

MWP - MOBILE WEIGHING POINT

INTRODUCTION

The REVERE TRANSDUCERS on-board frame mounted truck weighing system is a highly advanced electronic measuring device. Weight is “sensed” by MWPs, mobile weighing point load cells, that are mounted between the body and the truck or trailer frame. These rugged load cells are strong enough to provide years of reliable service, yet are sensitive enough to detect a change in weight of just a few kilograms.

It is extremely important to follow these installation guidelines and use the specified materials to ensure that the completed assembly will maintain its high strength for maximum safety. It will also result in minimum installation costs, high accuracy and long life for your weighing system.

WARNING: *Failure to follow these instructions could cause hazardous operating condition.*

Upon completion of the MWP installation, you will need to install a weight indicator and calibrate the weighing system (calibration is simply an electronic adjustment of the weighing system to compensate for minute installation variations). Corner correction or balancing may be required at calibration. This means taking into account any slight differences in the load distribution per corner, or load cell, and making adjustments for this. Complete instructions for these procedures should be found in the operator’s manual included with your indicator.

An installation checklist has been provided on the back cover of this application note. Refer to it during installation and check off the important steps as they are completed.

NOTE: **Please refer installation questions to the company from whom you have purchased your MWP load cells.**

1 WEIGHING SYSTEM OVERVIEW

Revere Transducers’ Mobile Weighing Points are ideal for industrial weighing applications and suitable for measuring either gross vehicle weight or the weight of cargo being loaded or delivered. The basic weighing system consists of load supporting transducers (load cells), an electronic meter (indicator) capable of being calibrated to display the weight in convenient units (kg or t) and electrical cabling connecting the load cells and indicator (see Figure 1).

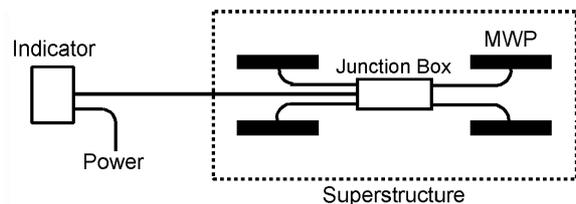


Fig. 1: MWP on-board weighing system

This application note is primarily concerned with installation of the load cells and cables. Please refer to the appropriate owner’s manual for the proper installation and use of the indicator.

Optimum truck weighing performance is obtained when the load cells are installed between the load-carrying superstructure (box, tank, flatbed, etc.) and the vehicle chassis and carrying the entire weight of the superstructure and payload. No weight supporting structure other than the load cells, such as braces or gussets, should attach the superstructure to the chassis, as this will result in an alternate load path which will degrade the accuracy of the weighing system.

Typical applications include: dump bodies (tippers), tankers, flat beds and van type superstructures mounted on either truck chassis or trailers.

1.1 INSTALLATION TYPES

Truck installations generally support the superstructure and payload with load cells mounted directly to the truck frame (see Figure 2).

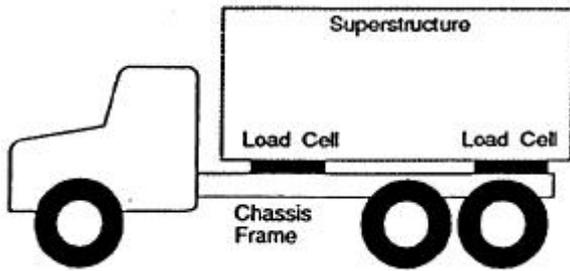


Fig. 2: MWP truck installation

A **trailer installation** is usually accomplished by separating the rear suspension subframe from the trailer frame and installing load cells between these two structures (see Figure 3).

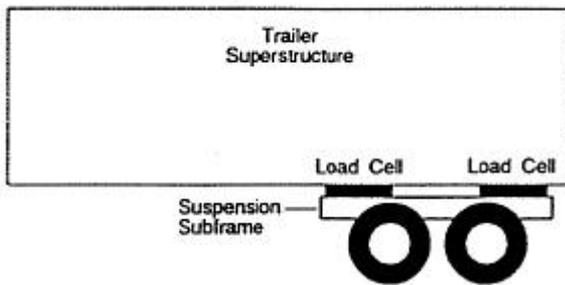


Fig. 3: MWP trailer installation

NOTE: Other related applications not covered in this application note include tractor mounted 5th wheel weighing systems, trailer mounted kingpin plate weighing systems, pivot mounted dump body weighing systems and light duty installations for agricultural feed wagon weighing systems.

1.2 MOUNTING STYLES

Two basic mounting styles are used for installing frame mounted on-board weighing systems: the in-line mount and the outboard mount.

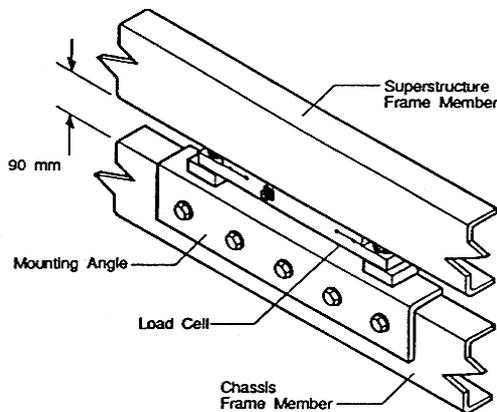


Fig. 4: In-line mounted load cell

An **in-line mounted load cell** is simply installed between the flanges of the upper and lower frame members and aligned with those frame members.

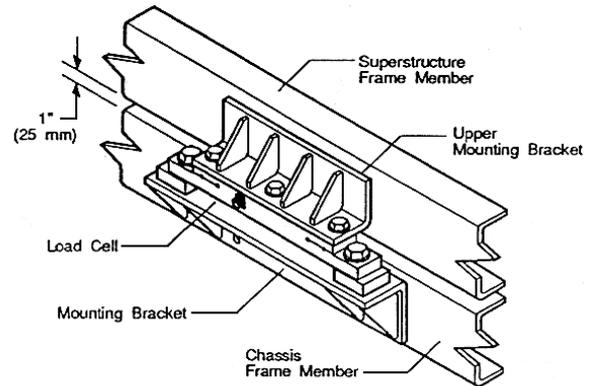


Fig. 5: Outboard mounted load cell

An **outboard mounted load cell** is installed along side the frame members using brackets located outboard of the frame members. Details of bracket construction for each style and load cell type are included in the appendix on page 8 of this application note.

Considerations such as available space, tyre clearance and restrictions for overall vehicle height will generally determine which mounting style will be used. The following table illustrates the features of each mounting style:

In-line mounting	Outboard mounting
Used when outboard clearances with tyres or suspension are limited	Requires space for load cell installation outboard of chassis
Requires only one mounting bracket per load cell	Requires an upper and lower mounting bracket per load cell
Will raise the overall vehicle height approximately 90 mm (3½") unless frame is recessed (see illustration on page 3)	Will raise the overall vehicle height approximately 25 mm (1")
Mounting holes for the load cell must be added to the frame structure	Mounting holes for the load cell are located in the mounting brackets

The most common method for load cell mounting is to position the load cell so that the mounting blocks are underneath the load cell. However, installation can sometimes be simplified by inverting the load cell and installing with the mounting blocks above the load cell, especially when combined with the outboard mounting style.

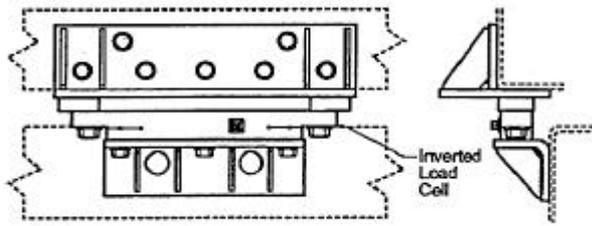


Fig. 6: Inverted installation

1.3 ACCURACY AND PERFORMANCE

Three factors that can affect the accuracy and performance of the weighing system are:

1. **Maximum weight supported by the load cells.** The load cell's rated capacity indicates the maximum load for each load cell while the vehicle is moving at speeds greater than 8 kmph (5 mph). Possible effects of shock loading should always be taken into account, especially when the vehicle is travelling on rough road surfaces.
2. **Cantilevered loading of load cells.** Locate load cells within 1 m (3 ft) of the end of the superstructure, if possible, to avoid overhanging loads. This not only provides for a stronger structure, but can avoid potential accuracy problems.

2 SUPERSTRUCTURE PREPARATION

Load cell mounting brackets are generally attached to the superstructure by means of welding. In order to provide for the mounting of load cells and mounting brackets (to be illustrated in a later section), some modification to the superstructure may be required. The modifications may be as simple as providing a flat surface for bracket welding or may be as extensive as providing a recess in the underframe for the mounting of the load cells.

Modification to the superstructure will vary according to the specific type of installation to be performed; whether it is for a trailer suspension subframe assembly or for truck frame mounted systems supporting entire payload carrying superstructures. Outboard mounted load cells may only need space to weld or bolt load cell mounting brackets, while an in-line mounted load cell system will need holes drilled in the underframe of the superstructure for the load cell mounting bolts.

When making modifications to a structure, care must be taken to ensure for both strength and rigidity (stiffness) of the finished installation. Every structure will deform (bend, twist or sag) a certain amount when carrying a load. The installer must ensure that the modified structure is strong enough to prevent not only permanent deformation, but also to limit the

amount of non-permanent (elastic) bending so that upper structural elements will not contact lower elements and create an alternate load path around the load cells. Excessive frame bending can be prevented by either adding a "glove" to the frame or by adding additional load cells in that area for more support.

2.1 FRAME STIFFENERS

If the frame section above the load cell is an open section, such as a channel or "I" beam, web stiffeners are required to avoid frame twist (see illustration below). The stiffeners are located near the ends of each mounting block for inverted load cell mounting or between the mounting holes for load cells installed with the mounting blocks beneath the load cells.

2.2 RECESS MOUNTING

Often the most practical method for installing on-board frame mounted weighing systems (particularly with an in-line mounted system) without an undesirable height increase of the trailer or body, is to provide a recess in the superstructure underframe. A general recommendation for this approach is shown in the following illustration. **The installer should ensure that any modified structure will retain the strength and stiffness properties of the original structure.**

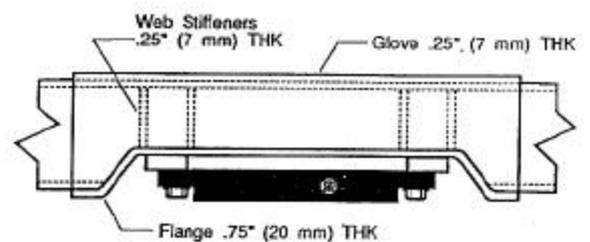


Fig. 7: Recess mounting

2.3 ALIGNMENT

Because the installation of on-board weighing systems involves the eventual separation of the superstructure from the supporting frame, care must be taken to ensure the separated elements are reinstalled in the proper alignment. Marking the relative positions on the frame elements before separation is an effective means of assuring proper realignment. Also ensure the straightness of frame elements when cutting or welding to prevent undesirable bending or warping during modification. The use of a simple temporary stiffener (stiff-back), welded into place prior to modification, is effective for this purpose.

2.4 MOUNTING STRUCTURE

Optimum performance of the weighing system is dependent upon a solid mounting base for the load cells. Brackets of heavy construction (usually 16mm (5/8") thick steel) are required. Since this is a thicker section than usually found on trucks and trailers, a cover plate may be necessary to evenly distribute forces to avoid stress concentrations and possible cracking in the thinner sections of the superstructure.

Locating load cells in the immediate vicinity of crossmembers or other frame strengthening/stiffening elements to provide maximum support, is also important for providing a structurally sound installation as well as a reliable on-board weighing system.

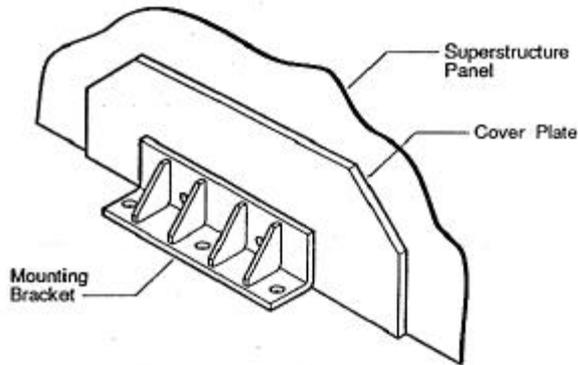


Fig. 8: Mounting bracket with a cover plate

When separating the superstructure from the supporting frame, be careful when re-routing hoses, air lines, fuel lines etc. Some of these items may need to be replaced by longer ones to prevent secondary load paths which cause poor performance of the weighing system. These items are also susceptible to damage if they are not of sufficient length to allow for frame separation or are not properly protected at installation.

Upon completion of the weighing system installation, look closely at all elements of the mechanical installation to avoid problems with pinched wires, ruptured hoses etc., especially during the first operation of any moving structure such as a dump body.

3 FRAME PREPARATION

Load cell mounting bracket installation methods differ depending upon whether the supporting structure is a truck chassis or a trailer suspension subframe. Truck frames are manufactured from heat treated high strength steel, requiring load cell mounting angles or brackets to be bolted to these frames. Trailer subframes, however, are not heat treated and mounting brackets can be welded to these frames.

CAUTION: Review truck or trailer manufacturer's recommendations before welding to or drilling in frame.

3.1 BOLTING REQUIREMENTS:

The structural requirements for the load cell mounting brackets are affected by the actual weight being supported by the load cells and by dynamic service factors caused by road conditions. Bolted

load-carrying brackets are susceptible to slippage if the proper number of bolts are not used or if the bolts are not tightened to the recommended torque. Use the following table to determine the proper number of bolts for bolted installations. Refer to the table on page 7 for the recommended torque values when tightening.

No. of bolts used	Maximum load on load cells	
	Highway use only	Rough road use
5	6000 kg	3000 kg
6	Not required	4000 kg
7	Not required	4500 kg
8	Not required	5500 kg
9	Not required	6000 kg

For in-line installations, use the bolting recommendations for highway use regardless of road conditions.

3.2 FRAME RAIL INSPECTION

Inspect the frame rails to ensure they are clean, straight and free of cracks, corrosion, pitting, burrs or any other imperfections that may affect the installation and fit of the mounting angles/brackets or the strength of the frame.

3.3 MOUNTING BRACKET INSTALLATION

Set the mounting angles (for in-line installations) or mounting brackets (for outboard installations) in place on the frame rails. Determine if and where they must be cut or contoured to allow clearance for existing bolts, rivets, spring hangers etc. on the frame. Mark these locations on the mounting angles/brackets, allowing for a minimum 25 mm (1") radius – no sharp corners. Remove angles/brackets, trim as required, and grind edges smooth.

NOTE: It is not necessary to cut-out load cell mounting angles and brackets for easily moved items such as fuel tanks, battery boxes etc. These items are simply repositioned or spaced out to allow for the added thickness of the load cell mounting angles/brackets.

Clamp the mounting angles/brackets tightly to the frame. Be sure that the clearances and cut-outs are correct. Locate and drill holes per the recommendations in the table above and bracket drawings in the appendix on page 8 of this application note.

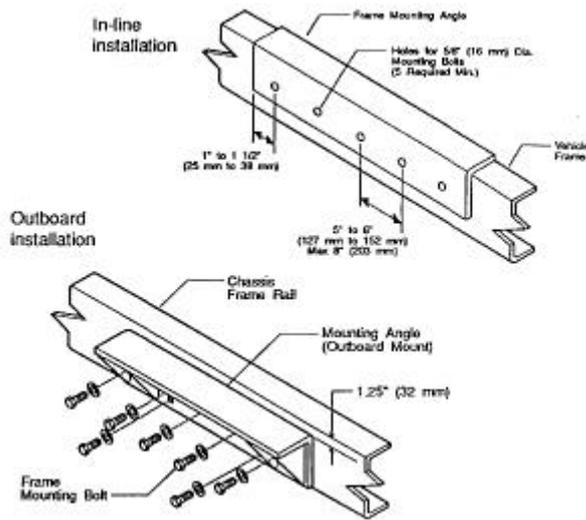


Fig. 9 Mounting the brackets

NOTE: Bolt holes in mounting structures must be drilled, not burned. Holes should not be oversized more than 1 mm (1/32") to ensure a snug fit for bolts.

Use a minimum of 5 bolts per mounting angle or bracket. Also locate bolts within 25 mm to 38 mm (1" to 1½") of each end of the mounting angle/bracket. Do the same for the edge of each cut-out deeper than 25 mm (1").

Attach the mounting angle/bracket using ISO/DIN grade 10.9 quality bolts and lock nuts and a hardened washer under each lock nut. The bolts must have a diameter of 16 mm minimum and sufficient length to provide a minimum of 3 threads past the end of the lock nut. Tighten all bolts to the proper torque value listed in the table on page 7.

When welding brackets to non-heat treated frames, use a low hydrogen process and AWS E7018 rod or equivalent (see EN499).

Check the lengths of all connections for items that have been moved during the installation of the mounting angles/brackets. These connections may include battery cables, fuel lines, air lines and electrical cables.

4 FINAL SYSTEM ASSEMBLY

Assemble upper mounting brackets to the load cells using the bolt kits provided (for in-line mounted systems where the load cells bolt directly to the upper frame structure, simply mount the load cell assemblies to the upper frame). Make sure bolts are of the proper length and do not bottom out in the tapped holes. If the mounting bolts are too long, damage to the load cells is possible. A dangerous

operating condition could exist if the bolts are not secure. A minimum thread engagement of 16 mm (0.6") is required on all bolted connections. Refer to the bolt tightening table on page 7 for the recommended bolt tightening torque. If using the in-line mounting technique, skip to the first paragraph on the following page.

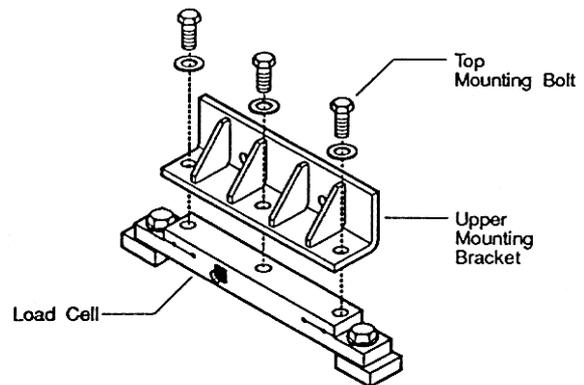


Fig. 10: Assembly of MWP and brackets

The load cell / upper mounting bracket assemblies are now ready to be installed on the superstructure. To do this, place temporary spacers, usually 20 mm (1" if using imperial plate), on the vehicle frame to provide the proper spacing between the superstructure and the vehicle frame. Lower the superstructure onto these spacers. Be sure to check the superstructure for proper alignment with the vehicle frame.

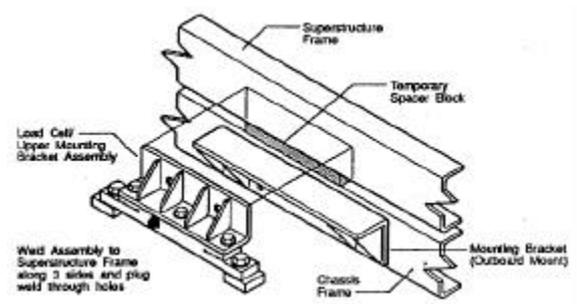


Fig. 11: Outboard assembly

Place the load cell assemblies on the vehicle frame mounting brackets which were installed in **Frame Preparation**. Adjust the load cell assemblies into their final position, verifying fit and clearances with the superstructure. Bolt or weld upper mounting bracket securely to superstructure using a low hydrogen process and AWS E7018 rod or equivalent (see EN499). **DO NOT WELD MOUNTING BLOCKS YET.** See CAUTION in 4.1 before proceeding with welding. Lift the superstructure and remove the temporary spacers.

The superstructure with the load cell assemblies attached is now ready to be secured to the vehicle frame mounting angles/brackets. Lower the

superstructure so that the load cell mounting blocks sit in the proper position on the vehicle frame mounting angles/brackets. Check for proper alignment between the superstructure and vehicle frame and check all mounting blocks for contact with the frame mounting angles/brackets (shim any gaps greater than 1.5 mm (1/16")).

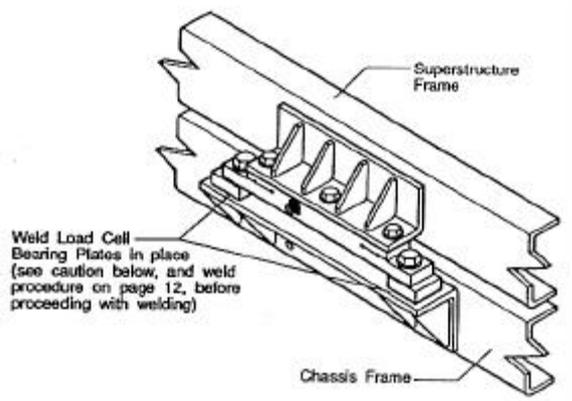


Fig. 12: Positioning before welding

4.1 MOUNTING BLOCK WELDING

CAUTION: Please read the following welding procedures completely before proceeding. The welding of the mounting blocks is the most crucial step in the installation process.

Take precautions to ensure that the vehicle electrical system is not damaged by the welding. **TO PREVENT ELECTRICAL CURRENT FLOW THROUGH THE LOAD CELL, ATTACH GROUND STRAP DIRECTLY TO THE STRUCTURE ON THE SAME SIDE OF THE LOAD CELL ON WHICH WELDING IS BEING DONE. WHEN POSSIBLE, THE USE OF DUMMIES IS PREFERRED.**

Complete the attachment of the superstructure / load cell assembly in the following order (in accordance with the welding procedures in section 5):

1. Tack weld the mounting blocks to the mounting angles or brackets.
2. Remove slag from tacks and “feather” end of tack with a grinder to provide a smooth transition for the root pass as it passes through tack. Welding can be completed without disassembly of load cells from mounting blocks. Direct electrode away from unprotected underside of load cell.
3. Alternate welds from side-to-side and end-to-end to avoid weld distortion.

5 WELDING PROCEDURE

This procedure has been prepared to guide the welder on the proper method for welding mounting blocks to frame mounting members.

WARNING: All welding, metal working and assembly must be performed by a qualified person using proper tools and safe work habits. When welding, use a procedure which assures a sound, good quality weld. Overwelding may cause distortion and damage; underwelding may not develop sufficient strength.

CAUTION: Take precautions to ensure that the vehicle electrical system is not damaged by the welding. **ATTACH GROUND STRAP DIRECTLY TO VEHICLE FRAME MEMBER (NOT LOAD CELL BODY) TO WHICH THE MOUNTING BLOCKS ARE BEING WELDED TO PREVENT ELECTRICAL CURRENT FLOW THROUGH LOAD CELL.**

5.1 WELDING PROCESS

Use a low hydrogen process and AWS E7018 rod or equivalent (see EN499). The mounting block may be welded using MMA (Manual Metal Arc welding) stick, MIG/MAG (Metal Inert/Active Gas welding) spray transfer or FCAW (Flux Cored Arc Welding). The user should not use MIG/MAG short circuit transfer.

5.2 WELD CONFIGURATION:

The mounting block shall be attached using a multipass fillet weld sequence as shown in the illustration below.

5.3 DEPOSITED WELD METAL FILLET SIZES

The finish multipass fillet assembly shall be a minimum of 13 mm (1/2”) as shown in the illustration below.

5.4 FILLER METAL

The electrode shall be as detailed in the following table:

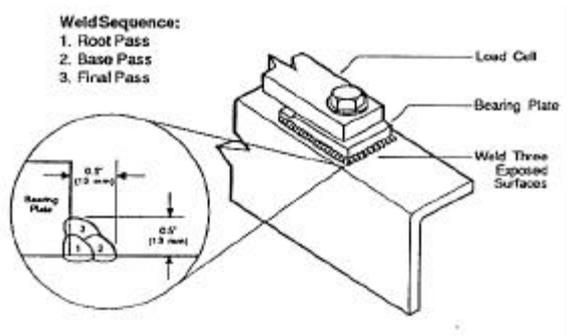


Fig. 13: Weld sequence

5.5 ELECTRODE SPECIFICATIONS

Process	Size	Type	Comment
MMA	1/8, 5/32 or 3/16	E7018 (for equivalent see EN499)	Must be dry
FCAW	.045 thru 3/32	E71T-5 or E70T-5 (for equivalent see EN758)	Gas shielded
MIG/MAG	.035 thru 1/16	E70S-6 (for equivalent see EN440)	Spray transfer

5.6 PREHEAT

The mounting block and the base metal mounting surface shall be warmed in preparation for welding to reduce shrinkage stress. Any suitable torch arrangement is satisfactory. Spot heating shall be avoided. The preheat temperature shall be a MINIMUM of 20° C (70° F) and a MAXIMUM of 65° C (150° F).

5.7 CLEANING BEFORE WELDING

The mounting block will come to the customer ready for welding, except the base and edges of the mounting block shall be visually inspected to verify that there is no oil, grease, dirt, paint or other foreign substance that will reduce the weld quality. The mounting angles shall be surface ground or power wire brushed so as to remove all paint, primer or other surface coating. An area the size of the mounting block plus one inch shall be cleaned and ground to bare base metal.

5.8 INPROCESS CLEANING

Each fillet bead shall be visually inspected with all slag cover removed, before proceeding with the next bead. A stiff wire brush or needle scaler may be used for slag removal.

5.9 FINAL INSPECTION

Long service life depends on quality application of the fillet welds and THE FINAL SIZE OF THE FILLET. There shall be no undercut on either the upper leg (on the mounting block) or the lower leg (frame base metal). Any undercut shall be repaired with an additional fillet or contoured by grinding to

remove the mechanical notch. Visually inspect all weld stops and starts. Weld craters should be filled. All weld stops shall be staggered. A light coat of primer and paint may be applied after final inspection.

5.10 PERIODIC INSPECTION

These primary load carrying fillet welds should be inspected during routine maintenance.

WARNING: Heat from welding may loosen bolts. Therefore, all torque values should be rechecked after installation when all welds have cooled.

6 BOLT TORQUE VALUES

Torque values can vary significantly depending upon the lubricating of threads. The following values are based upon new, clean threads in “as received condition” without additional lubrication. Revere Transducers recommends the use of a thread lubricant, such as Loctite 767 or equivalent, to prevent the seizing of threads over a long period of time. These torque values can be used for bolts with this lubricant without over-stressing bolts.

All bolts all lock nuts are to be grade ISO/DIN 10.9. Use only new bolts and lock nuts.

Application	Bolt Size	Torque (Nm)
Frame mount	M16	210 → 270
Load cell mount	M24	700 → 900
Top load cell mount	M24	700 → 900

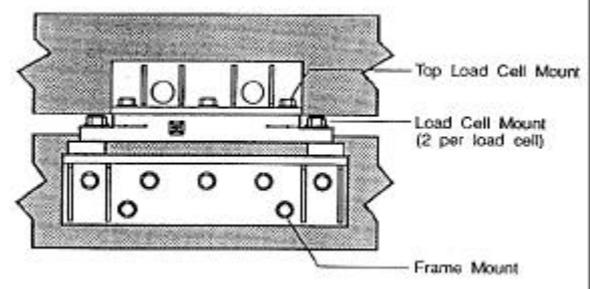


Fig. 14: Bolt positions

7 CABLES

Revere Transducers fits cables to the MWP's, which are specially designed to provide maximum signal strength and high reliability. The screen of the cables is not connected to the body of the MWP load cell. MWP's are supplied with a 11 m (36 ft) cable which, in general, should not be cut. Should this prove necessary please make sure that cables of all MWP's within the same system are cut to the same length. Care should be taken when routing the cable to provide protection from sharp edges, driveline rotation, exhaust pipe or any other potential damage. Secure in place with cable ties to a snug fit.

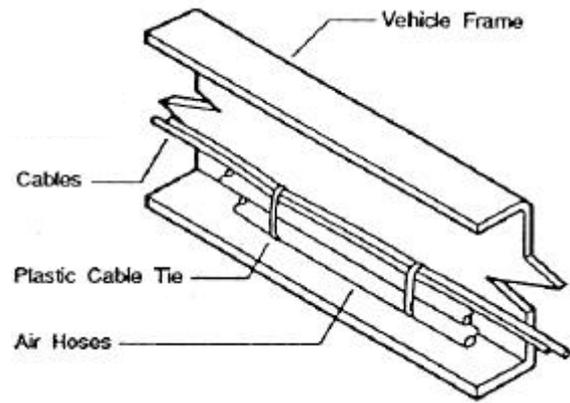


Fig. 15: Cable routing

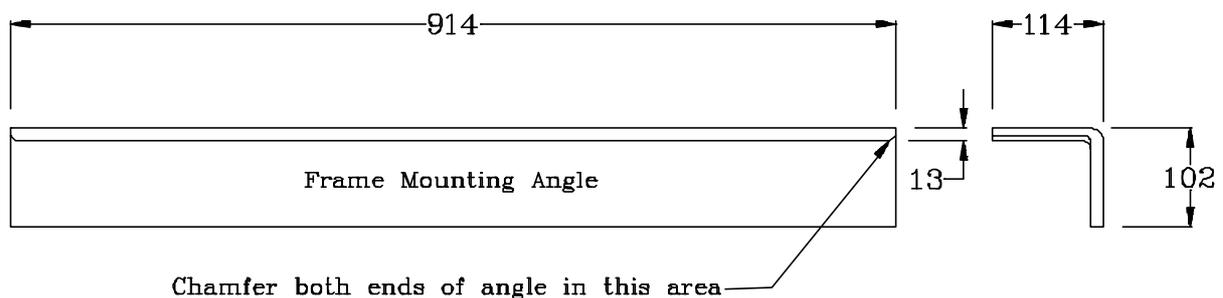
8 APPENDIX

This appendix provides dimensional drawings for the brackets required to properly and safely mount Revere Transducers load cells. Enlarged copies are available upon request. These accessories are not available by purchasing from Revere Transducers. The drawings are provided to assist the customer in designing and manufacturing his own mounting brackets. The following notes apply to all brackets:

1. All dimensions are in millimeters.
2. Material: ASTM A36 steel or equivalent.
3. Welds per ANSI/AWS D1.1 or EN288 structural welding code – steel.
4. Finish: rust inhibiting primer.

Mounting angle for in-line load cell installation

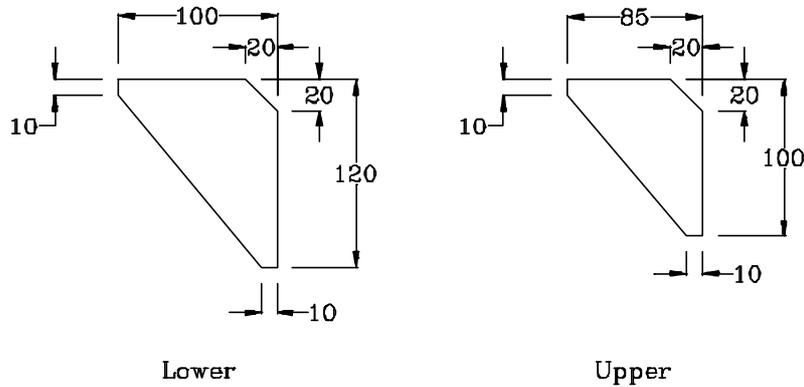
This mounting angle is bolted to the frame member to add stiffness and provide a solid surface on which to weld the load cell mounting blocks (see section 3.3 for the location of the mounting bolt holes).



NOTE: At the installer's option, mounting angles for in-line installations may be fabricated the same as outboard mounting brackets shown on page 8, except without gussets.

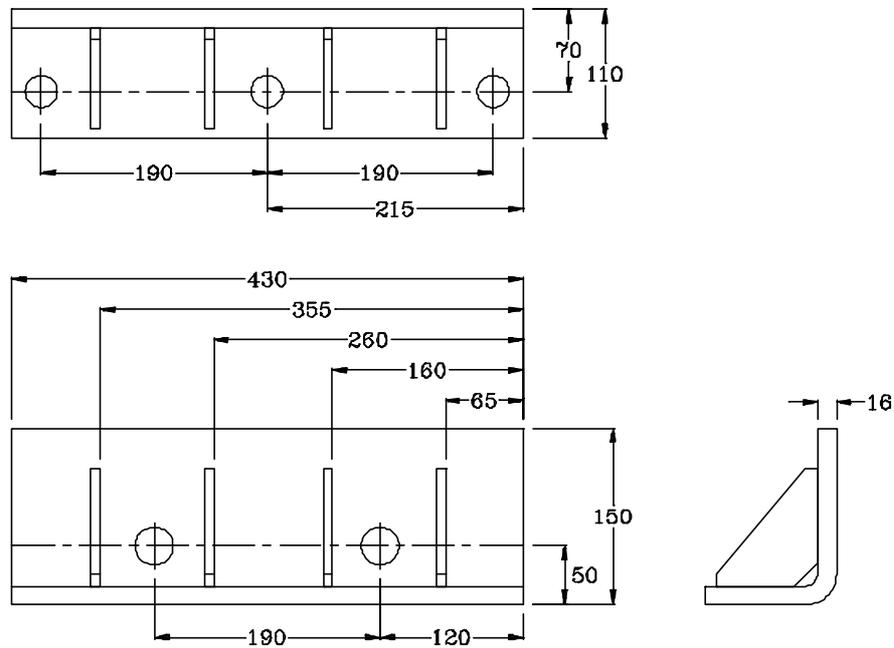
Mounting bracket gussets

The drawings below show the proper gusset dimensions for all of the outboard mounting brackets on the following pages.



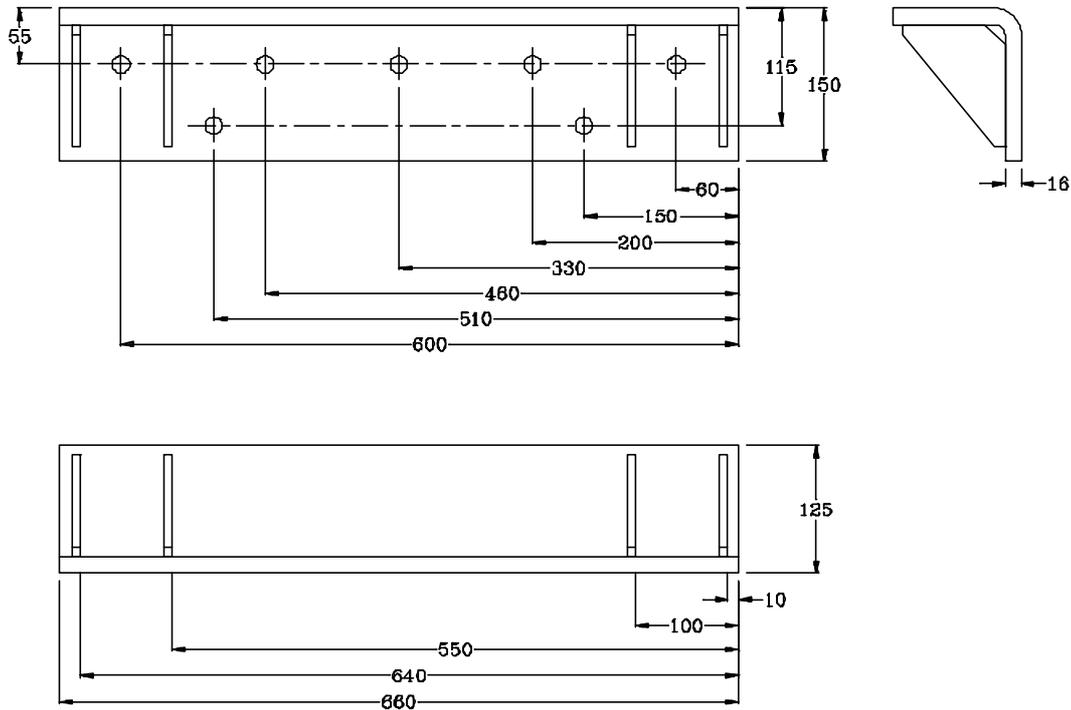
Superstructure (upper) mounting brackets for outboard installation

The brackets shown here are bolted to the superstructure frame and used to mount the load cells in an outboard position. See above drawing for gusset dimensions.



Vehicle (lower) mounting brackets for outboard installation

The brackets shown here are bolted to the vehicle frame and used to mount the load cells in an outboard position. See above drawing for gusset dimensions.



ROUTINE MAINTENANCE

Listed below are four simple steps that should be periodically performed to ensure safety and to maintain your weighing system in optimum operating condition.

1. Inspect all welds for signs of cracking or corrosion.
2. Check and adjust all bolts to specified torque values (see page 7).
3. Inspect cables for damage, tautness and cleanliness.
4. Clean truck/trailer connections.

INSTALLATION CHECKLIST

- Mounting angles or places have been inspected for burrs, inconsistencies and trueness.
- Frames have been inspected and are in good condition.
- Surfaces for load cell mounting blocks are rigid and have been reinforced.
- All mounting block welds are “triple pass” (see welding procedure page 12).
- All bolts are torqued to specifications (see page 14).
- All cables are routed and secured in protected areas of the frame.
- Indicator installation: see “Digital Indicator Operator’s Manual”.

- System calibration: see “Digital Indicator Operation’s Manual”.

For more information, application notes and load cell instructions, please contact your supplier, our manufacturing operation or any one of our regional sales offices.

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