



Tuffer Weigh-in-Motion Loader Scales

P/N: 85-00920-01L

Installation & Calibration

Manufactured & Sold by:
SI ONBOARD

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Introduction

Congratulations on your purchase of a new Tuffer scale system! The care and quality that goes into each system we manufacture ensures years of trouble-free service for you.

Should you have any problem with the installation or operation of your scale, call us.

USA -Sales Support: 800-638-5111 | Technical Support: 626-202-5047

Canada – Sales and Technical Support: 800-989-1499

Your TUFFER scale is a fine piece of precision equipment. This manual contains instructions on installation and troubleshooting of the Tuffer scale system. For operating instructions, please refer to the Owner's Manual.

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IMPORTANT NOTE: Factors such as loader make and model, environmental conditions, and operator/installer experience can greatly influence the installation and calibration procedures. SI Onboard makes no stipulation regarding the time required to install and calibrate this scale system. Following the procedure contained in this manual, however, can help to minimize the installation and calibration time.

INSTALLATION

Parts List for System Number 91-01655-01:

<u>DESCRIPTION</u>	<u>PART #</u>	<u>QTY</u>
Owner's manual	61-90106	2
Tuffer WM indicator	85-00920-01L	1
U-Bracket *	25-00403-01	1
Proximity Switch Sensors	5500063	2
Proximity switch harness *	81-00555-01	1
Proximity sw mountg brkt Assy *	25-00400-05	1
Cable Guard	25-00400-04	1
Target plate assembly (2 parts) *	25-00401-01	1
Power cable *	8100571-02	1
Remote switch assembly *	8100558-01	1
External pressure sensor *	5500111	2
Lift pressure sensor cable *	81-00608-01	1
Return pressure sensor cable	81-00608-02	1
Hydraulic hose with fittings *	81-00609-10	2
Installation kit (in small box) *	71-00214	1
***** Items within kit*****		
37° flare to ¼-NPT fitting	25-00559	2
37° flare to ¼-NPT 90° fitting	25-00640	2
7/16" drill bit	25-00606	1
1/4-18 NPT tap	28-00607	1
#17 drill bit	25-00608	1
10-24 × 3/8" self-tapping screws	28-00720	4
Sandwich block for 1" line	71-00201	2
Sandwich block for 1¼" line	71-00202	2
10-32 x 5/8" pan head screw	28-00102	4
7½" & 8" black cable ties	28-00078	38
#12 flat washer	28-00721	4
5/8" hose clamp	28-00774	3
10-32 nylock nut	28-00798	4
Teflon sealing Tape	6000244	1

* These parts are also included in the optional second loader set-up.

INSTALLATION

IMPORTANT! Installation requires welding to the frame and boom of the loader and connection to the loader's electrical and hydraulic systems. Read through this section carefully before beginning the installation!

INSTALLING THE INDICATOR

Step 1 Installing Indicator

Install the indicator where it will be convenient to the operator. Attach the U-bracket to the ceiling or dashboard of the loader using the 10-24 x 3/8" self-tapping screws and the #17 drill bit provided in the installation kit.

The indicator has been shipped with the knobs and studs in position for ceiling mount use. Refer to Figure 1. Tilt the indicator for easy viewing, and tighten the knobs to lock the indicator in place. Apply small amount of LOCTITE to threads of studs.

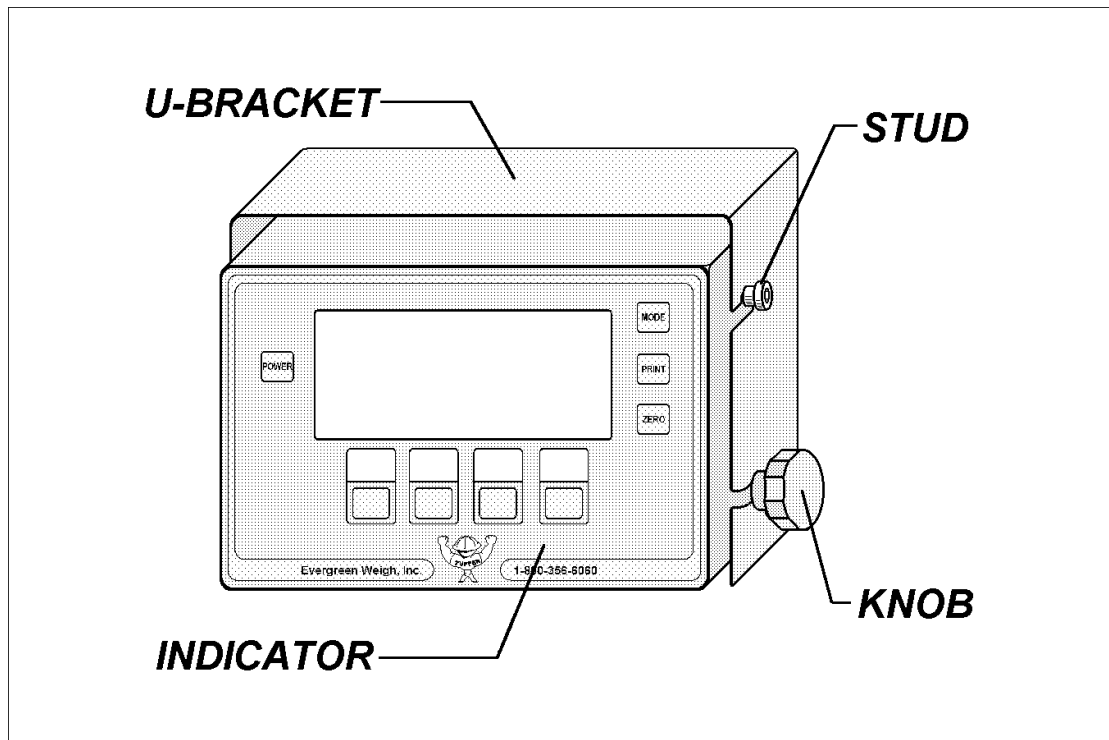


Figure 1, Ceiling Mounted Indicator

INSTALLATION

For a dashboard installation, reverse the positions of the knobs and studs. Refer to Figure 2.

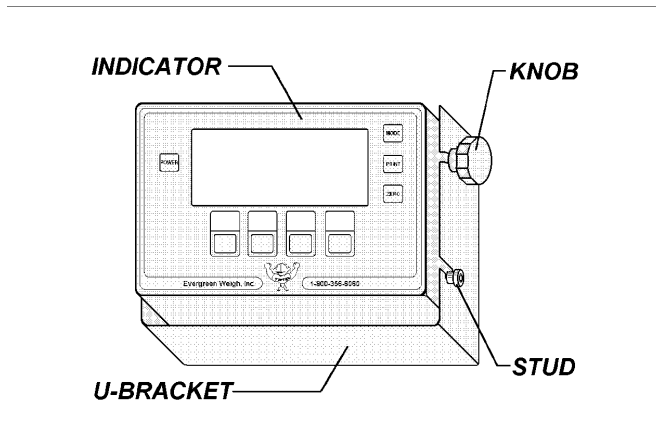
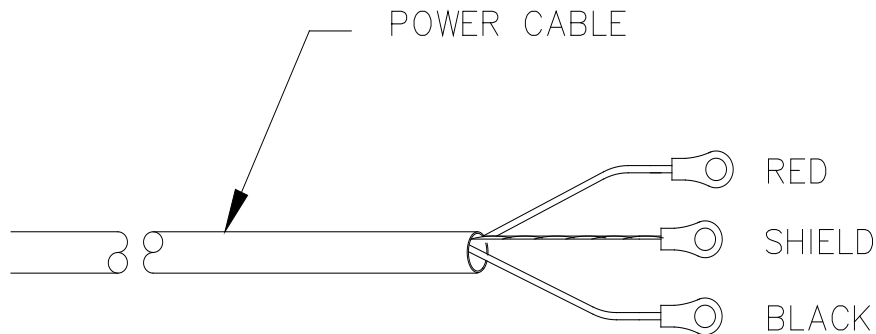


Figure 2, Dashboard Mounted Indicator

Step 2 Installing Indicator



1. Connect Red wire (P/N 8100557-02) to a filtered and fused 24V DC bus outlet on the Front Loader dashboard.
2. Connect shield to frame. Make sure that the shield is making a metal to metal contact with the frame. Use an Ohm meter or Multi-meter to verify continuity.
3. Connect Black wire to filtered instrument ground or to the bus ground (dashboard ground).

Step 3 Installing Indicator

Attach the connector on the **remote switch** (part number 8100558-01) to the connector on the indicator labeled "REMOTE SWITCH". Use **tie wraps** to secure the **remote switch** to the boom control lever on the loader.

INSTALLATION

TAPPING INTO THE HYDRAULIC SYSTEM

Step 1 Tapping into Hydraulic

Locate the hydraulic line which applies pressure to the boom cylinder for lifting. The lift line will be the hydraulic line on the bottom of the boom cylinder that pushes fluid up toward the piston. Do not tap into the return line on the cylinder; the scale will not function properly. Refer to Figure 3 for a typical lift line location on a hydraulic cylinder.

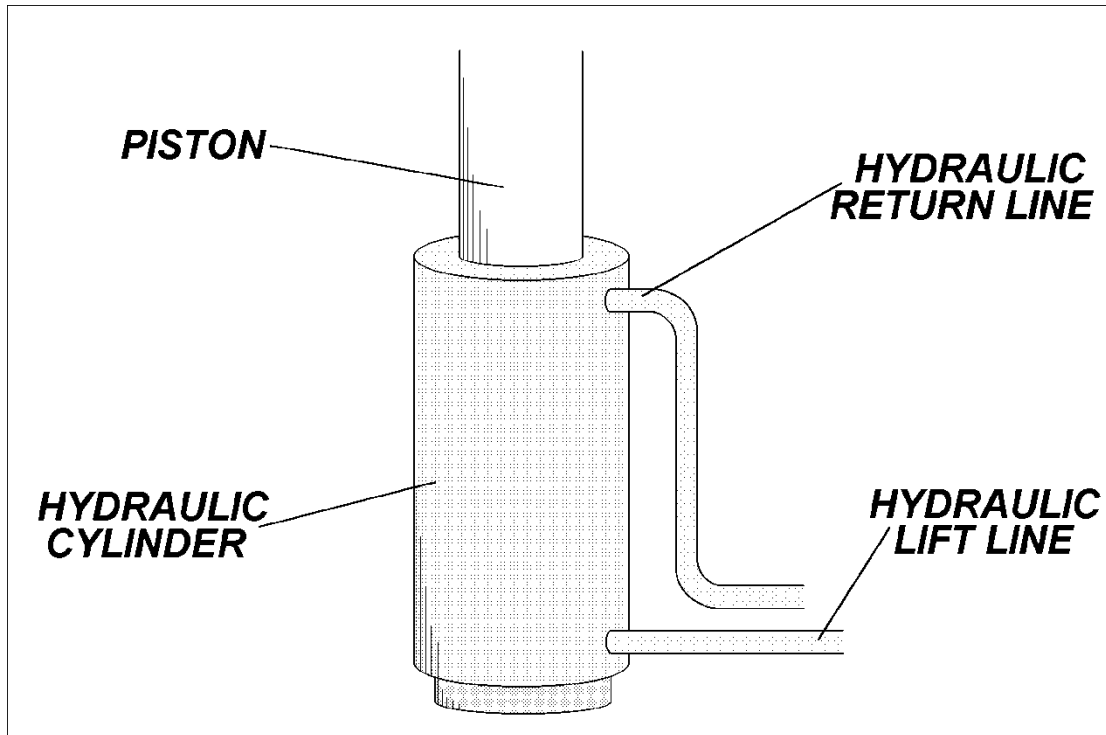


Figure 3, Tapping Into the Hydraulic Cylinder

Trace the lift line from the hydraulic cylinder to the control valve. The lift lines will usually join together at a "T" connector, and then connect to the valve. If possible, the "T" connector or an elbow should be removed and brought into the shop for more careful drilling. Use the #17 drill bit to make a pilot hole in the lift line or "T" connector. Then, use the 7/16" drill bit and tap provided in the installation kit.

INSTALLATION

If the hydraulic system on the loader uses split flange fittings, a “sandwich block” can be used instead of tapping into the line. Three sandwich blocks are included in the installation kit. Contact Evergreen Weigh for other sizes. Insert the rubber O-ring included with the sandwich block into the circular groove on the sandwich block. Remove the four bolts from the split flange fitting on the loader, and carefully pull the hydraulic hose away from the fitting. Place the sandwich block on top of the fitting. Refer to Figure 4. Connect the hydraulic hose to the top of the sandwich block, and bolt the fitting and sandwich block into place with the longer bolts provided.

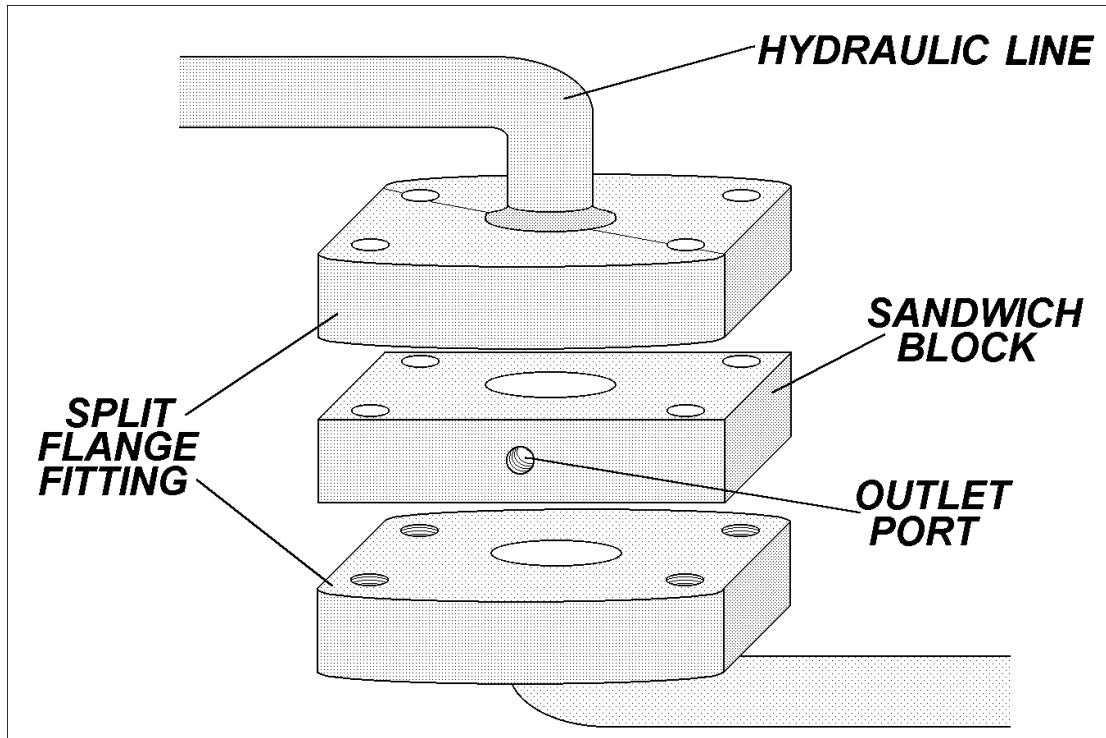


Figure 4, Using a Sandwich Block

Step 2 Tapping into Hydraulic

Wrap Teflon tape on the threads of the external pipe thread fitting (part number 2500640- 90degree fitting to keep hydraulic hose close to body of cylinders or 2500559 straight fitting) and install into the tapped hole (or the hole on the side of the sandwich block, if you are using one).

INSTALLATION

Step 3 Tapping into Hydraulic

Attach the end of the **lift pressure sensor cable** (p/n 8100608-01) to the connector on the back of the TUFFER labeled "LIFT PRESSURE SENSOR". Use the end of the **pressure sensor cable** with the 90° bend near the connector. Route the cable down to the tap-in point in the hydraulics. (note return pressure cable, p/n 8100608-02, at meter side has a 5 pin in circle & 1 pin in middle connector. This style connector is at meter return pressure sensor connection only)

IMPORTANT! *Be sure to allow extra length in the cable so that the loader can be turned without putting strain on the cable! Slowly turn the loader fully to the left and right. Check to see that there is still some slack in the cable when fully turned!*

Step 4 Tapping into Hydraulic

Locate the hydraulic return line which applies pressure to the top of the boom cylinder. The return line will be the hydraulic line on the top of the boom cylinder that pushes fluid down toward the piston. Refer to Figure 3 for a typical return line location on a hydraulic cylinder.

Trace the return line from the hydraulic cylinder to the control valve. The return lines will usually join together at a "T" connector, and then connect to the valve. If possible, the "T" connector or an elbow should be removed and brought into the shop for more careful drilling. Use the #17 drill bit to make a pilot hole in the lift line or "T" connector. Then, use the 7/16" drill bit and tap provided in the installation kit.

If the hydraulic system on the loader uses split flange fittings, a "sandwich block" can be used instead of tapping into the line. Refer to Figure 4.

Step 5 Tapping into Hydraulic

Wrap Teflon tape on the threads of the external pipe thread fitting (p/n 2500640 90degree or 2500559 straight) and install into the tapped hole (or the hole on the side of the sandwich block, in you are using one).

Step 6 Tapping into Hydraulic

Attach the end of the **return pressure sensor cable** (p/n 8100608-02) to the connector on the back of the TUFFER labeled "RETURN PRESSURE SENSOR". Use the end of the **pressure sensor cable** with the 90° bend near the connector. Route the cable down to the tap-in point in the hydraulics. (note return pressure cable, p/n 8100608-02, at meter side has a 5 pin in circle & 1 pin in middle connector. This style connector is at meter return pressure sensor connection only)

INSTALLATION

Step 7 Tapping into Hydraulic

Connect the 2 hydraulic hoses p/n 8100609-10 to the external pipe thread fittings (part number 2500640 or 2500559, located on either sandwich blocks or tap in points on T-connector or elbows) and tighten securely.

Step 8 Tapping into Hydraulic

Connect the fitting on the opposite end of the **hydraulic hose** to the hydraulic fitting on the **external pressure sensors** (part number 5500111) and tighten securely. Use a second wrench to support pressure transducer during tightening of hoses.

NOTE: Be sure to route all hoses and electrical cables in such a fashion as to not bind or break during operation of loader.

Step 9 Tapping into Hydraulic

Connect the ends of the **pressure sensor** electrical cables with the straight connector to the connector on the **external pressure sensors**. Be sure to connect Lift pressure cable to transducer connected to hydraulic lift pressure hose and Return pressure cable to transducer connected to hydraulic return pressure hose

Step 10 Tapping into Hydraulic

Secure the hydraulic hose, external pressure sensor, and pressure sensor cable to the vehicle using the cable ties in the installation kit.

NOTE: Be sure to route all hoses and electrical cables in such a fashion as to not bind or break during operation of loader.

INSTALLATION

INSTALLING THE PROXIMITY SWITCH BRACKET

Step 1 Proximity Switch Bracket

Raise the boom on the loader so that the bucket is just below truck loading height. Use a large 'C' clamp to hold the **proximity switch bracket** (part number 2500400-05) in place as near to the pivot point of the boom as possible. Refer to Figure 6. Position the bracket so that the middle hole on the upper half of the bracket is near the middle of the boom.

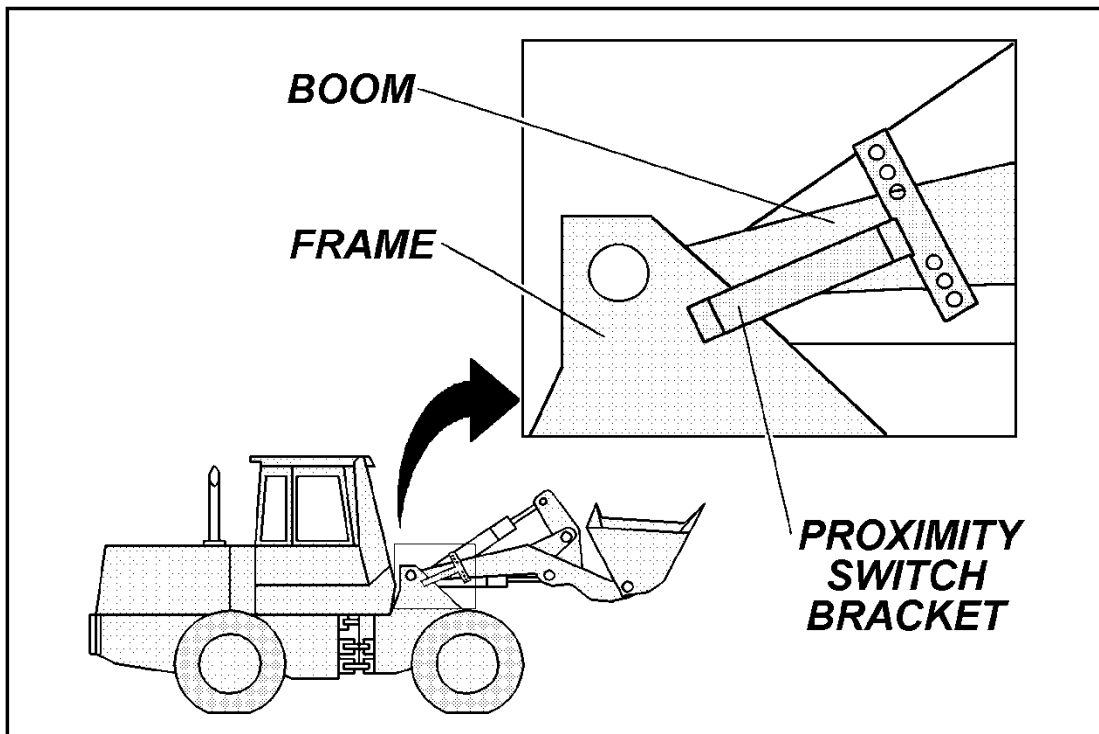


Figure 6, Proximity Switch Bracket Placement

NOTE: If there is not enough room to fit the **proximity switch bracket** outside of the boom and frame, it can be attached to the inside of the frame. Check carefully for interference with other parts of the loader!.

INSTALLATION

Step 2 Proximity Switch Bracket

Use a second 'C' clamp to hold the adjustable **target plate** (part number 2500401-01) in place horizontally in the middle of the boom of the loader. The large flange of the **target plate** should face the boom.

The **target plate** should be visible through all six holes in the **proximity switch bracket** as it passes by. Refer to Figure 7.

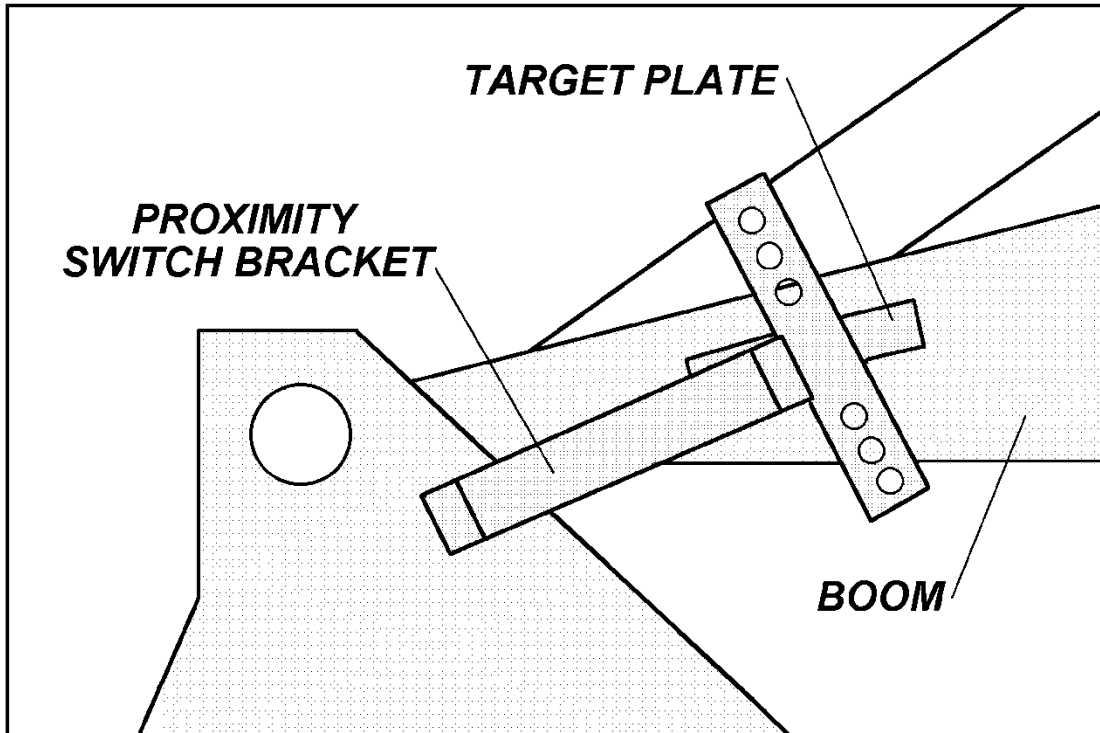


Figure 7, Target Plate Placement

Step 3 Proximity Switch Bracket

Adjust the width of the **target plate** so that there is approximately one inch between the **proximity switch bracket** and the **target plate**. Refer to Figure 8. Tighten both adjustment bolts on the **target plate**.

INSTALLATION

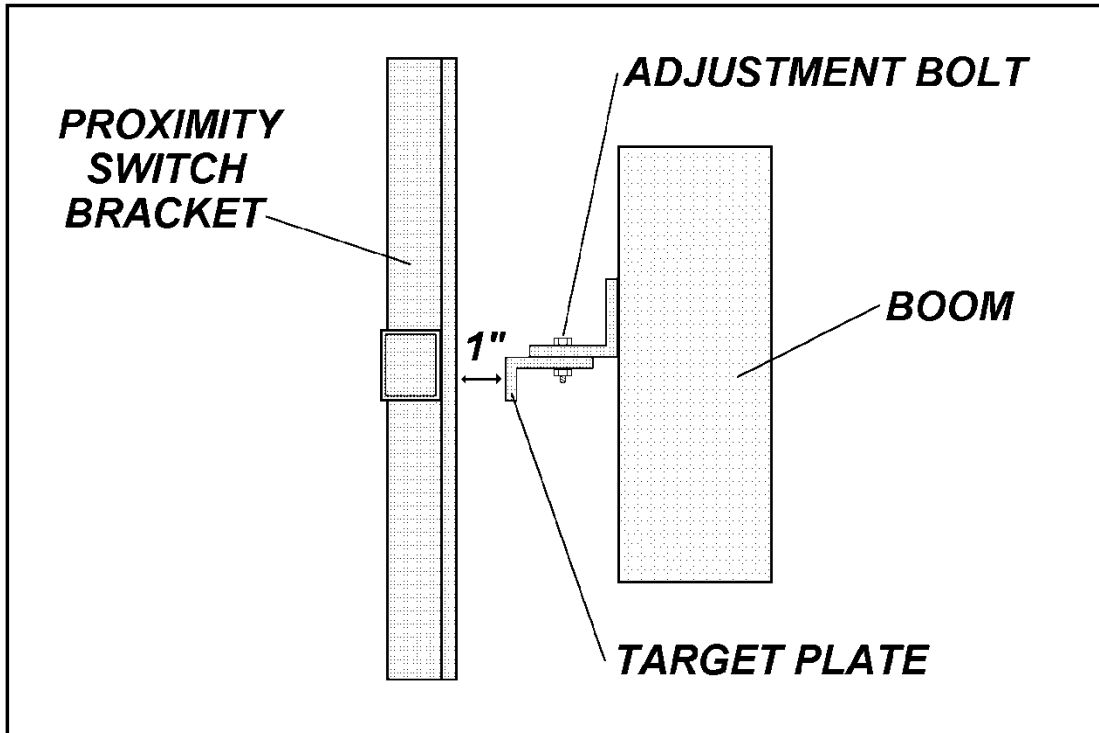


Figure 8, Target Plate Adjustment

Step 4 Proximity Switch Bracket

Move the loader onto a hill that slopes to the left. Raise and lower the boom several times, so that the boom moves as far to the left on its pivot pins as possible. Check the spacing between the **proximity switch bracket** and the **target plate**: it should be between $7/8"$ and $1\ 1/8"$.

Move the loader onto a hill that slopes to the right. Raise and lower the boom several times, so that the boom moves as far to the left on its pivot pins as possible. Again, check the spacing between the **proximity switch bracket** and the **target plate**: it should be between $7/8"$ and $1\ 1/8"$.

Make sure that the spacing does not change more than $1/8"$. Permanent damage to the **proximity switches** will occur if the **target plate** comes in contact with the **proximity switches**!

INSTALLATION

INSTALLING THE PROXIMITY SWITCHES

Step 1 Proximity Switch

Remove one of the large nuts from each of the two **proximity switches** (part number 8100555-01). Insert the switch marked “UPPER” into the **middle hole on the top half** of the **proximity switch bracket** and the switch marked “LOWER” into the **middle hole on the bottom half** of the **proximity switch bracket**. If no “UPPER” and “LOWER” markings place either switch in either location. The flat plastic face of each switch should point toward the **target plate**. Replace the large nuts to hold each switch in place. Do NOT over tighten the **proximity switch** nuts! Damage may result!

Adjust the nuts on each **proximity switch** so that there is 1/4 to 3/8” between the face of the **proximity switch** and the **target plate**. Refer to Figure 9.

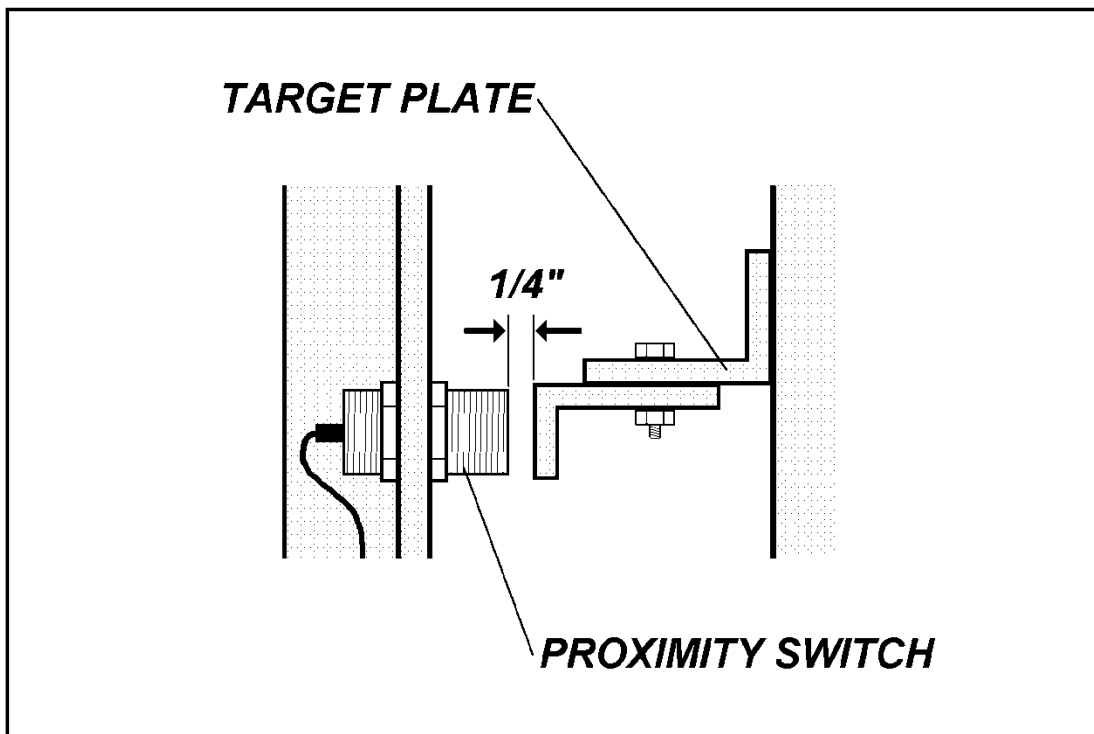


Figure 9, Proximity Switch Adjustment

INSTALLATION

Step 2 Proximity Switch

SLOWLY raise the boom and check to see that the **proximity switches** do NOT come in contact with the **target plate**. Adjust the nuts on the **proximity switches** if necessary. Check the spacing on a left sloping and a right sloping hill as in step 4 on page 14. The spacing between the **proximity switches** and the **target plate** should be between 1/8" and 3/8".

Check to see that the **proximity switch bracket** and the **target plate** do not come into contact with each other, or with other parts of the loader (hydraulic cylinders, hoses, etc.) Adjust the position of the **target plate** or the **proximity switch bracket** if necessary.

Lower the boom so that the **target plate** is at the level of the **proximity switch** in the bottom half of the **proximity switch bracket**. The boom should be above carry position. If not, the **proximity switch** can be moved up one hole.

Step 3 Proximity Switch

Route the cable on the **proximity switch** harness through the tube in the **proximity switch bracket** and back to the cab. Secure with wire ties.

Attach the metal connector at the end of the **proximity switch harness** to the connector on the back of the Tuffer labeled, "Proximity Switches".

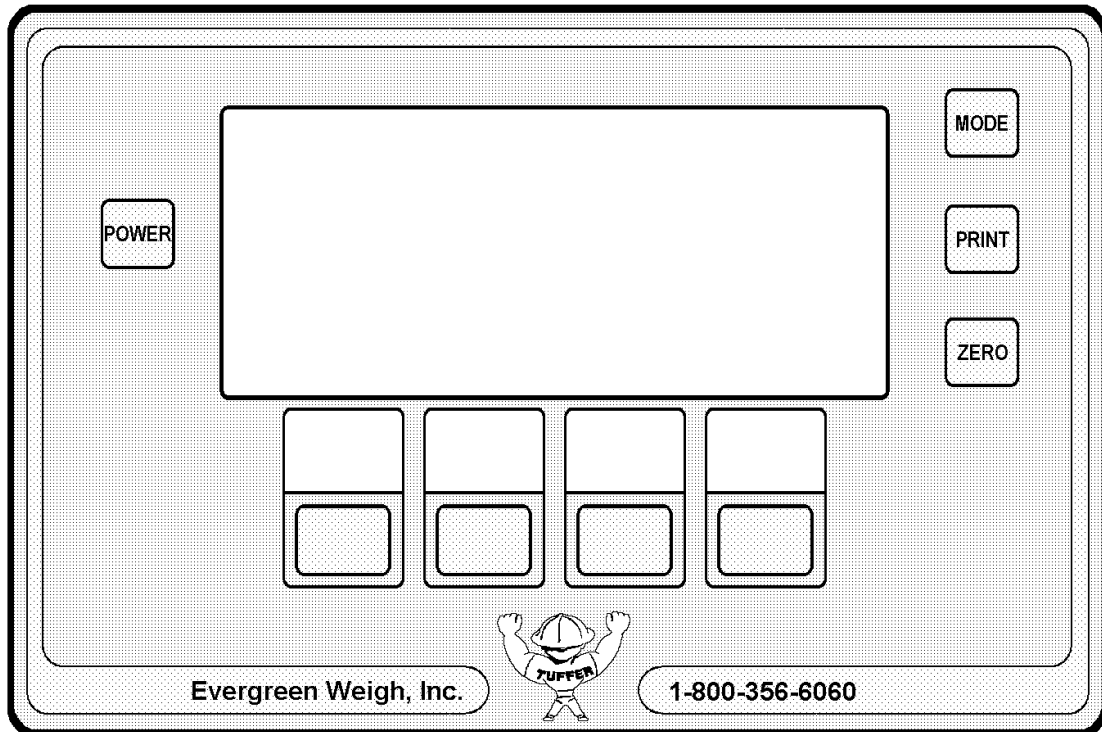
INSTALLATION

Scale System Basics

The POWER button is used to turn the Tuffer on and off. Press the POWER button once to turn the Tuffer on. Press the POWER button again to turn the Tuffer off.

The MODE button is used to control the operating mode of the scale system. The PRINT button is used to send weight information to the PRINTER (available as a system option). The ZERO button is used to 'zero' the scale system before weighing.

Figure
10,,
Tuffer
WM
Front
Panel



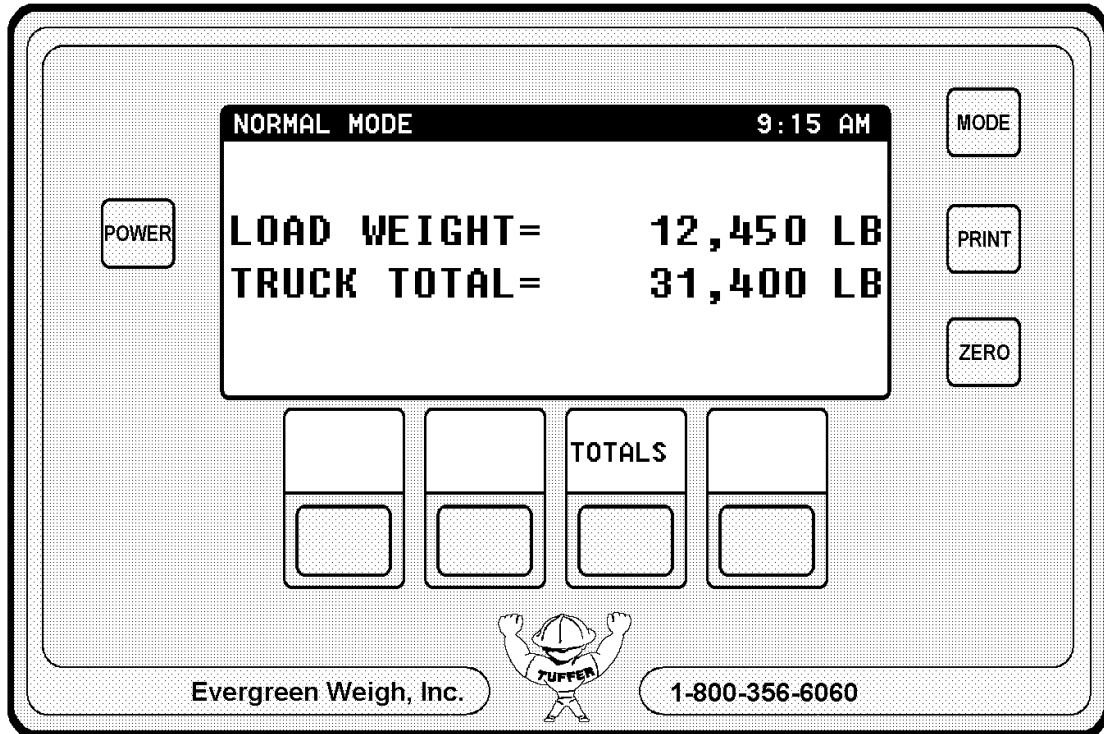
Below the display are four "soft" keys. The function of each of these keys changes depending on the mode that the Tuffer is in. The function of each soft key is displayed in the clear panel above each of the keys. Refer to Figure 10 for button and soft key locations.

INSTALLATION

The Tuffer is equipped with a high resolution black and white liquid crystal display. Each area of the display is used to show different information.

The upper left hand corner is used to show the current operating mode. The upper right hand corner of the display shows the current time. The remaining display area is used to show operator prompts, weight data, and error messages. Refer to Figure 11.

Figure
11,
Tuffer
WM



Display Areas

Checking the Installation

Before calibrating, it is important to check the installation of the system components to make sure that they have all been connected and are functioning properly. *If any component does not respond as expected during this installation check, please see “Troubleshooting” on Page 33.*

Turn the Tuffer on by pressing the POWER button. The display will light up. Press the MODE button in the upper right hand corner of the Tuffer. The Tuffer will display the MAIN MENU. Refer to Figure 12.

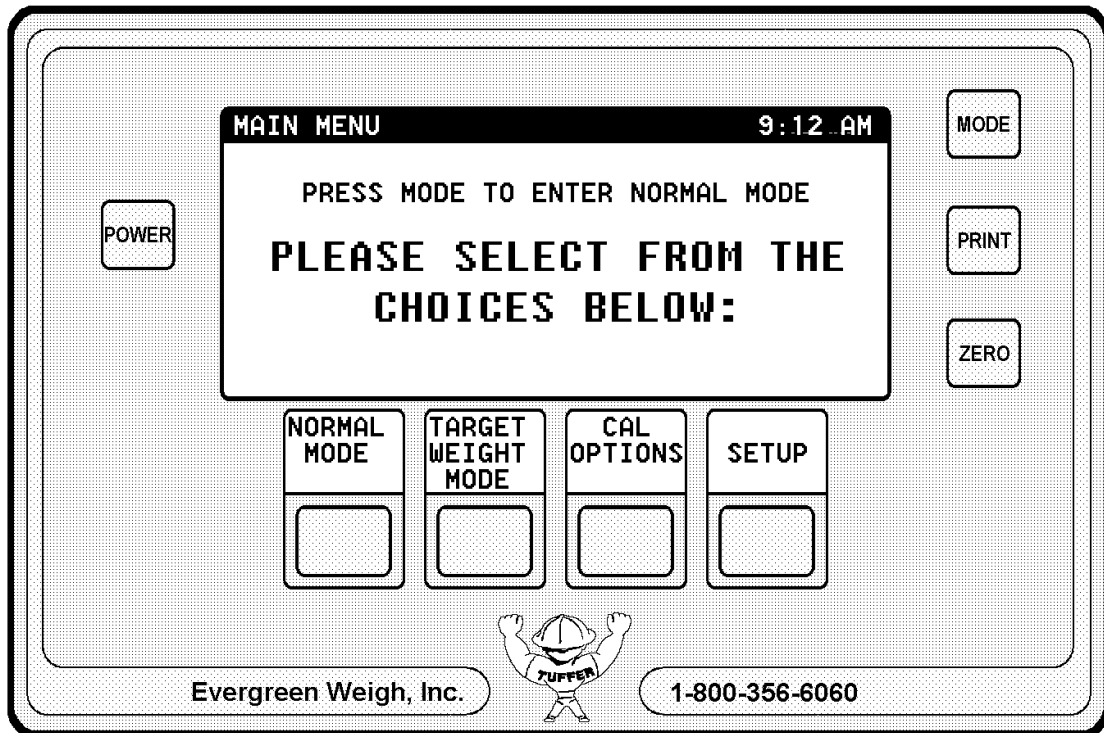


Figure 12, MAIN MENU

Now, press the soft key labeled “CAL OPTIONS”. Next, press the soft key labeled “DISPLAY LIFTING PSI”. The Tuffer will enter LIFT PRESSURE MODE, a special diagnostic mode. Refer to Figure 13.

INSTALLATION

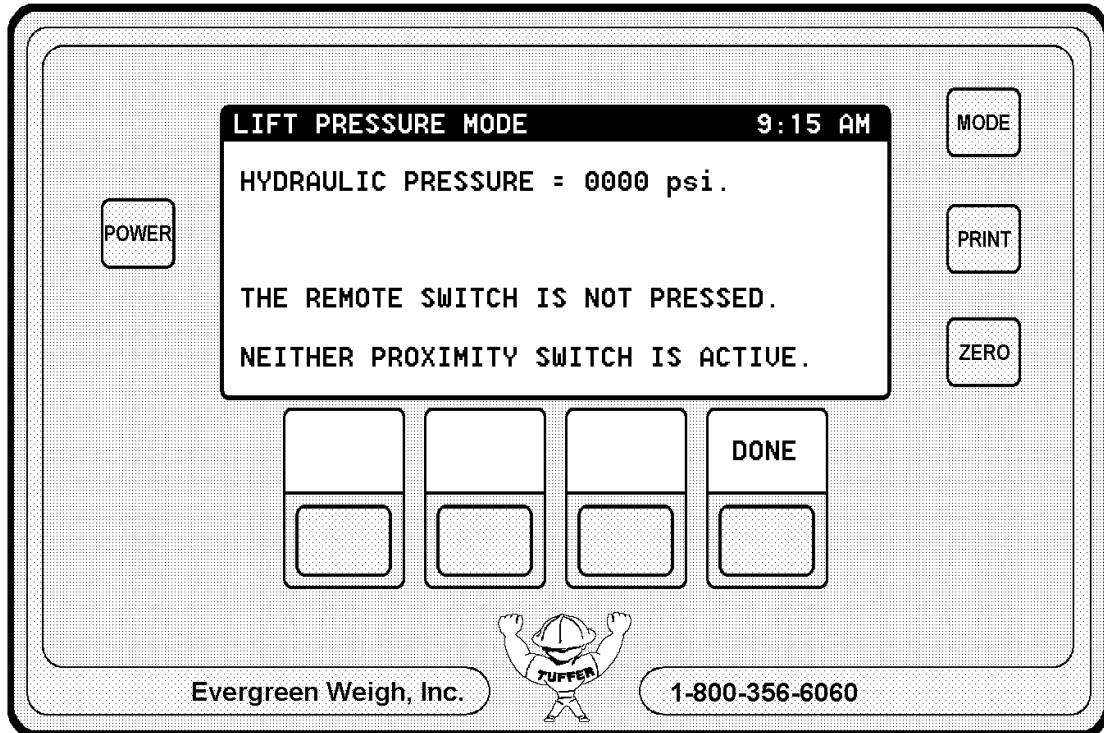


Figure 13, LIFT PRESSURE MODE

Raise the boom until the **target plate** covers the **lower proximity switch**. The bottom line of the display will read:

Lower Switch has been Activated

Now, raise the boom until the **target plate** covers the **upper proximity switch**. The bottom line of the display will read:

Upper Switch has been Activated

Raise the boom so that the **target plate** is above both **proximity switches**. The bottom line of the display will read:

Target Plate is Above the Upper Switch

Next, lower the boom until the **target plate** is below the **lower proximity switch**. The bottom line of the display will read:

Target Plate is Below Both Switches

INSTALLATION

Lower the boom until the **target plate** is below the **lower proximity switch**. Now, at full engine RPM, raise the boom until the **target plate** is above the **upper proximity switch**. The second line of the display will show the time it took for the boom to move between the switches, the average pressure in psi during that time period, and the weight in pounds calculated by the indicator. Since the calibration has not been done, the weight will read zero pounds.

The lift pressure on many front end loaders is typically about 500-700 psi during the lifting range with an empty bucket. Check the average pressure displayed on this line to see that it is in this range.

NOTE:

While in this mode establish 3 different RPM lift speeds which provide **“Symmetric lift times”**, that is example: FAST= 2.0 Seconds, MEDIUM= 4.0 sec & SLOW= 6.0 sec. Another example: FAST=1.5, MEDIUM= 3.0, SLOW= 4.5 seconds. Use these recorded RPM's in your calibration process to follow. Symmetric lift speeds provide the best calibration results.

If you have installed the **remote switch**, press it now. The third line of the display should indicate that the switch has been pressed.

The installation check is now complete. Press the soft key labeled “DONE.” to exit **lift pressure mode**.

INSTALLATION

Completing the Installation

After the installation has been thoroughly checked, the **proximity switch bracket** can be welded in place on the loader. Be careful not to damage the **proximity switch harness**. The cable can be easily melted from the heat generated during welding.

Weld the **target** plate in place on the boom. Weld the two pieces of the **target plate** to each other so the **target plate** does not vibrate out of adjustment.

Attach the **cable guard** (part number 25-00400-03) to the **proximity switch bracket** to protect the switches from damage. Refer to Figure 14.

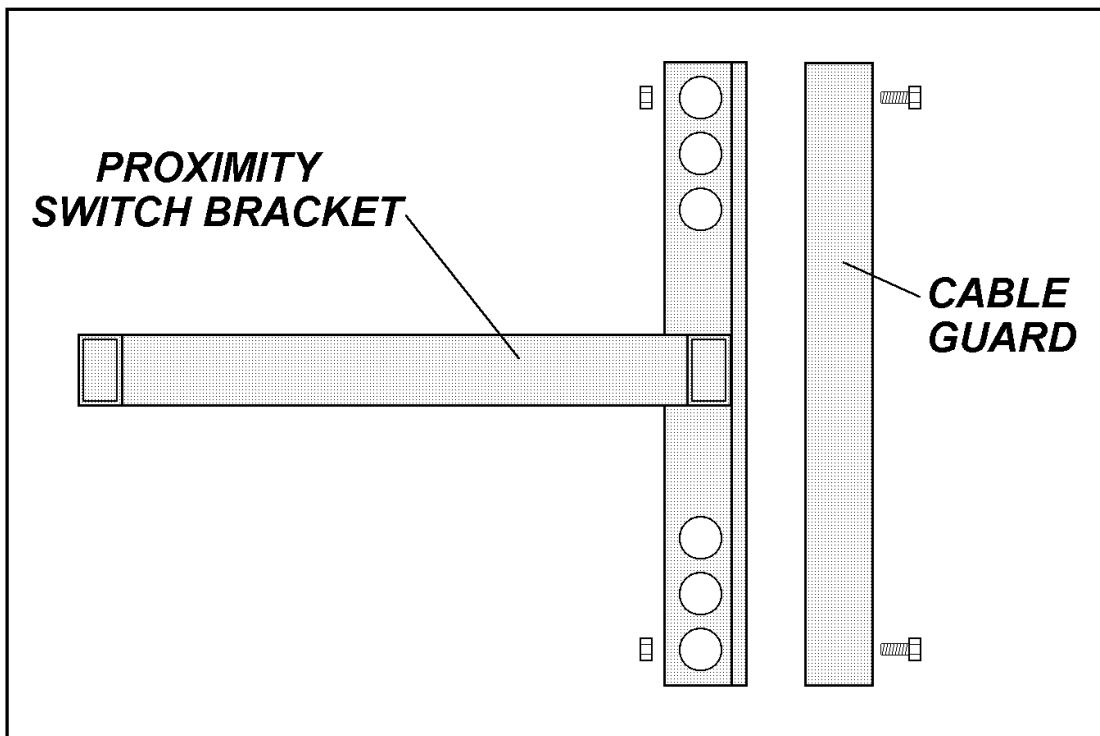


Figure 14, Attaching the Cable Guard

CALIBRATION

Beginning the Calibration

IMPORTANT: Depending on the outside temperature, it may take as long as forty five minutes for the hydraulic system on the loader to “warm up” to operating temperature. If the hydraulic system is not warmed up before starting the calibration, the accuracy will be greatly affected. Make sure the loader has been fully warmed up before beginning the calibration! READ THIS SECTION THROUGH COMPLETELY BEFORE CALIBRATING!

Press the POWER button. Now, press the MODE button. The Tuffer will display the MAIN MENU. Refer to Figure 12. Press the soft key labeled "DO CAL & ZERO". The display will show, "SELECT CALIBRATION" in the upper left corner. In the center of the display, the four **cal positions** with corresponding **calibration IDs** will be shown.

Each **cal position** corresponds to a different set of calibration information that the Tuffer can use. If this is the first or the only vehicle that you will be using this Tuffer on, then it is recommended that the first calibration, labeled "CAL 1", be used. Press the soft key corresponding to the **cal position** that you wish to use. The Tuffer will display:

Enter or Modify Cal ID

If you will be using this scale on more than one vehicle, you can use the ten digit **calibration ID** to make it easier to keep track of each calibration. For example, the model number of the loader or fork truck, your company's ID number for the vehicle, or the name of the operator could be used.

Each soft key contains three letters and one number. Starting with the first digit of the **calibration ID**, press the soft key with the letter or number you wish to use. (If the letter or number is not shown, press the soft key labeled, "MORE".) Each letter or number will now be displayed on a separate soft key. Press the soft key with the appropriate letter or number. The flashing digit will move one place to the right. Repeat for each digit in the **calibration ID**.

After all of the digits have been entered, press the soft key labeled "MORE" until the soft key labeled "DONE" appears. Press the soft key labeled "DONE".

The Tuffer will display:

Select Weight Units

CALIBRATION

Press the soft key corresponding to the unit that you want the weight measurements displayed in. The Tuffer will now display:

**What is the Bore Diameter
Of the Lift Cylinder?**

Adjust the value shown to agree with the wheel loader manufacturer's specification. Press the soft key labeled "DONE". The Tuffer will display:

**What is the Rod Diameter
Of the Lift Cylinder?**

Adjust the value shown to agree with the wheel loader manufacturer's specification. Press the soft key labeled "DONE". The Tuffer will display:

Ready to do Calibration?

Press the soft key labeled "PROCEED" to continue with the calibration. At this point prepare to use your pre-recorded optimum RPM's for you 3 different lift speeds.

IMPORTANT: *This part of the calibration involves lifting an empty load. Be sure to use an empty load during this step!*

Lower the boom. The display on the Tuffer will read:

**Entering Fast Speed:
Raise EMPTY load FAST now**

It is recommended that the calibration be done in stationary mode: raising the boom while the vehicle is sitting still. This is much easier and more accurate than calibrating while the vehicle is in motion, and afterwards, the calibration can be checked for accuracy while driving.

With no weight in the bucket or on the forks, and at full engine RPM, raise the boom completely. After the boom has been raised, the Tuffer will display the lift speed on the first line of the display:

**Lift Speed: 2.0s
*** KEEP THIS SPEED FOR EACH LIFT *****

CALIBRATION

Lower the boom completely, then raise the boom again, keeping the speed as close to the previous speed as possible. If the speed is not within 10% of the speed of the first lift, the Tuffer will display, "Try again, but lift SLOWER", or "Try again, but lift FASTER".

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Medium Speed:
Lower the Boom to Continue**

Lower the boom. Adjust the throttle to medium speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Slow Speed:
Lower the Boom to Continue**

Adjust the throttle to slow speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Tip Off Calibration Now:
Lower the Boom to Continue**

Lower the boom completely. The Tuffer will then prompt you to raise the boom to the level of the **upper proximity switch**. Raise the boom until the **target plate** covers the **upper proximity switch**, and then release the boom control lever. The Tuffer will read the pressure sensor for about six seconds. *Do not move the boom while the Tuffer is calibrating!*

Zero calibration is now complete, and the Tuffer will now begin full bucket calibration.

CALIBRATION

Calibration Using a Full Load of Material

The display on the Tuffer will read:

**Fill the Bucket With Material
And Press Proceed**

Load the bucket with a full load of material. Weigh the vehicle (with full load) on a platform scale and write down this weight. (If the loader is too big to fit on the platform scale, weigh an **empty** truck on the scale and write down its weight.)

Lower the boom, and press the soft key labeled "PROCEED". The Tuffer will display:

**Entering Fast Speed:
Raise FULL Load FAST now**

It is recommended that the calibration be done in stationary mode: raising the boom while the vehicle is sitting still. This is much easier and more accurate than calibrating while the vehicle is in motion, and afterwards, the calibration can be checked for accuracy while driving.

With the engine at full speed (accelerator pedal depressed fully), raise the boom completely. After the boom has been raised, the Tuffer will display the lift speed on the first line of the display:

**Lift Speed: 2.0s
*** Keep This Speed For Each Lift *****

Lower the boom completely, then raise the boom again, keeping the speed as close to the previous speed as possible. If the speed is not within 10% of the speed of the first lift, the Tuffer will display, "Try again, but lift SLOWER", or "Try again, but lift FASTER". When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Medium Speed:
Lower the Boom to Continue**

Lower the boom. Adjust the throttle to medium speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

CALIBRATION

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering SLOW Speed:
Lower the Boom to Continue**

Adjust the throttle to slow speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

NOTE: *When lifting at both MEDIUM and SLOW speeds, it is recommended that you keep your foot on the accelerator pedal until all three lifts are completed. This will keep the engine RPM as constant as possible, and greatly reduce the calibration time.*

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Tip Off Calibration Now:
Lower the Boom to Continue**

Lower the boom completely. The Tuffer will then prompt you to raise the boom to the level of the **upper proximity switch**. Raise the boom until the **target plate** covers the **upper proximity switch**, and then release the boom control lever. The Tuffer will read the pressure sensor for a few seconds. *Do not move the boom while the Tuffer is calibrating!*

After the pressure readings have been taken, the Tuffer will display:

**Weigh the load using a platform scale
and enter that weight Now:
00,000 LB**

Dump the load of material, and weigh the vehicle on the platform scale. Subtract this weight from the weight recorded earlier to determine the weight of the load. (If the loader was too big to fit on the scale, dump the load into the empty truck and weigh the truck again. Subtract the empty weight of the truck from this weight to determine to weight of the load of material.)

Press and hold the soft key labeled "UP" to increase the flashing digit shown, or press and hold the soft key labeled "DOWN" to decrease the value shown until the displayed value equals the weight of the load. (Press the soft key labeled "NEXT DIGIT" to adjust the hundreds, thousands and ten thousands digits). When the displayed value equals the weight of the load, press the soft key labeled "DONE". Calibration is complete. Press the MODE button twice.

CALIBRATION

Calibration Using a Concrete Weight

Follow these guidelines when making a weight block:

- It must not shift or lean heavily against the front or back of the bucket during calibration. A cylindrical or rectangular shape that fits snugly in the bucket or on the forks is best.
- It must be approximately as heavy as a full load. Using a concrete weight which is too small in relation to the capacity can cause weighing inaccuracies.
- The block can be weighed beforehand on a platform scale. For future reference, spray paint the weight directly on the concrete block.

The display on the Tuffer will read:

Fill the Bucket with Material and Press Proceed

Load the concrete weight into the bucket. Lower the boom, and press the soft key labeled, "PROCEED". The Tuffer will display:

Entering FAST Speed: Raise Full Load FAST Now

It is recommended that the calibration be done in stationary mode: raising the boom while the vehicle is sitting still. This is much easier and more accurate than calibrating while the vehicle is in motion, and afterwards, the calibration can be checked for accuracy while driving.

With the engine at full speed (accelerator pedal depressed fully), raise the boom completely. After the boom has been raised, the Tuffer will display the lift speed on the first line of the display:

Lift Speed: 2.0s *** KEEP THIS SPEED FOR EACH LIFT ***

Lower the boom completely, then raise the boom again, keeping the speed as close to the previous speed as possible. If the speed is not within 10% of the speed of the first lift, the Tuffer will display, "Try again, but lift SLOWER", or "Try again, but lift FASTER". When three lifts have been completed at the same speed, the Tuffer will display:

Entering MEDIUM Speed: Lower the Boom to Continue

Lower the boom. Adjust the throttle to medium speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

When three lifts have been completed at the same speed, the Tuffer will display:

Entering SLOW Speed: Lower the Boom to Continue

CALIBRATION

Adjust the throttle to slow speed, and raise the boom. Repeat for two additional lifts. Be sure to watch the screen for any additional instructions.

NOTE: *When lifting at both MEDIUM and SLOW speeds, it is recommended that you keep your foot on the accelerator pedal until all three lifts are completed. This will keep the engine RPM as constant as possible, and greatly reduce the calibration time.*

When three lifts have been completed at the same speed, the Tuffer will display:

**Entering Tip Off Calibration Now:
Lower the Boom to Continue**

Lower the boom completely. The Tuffer will then prompt you to raise the boom to the level of the **upper proximity switch**. Raise the boom until the **target plate** covers the **upper proximity switch**, and then release the boom control lever. The Tuffer will read the pressure sensor for a few seconds. *Do not move the boom while the Tuffer is calibrating!*

For lift trucks, the tip-off feature is of limited value, and it is recommended that the tip-off calibration be skipped entirely. Press the soft key labeled "GO ON TO NEXT SPEED" to skip the tip-off calibration.

After the pressure readings have been taken, the Tuffer will display:

**Weigh the Load Using a Platform Scale and Enter That Weight Now
00,000 LB**

Press and hold the soft key labeled "UP" to increase the flashing digit shown, or press and hold the soft key labeled "DOWN" to decrease the value shown until the displayed value equals the weight of the concrete block. (Press the soft key labeled "NEXT DIGIT" to adjust the hundreds, thousands and ten thousands digits). When the displayed value equals the weight of the load, press the soft key labeled "DONE". Calibration is complete, and the Tuffer will return to the CALIBRATION MENU. Press the MODE button twice.

CALIBRATION

Tuffer WM Calibration Checklist

The following sequence of things to check after installation and calibration have been completed. This section not only checks the calibration, but also shows the operator which operating techniques are important on his particular loader.

1. Lift the bucket 1" off the ground and bleed the air from the hydraulic line by loosening the fitting on the pressure sensor a turn or two until oil flows clearly. Re-tighten.
2. Go over operation techniques with the operator. Stress the need to keep the bucket curled all the way back, the lift lever pulled all the way into detent during the lift. Also stress the need to start the lift 1" to 2" below the lower switch to lift smoothly without stopping between switches.
3. Get a full bucket load, and do four lifts each at fast, medium, and slow RPM. Record weight data.

Fast	Medium	Slow
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Look at the repeatability. If you don't have good repeatability at a given speed, re-stress operating techniques and/or re-bleed the hydraulic line. If you have good repeatability at a given speed, but the weight changes from one speed to the next, redo the calibration (in another cal position). Check the cal data and look for large changes in pressure from one speed to the next. You may need to move the medium speed and slow speed up or down.

4. Recheck repeatability if you had to make any changes.

Fast	Medium	Slow
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

5. Using the same bucket from the previous repeatability test, check the effect of improper operating techniques on this machine. Raise and stop the full bucket just below the lower proximity switch. Rev the engine to full RPM and weigh the bucket. Do this three times.

CALIBRATION

6. Have the operator weigh the same bucket three times without pulling the lift lever all the way back.

7. Have the operator curl the bucket forward about 6" or so, but don't spill any material. Weigh the bucket three times in this position.

8. Still with the same bucket, simulate actual loading conditions by backing away from the pile, changing directions, and weighing while driving forward to an imaginary truck. Repeat three times to make sure the operator has the proper technique down. Emphasize that the operator should do all weighing while traveling in one direction, either backing up, or driving forward.

9. Demonstrate the tip-off mode by weighing a bucket and tipping some material off in tip-off mode. Record tipped weight, and then check it by reweighing.

Tipped Weight

Reweigh Weight

<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

10. If possible, load some trucks, and check scale accuracy against a platform scale. Show the operator how to fine tune the calibration if need be.

11. Calibration is complete! Copy the final good calibration over any previous bad calibrations, and also into other cal positions if the operator wants to keep track of more than one material. Customize the cal names for the operator, and add password protection on the calibration, if desired.

12. Record the calibration data and password (if used).

Empty Pressure

Time

<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

CALIBRATION

Calibration Weight _____

Count By _____

Loaded Pressure

Time

Resolution _____

Password _____

TROUBLESHOOTING

NOTE: *The Tuffer WM Loader Scale System has been designed for simple operation and maintenance. Although problems do occur, most can be easily corrected. The causes and solutions below are listed in order of probability. Therefore, it is recommended that the solutions be investigated and tried in the order listed. If the scale system does not operate properly after these solutions have been tried, please contact Evergreen Weigh's Service Hot Line at:*

(800) 638-5111 626-363-7541

The display does not light up when the POWER button is pressed:

- 1) *The power has not been connected or the power cable has been damaged:* Check the power cable from the vehicle's battery to the Tuffer. Use a volt meter to check for proper voltage level.
- 2) *The circuit breaker has been tripped:* Reset the circuit breaker by pressing the button under the rubber dome on the back of the Tuffer.

The display is not visible or is very dim.

- 1) *The viewing angle is not correct:* At certain viewing angles, the display will not be visible. Rotate the Tuffer so that the display is visible.
- 2) *Display has been dimmed:* Brighten the display.

The Tuffer does not display a weight reading when the boom is lifted.

- 1) *The **proximity switches** are not connected to the Tuffer:* Check the connection from the **proximity switch harness** to the back of the Tuffer.
- 2) *The **proximity switch** spacing is incorrect:* Check the distance between the **proximity switches** and the **target plate**. It should be about 1/4". See "Installing the Proximity Switches" on page 20. ①
- 3) *The **proximity switch** or the **proximity switch harness** has been damaged:* Place a small piece of metal (the blade of a screwdriver for example) in front of the **proximity switch**. The yellow light on the back of the switch will light up. If not, the switch or cable may need to be replaced. ①

TROUBLESHOOTING

The Tuffer does not respond when the remote switch is pressed

- 1) *The **remote switch** is not connected to the Tuffer or the cable has been damaged:* Check the connection from the **remote switch** to the Tuffer. Check the cable for damage. ②
- 2) *The scale is not in MANUAL ADD MODE:* Turn on MANUAL ADD MODE.

The weight readings are erratic

- 1) *The hydraulic hose may be connected to the wrong hydraulic line:* Make sure that the hose is connected to the LIFTING line. See “Tapping Into the Hydraulic System” on page 6. ③
- 2) *The hydraulic hose may be clogged:* Loosen the hydraulic connection on the back of the Tuffer. Lift the boom slightly. If oil does not flow out, the line may be clogged. Disconnect and clean out the line. ③
- 3) *Air is trapped inside the hydraulic line:* Loosen the hydraulic hose connection on the back of the Tuffer. Lift the boom slightly until oil flows out. Tighten the hose connection.
- 4) *Not enough time during the weighing range:* At fast engine RPM, the weighing range should be about 2 seconds long. Use LIFT PRESSURE MODE to check the weighing time. ⑤
- 5) *The loader was not warmed up before calibrating:* Thoroughly warm up the loader and then calibrate the scale. See “Beginning the Calibration” on page 21.
- 6) *Improper weighing procedure:* Make sure to pull the lift lever all the way back during weighing, and start each lift with the **target plate** well below the lower **proximity switch**. Lift the boom several times in LIFT PRESSURE MODE. Watch how the pressure changes when the lift lever is not pulled back all the way. ⑤

TROUBLESHOOTING

Weight readings are very low (at or near zero)

- 1) *The scale has not been calibrated properly:* Calibrate the scale again. Be sure to use a full bucket during full bucket calibration. See “Beginning the Calibration” on page 21.
- 2) *The hydraulic hose may be completely clogged:* Loosen the hydraulic connection on the back of the Tuffer. Lift the boom slightly. If oil does not flow out, the line may be clogged. Disconnect and clean out the line. ③

Weight readings are consistently too high or consistently too low

- 1) *The scale has not been zeroed recently:* Zero the scale.
- 2) *The scale has not been calibrated properly:* Calibrate the scale again. Be sure to use a full bucket during full bucket calibration. See “Beginning the Calibration” on page 21.
- 3) *The calibration may need to be adjusted.*
- 4) *The wrong calibration is being used:* Check the calibration number.

①, ②, ③, ④, and ⑤: See “Troubleshooting Using Lift Pressure Mode” on page 34 for additional details.

TROUBLESHOOTING

Troubleshooting Using LIFT PRESSURE MODE

The Tuffer WM Loader Scale System is equipped with a special diagnostic mode that can be used during the troubleshooting process. To enter LIFT PRESSURE MODE, press the MODE button. Press the soft key labeled "CAL OPTIONS". Next, press the soft key labeled, "DISPLAY LIFTING PSI". "LIFT PRESSURE MODE" will be displayed in the upper left hand corner of the display, and the Tuffer will display the current hydraulic lift pressure, and the conditions of both proximity switches and the remote switch. Refer to Figure 13.

NOTE: *The information displayed in LIFT PRESSURE MODE can be used to verify certain conditions during troubleshooting. Each of these conditions are labeled in the Troubleshooting section on the previous pages*

- ① Raise the boom. When the **target plate** passes in front of the **lower proximity switch**, the Tuffer will display, "THE LOWER SWITCH HAS BEEN ACTIVATED" on the bottom line of the display. When the **target plate** passes in front of the **upper proximity switch**, the Tuffer will display, "THE UPPER SWITCH HAS BEEN ACTIVATED". If not, the **proximity switches** may not be connected to the Tuffer or have been installed incorrectly.
- ② Press the **remote switch**. When the switch is depressed, the Tuffer will display, "THE REMOTE SWITCH IS PRESSED" on the third line of the display. If not, the **remote switch** may not be connected, or the **remote switch CABLE** may be damaged.
- ③ Raise the boom. If the pressure reading displayed on the first line of the display does not increase, the hydraulic connection may have been made to the wrong pressure line, or the hydraulic line may be clogged.
- ④ Raise the boom. If the pressure reading stays near zero, the hydraulic line may not be connected, or the line may be completely clogged.
- ⑤ Lower the boom until it is just above ground level. Raise the boom until the **target plate** is above the **upper proximity switch**. The second line of the display will show the time it took for the target plate to pass between the **proximity switches**, the average pressure in psi, and the **load weight** in the bucket. Refer to Figure 23.

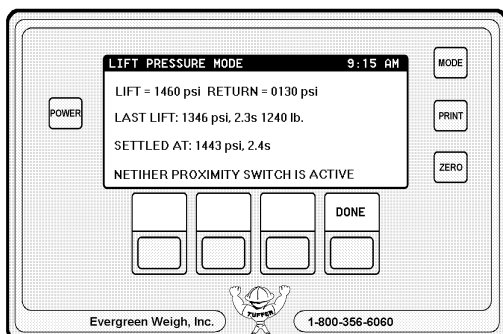


Figure 23, Lift Time in LIFT PRESSURE MODE

TROUBLESHOOTING

Making Adjustments to the Calibration

If the weight displayed is *consistently* high or *consistently* low, and there are **no** other problems with the scale system, the calibration can be adjusted so that the correct weight is displayed. Be sure that the weight is **consistently** incorrect. The error should be approximately the same amount at all engine speeds.

NOTE: *If the displayed weight is sometimes high and sometimes low, or if the problem is intermittent, the calibration should **not** be adjusted. Instead, follow the Troubleshooting section on page 33.*

Step 1 Adjustments to Calibration

Determine the amount of error

Weigh a load of known weight several times to determine the amount of error. Use as full a load as possible, and take the average of several weight readings.

The readings from several truck loads can be used as well. After loading a truck, weigh the truck on a platform scale to determine the weight of material. Write down the **truck total** displayed on the Tuffer. Total up several truck loads for best results.

Step 2 Adjustments to Calibration

Determine the original calibration weight.

Press the MODE button. Next, press the soft key labeled “CAL OPTIONS”. Press the soft key labeled “MODIFY THE CAL”. Then, press the soft key labeled “ADJUST THE CAL”. The Tuffer will display this warning:



Press the soft key labeled “PROCEED”. The Tuffer will display:

**Adjust the Calibration Weight Shown Below.
Press “Done” When Finished**

The original **calibration weight** will be shown below this message.

TROUBLESHOOTING

Step 3 Adjustments to Calibration

Calculate the adjusted calibration weight.

Use this formula to calculate the adjusted calibration weight:

Actual load weight ÷ Tuffer reading x calibration weight = adjusted calibration weight

EXAMPLE: The Tuffer was calibrated with 11,500 lb. The actual weight of the load is 9,600 lb., but the Tuffer reads 9,400 lb. The adjusted calibration weight would be:

$$9,600 \text{ LB} \div 9,400 \text{ LB} \times 11,500 \text{ LB} = 11,740 \text{ LB}$$

Step 4 Adjustments to Calibration

Enter the adjusted calibration weight.

Use the soft keys labeled "UP" and "DOWN" to adjust the original calibration weight displayed on the Tuffer either up or down. When the weight displayed is equal to the adjusted calibration weight calculated in step 3, press the soft key labeled "DONE".

Step 5 Adjustments to Calibration

Zero the scale system.

Raise an empty bucket. If the **load weight** does not read zero or near zero then press the ZERO button.

Step 6 Adjustments to Calibration

Check the calibration.

Weigh a full load to verify that the adjustment has been made.

TROUBLESHOOTING

Warnings and Error Messages

The WM Tuffer displays warnings and error messages to remind the operator of certain conditions and to help the operator diagnose problems. Each of the error messages and warnings are listed below, and if necessary, any steps that are needed to correct the error or condition.

WARNING: MUST CALIBRATE AND ZERO!

Before you can weigh, the Tuffer must be calibrated and zeroed. See “Calibration” on page 21. If you have already calibrated the scale, make sure that you are using the correct calibration position.

LOAD WEIGHT OUT OF RANGE

The Tuffer can display **load weights** up to a maximum of 65,000 lb. If the **load weight** exceeds 65,000 lb., this error message will be displayed. If the scale was not properly calibrated, this message may also be displayed.

TRUCK TOTAL OUT OF RANGE

The Tuffer can keep track of truck weights up to 1,000,000 lb. When the **truck total** exceeds 1,000,000 lb., “TRUCK TOTAL OUT OF RANGE” will be displayed. Press the soft key labeled, “TOTALS”. Then, press the soft key labeled, “STORE” to add the **truck total** to the **long total**, or press the soft key labeled, “CLEAR TRUCK TOTAL” to zero the **truck total**.

WARNING!

**** PRESSURE SENSOR OUT OF RANGE ****
PRESSURE EXCEEDED 3500psi DURING
THE LAST LIFT. SERVICE REQUIRED!
PRESS "PROCEED" TO CONTINUE.

Although the pressure sensor has a burst pressure of 25,000 psi, the Tuffer is equipped to read lift pressures up to only 3,500 psi. If the Tuffer senses a pressure greater than 3,500 psi during weighing, this warning will be displayed.

TROUBLESHOOTING

Sometimes the high hydraulic pressures encountered during digging may trigger this message. Make sure that the lower proximity switch is not triggered during digging. If the problem persists, contact Evergreen Weigh's service department for additional instructions.

! WARNING!

THREE LIFTS ARE RECOMMENDED AT EACH SPEED FOR BEST ACCURACY. PRESS "CANCEL" TO CONTINUE LIFTING AT THIS SPEED.

During calibration and zeroing, it is recommended that three lifts be done at each speed to maintain a high level of accuracy. If desired, one or two lifts can be done to reduce the time it takes to calibrate and zero the scale.

The accuracy of the scale system may be affected, however. Evergreen Weigh strongly recommends that all three lifts be done at each speed.

! WARNING!

OVERFLOW ERROR! THE TRUCK TOTAL CANNOT BE ADDED TO LONG TOTAL. YOU MUST CLEAR THE LONG TOTAL FIRST. PRESS "PROCEED" TO CONTINUE

The **long total** has a limit of 99,000,000 pounds, 49,500,000 Kg. The Tuffer will not add the **truck total** to the **long total** if this limit would be exceeded. Clear out the **long total** before storing the **truck total**.

! WARNING!

THAT PASSWORD IS NOT CORRECT. CALIBRATIONS CANNOT BE ACCESSED WITHOUT THE CORRECT PASSWORD!

The calibration has been protected, and the password you entered is not correct. Enter in the correct password, or call Evergreen Weigh for assistance if you cannot remember your password.

! WARNING!

YOU ARE ABOUT TO ERASE CAL DATA? PREVIOUS CAL DATA WILL BE PERMANENTLY ERASED!

In cal utilities mode, calibrations can be erased. If you are calibrating the scale and would like to erase the old calibration data, press "PROCEED". Otherwise, press "CANCEL" to save your calibration data.

INSTALLATION AND TROUBLESHOOTING MANUAL

ROD and BORE Listing

BRAND	MODEL	ROD	BORE
Bell	L1760B	2.76	4.92
Case	621	2.99	5.00
Clark	75B	2.24	5.00
	125B	2.70	5.98
	175C	2.69	5.98
Caterpillar	IT12 I & F	2.20	3.50
	IT 24	2.50	4.75
	IT 28	2.50	4.75
	910E	2.25	4.00
	910F	2.25	4.00
	918F	2.25	4.00
	924F	2.50	4.25
	926 & E	2.50	4.50
	928F	2.50	4.50
	936 E & F	2.50	5.50
	938F		
	950 B,E, & F		6.00
	966 A& B	2.50	6.50
	966 D,E. & F		7.00
	970F	3.54	7.09
	980C	3.50	7.50
980F	4.33	8.66	
988 B & F	4.02	8.50	
Caterpillar	R1500	3.25	7.76
Elphinstone	R1700	4.00	8.50
	R2800	4.00	8.50
John Deere	244E	1.77	3.15
	310	1.77	3.11
	344E	2.36	4.33
	344G	2.17	3.94
	444E	2.36	4.33
	444G	2.36	4.33
	544 E & G	2.48	4.92

INSTALLATION AND TROUBLESHOOTING MANUAL

BRAND	MODEL	ROD	BORE
	624 E & G	2.48	5.51
	644 E & G	3.15	6.30
	744E	3.94	6.69
	744H	3.74	7.09
	844	3.50	7.00
Dresser	510B	2.01	4.02
	515B	2.76	4.50
	520	2.68	4.88
	520C	2.76	4.50
	530	3.03	5.50
	558	5.00	8.00
Fiat Allis	FR10	2.20	4.33
	FR12	2.76	5.51
	645		6.00
Furakawa	FL230	2.76	5.51
Hyundai	HL17	2.76	8.27
	HL25	2.95	5.51
	HL35	3.54	6.30
	HL750	2.95	5.51
	770	3.54	6.30
Hitachi	LX70	2.36	4.33
	LX80	2.36	4.33
	LXI00	3.15	6.30
	150	3.15	6.30
	LX200	3.74	6.69
Kawasaki	70ZIII	2.95	5.51
	80ZII	3.15	6.30
	80ZIII	2.95	5.91
	88ZII	3.74	6.69
	95Z	3.94	7.48
	KSSI00	4.41	8.66
	110Z	4.72	8.82

INSTALLATION AND TROUBLESHOOTING MANUAL

BRAND	MODEL	ROD	BORE
Komatsu	WA120	2.76	4.33
	WA180	2.76	4.72
	WA320	3.03	5.51
	WA380	3.35	5.91
	WA420	3.54	7.48
	WA450	3.70	7.40
	WA470	7.09	0.00
	WA500	7.87	0.00
	WA600	8.86	0.00
Michigan	L120	2.01	4.02
	L150	4.00	6.75
	275C		
Volvo	L50	1.97	3.54
	L50C	2.76	3.94
	L70	2.36	3.94
	L70 B & C	2.76	3.94
	L90	2.36	4.72
	L90C	2.76	5.12
	L120	2.76	5.91
	L120C	3.15	6.30
	L150	3.15	6.69
	L160	3.15	6.30
	L180C	3.54	7.48
	L330C	3.54	8.66