards the machine until it is touching the front of the machine and leave it there. Measure the time until the playback “kicks out” (quits playback). It should kick out within 20 seconds. If it doesn’t kick out within 20 seconds, it fails the test..

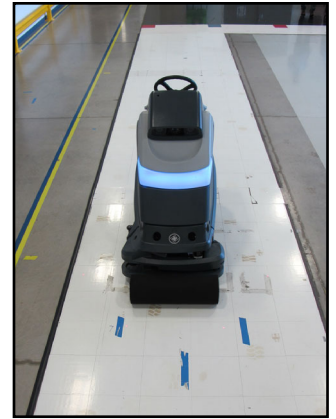


Figure 15: Moved cylinder to touch machine

TEST PROCEDURE - LOW SPEED STOP, FORWARD

For this test, you will use the small target cylinder in the vertical position in three locations; right, center and left. You will also use the large target cylinder in the horizontal position using three different orientations and three positions for each orientation. **If the machine contacts the target cylinder in any of the tests, it fails the test.**

Test Preparation:

Use the same plan you recorded for the maximum speed stop test with system command 50 selected to disable obstacle avoidance.

1. Drive back to the start location.
2. Place the small target cylinder approximately 1 meter (3 feet) in front of the machine as shown in [Figure 16: Right](#).

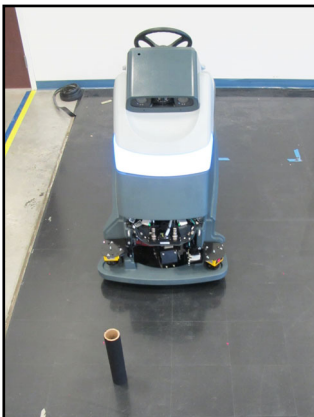


Figure 16: Right

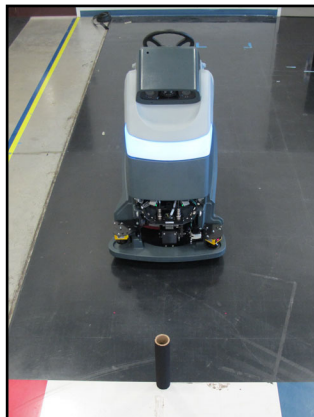


Figure 17: Center

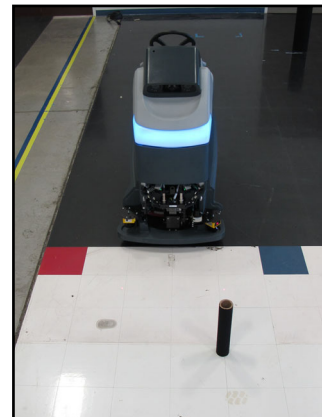


Figure 18: Left

3. Press the play button. The machine should move and then stop before it contacts the target cylinder.
4. Once the machine has stopped, and before it kicks out of playback, move the cylinder so that it is approximately 1 meter (3 feet) ahead of the machine as shown in [Figure 17: Center](#). The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat for the left side as shown in [Figure 18: Left](#).

5. Place the large target cylinder approximately 1 meter (3 feet) in front of the machine as shown in [Figure 19: Right](#).

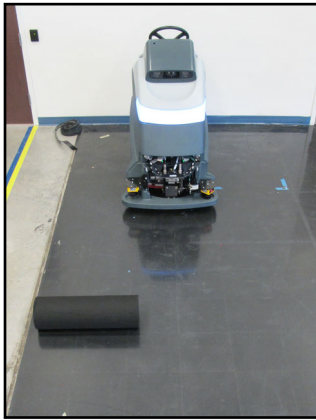


Figure 19: Right



Figure 20: Center

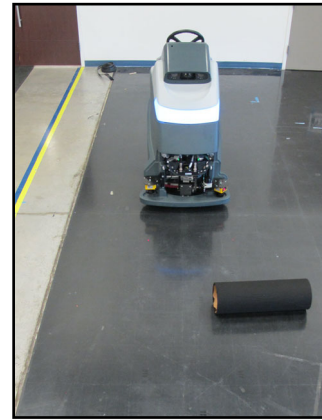


Figure 21: Left

6. Press the play button. The machine should move and then stop before it contacts the target cylinder.
7. Once the machine has stopped, and before it kicks out of playback, move the cylinder so that it is approximately 1 meter (3 feet) ahead of the machine as shown in [Figure 20: Center](#). The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat for the left side as shown in [Figure 21: Left](#).
8. Place the large target cylinder approximately 1 meter (3 feet) in front of the machine as shown in [Figure 22: Right](#).

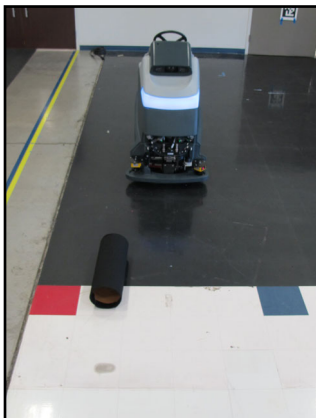


Figure 22: Right

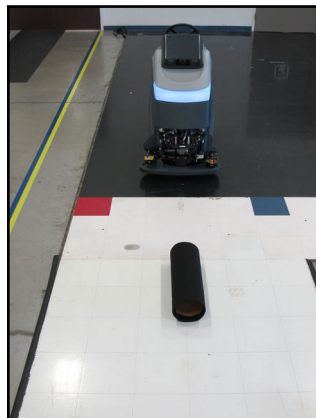


Figure 23: Center

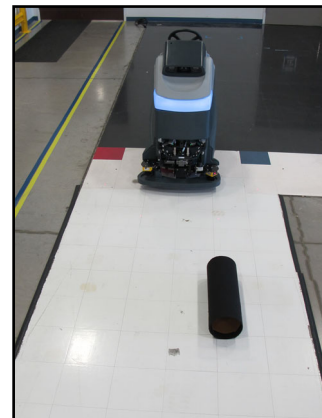


Figure 24: Left

9. Press the play button. The machine should move and then stop before it contacts the target cylinder.
10. Once the machine has stopped, and before it kicks out of playback, move the cylinder so that it is approximately 1 meter (3 feet) ahead of the machine as shown in [Figure 23: Center](#). The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat for the left side as shown in [Figure 24: Left](#).

11. Place the large target cylinder approximately 1 meter (3 feet) in front of the machine as shown in [Figure 25: Right](#).

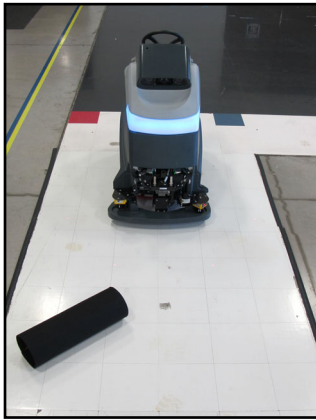


Figure 25: Right

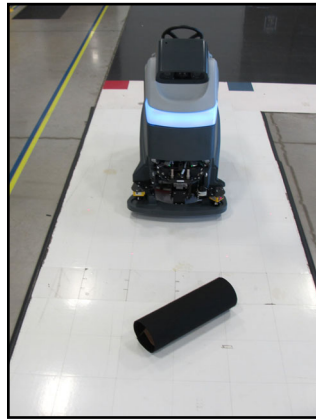


Figure 26: Center

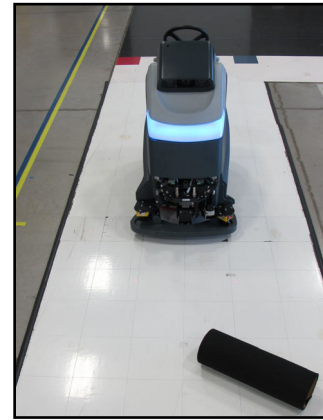


Figure 27: Left

12. Press the play button. The machine should move and then stop before it contacts the target cylinder.
13. Once the machine has stopped, and before it kicks out of playback, move the cylinder so that it is approximately 1 meter (3 feet) ahead of the machine as shown in [Figure 26: Center](#). The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat for the left side as shown in [Figure 27: Left](#).
14. Return to the start location and use the autonomous help menu to Delete the plan when finished.

TEST PROCEDURE - LOW SPEED STOP, TURNING RIGHT

For this test, you will use the large target cylinder in the horizontal position in three locations to the side of the machine.

Test Preparation:

From a new start location, record a transport only copy-cat plan for a 90 degree turn to the right - with the steering wheel turned all the way to the right until it reaches the mechanical stop. Mark the exact position of the machine start location using tape on the floor which will be easy to remove. This will allow you to bring the machine to the exact start location for the test. System command 50 must be selected to disable obstacle avoidance.

If the machine contacts the target cylinder in any of the tests, it fails the test.

1. Position the machine at the exact start location. The squeegee should be in the "center" position so that it is at risk of contacting the target cylinder during the test.
2. Place the large target cylinder to the right side of the machine as shown in [Figure 28: Near Front Bumper](#).



Figure 28: Near Front Bumper



Figure 29: Near Squeegee



Figure 30: Behind Squeegee

3. Press the play button. The machine should move toward the target cylinder and then stop before any part of the machine contacts the target cylinder.
4. Once the machine has stopped, move the target cylinder to the next position before it kicks-out of playback mode. The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat until all positions have been tested with the large target cylinder.
5. Return to the start location and use the autonomous help menu to Delete the plan when finished.

TEST PROCEDURE - LOW SPEED STOP, TURNING LEFT

For this test, you will use the large target cylinder in the horizontal position in three locations to the side of the machine.

Test Preparation:

From a new start location, record a transport only copy-cat plan for a 90 degree turn to the left- with the steering wheel turned all the way to the left until it reaches the mechanical stop. . Mark the exact position of the machine start location using tape on the floor which will be easy to remove. This will allow you to bring the machine to the exact start location for the test. System command 50 must be selected to disable obstacle avoidance.

If the machine contacts the target cylinder in any of the tests, it fails the test.

1. Position the machine at the exact start location.
2. Place the large target cylinder to the left side of the machine in one of the 3 positions as shown.



Figure 31: Near Bumper



Figure 32: Near Center



Figure 33: Behind Squeegee

3. Press the play button. The machine should move toward the target cylinder and then stop before any part of the machine contacts the target cylinder.
4. Once the machine has stopped, move the target cylinder to the next position before it kicks-out of playback mode. The machine should resume playback and move toward the target cylinder and then stop before it contacts the target cylinder. (If the machine kicks out of playback, simply press the play button to resume playback). Repeat until all positions have been tested with the large target cylinder
5. Return to the start location and use the autonomous help menu to Delete the plan when finished.

TEST PROCEDURE - STAY PUT

For this test, you will play back a plan in “normal” operation and use both the small and large target cylinders.

If the machine moves forward in any of the tests, it fails the test.

Test Preparation:

Power the machine off and back on to return it to “normal operation.” Record a copy-cat plan for transport only following a short, straight line.

1. Drive the machine to the start location.
2. Place the large cylinder directly in front of the machine as shown so that it is touching the front bumper.
3. Press the play switch. The machine should stay put and not move. It should “kick-out” (quit playback) within 20 seconds.
4. After it has “kicked-out” (quit play back), remove the large target cylinder and place the small cylinder directly in front of the machine as shown so that it is touching the front bumper.
5. Press the play switch. The machine should stay put and not move. It should “kick-out” (quit playback) within 20 seconds.
6. Return to the start location and use the autonomous help menu to Delete the plan when finished.
7. This completes the installation of a lens on a safety sensor.



Figure 34: Touching Front Bumper



Figure 35: Touching Front Bumper