7540

Technical Manual

INTRODUCTION

This publication is provided solely as a guide for individuals who have received METTLER TOLEDO Technical Training in servicing the METTLER TOLEDO product.

Information regarding METTLER TOLEDO Technical Training may be obtained by writing to:

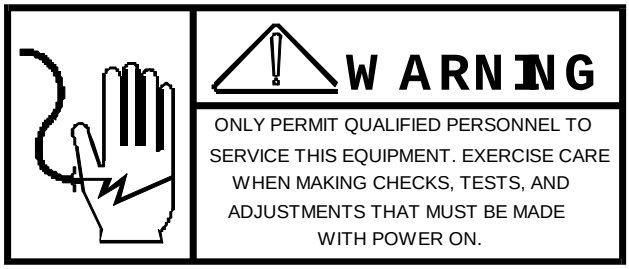
METTLER TOLEDO
Training Center
P.O. Box 1705
Columbus, Ohio 43216
(614) 438-4400

PRECAUTIONS

- **READ** this manual before operating or servicing this equipment.

- **ALWAYS REMOVE POWER** and wait at least 30 seconds **BEFORE** connecting or disconnecting any internal harnesses. Failure to observe these precautions may result in damage to, or destruction of the equipment.

- **ALWAYS** take proper precautions when handling static sensitive devices.



- **DO NOT** connect or disconnect a load cell scale base to the equipment with power connected or damage will result.

- **SAVE** this manual for future reference.

- **DO NOT** allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.

- **ALWAYS DISCONNECT** this equipment from the power source before servicing.

- **CALL** METTLER TOLEDO for parts, information, and service.

CONTENTS

1.0 INTRODUCTION

The recommendations provided in this manual are for installation of Toledo Model 7540 Pit Type Truck Scale. Installation should be performed by qualified personnel only. Read and understand this manual and the drawings for the scale before starting construction.

All sales of goods are described herein shall be subject to the Standard Warranty and the Standard Terms and Conditions of Sales published by Toledo Scale. The specifications and product description contained herein are accurate at the time of publication but are subject to change without notice. Current engineering drawings take precedence over this information and are the definitive document for all phases of construction.

2.0 PRODUCT SPECIFICATION

2.1 GENERAL DESCRIPTION

Model 7540 Pit Type Concrete Deck Truck scale is a full load cell scale.

The Toledo Cap Check® suspension is utilized. This suspension consists of the Toledo shear-type load cell, with a rocker pin and a receiver which encircles the top of the cell with a gap of 0.16 inches. Horizontal forces resulting from the braking action of the vehicles are transmitted through this receiver to the top of the load cell and into the piers of the pit.

The platform consists of steel main girders supporting a reinforced concrete deck. The structural steel conforms to ASTM A-36 specification and is welded in conformance with the structural welding code D1.1 of the American Welding Society.

The platform and the put are of reinforced concrete of 3750 PSI strength and are placed in accordance with American Concrete Institute code. They are reinforced with deformed steel bars conforming to ASTM A615 grade 60 specification.

The pit is for use with soil having minimum bearing capacity of 1500 pounds per square foot.

The Model 7540 is intended for operation with any Toledo digital indicator having suitable display capability.

2.2 SPECIFICATION

TOTAL CAPACITY*	SECTIONAL CAPACITY	PLATFORM SIZE	LOAD CELL	TANDEM AXLE CAPACITY
120,000 X 20 lb (60,000 x 10kg)	70,000 lb (32,000 kg)	60 ft x 10ft (18.3m x3m)	50,000 lb (22,700kg)	35,000 lb (16,000 kg)
120,000 X 20 lb (60,000 x 10kg)	70,000 lb (32,000 kg)	70 ft x 10ft (21.3m x3m)	50,000 lb (22,700kg)	35,000 lb (16,000 kg)
200,000 X 20 lb (100,000 x 10kg)	90,000 lb (41,000 kg)	60 ft x 10ft (18.3m x3m)	50,000 lb (22,700kg)	45,000 lb (20,000 kg)
200,000 X 20 lb (100,000 x 10kg)	90,000 lb (41,000 kg)	70 ft x 10ft (21.3m x3m)	100,000 lb (45,400 kg)	45,000 lb (20,000 kg)
200,000 X 20 lb (100,000 x 10kg)	110,000 lb (50,000 kg)	70 ft x 10ft (21.3m x3m)	100,000 lb (45,400 kg)	55,000 lb (25,000 kg)

* The total capacity is only obtainable with a two trailer vehicle.

2.3 LOADING RATE

120,000 lb SCALES

The maximum allowable loads are: 20,000 lb (9,000 kg) per single axle, 35,000 lb (16,000 kg) per group of two or more axles spaced between 40 inches (1.02 m) and 96 inches (2.44) . The total weight of a group of two or more axles shall not exceed W given by the following Federal Bridge Law formula, enacted January 4, 1975:

$$W = 500 (LN/(N-1) + 12N +36)$$

Where N=Number of axles in group and L=Distance in feet between the extreme axles of the group. The maximum load for a vehicle with a three axle tractor and a two axle semi trailer is 82,000 lb (37,250 kg) **.

200,000 lb SCALES
There are two load ratings got the 200,000 lb scales:

1. The maximum allowable loads are: 25,000 lb (11,000 kg) per single axle, 45,000 (20,000 kg) per group of two or more axles spaced between 40 inches (1.02 m) and 96 inches (2.44 m). The minimum distance between inside axles of adjacent tandems is 128 inches (3.25m). The total weight of a group of two or more axles shall note exceed 130% if W given by the Federal Bridge Law formula. The maximum allowable load for a vehicle with a three axle tractor and a two axle semi trailer is 102,000 lb (46,300 kg) **.
2. The maximum allowable loads are: 28,000 lb (13,000 kg) per single axle, 55,000 lb (25,000 kg) per tandem axle with axle spacing between 50 inches (1.27 m) and 110 inches (2.8 M) and more than 100 inches (2.8 m) between the axles of adjacent tandem, 17,000 lb (7,500 kg) per ale for groups of two or more axles with adjacent axles spaced between 42 inches (1.7m) and 110 inches (2.8m). . The total weight of a group of two or more axles shall not exceed 160% of W given by the Federal Bridge Law formula. The maximum allowable load for a vehicle with a three axle tractor and a two axle semi trailer is 122,000 lb (55,400 kg)**.

** May differ by the amount the steering axle differs from the assumed 12,000 lb (5,450 kg).

2.4 ACCURACY

Scales meet NSB Handbook H-44 specifications for accuracy for vehicle scales.

2.5 ENVIRONMENTAL CONSIDERATIONS

The load cells are temperature compensated for a range of -10 to 40ºC (14 to 104ºF). The scale will perform to the stated accuracy under normal outdoor conditions provided that installation requirements are met. This includes adequate drainage and clearance of snow and debris from around and under the scale.

3.0 SITE SELECTION

1.) The site selection must meet state and local requirements id the scale will be used for commercial ..weighing.

The following is taken directly from Handbook 44 (H-44) issued by the National bureau of Standards:

UR.2.6 APPROACHES.

UR.2.6.1 VEHICLE SCALES - in the approach end or ends of a vehicle scale installed in any one location for a period of six months or more, there shall be a straight approach as follows:

(a) the width at least the width of the platform, and
(b) The length at least one-half the length of the platform but not required to be more than 40 feet, and
(c) not less than 10 feet of any approach adjacent to the platform shall be constructed of concrete or similar durable material to insure that this portion remains smooth and level and in the same plane as the platform. However, grating of sufficient strength to withstand all loads equal to the sectional capacity of the scale may be installed in the portion. Any slope in the remaining portion of the approach shall insure (1) ease of vehicle access. (2) ease for testing purposes, and (3) drainage away from the scale.

Toledo drawings meet all parts of the requirements. The sire must be located to meet parts (a) and (b). Toledo drawing number 093409 shows the details of concrete approaches from 10 to 12 feet wide and in 5 foot increments to any length.

The standard pit for the 7540 truck scale is 4 feet deep measuring from the top of the coping to the pit floor. Deep pits are 4 feet deep measuring from the bottom of the main girder to the pit floor.

Construction drawings are available for standard, deep, and special deep pits. Pit drawings vary with size and capacity of the scale.

NOTES:

A) Deep Pit states (Minnesota, North Dakota, South Dakota and Montana) require a 4' clearance between the bottom flange of the weighbridge girder and the pit floor.

B) In addition to a deep pit; the states of Iowa, Nebraska and Wisconsin require thicker end and side walls. These pits are "Special Deep" pits. The state of Iowa required special drainage provisions, details of which are shown on Toledo Scale drawing number 106884.

2. The sire should have good drainage. Surrounding areas must not drain through the scale pit. The ideal scale site is on ground elevated above the surrounding area.

3. The soil must have a minimum bearing capacity of 1,500 pounds per square foot (psf). The scale owner must be made aware of the soil bearing requirements and it is his responsibility to have tests made if the soil bearing capacity is not known.

4. Check for buried pipes, sewer lines, wires foundations that would interfere with pit construction.
5. Locate the scale away from high power electrical transmission lines or substations.
6. Pit footings must extend below the frost line. See frost penetration map on drawings or Figure 3.1.

FIGURE 3.1 - Extreme frost penetration, inches, based upon state averages. (U.S. Weather Bureau)

7. Provide adequate room at the sire for trucks to properly align with the platform before pulling on. This is especially important if trucks must turn before pulling onto the scale. Scale approaches must conform with Weights and Measures regulations.

8. Do not permit trucks to remain on the scale for a period of time longer than is necessary for obtaining the vehicle weight and printed record.

9. Some weights and measures jurisdictions require that the scale platform be clearly visible from the location of the scale instrument. Others allow the use of closed circuit TC or even a voice intercom, if this type of installation is contemplated, obtain their approval before starting construction.

10. Provide a hard surface driveway to the scale that can be kept clean and dry, this will in turn keep the scale pit clean and dry and reduce scale maintenance costs.

11. Check state weights and measures regulations for the proper number and placement of manholes in thedeck. It is recommended that the sump or drain be located near a deck manhole for ease of inspecting the drain or sump pump. A submersible sump pump is recommended over the pedestal type with an open motor. If power should fail for a short time during a storm the exposed pump motor could become covered with water and could be ruined when power is restored.

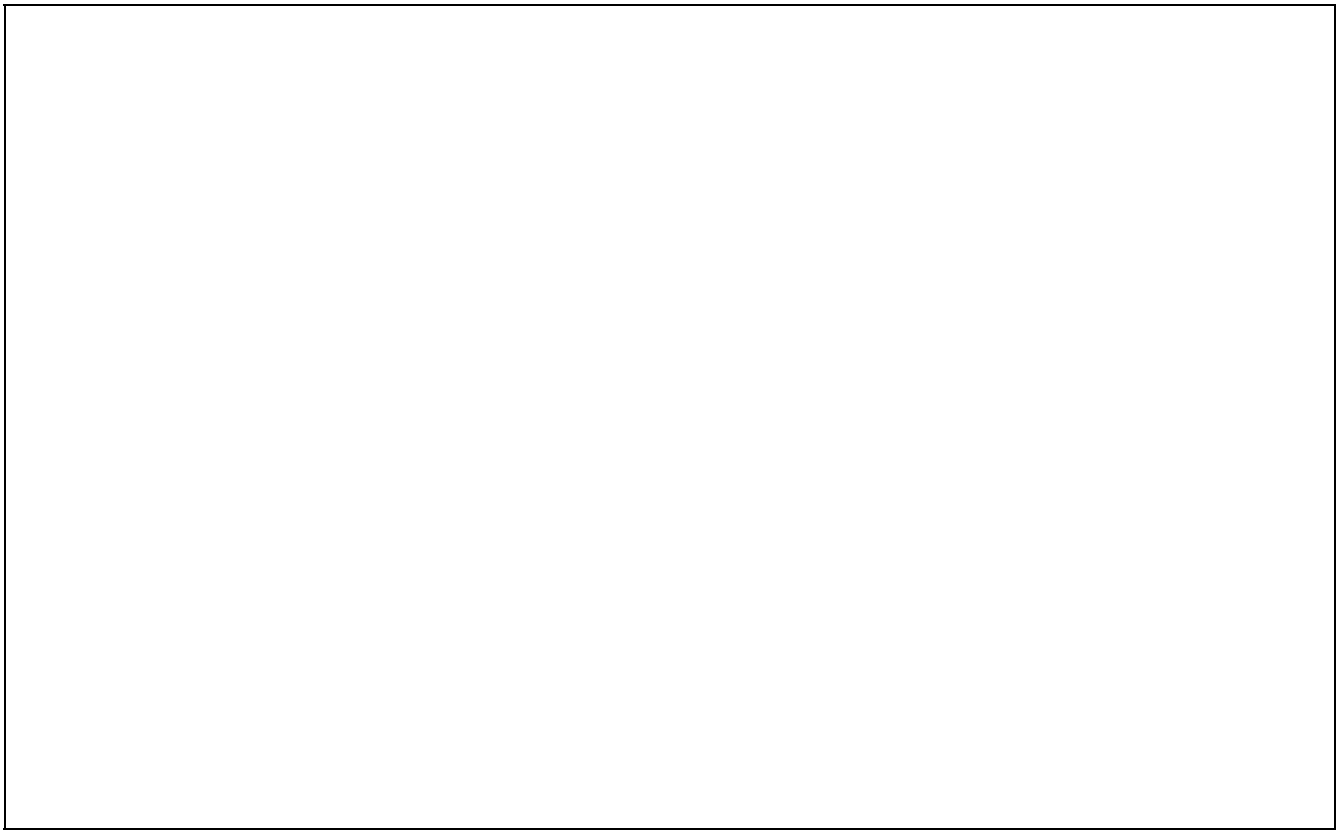


FIGURE 3.2 - SITE PLANNING

4.0 PIT CONSTRUCTION

The following sequence of construction should be followed:

1 Obtain all pit, wiring, and general layout drawings. Make certain they are the latest released by Toledo Scale Engineering. The latest drawings will be sent upon receipt of the scale order. Standard drawings are available for deep pit states (see Section 3.1) Study all drawings, read and understand all general notes on general layout and the pit drawings.

2 Excavate for pit and approached. Make arrangements at this time for the put drain, to connect with sewer pipe or drainage ditch.

3 Place gravel underfill (Optional).

4 Place the reinforcing bars for the pit. Insure they are placed exactly as shown on the drawings. For electrical grounding purposes, tie the reinforcing bars together with a minimum #16 wire ties at no less than 25% of the intersection points of the rebars. The importance of grounding is discussed in Section 8 of this manual. Read this section prior to installation.

5 Form and pout pit floor slab in one continuous section using concrete of the strength specified on the drawings. Use air entrained concrete if the foundation is subject to frost. Experience and tests have shown that air entrained will help prevent concrete scaling from chemical de-icers and freezing temperatures. De-icers must not be applied to the scales but it is difficult to prevent the trucks from carrying it onto the scale.

6 Allow the foundation to cure for sufficient time (usually 24 hours) so that it will support the forms for the pit walls.

7 Form the pit walls. The curb angles are bolted to the forms. The method shown on the drawings is the easier and helps to keep the pit edges straight. The forms must be string enough to withstand the pressure of concrete and hold the walls straight while the concrete cures.

8 Allow the pit walls to cure in order to attain sufficient strength to stand alone when the forms are removed.

NOTE: Some states require that the piers be poured at the same time as the walls. Consult your local Weights and Measures agency.

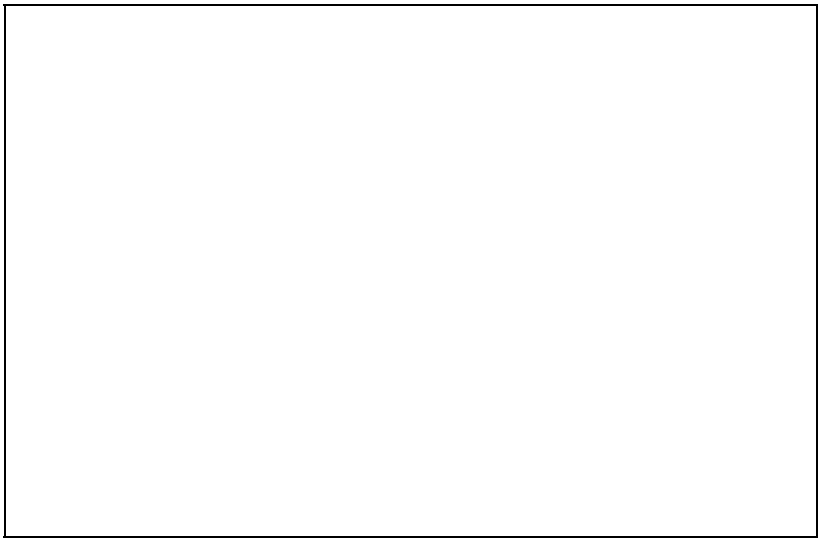


FIGURE 4.1 - ANCHOR BOLT SLEEVE DETAIL

9 Form the piers and set the anchor bolts at this time. Locate the anchor bolts from the center line of the pit. Accuracy in the location of the anchor bolts is very important. The anchor bolts can be held in position with boards drilled for the bolts and nails to the forms for the piers. The bottom ends of the bolts are fastened to

the rebars with nuts clamping bars. This forms the ground connection from the load cell mounting plates to the rebar grid in the pit concrete. Usually 2 inches is allowed for grout and the top of the piers. Plastic foam sleeves can be used over the anchor bolts to give clearance for adjustment. See Figure 4.1.

10 Pout the piers using the concrete of the same specifications as that used for the pit.

11 Remove the forms when the concrete has reached sufficient strength that will enable it to support its own weight.

12 Allow the foundation to cure for 2 or 3 days before providing with construction. The concrete must be allowed to cure to design strength (up to four weeks) and must not be loaded with vehicular traffic until it has reached its design strength.

5.0 LOAD CELL INSTALLATION

1. Before starting any assembly, check all pit dimensions carefully. The pit opening should be square. Refer to the pit drawings for these dimensions.

   The relative location of the load cell mounting plates and bolts are the most critical dimensions and must be strictly help to the tolerances given on the pit drawings.

   Correct any discrepancy before starting assembly.

2. At this time the load cell mounting plates are installed. The plates must be level within 0.03 inches in 12 inches and in the same plane to within 1/8 inch. Check the height to the coping angle. Do not grout at this time. Do not apply any load to the scale before the grout is installed and has cured.

3. Make sure that all the load cells are centered on the cap assembly. The load cell assemblies are held together with temporary shipping straps fastened with 8 bolts. The top ends of the straps also hold the cap mechanism which is centered on the top of the cell. Check the caps for centering. The clearance should be 5/32 inches on all sides (see details in Figure 5.1). The shank end of a 5/32 twist drill is a convenient gauge for this measurement (0.156 inches diameter), It may be necessary to loosen the top bolts to center the cap. Tighten the bolts once the cap is set correctly. A 3/8 drive 7/16 inch socket, a short extension and ratchet handle can be used.

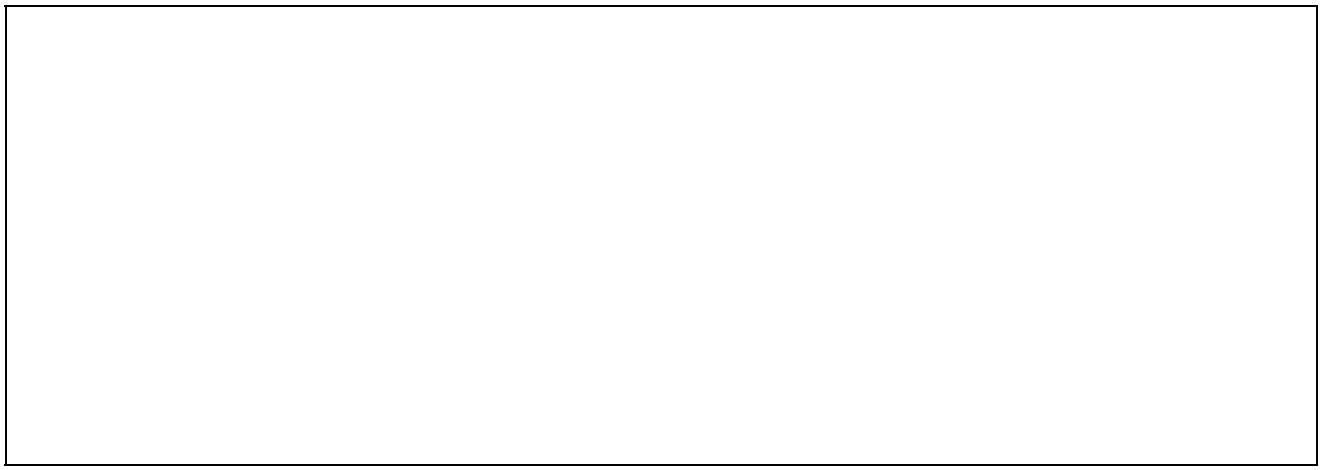


Figure 5.1 - Cap Check Load Cell

4. Set the load cell assembled on top of the load cell mounting plates. Secure them with hexagon socket head screws which should have “Never-Seez” on the threads. Tighten to the required torque by using the “turn-of-nut” method described in Appendix C. It will be necessary to use an Allen head socket to tighten the bolts.

5. Leave the shipping straps in place until the weighbridge is assembles and the concrete poured.

6.0 WEIGHBRIDGE ASSEMBLY

6.1 SAFETY PRECAUTIONS - CAUTION

When using jacks on the weighbridge, as with any heavy structure, always place shoring or hard wood blocks for support under the steel before reaching under or working on the weighbridge (see Figure 6.1).

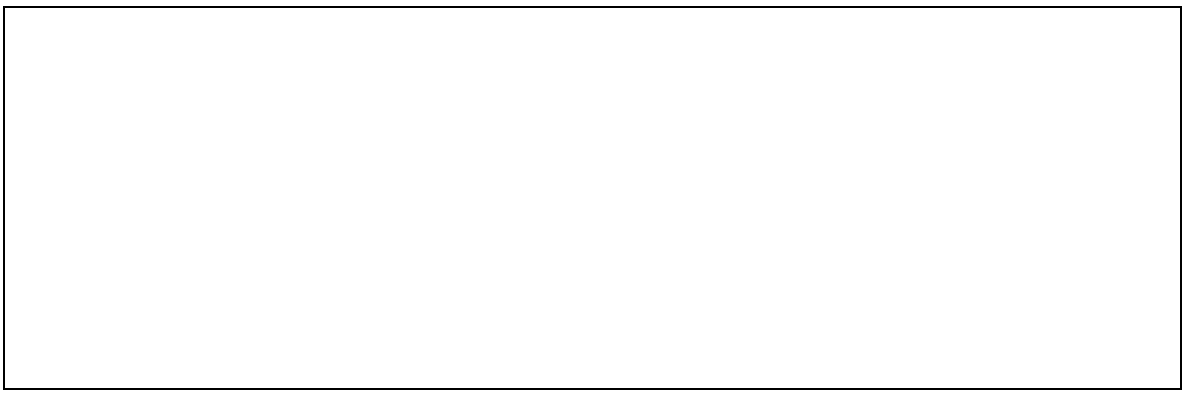


Figure 6.1 - Blocking Instructions

Never use cinder or concrete blocks.

When blocking the weighbridge, do not use a high single stack of blocks, but arrange the blocks to form cribbing as shown below. (See Figure 6.2).

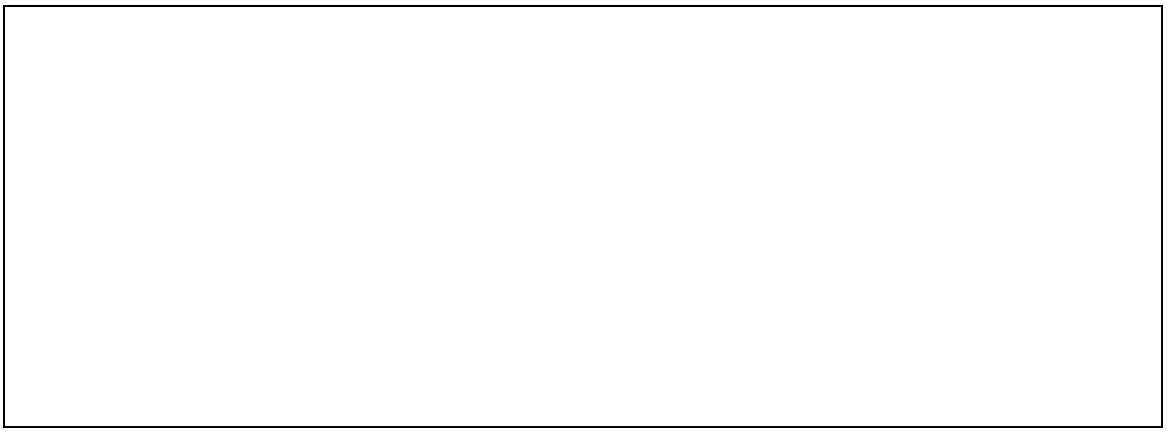


Figure 6.2 - Cribbing Instructions

6.2 TOOLS REQUIRED FOR WEIGHBRIDGE ASSEMBLY

6.2.1 LIFTING MECHANISM
A method of lifting and moving a 2000 pound girder is required. A heavy duty test truck with broom or a fork lift truck may be utilized.

6.2.2 ELECCTRIC WELDER AND CUTTING TORCH

CAUTION:

All electric welding on or around the scale should be completed before the electronic parts are installed.

The welding circuit ground clamp must be connected to the steel member being welded. The high amperage welding current must not pass through any electronic parts.

A portable electric welder of at least 150 amps capacity will be needed for welding the deck coping channel to the main girder and for welding the temporary spacers to hold the platform coping channel in place.

An acetylene cutting torch will be needed to remove the temporary spacers once the concrete platform has cured.

6.2.3 IMPACT WRENCH
A 3/4 or 1 inch size impact wrench will save installation time since there are approximately 100 bolts, depending on the length of the platform, which must be tightened to 360 foot pounds each. If an impact wrench is not available, a large socket handle (or steel pipe) about 4 to 5 feet long will be needed to develop the torque necessary to shear the heads of these special bolts. These bolts are used to connect the cross-members to the main girders.

6.2.4 SPECIAL “TORX E20” 3/4 SQUARE DRIVE SOCKET
This socket is provided with the scale steel is used to tighten the special “Torx” bolts that fasten the crossmembers to the main girders.

6.2.5 A wrench to fit 1-7/16” nuts is required to hold the nuts on the “Torx” bolts.

6.2.6 Sockets needed for tightening the load cell assemblies as shown in Appendix C.

6.2.7 A short Allen socket (of 2” overall height and the required size) is needed to tighten the hexagon head screw used to secure the load cells to the mounting plates.

6.2.8 A spud wrench or tapered punch to line up bolt holes when assembling girders.

6.2.9 Equipment for Mixing Grout: A 1/2 inch drill, a mortar mixing paddle for use with the drill motor, and a 5 gallon pail for mixing.

6.3 BREAK-AWAY BOLTS

The bolted crossmember connections use break-away head retaining bolts. This bolt head will shear when the proper torque is reached.

The “Auditorx” High Strength Pan Head Bolt (7/8 - 9-3’) long is tightened using the 3/4” square drive “Torx” socket provided. BE SURE to carefully follow the assembly instruction drawings for bolt, washer, and nut orientations for each connection.

Figure 6.3 - "Torx" Bolt, Washer, and Nut Assembly

LEAVE ALL BOLTS LOOSE UNTIL WEIGHBRIDGE STEEL MEMBERS ARE COMPLETELY ASSEMBLED, then apply snug tight and final torque values. Do not open any holes and do not taper bolts to facilitate installation.

NOTE: Strength development of the bolted connections required that the bolts, buts and washers conform to ASTM A-490 specifications, and that the bolt lengths be such that threads are excluded from the shear plane. The mating surfaces of the shear plane must be free of dirt or oil.

The "Auditorx" high strength bolts are coated with a lubricant. No additional lubricant shall be used.

6.4 WEIGHBRIDGE ASSEMBLY

To aid in handling the heavy beams of the scale the following approximate weights are given. The main beams used in the weighbridge weigh as little as 1200 lb on the 60 foot 60 ton scale and as much as 2200 lb on the 70 foot 100 ton scale. The 10 foot long crossbeam weights about 200lb and the two 7 foot long end cross braces weight about 150 lb. Each. The smaller 7 foot long cross brace channels weight about 75 lb each.

6.3.1 WEIGHBRIDGE ASSEMBLY

Because the load cell assemblies are held in alignment with only shipping straps it is advisable to use some blocking to stabilize the first beam set into the put. Place wood blocks on the piers on the floor to hold the beam a little higher than the top of the load cell assembly. This is necessary on the first beam only, when the second beam is set parallel to the first beam one of cross members can be set in place and loosely bolted, this will stabilize both beams on the cells.

After the second beam is in place and secured with bolts in the cross beams the first beam can be lifted slightly and the blocking can be removed at this time.

Continue lowering the beams into place and inserting bolts. DO NOT tighten any bolts until all bolts are in place.

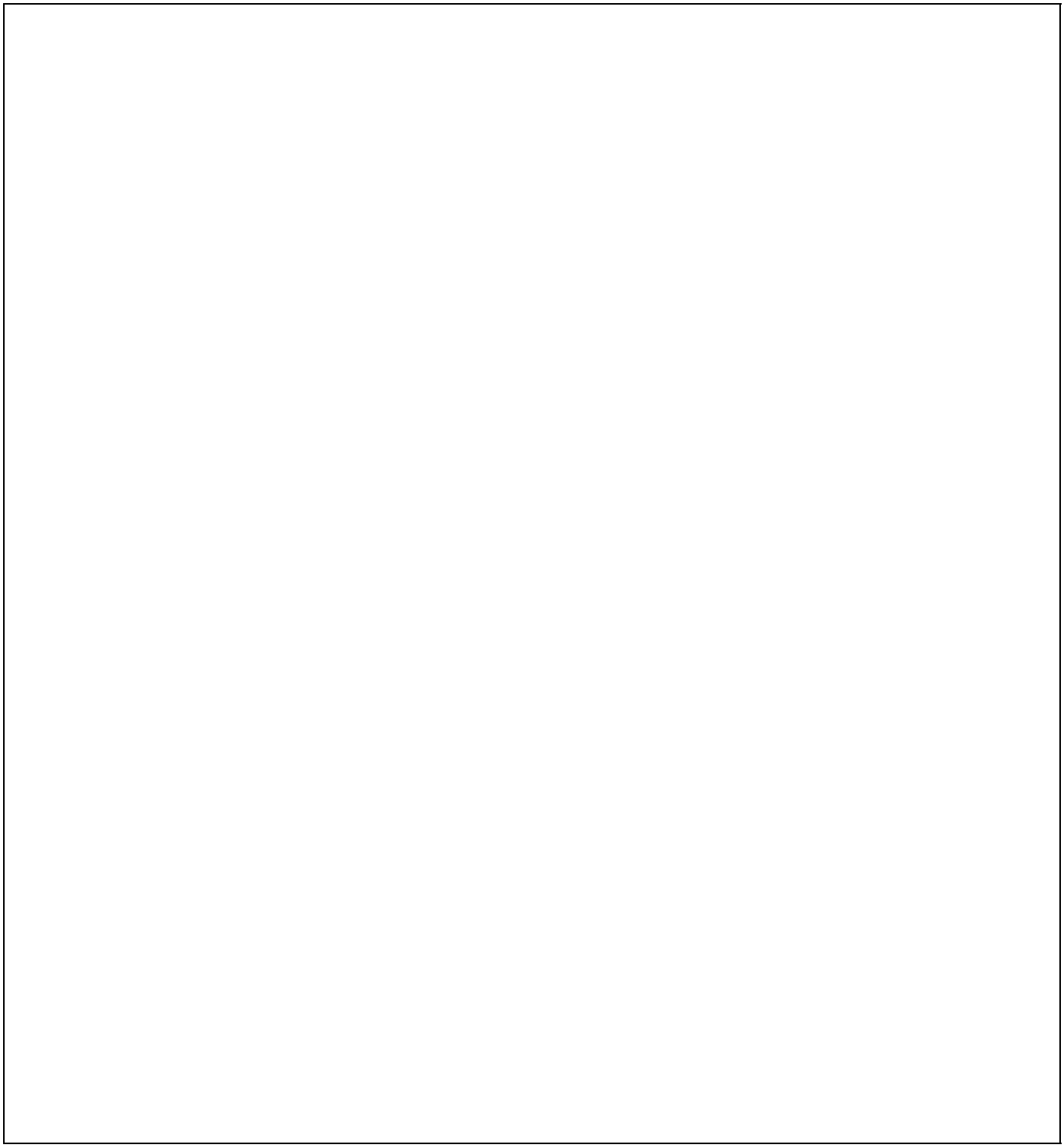


Figure 6.4

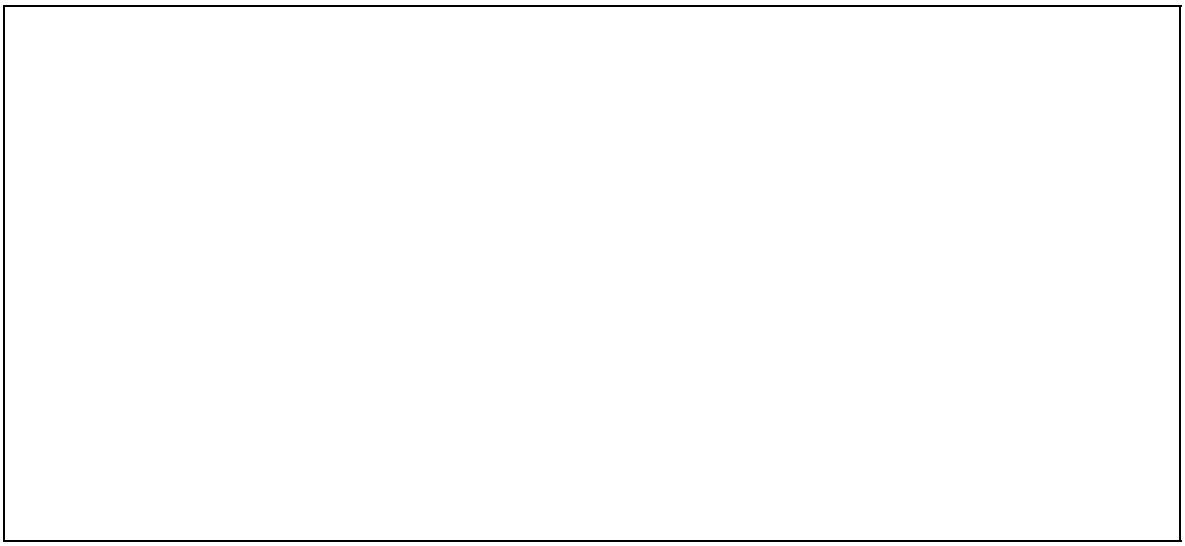


Figure 6.5 - Relative Location of Components

7.0 CONCRETE DECK CONSTRUCTION

1. The deck copping id 6,7 or 8 inch channel steel and is also used as the form when the concrete is poured. This channel also supports the outside edge of the bottom of the concrete form while it cured. The coping channel has a 3/8 x 1/2 steel bar at the top. This bar acts as stone guard, prevents stones from lodging in the gap where they can bind and cause scale errors.

   The deck coping must be held firmly in place as the concrete is poured and while it is curing. A nut is welded to the pit coping angle. The end of the bolt contacts the stone guard supporting the deck coping channel and is adjusted to set the two coping channel at the same height.

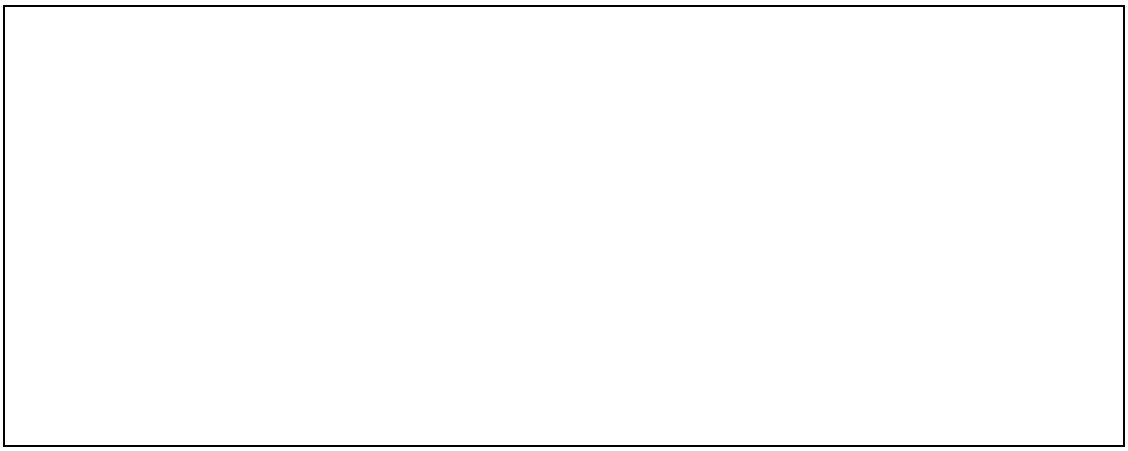


Figure 7.1

2. Weld the nuts to the pit coping angle at about 3/4 inches from the top. Space them about every 5 feet (see general layout drawings for spacing).

   When the arc welding on or around scales there are important precautions that must be taken.
   Make certain the welding circuit ground clamp is attached to the steel being welded so the high current or voltage does not pass through any sensitive scale components. Carelessness can destroy load cells and instruments.

CAUTION: All electrical welding on or around the scale should be completed before the electronic parts are installed.

The welding circuit ground clamp must be connected to the steel member being welded. The high amperage welding current must not pass through any electronic parts.

If at all possible of the welding before the electronics are connected. Otherwise disconnect the instrument from the power source and disconnect the load cells from the instrument during the welding process.

3. Set the channel in place. Adjust the bolts to set the top of the two copings so they are the same height. Weld the deck coping stone guard to the top end of the bolt. The bolts will be cut after the deck concrete has cured.

4. The deck coping channels can be welded where they join to help hold them in place.

5. Weld the deck coping channel to the weighbridge main beams, at the ends, and to the ends of the crossbeam. This weld should have a 5/16 inch root cross section.

6. Corrugated sheet metal (28 ga., not provided with weighbridge steel package) should be used for the bottom form of the deck concrete. The corrugation is to be laid flat across the weighbridge steel and will be life in place after the concrete cured. Particular attention should be made on the flatness over the splice plates shown in Figure 6.4. The corrugates forming cannot support the wet concrete and must be supported from below.

7. Reinforcing rods must be places as shown on the general layout drawing. Wire tie the reinforcing rods at as many intersections as needed to hold them in place while concrete is poured and also during curing. See Figure 7.2.

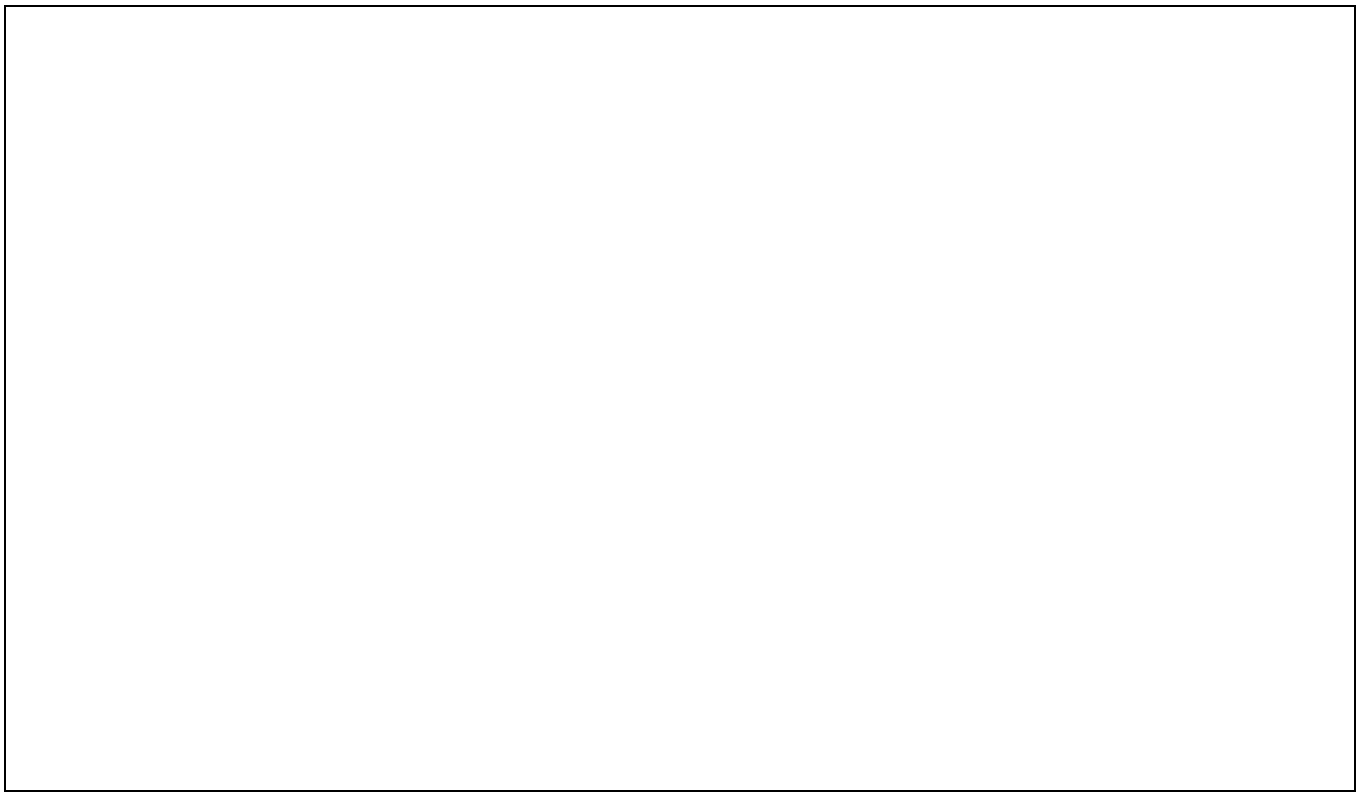


Figure 7.2 - Rebar Details in Platform

8. See the general layout drawing for the correct location of the expansion joint. Place expansion joint filler in the form. A form can be used to hold the filler in place while the concrete is poured. After the concrete is poured the form can be pulled out and concrete added to fill in the space.

9. Place the manhole in accordance with the general layout drawing, usually they are located near the drain sump or the sump pump. Some states require mote than one manhole. Check state regulations for location and number required.

10. Pout the deck per the general layout drawings using concrete specified. Do not apply any vehicular load during the full curing period or until the concrete meets specified strength. If the area is subject to frost, air entrained concrete should be used.

11. After the concrete has cured remove the shoring under the corrugates steel forming. With an acetylene cutting torch, cut out the bolts at pit coping gap.

12. Remove the shipping straps from the load cell assemblies. Keep the straps for convenient handling of the cells. This cap must have uniform clearance around the load cell. UNDER NO CIRCUMSTANCES MAY THE COP TOUCH THE LOAD CELL UNDER STATIC CONDITIONS (Static load, no movement). See Figure 5.1 for details.

13. Check alignment between deck and approaches. Make any adjustment before the grout is placed.

14. Grout load cell mounting plates and allow to cure before applying any load to the weighbridge. MAKE SURE THAT THE GROUT FULLY SUPPORTS THE PLATES, FILLING ALL VOIDS. Use EXPANDING TYPE grout as specified on drawings. EMBECO 636, POR-ROK EPOXY GROUT, or equivalent, to develop 3750 psi compressive strength.

    Follow the grout manufactures instructions careful. Some basic rules apply to all types:
    a) The area must be clean and free from loose materials, oil and dirt.
    b) Soak the concrete with clean water for a period of several hours prior to pouring the grout.
    c) Build forms for the grout. Use grout in a flowable consistency and pout into form. It is important that grout reaches design strength before any load is applies to scale.
    d) Mix grout completely and do not add more water than is required as this will cause shrinkage.
    e) Ensure grout funny supports plate.
    f) Grout can be put in place in a plastic state. It must forced under the load cell mounting plate. This can be done with a wood 1x4 about 2 or 3 feet long. Be sure the grout completely fills the space.

8.0 WIRING AND GROUNDING

8.1 WIRING

It is absolutely essential that all load cell cables be installed correctly. It is equally important that all electrical parts be kept absolutely dry. The load cells and the junction boxes are watertight; however, continuous exposure to moisture may cause corrosion which would eventually break down the deal and ultimately allow moisture to reach sensitive parts. Any moisture can cause drifting or zero change and degrade the accuracy of the scale. To insure easy installation and satisfactory operation the following procedures should be followed:

8.1.1Make sure that all connections into the junction box have pipe joint compound on them and that they are tight. Unscrew any plugs that were not previously removed. Coat with pipe joint compound and replace. Again make sure they are tight.

8.1.2Tighten, but do not overtighten the cover bolts. Overtightening can warp the cover forcing the gasket out of place. After final checkout, a silicone sealant (provided) will ensure the integrity of this joint. If applied at this time the sealant my become contaminated with dirt.

8.1.3On one of the mounting feet, connect the ground wire to the outside of the junction box as shown in Figure 8.1. Do not run the ground wire inside the junction box. It cannot be sealed completely since air and moisture can pass between the wire strands.

8.1.4Conduit to indicator. One inch rigid metal conduit must be used for the cable connecting the instrument to the junction box. Each cable must be in its own conduit. Do not attempt to run more than one cable in any conduit. Instruments will interfere with another if they are connected to multiple load cell cables in a common conduit.

8.1.5Mount the junction box so that the load cell cables enter the sides of the box. The box should have the surface with no holes in it at the top to reduce the possibility of water entry.

8.2 GROUNDING

Grounding of the 7540 Pit Type Truck Scale is important for several reasons. Most importantly is safety. Electrical devices of this type must be grounded to protect the operator and others that come in contact with it. Grounding details are shown in Figures 8.1 and 8.2.

Grounding will help the scale operate more accurately. A good ground system used in conjunction with a surge voltage protection system will minimize the damage due to transient surge voltages.

Methods for obtaining a good ground.

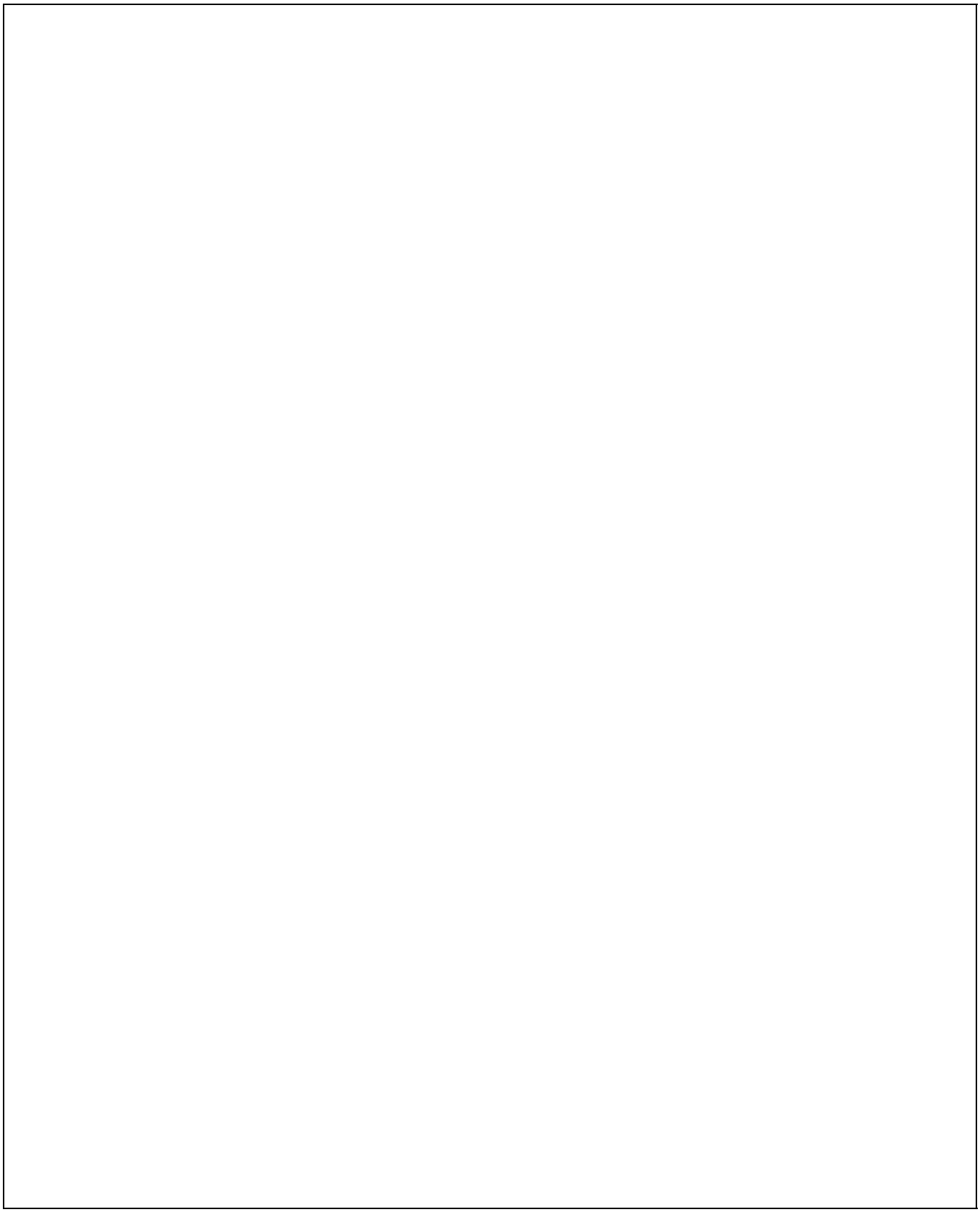
8.2.1The best ground connection available is the concrete reinforcing bars in the scale foundation. The bars form a grid consisting of longitudinal and transverse bars tied together with #16 (min.) wire ties extending the full length and width of foundation. This grid is connected to the load cell mounting plates through the anchor bolts. The bars have a large surface area, and the concrete below the surface of the earth has a high concentration of moisture. These factors contribute to a very effective low resistance ground connection. All anchor bolts are connected to the foundation reinforcing bars via clamp plates. This grid in concrete provides the maximum surface area available for dissipation and is superior to techniques using only ground rods.

8.2.2All component parts of the scale are connected together with wires, metal conduit, or metal frame to form a continuous metallic low resistance path which shunts unwanted, stray electrical currents. This is more effective than several ground rods that may exhibit a high resistance to ground and can introduce unwanted electrical currents into the sensitive electronics of the scale system causing inaccuracies or permanent damage. Details of transient surge voltage protection can be found in Toledo's Surge Voltage Protection Guide TM 00913 100 (or latest revision)

8.2.3Rigid metal conduit buried in a trench along side a #6 copper ground wire is the ideal conduit for load cell cable. The metal conduit protects the load cell cable from unwanted electrical interference, keeps the cable dry and the #6 copper ground wire provides a good ground connection between the instrument, the junction box and the load cells. Plastic pipe must **NEVER** be used for load cell cables.

8.3 SURGE VOLTAGE PROTECTION

For applications to be installed with Toledo's Surge Voltage Protection Kit, refer to the Surge Voltage Protection Guide (TM 000913 100, or latest revision) for specific instructions. In order to put the surge protection warranty into effect, the certificate contained in the surge guide must be returned to Mettler Toledo's Warranty Administrator.

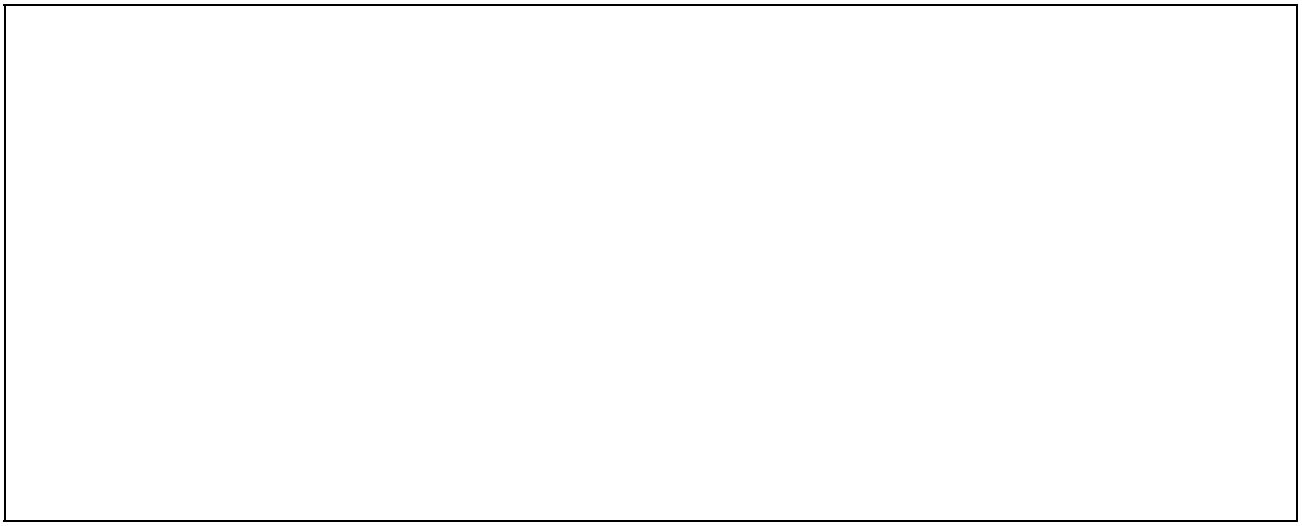


9.0 CALIBRATION PROCEDURE

1. Drive the test truck across the scale three (3) times in both directions. This should seat all mechanical parts.
2. Calibrate the scale. Set zero and span to within a few graduations. Do not spend time making an exact span setting at this stage. This can be done with a load cell simulator then check with a test truck.

3. Check for repeatability and zero return. This may be accomplished by bringing the truck to precisely the same position near the center of the platform three (3) times, recording the truck weight and the return to zero value each time (it is recommended that the auto zero maintenance be disabled at this time.) These readings must be within one graduation of each other. If they are not, interferences or misalignment exist and must be corrected before proceeding.

   Do not leave the test truck on the platform for more than ten minutes.



4. Check for shift error. Record the test truck weight with the tandem axle centered as near as possible over each pair of load cells as shown in Figure 9.1. This reading must be within one graduation (20 pounds).

5. To perform the shift adjustment, find the section with the lowest reading, then calculate how many pounds the other sections must be reduced to bring them to an equal value. This will be error weight, the amount in pounds to be trimmed out.

6. Divide the test weight in pounds (the weight applied during the tests) by the error weight in pounds. Multiply the resultant by the load cell resistance (770 ohms). The product will be the value in ohms of the trim resistor to be placed across each load cell output of each section that is to be adjusted.

$$\frac{\text{Test Weight}}{\text{Error}} \times \text{Load Cell Resistance} = \text{Trim Resistor Value in ohms.}$$

EXAMPLE #1:

Where Test Weight = 20,000lb
Error Weight = 20 lb; and
Load Cell Resistance = 770 Ohms

20,000/20 = 1000
1000 x 770 = 770,000 ohms

Therefore use 750,000 ohms for trimming.

EXAMPLE #2:

Where Test Weight = 20,000lb

Error Weight = 80lb; and
Load Cell Resistance = 770 ohms

20,000/80 = 250
250 x 770 = 192,500 ohms

Therefore use 180,000 or 200,000 ohms for trimming.

NOTE: Round off resistance to nearest available value.

7. Solder the trimming resistors in the junction box. Make sure they are secure and then repeat steps 9.4.9.5.9.6 and 9.7 if necessary. Because the full force of the test weights cannot be concentrated on one load cell or a pair of load cells the adjustment will not be as predictable as desired. This it may be necessary to repeat the procedure several times in order to complete the shift adjustment.

   Do not use resistance values[lower than 50,000 ohms for trimming 770 ohm load cells. If lower values are indicated it is advisable to look elsewhere for the problem and solutions. The use of lower values of trimming resistance will be very critical and will make the scale unstable.

   Resistance values higher than 2 Meg ohms will have little or no affect on the calibration. 2 Meg ohms will reduce the output about one graduation or 20lb with a test weight of 50,000lb.

   Trimming resistors should be of the metal film type rather than carbon resistors., The exact value of resistance is not critical as trimming is a cut and try procedure. The resistor should be temperature stable, 100 PPM/degree C is ample. The wattage is not important.

   Mettler Toledo Scale service parts has available resistors that are suitable for trimming load cell scales. A selection of various values should be available when calibrating the scale for the first time.

   9.7.1 When working inside the junction box while trimming the load cells remove the cover only long enough to do whatever is necessary then replace the cover immediately. Take every precaution to keep the box dry at all times.

9.1 SPAN CALIBRATION

1. Set approximate span with load cell simulator (if it hasn't been done before).
2. Place 20,000 pounds of test weights on platform.
3. Adjust indicator to read 20,000 pounds.
4. Remove test weights. Do not place weights on the truck.
5. Drive empty truck on scale and record reading.
6. Remove truck. Scale will return to zero.
7. With truck off scale, load 20,000 pounds of test weights back on truck.
8. Drive truck with at least 20,000 pounds of test weights on scale. Adjust indicator to read weight of empty truck (per 8.8.5) plus 20,000 pounds or test weights used.

9.2 LINEARITY

Place the 20,000 pounds of test weights on the scale in 3,000 pound increments and record the indication for each 3,000 pound increment. The deviation of the indication from the test load must be within 0.1 percent of the test load

Make a note of load cell simulator readings and file in instrument for future reference.

9.3 FINAL CLOSURE OF JUNCTION BOX

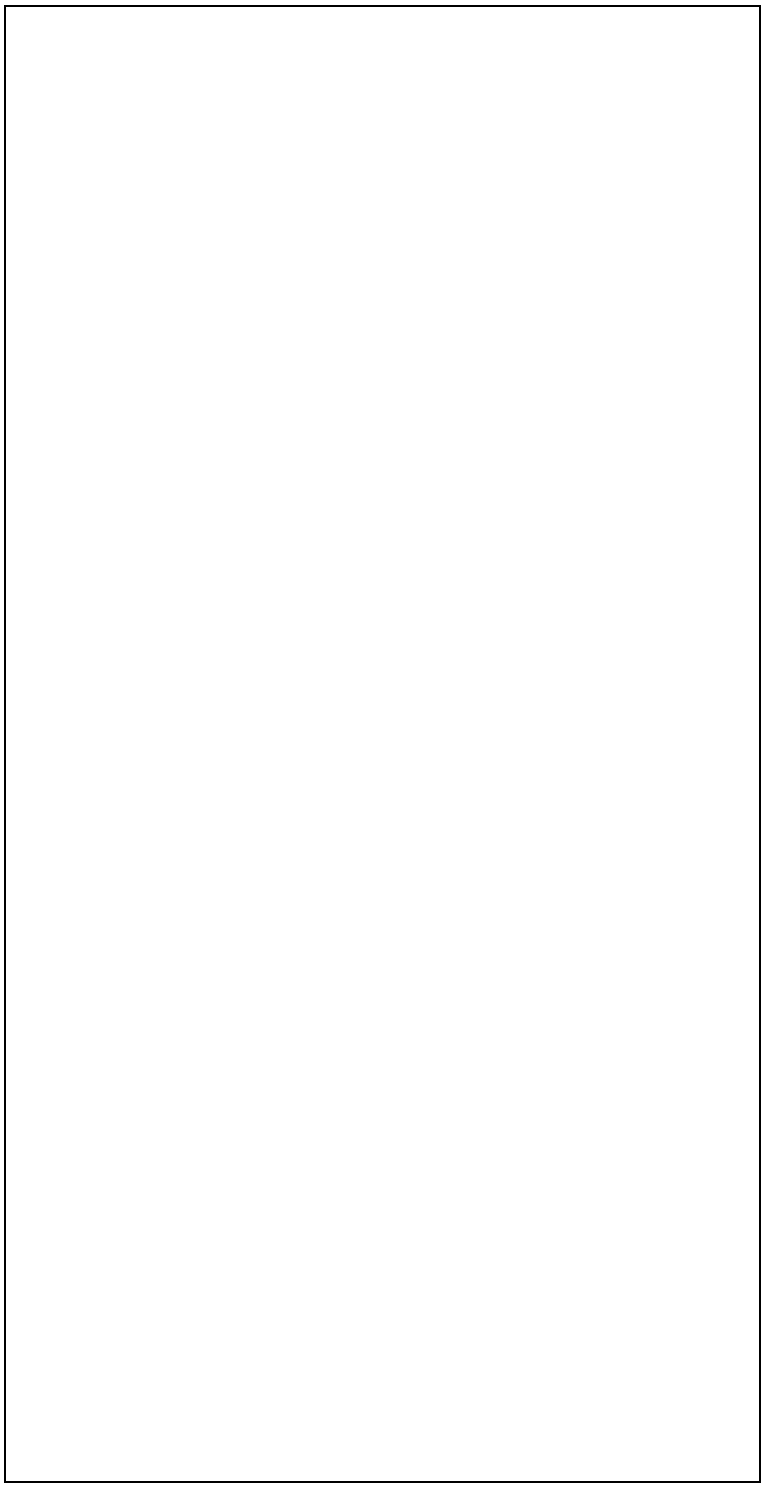
After calibration is complete carefully seal the junction box. Place the dehumidifier package in the box. Make sure the desiccant is in an active (dry) condition. Apply sealing grease (provided) to both sides of the gasket and assemble the gasket to cover. Attach cover to box, making sure that the grease does not become contaminated. Tighten cover bolts securely. Be careful that the bolts are not over tightened as this could warp the cover or force the gasket out of place, thus violating the seal.

FAILURE TO SEAL JUNCTION BOX AND MAINTAIN MOISTURE INDICATOR IN A BLUE CONDITION WILL CAUSE SERIOUS SCALE ERRORS.

Inform the owner of the need to periodically check the moisture indicator.

10.0 APPENDICES

10.1 APPENDIX A.1



Minimum Distance in Feet D	Maximum Truck Weight In Thousands of Pounds		
	Scale Tandem Axle Loading Rate		
	35k	45k	55k
8	32	42	51
12 14	45 47	59 61	72 75
12 15 20	45 48 51	59 62 66	72 77 82
12.5 15 20	57 62 67	73 80 86	89 97 105
18 25 30	72 77 82	94 100 107	115 123 131
25 30	77 87	100 113	123 139
17 23 27	68 72 76	88 94 99	109 115 122
20 25 30 35	77 82 87 91	100 107 113 118	123 131 139 146
10	92	120	147
18	120	156	192

10.2 APPENDIX A.2

Present day Mettler Toledo Scales rated at 35,000 lb per tandem axle are designed to the same weight limits as the nation's highway bridges. Consequently, the bridge formula can be used to determine if a particular truck is within the design limits of the scale weighbridge.

For scales rated at 45,000 lb per tandem axle multiply the weight obtained from the bridge formula by 130%.
For scales rated at 55,000 lb per tandem axle multiply the weight obtained from the bridge formula by 160%.

Gross Weight Allowable under Federal Law Formula Enacted January 4, 1975.

$$W = 500 \left(\frac{LN}{N-1} + 12N + 36 \right)$$

W= maximum weight in pounds carried on any group of two or more axles computed to nearest 500lb.
L= Distance in feet between the extremes of any group of two or more consecutive axles.
N= Number of axles in group under consideration.

EXAMPLE: 5 Axle Semi Truck Trailer

There is 10 feet between the steering axle and the first drive axle. There is 5 feet between the first drive axle and the second drive axle. There is 30 feet between the second drive axle and the first trailer axle. And, there is 5 feet between the first trailer axle and the second trailer axle. Therefore, the distance in feet between the extremes of any group of two or more consecutive axles (L) is 50 feet.

$$N = 5,\ L = 50 \qquad \left(\frac{50 \times 5}{4} + 60 + 36 \right) = 158.5$$

158.5 X 500 = 79,250 = 79,000 rounded to the nearest 1000 lb

Then take the tractor only

$$N = 3,\ L = 15 \qquad \left(\frac{15 \times 3}{2} + 36 + 36 \right) = 94.5 \times 500 = 47{,}250 \text{ lb}$$

47,000 lb would be the maximum weight allowed for that part of the truck.

For this example we calculated the maximum weight for two parts of the truck. If this were an actual truck it would be necessary to calculate combinations to be sure that no part of the truck, or the complete truck exceeds the limits.

10.3 APPENDIX B - 7540 INSTALLATION SCHEDULE

STEP	RESPONSIBILITY	EQUIPMENT OR TOOLS REQUIRED
A. Site Selection	Owner,, with Mettler Toledo Scale Recommendations	Plans, Drawings for scale and proposed site.
B. Pit Construction 1. Obtain drawings appropriate for the installation. 2. Excavate 3. Lay Stone (if needed) 4. Form Pit Floor 5. Place Rebars 6. Pour Concrete 7. Form Pit Walls 8. Pour Concrete 9. Cure concrete	Contractor	Back Hoe Forms Hand Tools Concrete (See Chapter 4)
C. Load Cell Installation	Toledo Scale/ Distributor or Contractor	Hand Tools (See Chapter 5)
D. Assemble Weighbridge	Contractor	Test Truck with Boom (See Chapter 6)
E. Concrete Deck Construction 1. Form 2. Pour Concrete	Contractor	 Electric Welder Concrete (See Chapter 7)
F. Connect Wiring Wire L.C. to Junction Box and to Instrument	Mettler Toledo Scale/ Distributor or Contractor	Hand Tools (See Chapter 8)
G. Calibration	Mettler Toledo Scale/Distributor	Test Truck with Weights (See Chapter 9)
H. Approval	Weights and Measures Mettler Toledo Scale/ Distributor	Test Truck with Weights

Each step must be completed in sequence before the next step can be started.

* it is not necessary to wait the full curing time before going to the next step, but the full curing time must be allowed before loading the scale for calibration.

10.4 APPENDIX C - BOLT AND WRENCH SIZES AND TIGHTENING SPECIFICATIONS.

BOLT LOCATION	50,000 LB LOAD CELLS			100,000 LB LOAD CELLS		
	Bolt Size	Wrench Size	Tightening Method	Bolt Size	Wrench Size	Tightening Method
Weighbridge Bolts (A-490)	7/8	1-7/16	Twist Off ***	7/8	1-7/16	Twist Off ***
Top of Load Cell (A-325)	5/8	1-1/16	Turn-of-Nut** (half turn)	3/4	1-1/4	Turn-of-Nut** (half turn)
Bottom of Cell (Grade 8)	5/8	1/2”	Turn-of-Nut (half turn)	3/4	5/8*	Turn-of-Nut** (half turn)
Anchor Bolts (A-307)	3/4	1-1/8	Turn-of-Nut (1/4 turn)	7/8	1-5/16	Turn-of-Nut** (1/4 turn)

* Allen Socket

** Turn-of-Nut Tightening
The turn-of-nut method is used to provide the bolt tension required. First, all bolts shall be brought to ‘snug tight’ condition to insure that the parts of the joint are brought into contact with each other. “Snug tight” is defined as the tightness attained by a few impacts of an impact wrench of the full effort of a man using an ordinary spud wrench. Following this initial operation, all bolts in the connection shall be tightened additionally one half turn (except the A307 bolts which shall be one quarter turn), with tightening progressing systematically from the most rigid part of the join to its free edges. During the operation there shall be no rotation of the part not turned by the wrench.

*** Twist-off-Turning
The weighbridge bolts have a special twist off head and use a special socket for the bolt head. The 1-7/16 wrench is to hold the nut from turning.

10.5 APPENDIX D - LOAD CELL CHARACTERISTICS FOR METTLER TOLEDO LOAD CELLS

Excitation voltage 15 volts D-C or A-C. Rates Output 2 Millivolts per Volt.

Function	Instrument Connector Pin Designations	J-Box terminal Designations	Six (6) Conductor Load Cell Cable Color Code	Internal Resistance Measurement (ohms)
Plus (+) Signal	A	1	Green	770 ± 5 (Green to Black)
Minus (-) Signal	B	2	Black	
Plus (+) Excitation	C	5	White	838 ± 5 (White to Blue)
Minus (-) Excitation	D	4	Blue	0 Ohms
Plus (+) Sense	E	6	Yellow	(Yellow to White) and
Minus (-) Sense	F	7	Red	(Blue to Red)
Shield	G	3	Orange	

There is a jumper in the load cell between the white and the yellow and also between the blue and the red wired.

The resistance measurements checks can be made right at the junction box if the leads are disconnected from the terminal block. The resistance of the interconnecting cable is small enough that it will not affect the above readings.