7210

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:

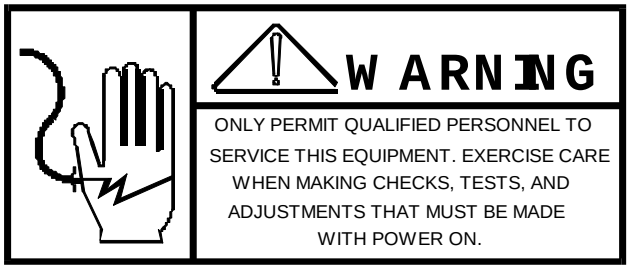
METTLER TOLEDO
Training Center
P.O. Box 1705
Columbus, Ohio 43216
(614) 438-4400

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 information provided in this manual is to be used as a guide in the assembly and installation of Mettler Toledo Model 7210/7220 RAILMASTER SCALES® . The contents of this manual are limited to the installation considerations only. Installation should be performed by qualified personnel only. Engineering drawings for each specific installation must be used as the definitive document for final scale assembly.

All sales of goods described herein shall be subject to the standard warranty and the standard terms and conditions of sale published by Mettler Toledo Scale. The specifications and product descriptions contained herein are accurate at the time of publication but are subject to change without notice. Current engineering drawings take precedence over this information.

2.0 PRODUCT SPECIFICATION

2.1 GENERAL DESCRIPTION

Mettler Toledo Models 7210 and 7220, full load cell, rail scales are designed for concrete pit installation. The 7210 is intended for shallow pit installation while the 7220 is designed for full concrete pit installation. The platform is of all steel construction meeting AAR/AREA Cooper E-80 requirements. The structural steel also conforms to ADTM A-36 specifications and is shop welded in conformance with the structural welding code D1.1 of the American Welding Society.

The TOLEDO CAP CHECK ® (100,000 pound capacity) load cell system is utilized. This system consists of the Mettler Toledo shear design load cell, with a rocker pin and a receiver which encircles the top of the cell with a gap of .16 inches. Horizontal forces resulting from the braking action of railcars are transmitted through this receiver to the top of the load cell and into the piers of the foundation. Cooper E-80 maximum vertical pier reaction due to live loads is 96,000 pounds, within the design capacity of the load cell.

Pit construction is of 3750 p.s.i. strength reinforced concrete and is places in accordance with the American Concrete Institute Code. Reinforcing bars conforming to ASTM A615 Grade 60 are used. Standard pits are for use with soil having a minimum bearing capacity of 2500 pounds per square foot. In the 720, a pit depth of 27 inches is required, however the concrete must extend below the local frost line. The 7220 required a pit depth of 5 feet 9 inches and clearance of 4 feet under the main beams.

As standard configurations, a two section scale of 85 ton nominal capacity and 12'-6" nominal length and a three section, 170 ton nominal capacity and 25' nominal length is furnished. General dimensional layouts with total scale capacity for scale combinations as listed below are available. Rated sectional capacity* is 85 ton as required by the AREA. The ACTUAL sectional capacity of all unites is 96 ton, this being the maximum live load which can be applied to any section.

Sectional capacity is defined as the maximum allowable live load resulting from a series of axles that can be applied to a section. The place of this section is the vertical place, perpendicular to the longitudinal axis of the scale and passing through the centers of the two load cells.

2.2 SPECIFICATIONS

The 7210/7220 is available in two live rail lengths:

Single	12'- 7-14" (3.842M)
Double	25'- 2-3/4" (7.690m)

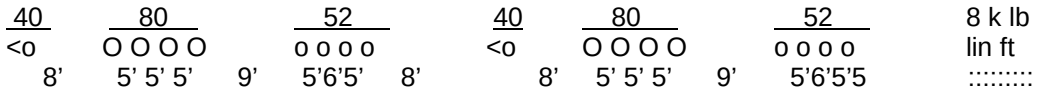
The following standard configurations are available:

Configuration	Gross Capacity
Single	170,000 lb (80,000 kg)
Double	340,000 lb (160,000 kg)
Single-Single	340,000 lb (160,000 kg)
Single-Double*	510,000 lb (220,000 kg)
Double-Double	680,000 lb (300,000 kg)

*For the Single-Double configuration the capacity of the single unit is restricted to 170,000 lb and cannot accept half the capacity of the combination. For most practical applications the Single-Double configuration is limited to 340,000 lb. capacity.

2.3 LOAD RATING

Structural steel, pit, pier, and load cell design has been made consistent with a COOPER E-80 loading schedule as follows:



Indicated loads per axle are in thousands of pounds.

Customer loading MUST be compared with this schedule to confirm suitability of application.

2.4 ACCURACY

Scales meet AREA scale handbook and NBS H-44 requirements for railway track scales.

2.5 ENVIRONMENTAL CONSIDERATIONS

The load cells are temperature compensated for a range of -10 to +40 degrees C (14 to 104 degrees F) and are rather NEMA 6.

The scale will perform to the stated accuracy under normal conditions provided that installation requirements are met. This includes adequate drainage and clearance of snow and debris from in and around the scale.

3.0 SITE SELECTION

1. The site must have room for straight and level approaches to extend 75 feet from each end of the scale. The approach rails should be lever to within .1% if the scale will be used for two draft weighing and level within .5% for single draft weighing. Concrete approach foundations shall extend 25 feet from each end of the pit walls.

2. The sire must have good drainage. It must not be the center of a natural drainage area such that other areas drain into the scale pit. The ideal scale sire is on ground elevated above the surrounding area.

3. The soil must have a minimum bearing capacity of 2500 pounds per square foot (PSF). The scale is designed to work with soil bearing pressure of 2500 pounds per square foot (PSF). However, AREA (American Railway Engineering Association) specifications require a soil bearing capacity of 4000 pounds per square foot (PSF).

4. Check the depth of local frost penetration. Scale footings must extend below the frost line. See Figure 3.1.

5. Check for pipes, sewer lines, wired, or obstructions that would interfere with the pit construction.

6. The scale is to be located away from high power electrical transmission lines or substations.

7. Do not locate the scale in high traffic area. Railcars must not remain on the scale for a period of time longer than is necessary for obtaining the car weight.

8. In advance of the installation date, consult state and railroad weights and measures officials to endure that both the location and the equipment will meet with all their requirements; notification should be submitted in writing. If the installation deals with grain handling, then contact FGIS. Some regulatory groups require that the scale platform be clearly visible from the location of the scale instrument. Scale drawings and site locations must always be approved by the serving railroad prior to the start of construction.

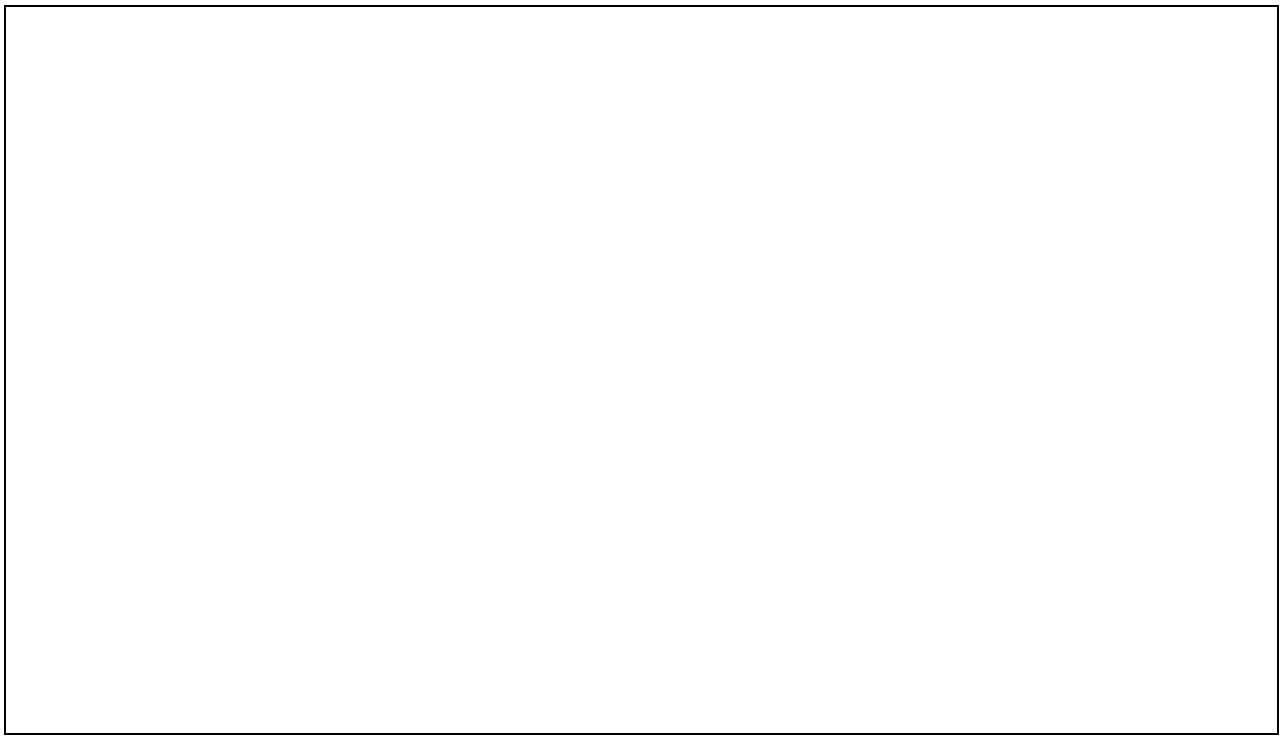


Figure 3.1

4.0 FOUNDATION CONSTRUCTION

1. Obtain drawings and make certain they are the latest released by Mettler Toledo Scale Engineering. The latest drawings will be sent upon receipt of the scale order and also with shipment of the load cells and scale electronics.

2. Grade the site - including approaches.

3. Excavate for footings and foundations.

4. Lay gravel underfill (Optional).

5. Place reinforcing bars for foundation. On the 7210 also place the anchor bolts for the load cell mounting plates. Insure that they are placed exactly as shown on the drawings. For electrical grounding purposes the reinforcing bars are tied together with a minimum #16 wire ties at no less than 50% of the intersection points of the rebars. The importance of grounding is discussed in Section 6 of this manual. Read Section 6 prior to installation.

6. Form and pour the foundation (pit floor). Use concrete specified on Mettler Toledo drawings. If subject to freezing weather, use an air entraining agent. Reinforcing steel is to be places in accordance with the American Concrete Institute codes as specified on the drawings.

   Extensive tests and experience by a cement association have proven that air entrainment will prevent concrete deterioration and scaling sue to freezing temperatures and de-icers. De-icers must not be applied to scales as inadvertent contamination may occur.

7. Place reinforcing bars for walls, piers, and approaches.

8. Form pit walls. Piers and approaches.

9. For Model 7220, set the anchor bolts and pit coping. A length of weed that reaches all the way across the pit can be used to position the anchor bolts for the load cell mounting plates. It is very important that the load cell mounting plates be accurately positioned in relation to each other and the pit walls.

10. It is important that the concrete be tested for 'slump' and degree of air entrainment prior to pouring. Test cylinders must also be poured to establish when the concrete has reached the required strength.

11. Allow concrete to cure for at least 24 hours (depending on concrete strength and ambient temperature), before removing forms and proceeding with the installation. CONCRETE MUST ATTAIN ITS DESIGN STRENGTH BEFORE LOADING THE SCALE.

12. Position the load cell mounting plates (Figure 4). They shall be level to within .03 inches in 12 inches and in the same place within 1/8 inch. Do not grout the load cell mounting plates until after the weighbridge and rails are set in place. This is done so that the rail height can be adjusted if necessary. DO NOT APPLY ANY LOAD TO SCALE PRIOR TO GROUTING THE MOUNTING PLATES.

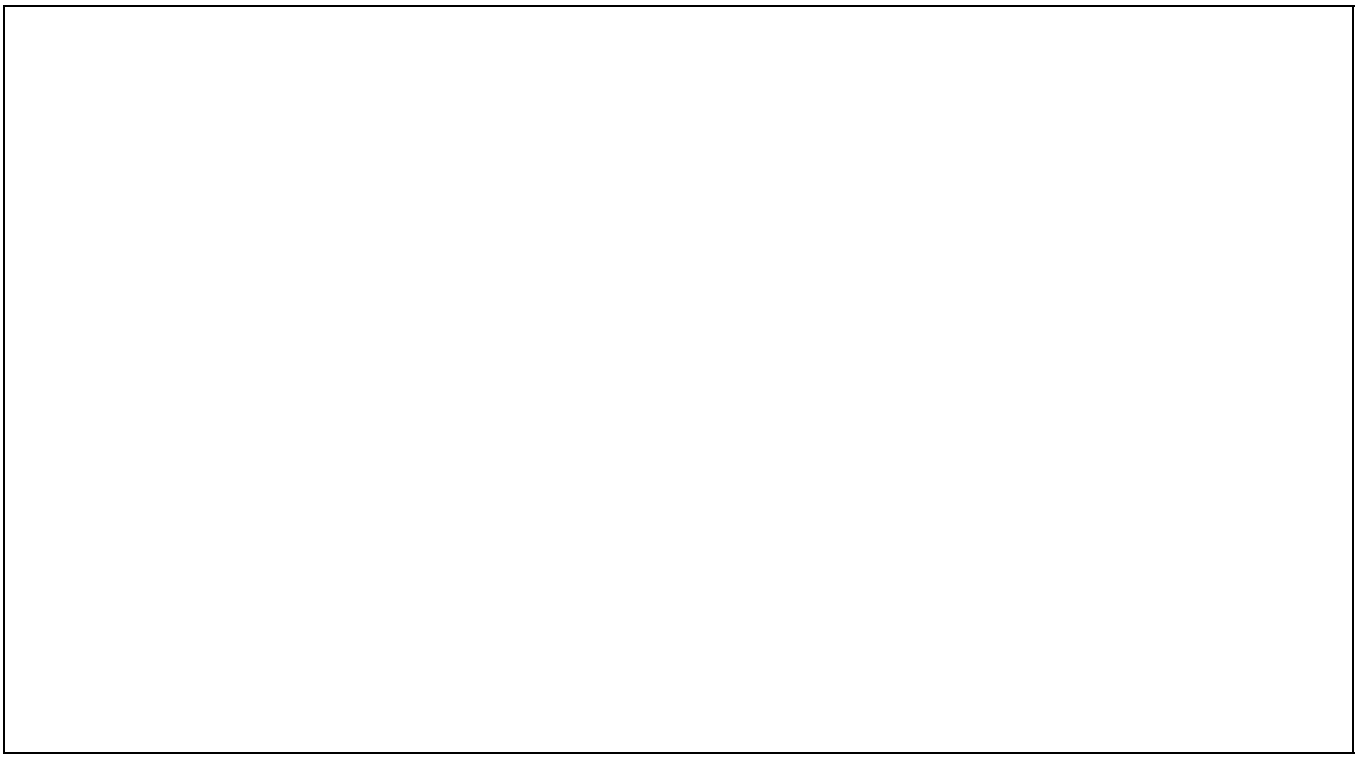


Figure 5.1a (7210 SINGLE)

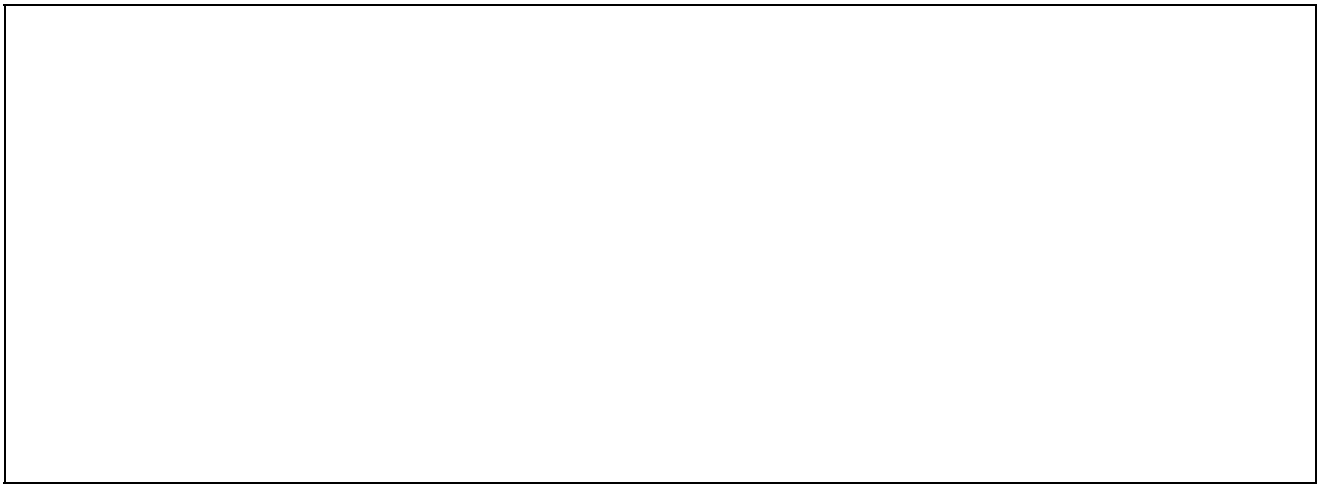


Figure 5.1b (7210 SINGLE)

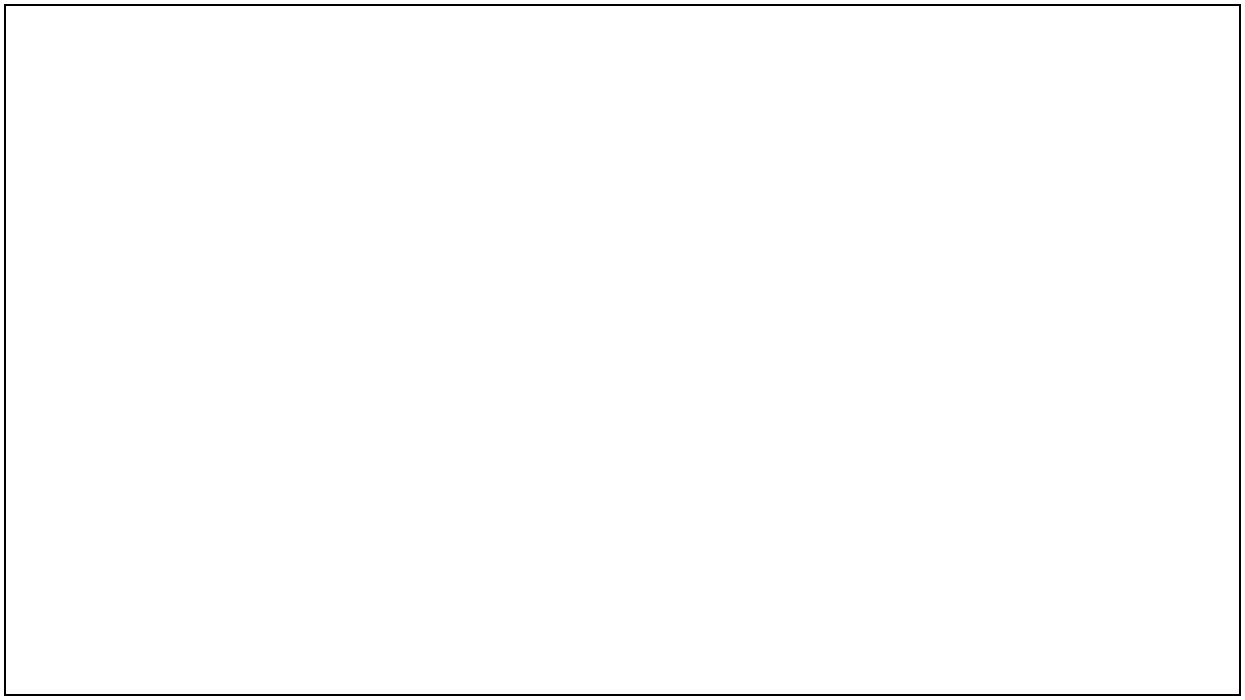


Figure 5.2a (7210 DOUBLE)

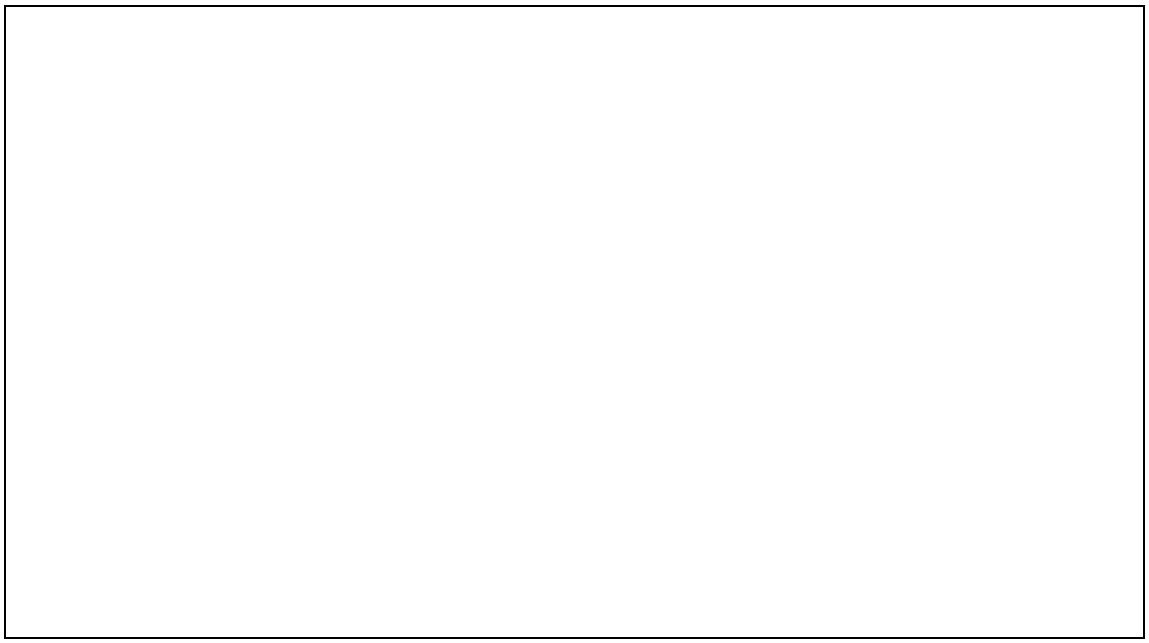


Figure 5.2b (7210 DOUBLE)

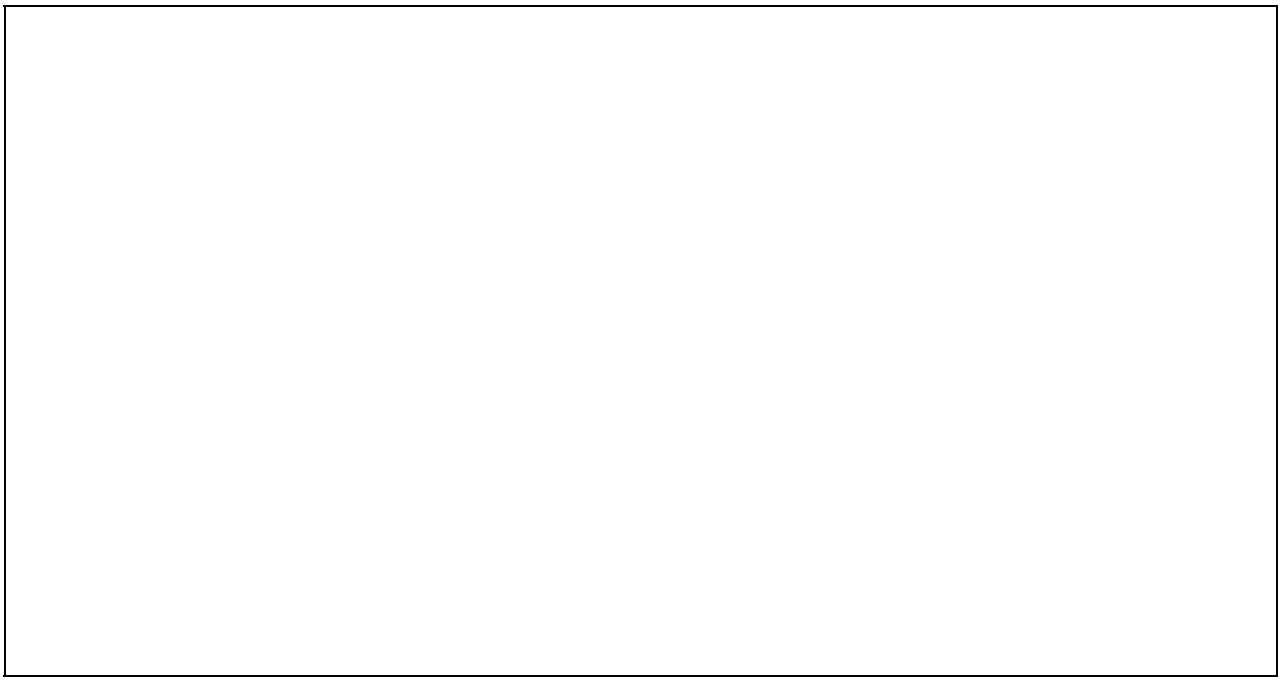


Figure 5.3a (7220 SINGLE)

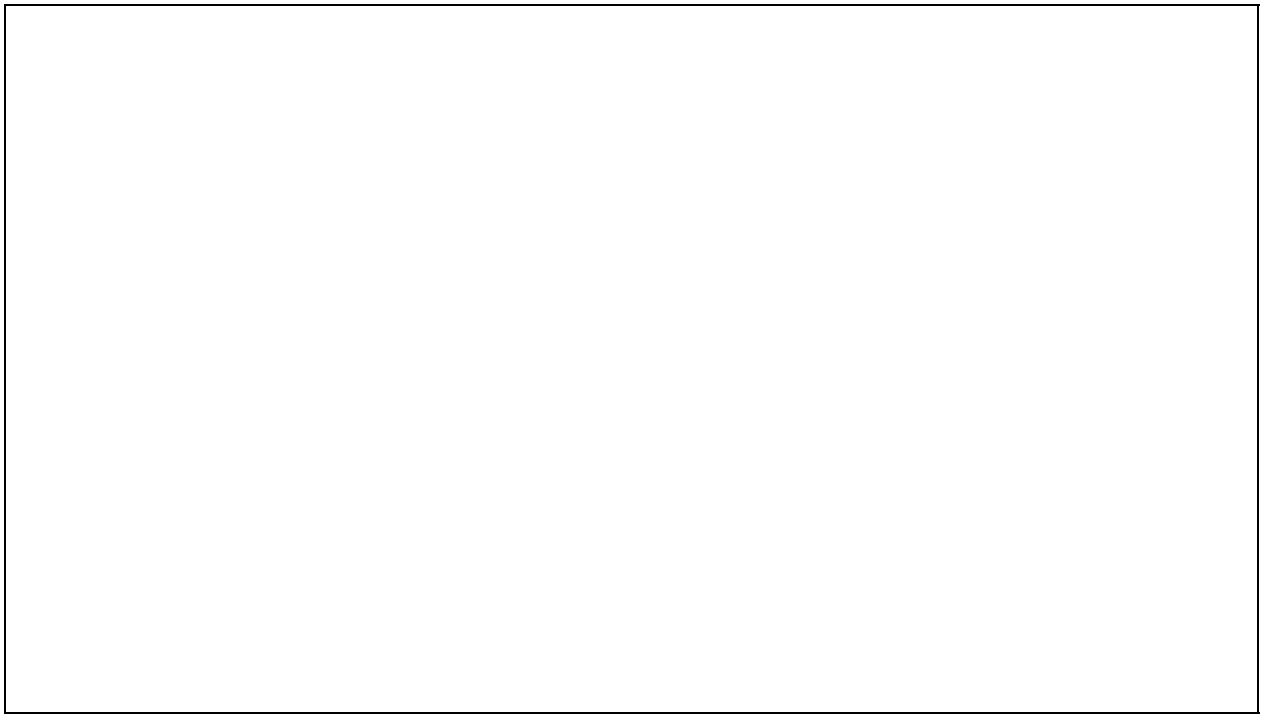


Figure 5.3b (7220 SINGLE)

5.0 WEIGHBRIDGE INSTALLATION

IMPORTANT NOTICE!!

Electrical arc welding around load cell scales will cause damage to electronic parts if certain precautions are not taken.

High current through the body of a load cell can cause heating that will damage sensitive parts.

High voltage will damage the strain gauges in a load cell. 25 volts can ruin the strain gauges. All arc welders produce at least 25 volts, the output of a welder is usually 70 or 80 volts open circuit. In every case this voltage must be kept out of the load cells to keep from destroying them.

If it is necessary to arc weld around load cell scales, follow these rules: 1. The welding circuit ground clamp must be attached to the primary member being welded. 2. Never weld with the ground clamp connected to any electrical conduit. 3. Disconnect load cell cables at instrument and insulate the connector from ground. The load cell must never be part of the welding current path.

5.1 TOOLS REQUIRED TO INSTALL WEIGHBRIDGE

Crane or Hoist: A device capable of lifting and positioning into the scale pit a 6000 pound weighbridge, 14 feet long and 9 feet wide.

Wrenches: An impact wrench should be used as there are at least 40 1-inch rail bolts that must be tightened in each 12 foot deck panel. If an impact wrench is not used, a wrench with a angle 4 feet long is needed to obtain specified bolt torques. The 3/4 inch bolts have 1-1/8 inch heads and nits, if the heavy duty type is used, the bolt heads and nuts will be 1-1/4 inches across the flats.

The 1 inch bolts have 1-1/2 inch heads, if the heavy size is used the heads and nuts will be 1-5/8 inches across the flats. The should bolts connecting the center of the double platform have 3/8th inch socket heads and 1-1/8 inch nuts.

The socket head bolts used to fasten the load cells to the load cell mounting plate have 5/8 inch hexagon socket heads. An adaptor for use with the 3/4 inch drive socket handles is needed for these bolts. In the assembly of double units, a 3/8th hex key wrench (Allen) or 3/8th socket adaptor will be needed to tighten the splice joint shoulder bolts. Other small wrenches will be needed for bolting deck plates and junction boxes.

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

Hydraulic Jacks: Two 5-ton jacks will be needed if it becomes necessary to raise the weighbridge to adjust the mounting plates after the crane has been removed from the scale location.

5.2 INSTALLATION

1 Before the weighbridge is installed (See Figures 5.1-5.3), the pit must be checked to make certain that it was built to specification. The scale cannot weigh accurately over a long period of time if the pit is not correct. The load cell anchor bolts must be located **to within 1/8 inch horizontally** and the load cell mounting plates must be located **to within 1/16 inch vertically** and be **level to within 1/32 inch in 12 inches**. The reference for horizontal dimensions is the pit center line and for vertical measurements the reference is the pit coping. The coping should be at the same place unless noted on the pit prints. The tolerance on other pit dimensions is **1/2 inch**, unless otherwise noted.

The pit center reference line can be a steel wire stretched from one end of the put to the other. After the center line is found by measuring, it's location should be marked with a cold chisel on the surface at each end of the curb angle. Do not continue with scale assembly until all pit construction errors are corrected.

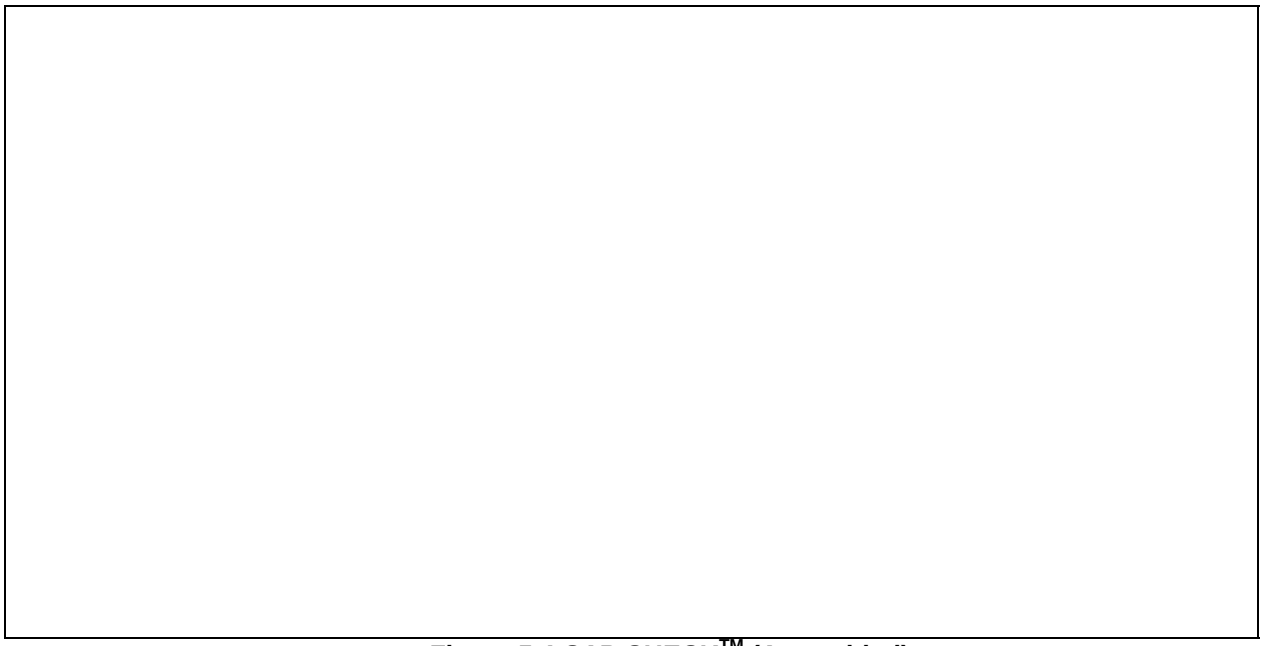


Figure 5.4 CAP CHECK™ (Assembled)

2 Next check all load cell assemblies (See Figure 5.4) to make sure they are centered. The cell assemblies are held together with temporary shipping straps fastened with 8 bolts on each assembly. The top end of these straps also holds the cap centered on the end of the cell, occasionally the caps may not be correctly centered. The clearance should be 0.16 inches all the way around. The shank end of a 5/32 twist drill is a convenient gauge for this measurement (/156 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 inch drive, 7/16 inch socket, a short extension and ratchet handle is very useful for this work.

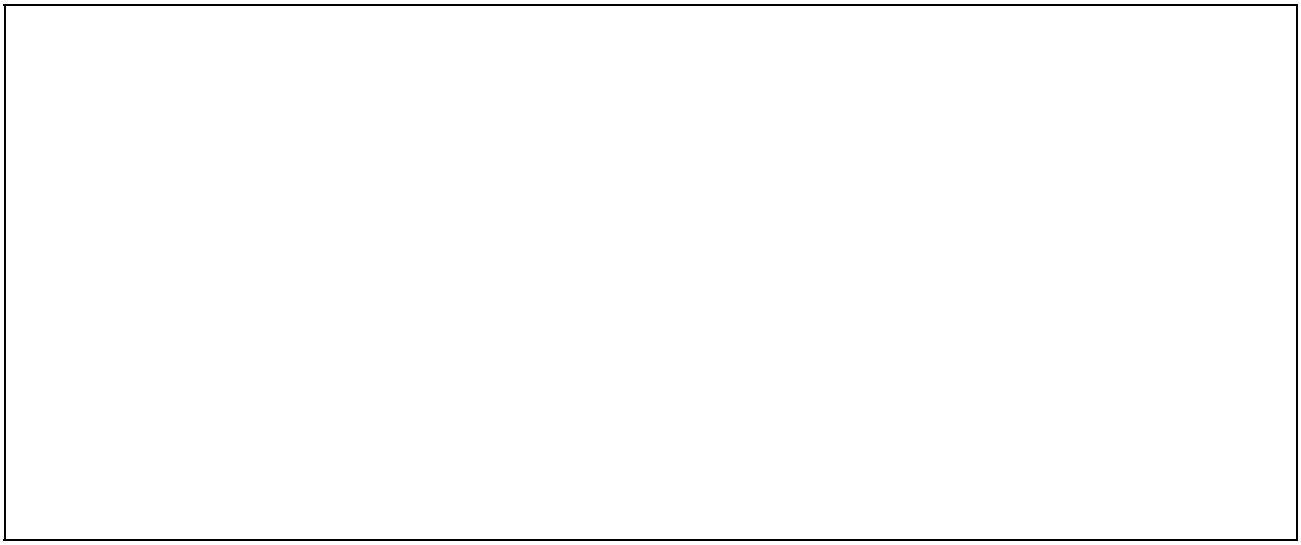


Figure 5.5 Load Cell Mounting Plates

3 Set the load cell assemblies in place on top of the load cell mounting plates (See Figure 5.5).Secure them with the hexagon socket head screws. Tighten the bolts to the specifications shown in Appendix C.

4 Set splice plates (See Figure 5.6) on the top of the two cell assemblies in the center of the double weighbridge. These splice plates are about 12”x13”x1-1/4” thick and have 8 holes in each plat3e for the shoulder bolts and 4 holes for the cap bolts.

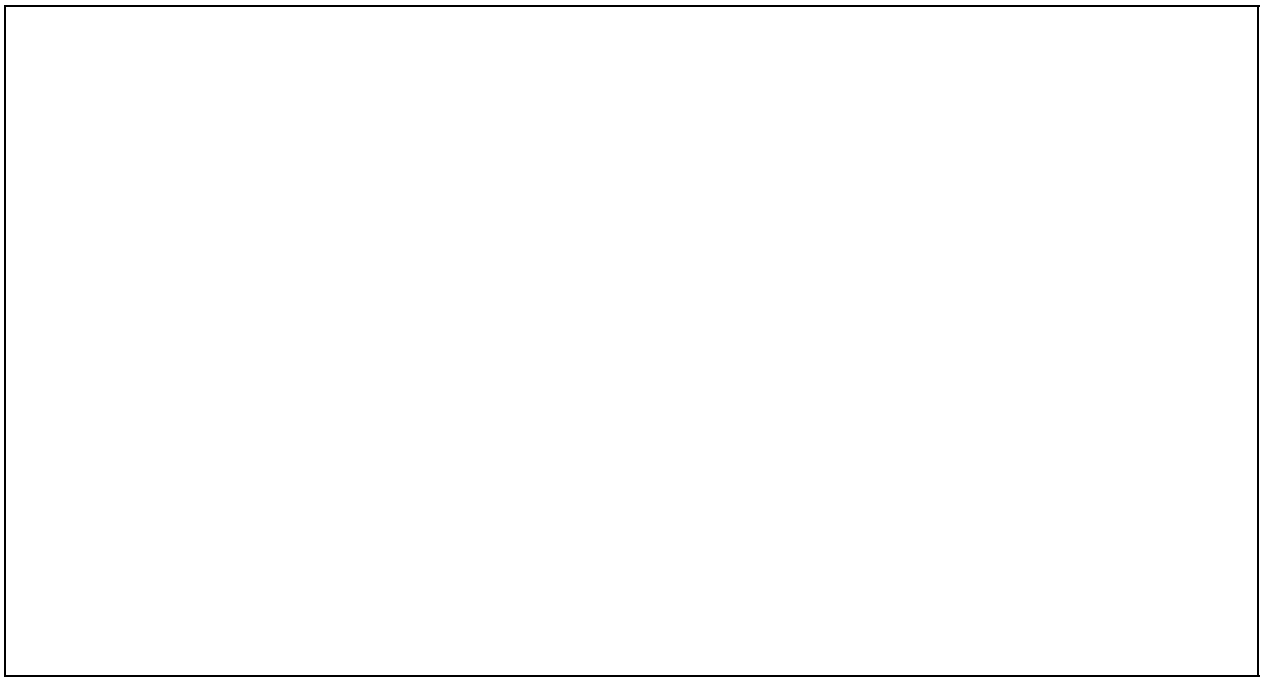


Figure 5.6a - Splice Connection Detail

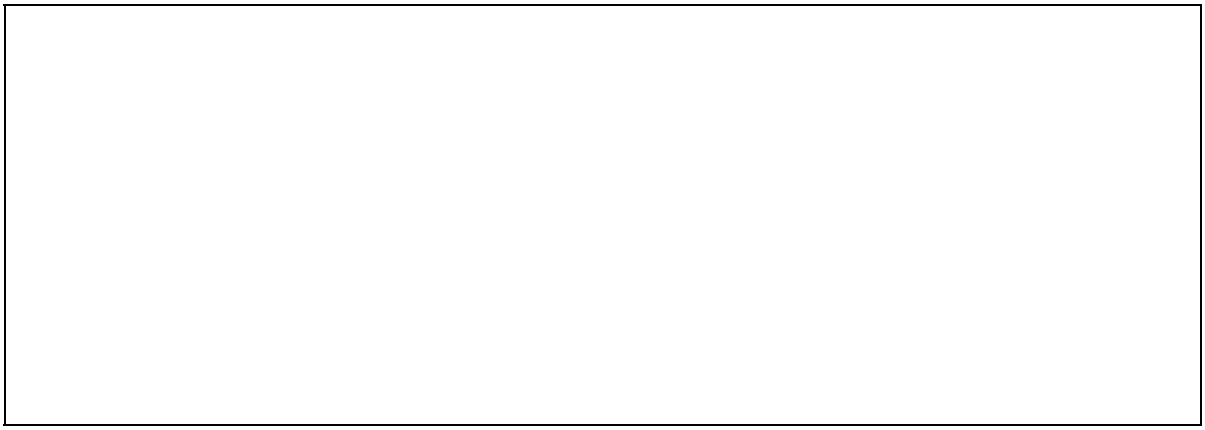


Figure 5.6b - Shoulder Screw

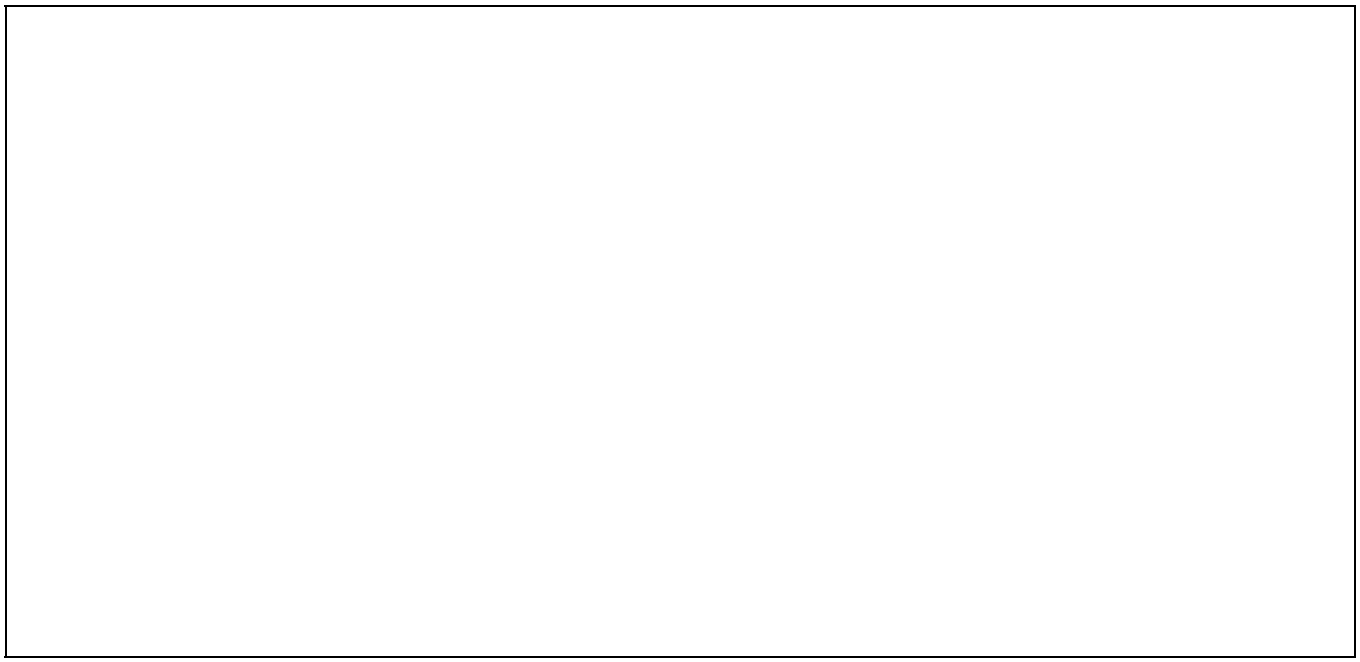


Figure 5.6c - Splice Plates and Connection Detail

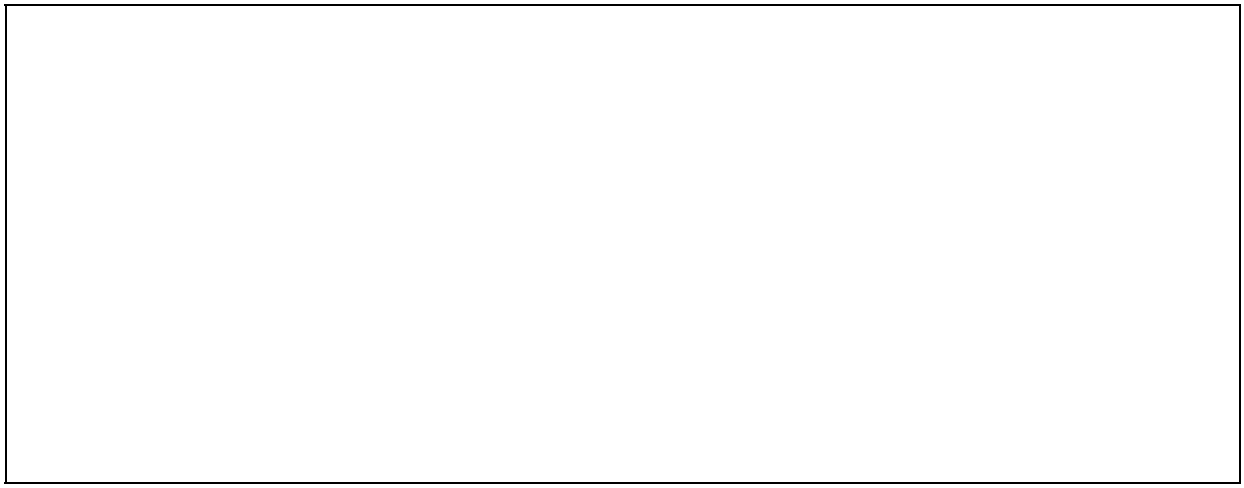


Figure 5.7a

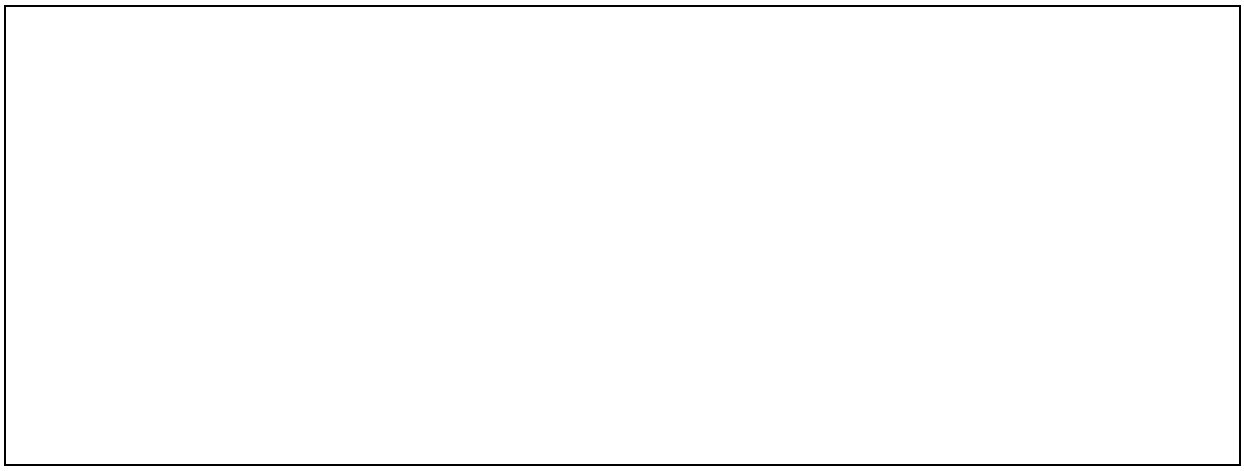


Figure 5.7b - Weighbridge Assembly

5 Set weighbridge on top of cell assemblies (see Figure 5.6 and 5.7). insert bolts but of not tighten. Use the special shoulder bolts and Belleville washers at the center connection. The Belleville washers must be installed exactly as shown on the sketch. Ensure **that seven (7) washers, six (6) disc spring and one (1) hardened flat washer per bolt** are installed.

6 Check to see that everything is in its proper location. If so, snug all bolts, then tighten all bolts to the specifications in Appendix C.

7 Install all beams that support rails that are not on 'live' sections of the scale beams. Do not grout at this time.

8 Install all railroad track. Usually the rails on the scale and approach, the rail clips, the 'anti-creep' angles and the attachment bolts are supplied by others (often the rail contractor). Local sourcing minimizes problems of rail height and gauge mismatch. **The use of 'anti-creep' angles as specified in the drawings and shown in Figures 5.8 is ESSENTIAL for continued performance of the scale.** Without these devices the rails may move and ground out the 'live' portion of the scale. The 'anti-creep' angles are first secured in place by the anchor bolts or the rail clip bolts. The rails and angles are then drilled to 15/16ths using the 7/8 inch hole as a pilot. The 7/8 bolts are then installed and tightened.

The track should be adjusted for height if necessary. Take special care to insure there is sufficient clearance between the love rails and the dead rails.

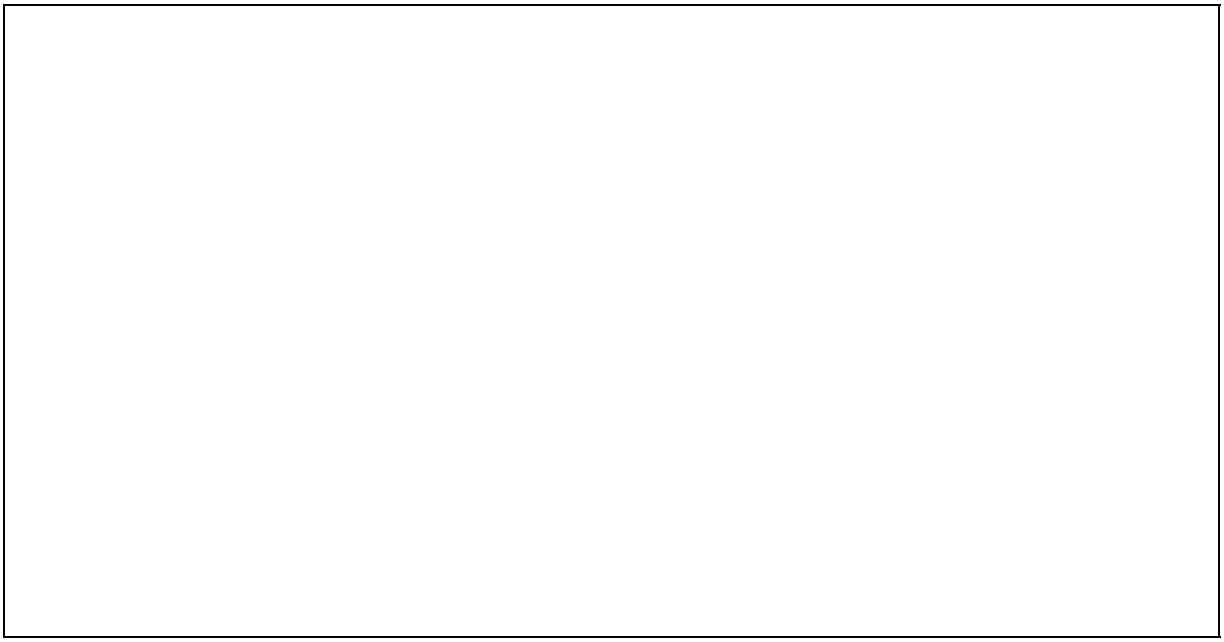


Figure 5.8 a - Anti-Rail Creep Layout Plan View

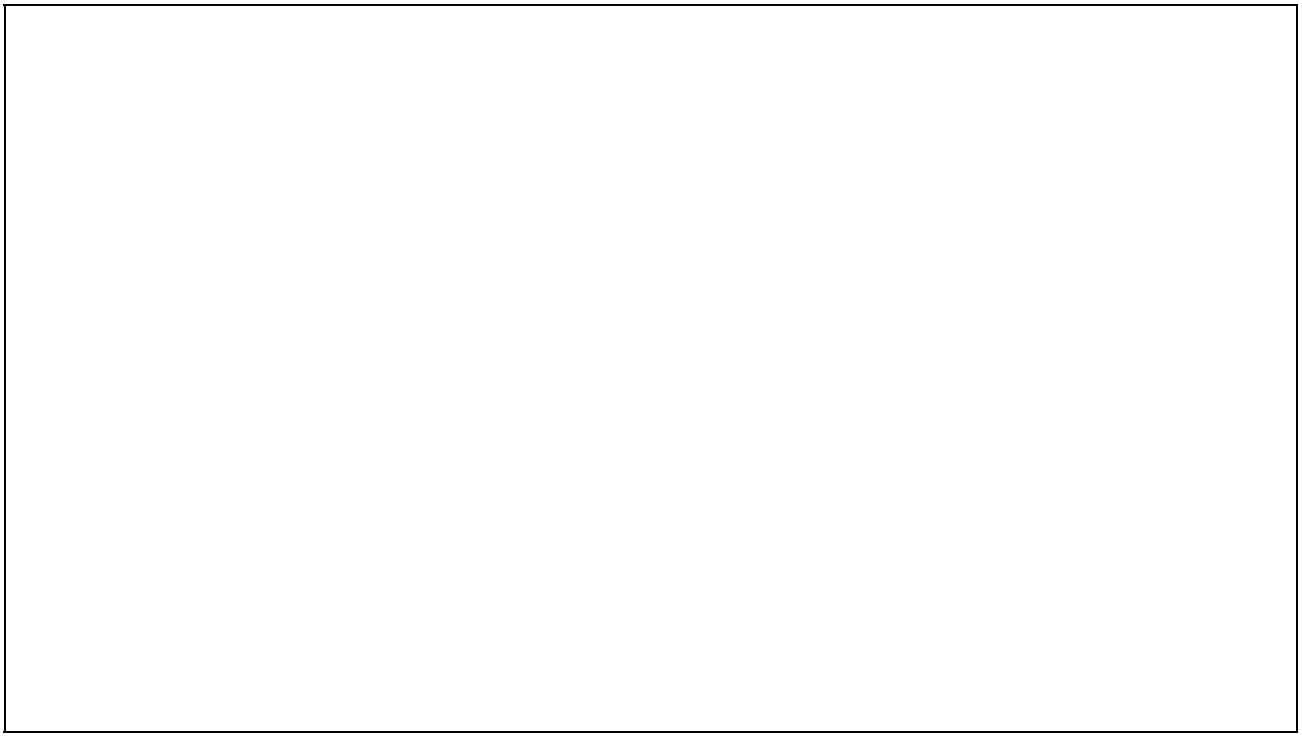


Figure 5.8b - Rail Anti-Creep Detail

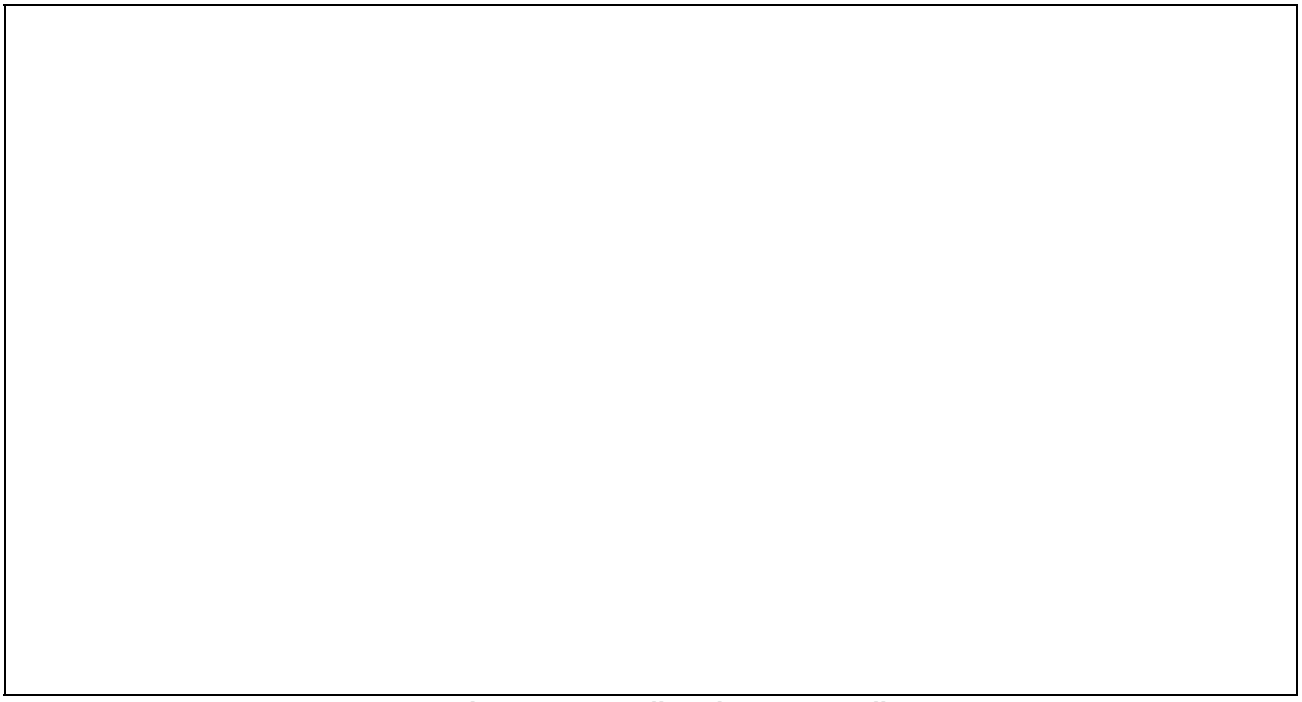


Figure 5.8c - Rail Anti-Creep Detail

5.3 GROUTING

Grout load cell mounting plates and allow to cure before applying any load to the weighbridge. MAKE SURE GROUT FULLY SUPPORTS 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 manufacturer's instruction carefully. Some basic rules apply to all types:

1 The area must be clean and free from loose materials, oil and dirt.
2 Soak the concrete with clean water for a period of several hours prior to pouring the grout.
3 Mix grout completely and do not add more water than is required as excess water will cause shrinkage.
4 Build forms for the grout. Use grout in a flowable consistency and pour into form. It is important that grout reaches design strength before any load is applied to the scale.
5 Ensure grout fully supports plate.

6.0 WIRING AND GROUNDING

6.1 WIRING

It is important that all electrical parts are kept absolutely dry. The junction boxes are gasketed, however, continuous exposure will cause corrosion which will eventually break down the seal and ultimately allow moisture to reach sensitive parts. Penetration of moisture can cause drifting, zero change and in general degrade the accuracy of the scale. To insure easy installation and satisfactory operation the following procedures should be followed:

Take every precaution against pit flooding. Unless unusually good drainage conditions exist at all times, **a good sump pump system is essential.**

Because most sump pumps are located in the pit and are out of sight, they are required special effort to observe their operation and condition. For this reason, **a second, or backup pump, is useful** in keeping water out of the pit.

The submersible type of pump is preferred over the upright type. If the power should fail, the pit could flood and cover the exposed motor on an upright type of pump. When power is restored, the motor will be ruined and **there may be a shock hazard** for anyone in the area.

1. **DO NOT LOCATE THE JUNCTION BOC IN A DAMP LOCATION OR WHERE WATER WILL FALL ON IT**. If installed on the pit wall, the junction box **must be mounted on spacers so that rain falling through the gap between scale and pit will run behind,** rather than directly on it. Sometimes a piece of sheet metal can be used to form a small roof to shed the rain water away from the junction box.

2. Make sure that all connections into the box have pipe joint compound on them and are tight. Check the plugs that were not removed, and make sure they are tight.

3. Tighten the cover bolts. **DO NOT overtighten** as this could warp the cover or force the gasket out of place.

4. There must be a compression fitting of the correct size (two sizes are used) on every cable connected to the junction box Be careful when screwing on the caps so as not to crossthread them.

5. If conduit is connected directly to the junction box, make sure it is sealed to the cable. Any air that can enter the box will contain moisture that can condense on the inside of the box.

6. By means of a bolt on the outside of the box, **connect the braided ground wire to the junction box**. DO NOT bring the ground wire into the junction box. Air can pass through the center of the braided wire making it impossible to seal this connection completely.

7. Dress the load cell cables to form a drip loop to a point before the cable connects to the load cell or to the junction box. Water will drop on to the cable and follow the cable to its lowest point before dripping off; if a drip loop is provided, the water will run off before reaching moisture sensitive components such as connectors or seals.

8. Keeping the pit dry helps keep the moisture out of sensitive components and also reduces rust damage to steel.

   Good ventilation will reduce pit moisture. Heat in the scale pit will reduce the moisture but may cause other problems. If the heat is from electrical heaters, thermostats can cause a problem with interference. Steam heat is good if available.

   Fans can be used to aid in pit ventilation, but they can create a pressure differential which, though very small, can cause scale zero problems due to the large area of the scale platform that this pressure can act against.

9. Coil up excess load cell cable and tie or clamp it high out of the way.

10. **Conduit** - once inch, steel, rigid conduit must be used for the cable connecting the instrument to the junction box. There should be one conduit for each instrument cable. Do not attempt to run more than one cable in each conduit. One instrument will interfere with another if they are connected to multiple load cell cables in a common conduit.

11. Mount the junction box so that the load cell cables enter **the sides or the bottom**. The box must have the surface with no holes in it at the top to reduce the possibility of water entering the box.

12. Do not connect thin wall tubing directly to the junction box. The thin wall tubing cannot be made air or water tight by the nature of the fittings used to connect the tubing. Thin wall tubing is useful to protect wires from mechanical damage but it can never be expected to keep moisture out and must not be used to do so.

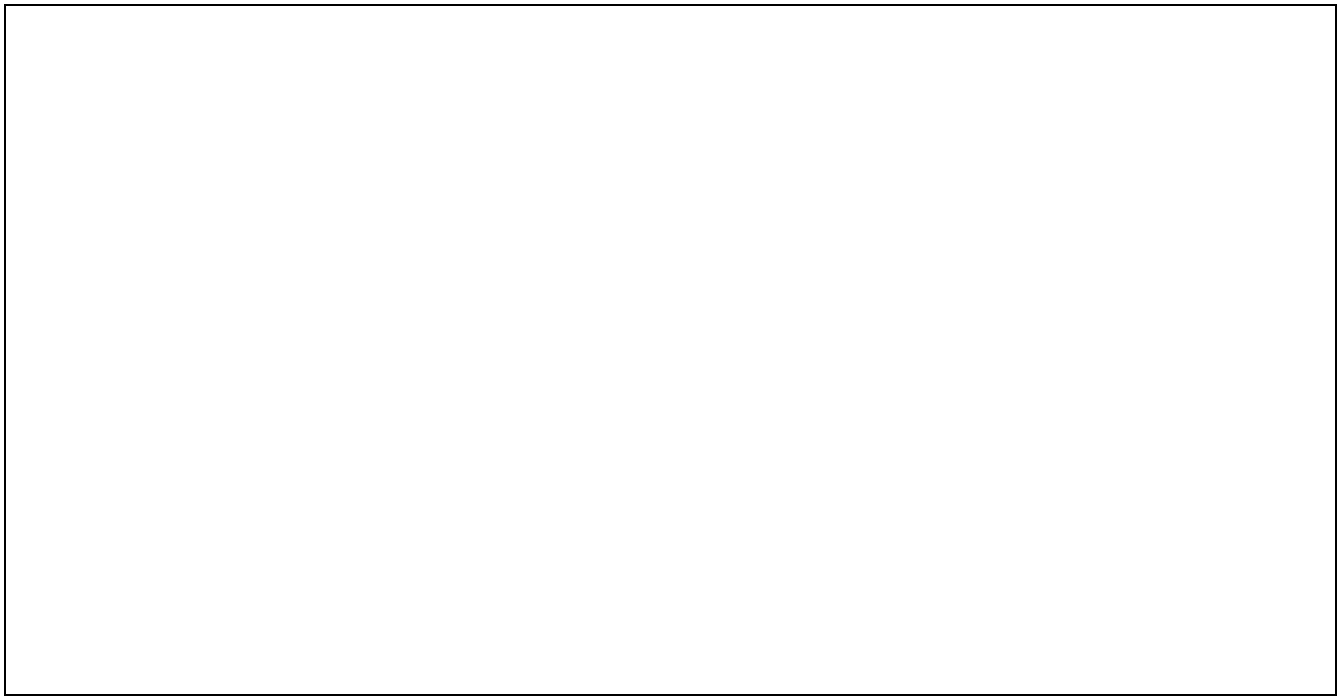


Figure 6.1a

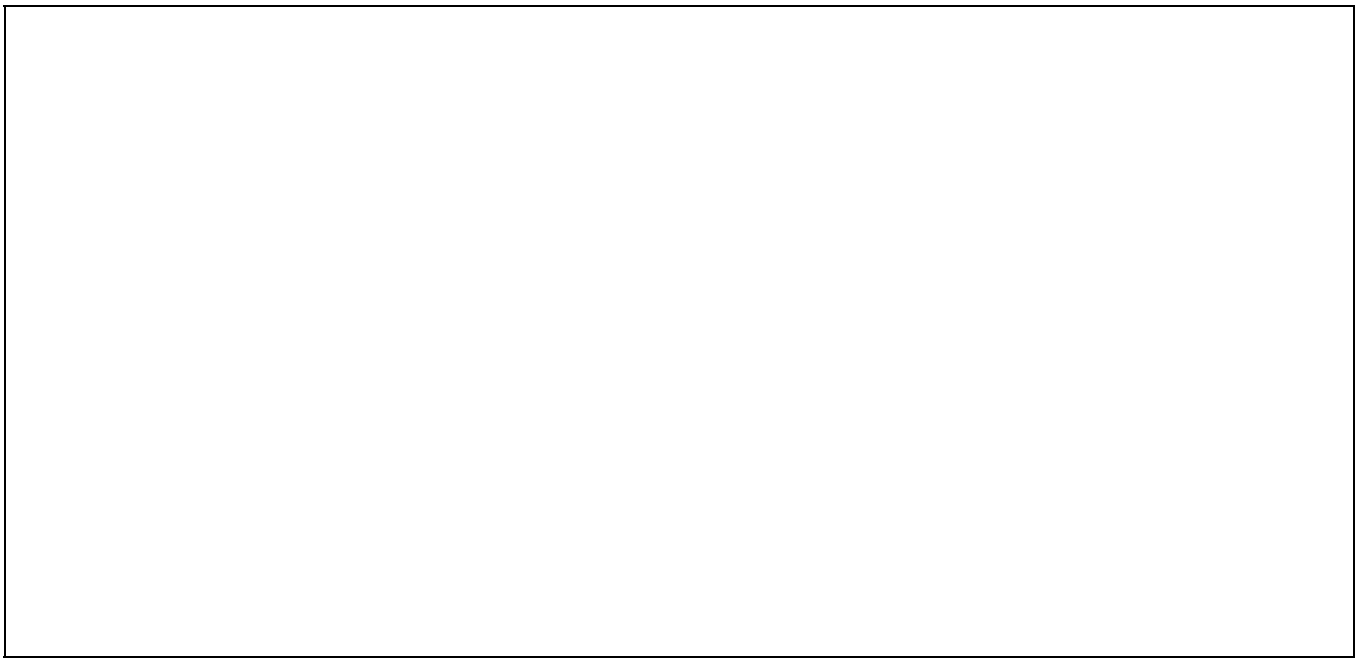


Figure 6.1b

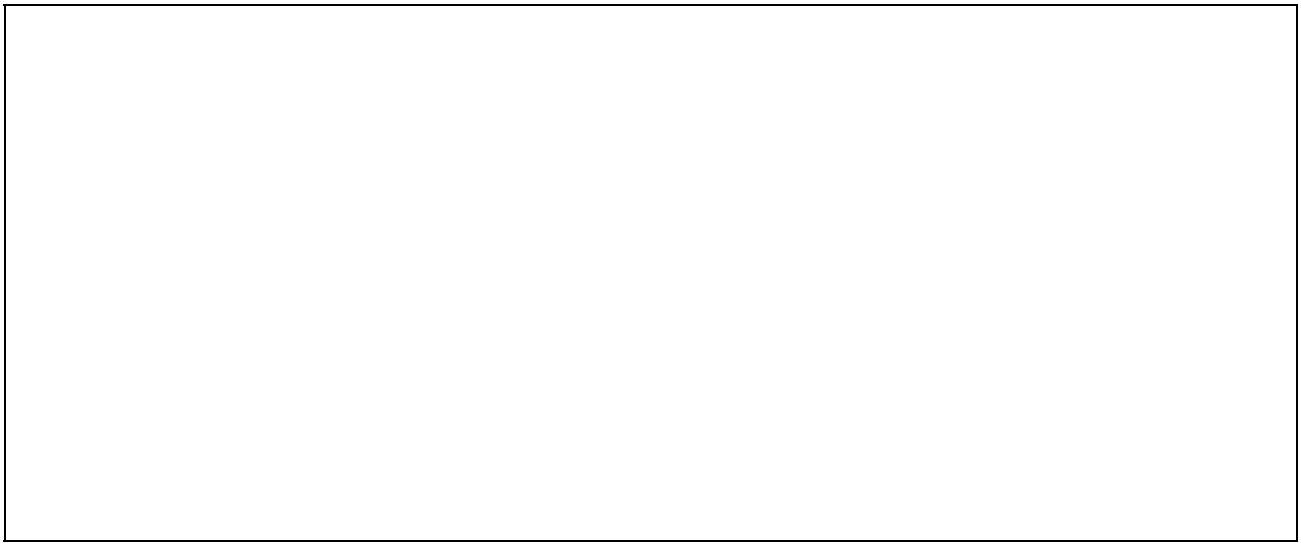


Figure 6.1c - 7210-7220 Wiring and Grounding Details

6.2 GROUNDING

Grounding the 7210/7220 Railroad Scale is very important for several reasons one of the most important is **safety** . Every device of this type, connected to electrical power lines, must be grounded to protect the operator and others that come in contact with it.

Grounding will also help the scale to be more stable, operate more accurately and be troublefree. A good ground system used in conjunction with the surge protection kit will minimize the probability of damage due to electrical surges due to various causes. (See Figure 6.1).

6.2.1 ESTABLISHING A PROPER GROUND

1 One of the very best grounds available is the concrete reinforcing bars in the pit or foundation. The bards form a grid consisting of longitudinal and transverse reinforcing bars tied together with #16 wire tied extending the full length and width of the foundation and is connected to the load cell mounting plates through the anchor bolts. The bars have a very large surface area

and the concrete below the surface of the earth will maintain a high concentration of moisture. All anchor bolts will be in contact with the foundation reinforcing bars. All of these factors contribute to a very effective low resistance ground connection.

2. All of the component parts of the scale must be connected together with wired, metal consult, or metal frame to form a continuous metallic low resistance path capable of shunting unwanted stray electrical currents to ground. The use of several ground rods, with their comparatively high resistance to ground is not recommended and will introduce unwanted electrical currents into sensitive parts of the scale system causing component damage. See Mettler Toledo Scale's 'Lightning Protection Guide' for further details.

3. Rigid metal conduit buried in a trench along with 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. It also keeps the cable dry and the #6 copper ground wire provides a good ground connection between the instrument and the scale components in the pit. PLASTIC PIPE MUST NEVER BE USED FOR LOAD CELL CABLES.

7.0 CALIBRATION

A known test weight or weights must be used to calibrate any scale used for commercial purposes. As most railroad scale test cards are owned by the railroads, it will be necessary to contact the serving railroad to secure the use of their test car to test and calibrate the scale. The minimum test weight that can be used for calibrating railroad scales is 30,000 pounds. Actual test weight and testing procedure will vary with the serving railroad and should be secured from them.

The most common test car presently in use by most railroads weighs 80,000 pounds. The cars usually have a very short wheel base, about 7 feet and are very useful for sectional scale testing. The cars usually have two axles and only manual brakes. The very short test cars must be pulled on the rear of the train and only at a very slow speed, about 25 MPH. Because of this, cars must be scheduled several weeks in advance of the time when they will be needed. Also, most railroads insist that only their people operate their test cars (See Figure 7.1).

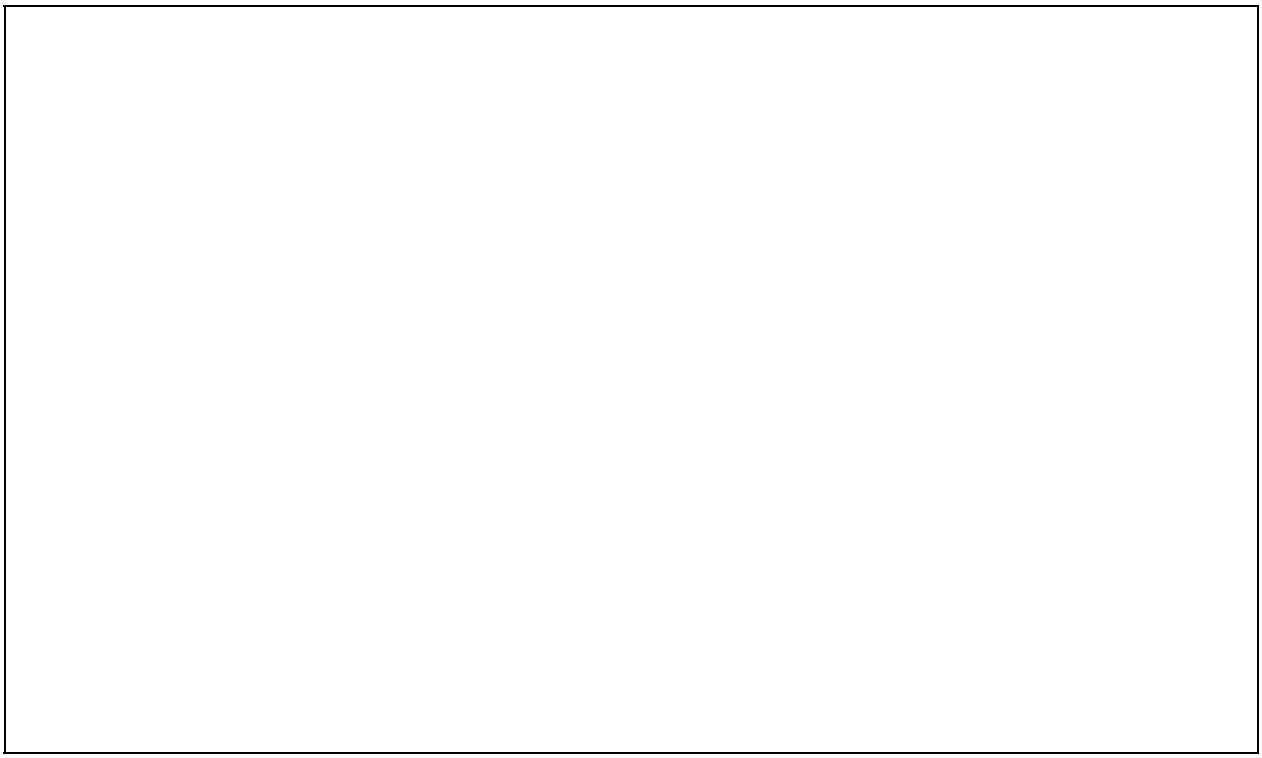


Figure 7.1 - Testing Scale Calibration Using Small Car Test

Some test cars are specially constructed. The car may be self-propelled with a small engine that also lifts the car with hydraulic cylinders. The cylinders allow the weight of the car to be concentrated on a short length of the track. These special cares are more conventional and easier to transport from one location to another. It is also important that this type of car to be operated by qualified railroad personnel only (see Figure 7.2).

There are several methods used to move the test car other than the self propelled type) when testing and calibrating railroad scales. The car can be moved by one person using a special hand operator lever. This process is very slow and very difficult and is usually considered the last resort. The preferred method is to secure the use of a small switching engine and operator. Other methods that can be used are less desirable, but sometimes the only means available. Some locations will have car pullers. They are arrangements of cables and pullets used with a winch or a capstan. They should be used very carefully as the cable can whip around and cause damage or injury. Again, it must be used with extreme caution.

In every case it will be necessary to make arrangements ahead of time to have some means of moving the test car.

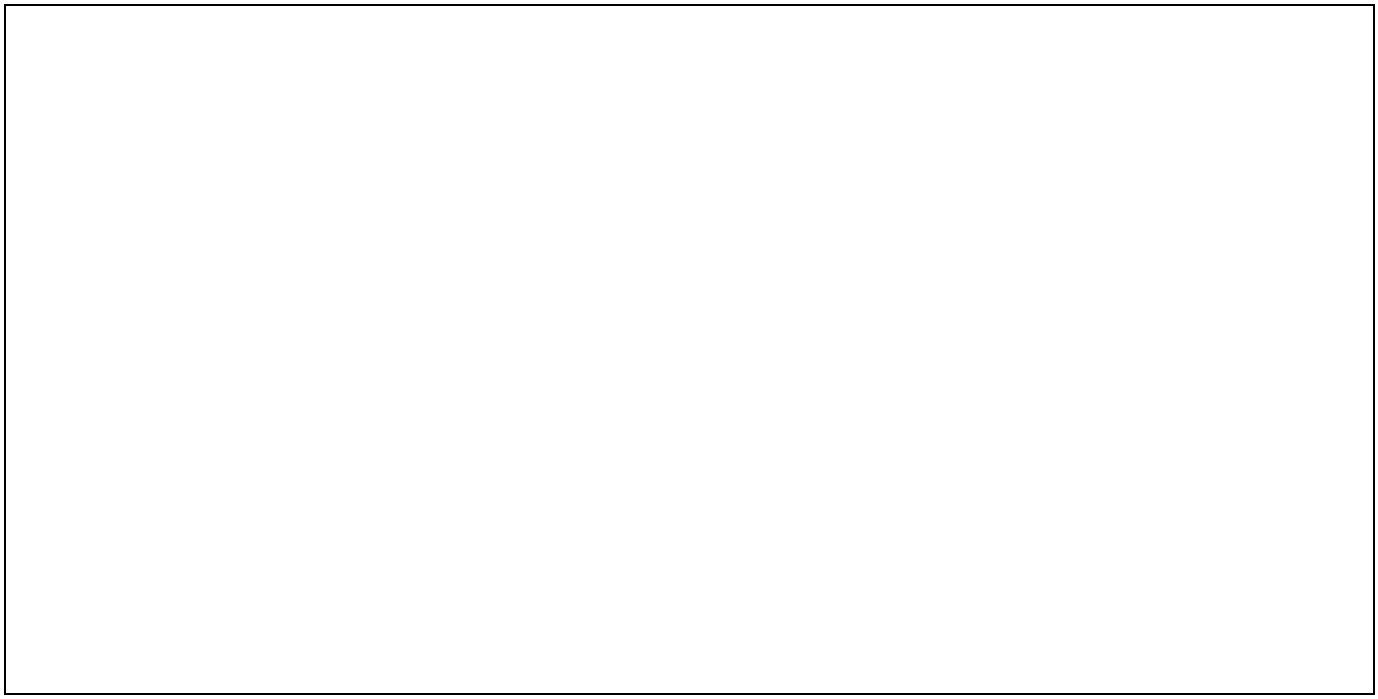


Figure 7.2

1. Before final scale testing and calibration is started, it is recommended that rail traffic consisting of at least 6 fully loaded cars be passed over the scale in both directions to allow all parts of the scale to take their normal operating position.

2. A Mettler Toledo Scale cell simulator can be used for preliminary scale adjustment. THIS IS NOT A SUBSITUTE FOR CALIBRATED TEST WEIGHTS, but the simulator can be used before the test car to save considerable time bringing the scale within a few graduations of the correct reading. Approximate agreement between simulator and actual indicated results will assure that the major component parts of the scale are functioning correctly.

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

   DO NOT LEAVE THE TEST CAR ON PLATFORM FOR MORE THAN TEN MINUTES.

4. Check for shift error. To do this, record the test car weight with the center as near as possible over each pair of load cells as shown in Figure 7.1. This reading should be within one graduation (50 pounds).

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

   Divided the test weight in pounds by the error weight in pounds. Multiply the test weight in pounds by the error weight in pounds. Multiply the resultant by the load cell resistance (775 ohms). The product will be the value in ohms of the trim resistor to be places across each load cell output of each section that is to be adjusted.

   $$\frac{\text{TEST WEIGHT}}{\text{ERROR}} \times \text{LOAD CELL RESISTANCE} = \text{TRIM RESISTOR}$$

   EXAMPLE:
   Test weight 80,000 lbs Error weight 50 lbs.
   Load cell resistance 775 ohms.

   80,000 divided by 50=1600
   1600 x 775 = 1,240,000 ohms
   Use 1.2 Meg ohms or 1 Meg ohms.

   EXAMPLE:
   Test weight 80,000 lbs Error weight 100 lbs.
   Load cell resistance 775 ohms.

   80,000 divided by 100=800
   800 x 775 = 620,000 ohms
   Use 600,000 ohms.

   Note: Round off resistance to nearest available value.

   Solder the trimming resistors in the junction box. Make sure they are secure and then repeat the shift test to confirm that resistors were selected correctly.

   Because the full force of the test weights cannot be concentrated on one load cell or a pair of load cells the results of the adjustment will not be as predictable as desired. Thus it may be necessary to repeat the steps several times to get the results needed.

   When working inside the junction box while trimming the load cells for instance, remove the cover only long enough to perform the necessary adjustments, then replace the cover immediately. Take every precaution to keep the box dry at all times.

5. SPAN CALIBRATION
   a. If a summing module is used follow the calibration instructions supplied with the instrument.
   b. If not already done, set approximate span with a load cell simulator.
   c. Place test car on scale rails and adjust electronic instrument to read the exact weight of the car.
   d. Remove the test car and check zero.
   e. If more than one test car is available for calibration use them to calibrate the scale to the maximum weight possible.

6. LINEARITY
   The extent of linearity testing will dependent on the number and type of test cars available. If two cars of different weights are available they can be used separately. Their weight can then be totaled and should agree with the sale reading within one tenth of one percent.

7. After calibration is complete the junction box should be carefully sealed against moisture. Place the dehumidifier package in the box. Make sure the desicant is in an active (dry) condition. Apply sealing grease provided, to both sides of the gasket and assemble the gasket to the cover. Attach the cover to the box,

making sure that the grease does not become contaminated. Tighten all cover bolts securely. **Be careful ,that the bolts are not over tightened as this could warp the cover and force the gasket out of place.**

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

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

8. OPERATING CONSIDERATIONS
   Gross errors can occur if the car is not located fully on the scale. It is advisable to paint live rails with a highly visible paint, perhaps phosphorescent paint, to eliminate weighing errors due to this problem.

   Consult an A.R.E.A. manual for guidelines for good operating practice. Make sure that the scale is free of accumulated snow, ice and spilled product at all times.

8.0 APPENDIX A - SCALE SELECTION

The Model 7210/7220 Railmaster permits flexibility in application which is not possible with conventional designed. Selection of the proper combination of single and double scale units is dependent upon the manner in which the scale is to be used. The following is a guide to determine the “range” of cars which can be weighed on the Single-Single, Single-Double, and the Double-Double scale configurations.

It should be noted that if the levelness of the scale and approaches is maintained, a car of any size can be accurately two-draft weights on either the single or the double scale unit. If the operation permits, the scale should be specified on the basis of the majority of car sizes to be weighed, with the occasional off-size car being two-draft weighed. This will assure the best economic package for the application.

Range: The key element in the following diagrams is the **range** of car sizes to be weighed. The **range** must be specified in terms of the **difference** between the truck-to-truck center distance of the longest car (max.) to be weighed and the truck-to-truck center distance of the shortest car (min) to be weighed. Overall length of the cars is not important. The information below each diagram specified the widest range of car truck-to-truck center distances which can be weighed on the single-single, single-double and double-double combinations.

“B” Dimensions: The Railmaster scale is installed by setting the scale units separated such that the shorted car to be weighed will fit on the scale platforms. A “B” dimension (see diagram) equal to the distance between the inside axles of the smallest car to fit on the platforms. The inside axle spacing is equal to the minimum truck-to-truck center distance (min.) less 1/2 the truck axle spacing (A) at each end or,

$$B + MIN - 1/2A - 1/2A = MIN - A$$

In the diagrams an extra one foot has been allowed to permit leeway for car positioning...

$$B = MIN - A - 1'$$

The B Dimension determines both the separation of the scale units and the length of dead rail between the units.

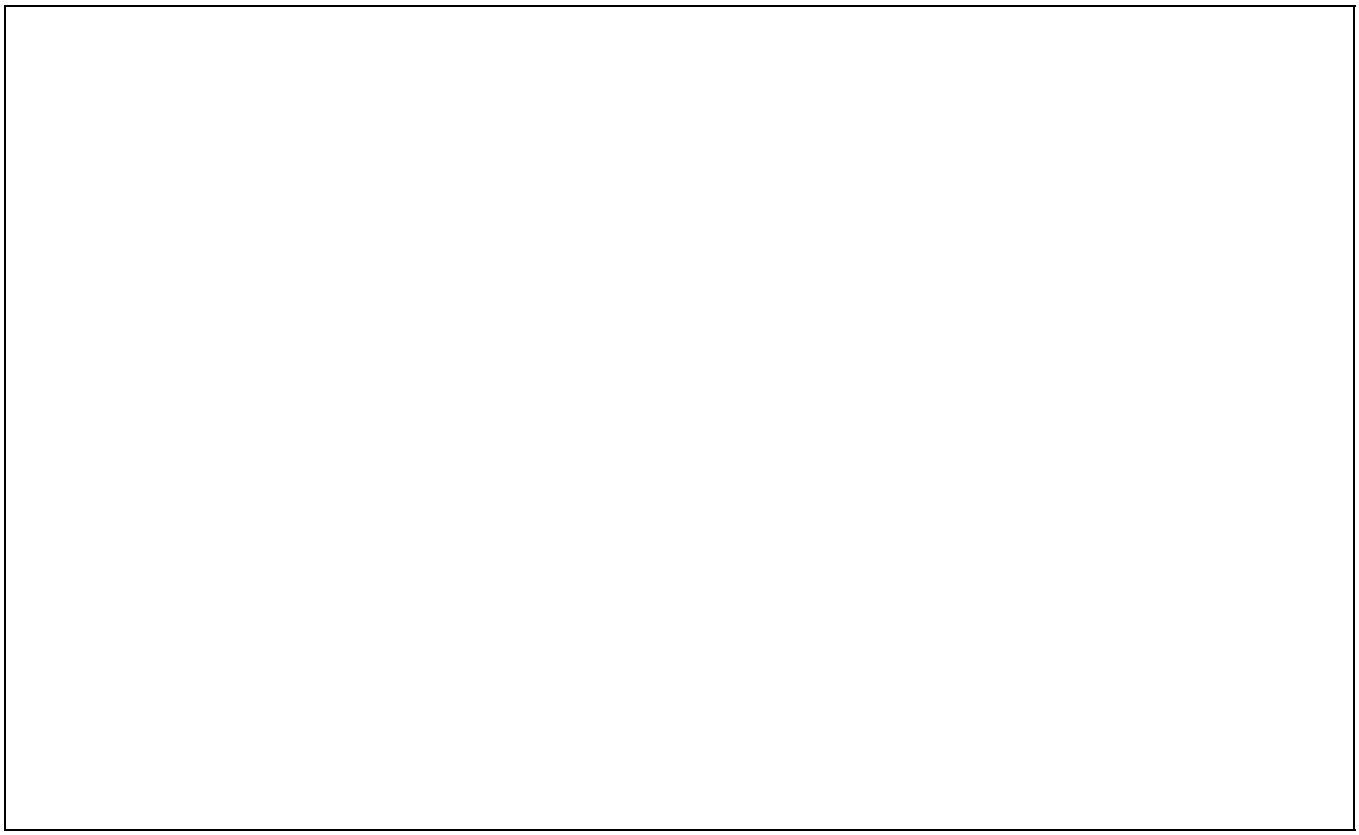


Figure A.1 Single Unit - Double Unit

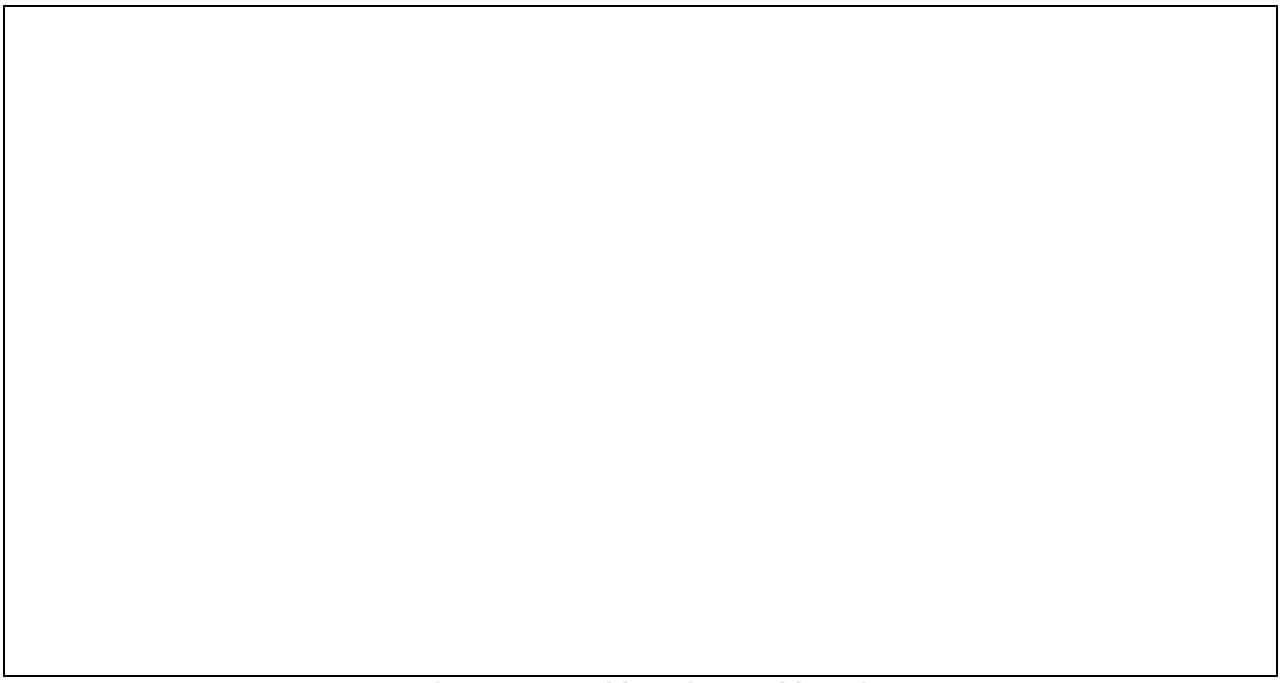


Figure A.2 Double Unit - Double Unit

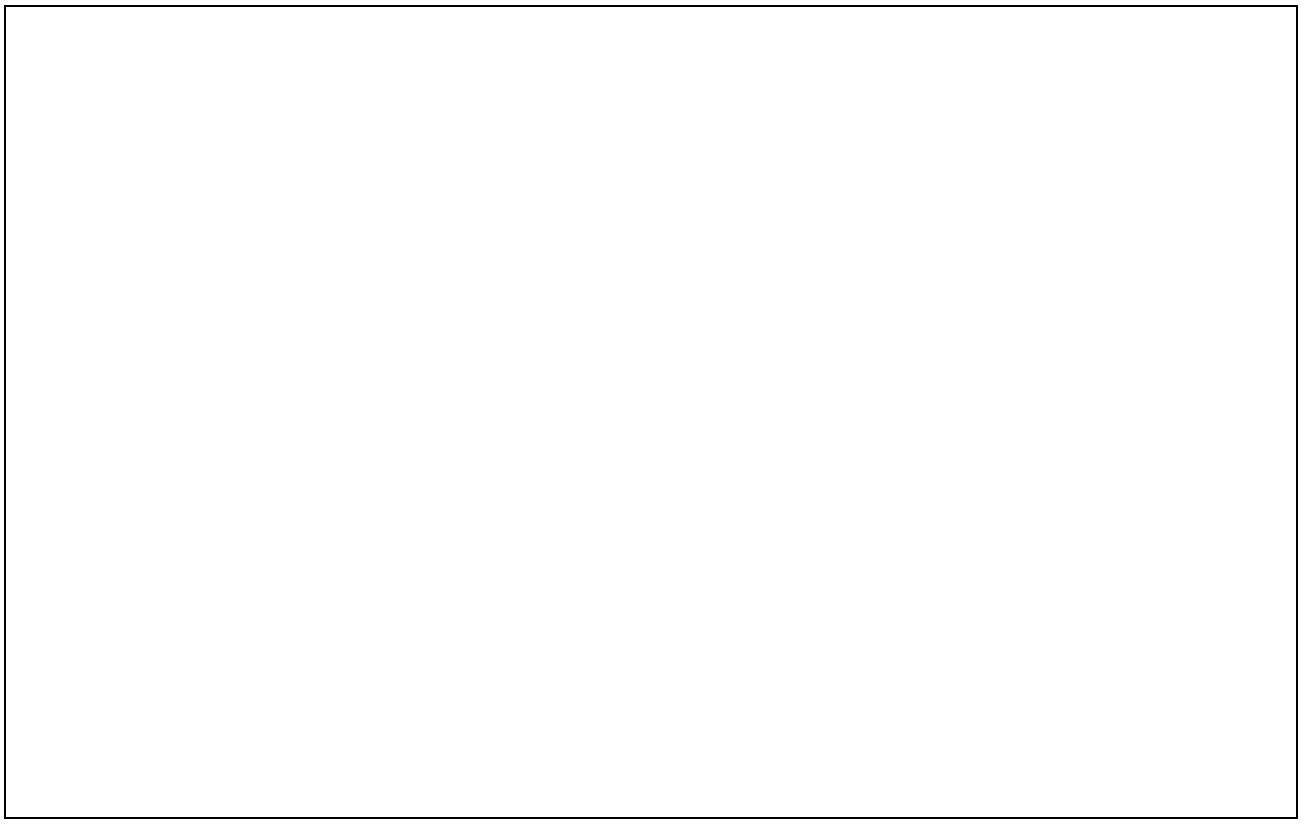


Figure A.3 Single Unit - Single Unit

9.0 APPENDIX B - 7210/7220 INSTALLATION SCHEDULE

STEP	RESPONSIBILITY PER CONTRACT	EQUIPMENT OR TOOLS REQUIRED
1. Site Selection	Owner, with Mettler Toledo Scale recommendations and W&M Approval	Plans, Drawings for scale and proposed site.
2. Pit Construction 1. Excavate 2. Lay Stone (if needed) 3. Form Pit Floor 4. Place Rebars 5. Pour Concrete 6. Form Pit Walls 7. Pour Concrete 8. Cure Conrete**	Contractor	Back Hoe Forms Hand Tools Concrete (See Chapter 4)
3. Load Cell Installation	Mettler Toledo Scale/Distributor or Contractor	Hand Tools (See Chapter 5)
4. Install Weighbridge	Contractor	Crane (See Chapter 5)
5. Rail Installation	Contractor	Rail Tools, Rail Saw, Rail Drill (see Chapter 5)
6. Connect Wiring Wire L.C. to Junction Box and to instrument	Mettler Toledo Scale/Distributor or Contractor	Hand Tools (See Chapter 5)
7. Calibration	Mettler Toledo Scale/Distributor	Rail Test Car(s) (See Chapter 5)
8. Approval	Weights and Measures Mettler Toledo Scale/Distributor	Rail Test Car(s)

Each step must be complete 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 fir calibration.

10.0 APPENDIX C

Bolt and Wrench Sizes and Tightening Specification			
BOLT LOCATION	**100,000 lb LOAD CELLS**		
	Bolt Size	**Wrench Size**	**Tightening Method**
Shoulder Bolts	3/4	3/8*	Turn-of-Nut** (half turn)
Top of Load Cell (A325)	3/4	1-1/4	Turn-of-Nut (half turn)
Bottom of Cell (Grade 8)	3/4	5/8*	Turn-of-Nut (half turn)
Anchor Bolts (A307) (Grade 2)	7/8	1-15/16	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 the '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 impact of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, all bolts in the connection shall be tightened additional one half turn (except the A307 bolts which shall be one quarter turn), with tightening progressing systematically from the most rigid part of the joint to its free edges. During the operation there shall be no rotation of the part not turned by the wrench.

11.0 APPENDIX D - LOAD CELL CHARACTERISTICS

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

Function	**J-Box Terminal Designations**	**Six (6) Conductor Load Cell Cable Color Code**	**Internal Resistance Measurement (ohms)**
Plus (+) Signal	1	Green	775 ± 5 Green to Black
Minus (-) Signal	2	Black	
Plus (+) Excitation	5	White	825 ± 35 White to Blue
Minus (-) Excitation	4	Blue	0 Ohms Yellow to White or
Plus (+) Sense	6	Yellow	Blue to Red
Minus (-) Sense	7	Red	
Shield	3	Orange	

There is a jumper on the load cell between the white wire and the yellow wire and the blue wire and the red wire.

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 interconnected cable is small enough that it will not affect the above readings.