

# Load Disc II<sup>®</sup> Transducer Installation Manual

## CAUTION

It is essential that all instructions in this manual be followed precisely to ensure proper operation of the equipment.

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## **NOTICE**

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## **CAUTION**

Follow these rules if welding is done on the vessel. The electrical current of the welder may pass through the transducer causing damage to it and possibly to the signal processor if these precautions are not followed.

1. Disconnect the transducer cable from the signal processor. If possible, remove the transducers or insulate them electrically. (Transducers that have fabreeka pads only require removing the mounting bolts. The pads will act as insulation.)
2. Ground the welder as close to the welding joint as possible.



# Kistler-Morse®

## Manual Addendum

## Load Disc II Transducer Installation Manual

(97-1086-01, Rev. E)

The following change will be incorporated at the next revision to the manual:

**1. Page 2-3.**

Add the following text and illustrations under *Important Installation Notes*:

### Load Disc II Orientation

Tank expansion/contraction caused by temperature changes can impose side loads on Load Disc IIs, causing the top bolts/load rings to tip. This can cause output changes unrelated to material movement. The result of these output changes is incorrect weight on the signal processor display. **Orient the Load Disc IIs as shown in Figures 1, 2, or 3, as applicable, to minimize the error.**

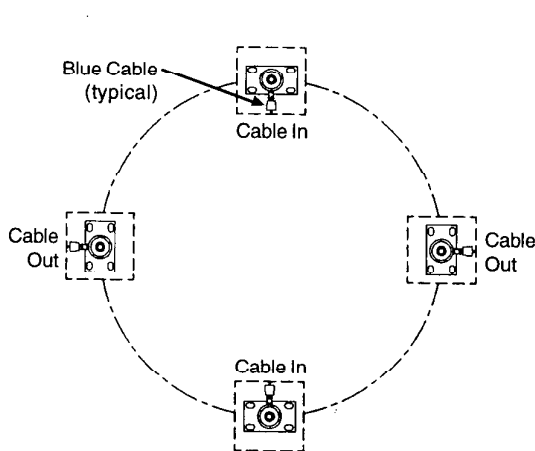


Figure 1. 4-Legged Vessel with 4 Active Load Disc IIs

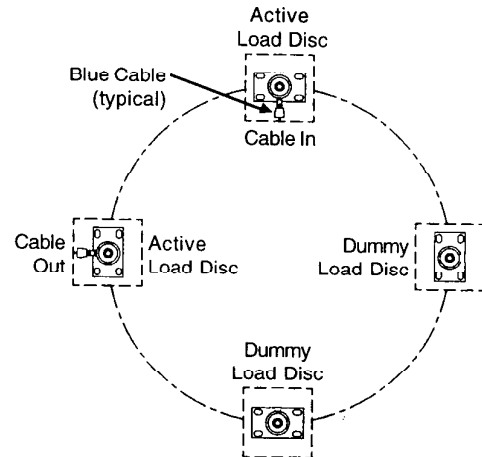


Figure 2. 4-Legged Vessel with 2 Active Load Disc IIs and 2 Dummy Load Discs

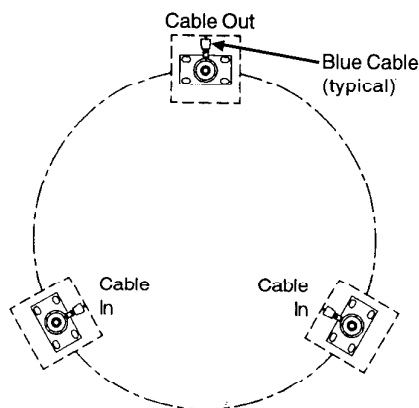


Figure 3. 3-Legged Vessel with 3 Active Load Disc IIs



# Kistler-Morse®

19021 120th Avenue NE  
Bothell, WA 98011 USA  
Tel: 800-426-9010 • 425-486-6600  
Fax: 425-402-1500  
www.kistlermorse.com

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# Table of Contents

## Chapter 1. Equipment Description . . . . . 1-1

INTRODUCTION . . . . .	1-1
EQUIPMENT DESCRIPTION . . . . .	1-1
FEATURES . . . . .	1-2
INSTALLATION HARDWARE OPTIONS . . . . .	1-2
<i>Option A</i> . . . . .	1-2
<i>Option B</i> . . . . .	1-2
<i>Option C</i> . . . . .	1-3
<i>Option D</i> . . . . .	1-4
<i>Option E</i> . . . . .	1-4
<i>Option F</i> . . . . .	1-4
<i>Option G</i> . . . . .	1-5
<i>Option H</i> . . . . .	1-6
<i>Option I</i> . . . . .	1-7
<i>Option J</i> . . . . .	1-8

## Chapter 2. Hardware Installation . . . . . 2-1

INTRODUCTION . . . . .	2-1
FACTORS TO CONSIDER BEFORE INSTALLATION . . . . .	2-1
IMPORTANT INSTALLATION NOTES . . . . .	2-2
INSTALLING THE LOAD DISC II TRANSDUCER . . . . .	2-3
<i>Load Disc II Transducer Installation (No Hardware Kit)</i> . . . . .	2-4
<i>Load Disc II Transducer Installation (Universal Top Adaptor Plate Hardware Kit)</i> . . . . .	2-5
<i>Load Disc II Transducer Installation (Leg Flange Adaptor Plate and Shock Absorption Pad Hardware Kit)</i> . . . . .	2-7
<i>Load Disc II Transducer Installation (Spun-Ball Leg Adaptor Hardware Kit)</i> . . . . .	2-8
Welding of Spun Ball Leg Adaptor Hardware Kit to Vessel Legs Installed on Load Disc II Transducers . . . . .	2-10

<i>Load Disc II Transducer Installation (Free-Standing Hardware Kit)</i> .....	2-10
<i>Load Disc II Transducer Installation (Free-Standing-to-Spun-Ball Leg Hardware Kit)</i> .....	2-12
<i>Load Disc II Transducer Installation (Omnislide Expansion, Sliding Hardware Kit)</i> .....	2-13
<i>Load Disc II Transducer Installation (Leg/Floor Tilt Adaptor Hardware Kit)</i> .....	2-15
<i>Load Disc II Transducer Installation (Weldable Gusset Adaptor Plate with Leveling Base Adaptor Plate)</i> .....	2-16
<i>Load Disc II Transducer Installation (Leveling Base Adaptor Plate Hardware Kit)</i> .....	2-19
<b>VESSEL LEVELING PROCEDURES</b> .....	2-20
<i>Vessel Leveling Procedure Using a Voltmeter</i> .....	2-20
Junction Box Preparation .....	2-20
Adjusting the Leveling Nuts .....	2-22
<i>Vessel Leveling Procedure Using a Signal Processor</i> .....	2-23
Shimming the Load Disc II Transducers .....	2-25
<b>MOUNTING THE JUNCTION BOX</b> .....	2-26
<b>SPLICING THE LOAD DISC II CABLE</b> .....	2-26
<b>WIRING LOAD DISC II TRANSDUCERS TO A STAINLESS STEEL JUNCTION BOX</b> .....	2-27
<b>WIRING LOAD DISC II TRANSDUCERS TO A PLASTIC JUNCTION BOX</b> .....	2-28
<b>WIRING STAINLESS STEEL JUNCTION BOXES TOGETHER AND TO THE SIGNAL PROCESSOR</b> .....	2-28
<b>WIRING PLASTIC JUNCTION BOXES TOGETHER AND TO THE SIGNAL PROCESSOR</b> .....	2-30
<b>Appendix A. Product Specifications</b> .....	<b>A-1</b>
MECHANICAL .....	A-1
ELECTRICAL .....	A-1
OUTPUT (for 12 Vdc excitation) .....	A-1
ENVIRONMENTAL .....	A-1
PHYSICAL .....	A-2

<b>Appendix B. Glossary of Terms . . . . .</b>	<b>B-1</b>
<b>Appendix C. Calculating Material Weight . . . . .</b>	<b>C-1</b>
INTRODUCTION . . . . .	C-1
TECHNICAL DESCRIPTION OF A LOAD DISC II MEASUREMENT SYSTEM . . . . .	C-2
CALCULATING THE MATERIAL WEIGHT IN A VESSEL . .	C-4
CALCULATING MATERIAL WEIGHT IN A VESSEL WITH BOTH LIVE AND DUMMY TRANSDUCERS . . . . .	C-7
<b>Kistler-Morse Service . . . . .</b>	<b>D-1</b>
START-UP AND TRAINING . . . . .	D-1
TROUBLESHOOTING . . . . .	D-2
RETURN MATERIAL AUTHORIZATION . . . . .	D-2
SERVICE CALLS . . . . .	D-2
PRODUCT WARRANTY . . . . .	D-2
ADDRESS AND TELEPHONE NUMBERS . . . . .	D-3
<i>Corporate Office . . . . .</i>	<i>D-3</i>
<i>European Office . . . . .</i>	<i>D-3</i>
<b>Appendix E. Technical Drawings . . . . .</b>	<b>E-1</b>

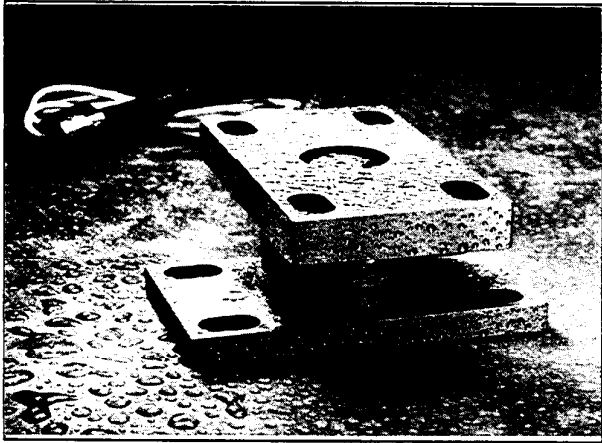


Figure 1-1. Kistler-Morse Load Disc® II Transducer.

# Chapter 1. Equipment Description

## INTRODUCTION

This manual describes how to install Load Disc® II transducers on different types of vessels. Wiring the transducers to junction boxes and wiring junction boxes together are also covered. Refer to the signal processor manual for specific information on wiring the junction boxes to the signal processor.

## EQUIPMENT DESCRIPTION

The Load Disc II transducer (Figure 1-1) is a low profile load cell constructed of stainless steel. It has a variety of different mounting hardware options that will accommodate almost all possible applications. Models are available from 150 to 100,000 pounds per vessel support with weighing accuracies of 0.1% and 0.2%. Figure 1-2 illustrates a typical Load Disc II configuration.

Load Disc II transducers mount underneath the legs of vessels and never come in contact with the material inside. The transducers are made to operate in industrial, washdown environments, require no periodic maintenance, and are immune to electrical noise due to high level output voltage. They can be used in many different industries to weigh any type of material and are especially suited for the food and chemical industry where aggitated vessels are used. Load Disc II transducers wire to Kistler-Morse signal processors which convert the transducer's voltage outputs to weight or level measurement.

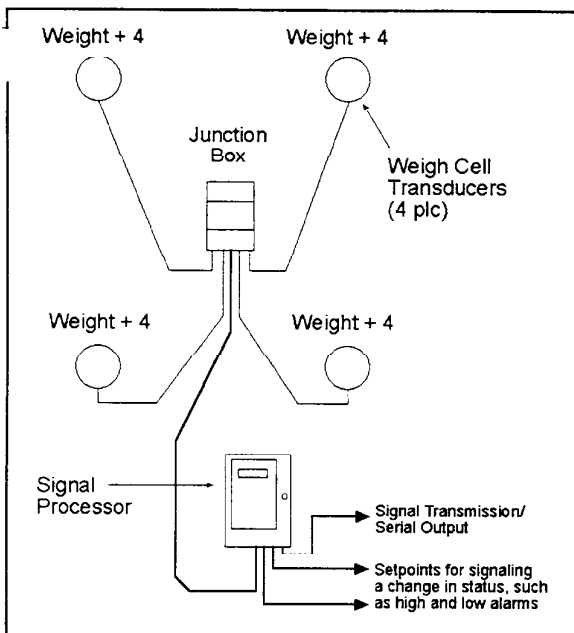


Figure 1-2. Load Disc II Configuration Diagram.

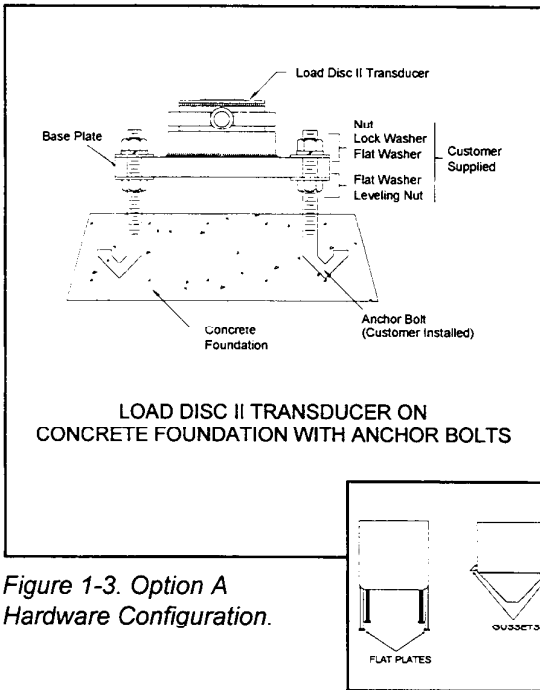


Figure 1-3. Option A Hardware Configuration.

## FEATURES

- Load Disc II transducers are equipped with a cable entry armor consisting of a short length (12 inch / 305 mm) of sanitary food-grade tubing surrounding the transducer cable.
- A water block is installed within the unit on the cable and therefore cannot be inadvertently cut off during installation.
- The armor tubing is terminated in a 1/2 inch (13 mm) stainless steel female conduit fitting (NPT 1/2"-14 thread) for easy, fully-conducted installation.
- All Load Disc II transducers within a given load rating are manufactured with the same output sensitivity (mV of output per applied weight units), giving the transducers a greatly improved standardization specification.
- In most of the installation options, the transducer bolts to the floor and to the vessel leg to accommodate agitated vessels.
- Most Load Disc II hardware kits can use leveling nuts instead of shims to adjust the height of the installation (Figure 1-3). The Spun-Ball Leg Adaptor hardware kit has a level-adjusting adaptor. The level-adjusting adaptor eliminates the need for inserting shims.

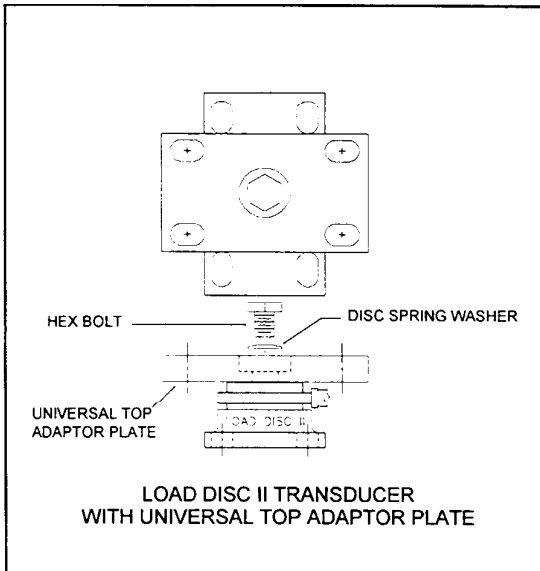


Figure 1-4. Option B Hardware Configuration.

## INSTALLATION HARDWARE OPTIONS

The Load Disc II transducer has several hardware options that accommodate specific applications. For mounting dimensions, refer to Appendix A and the drawings in Appendix E.

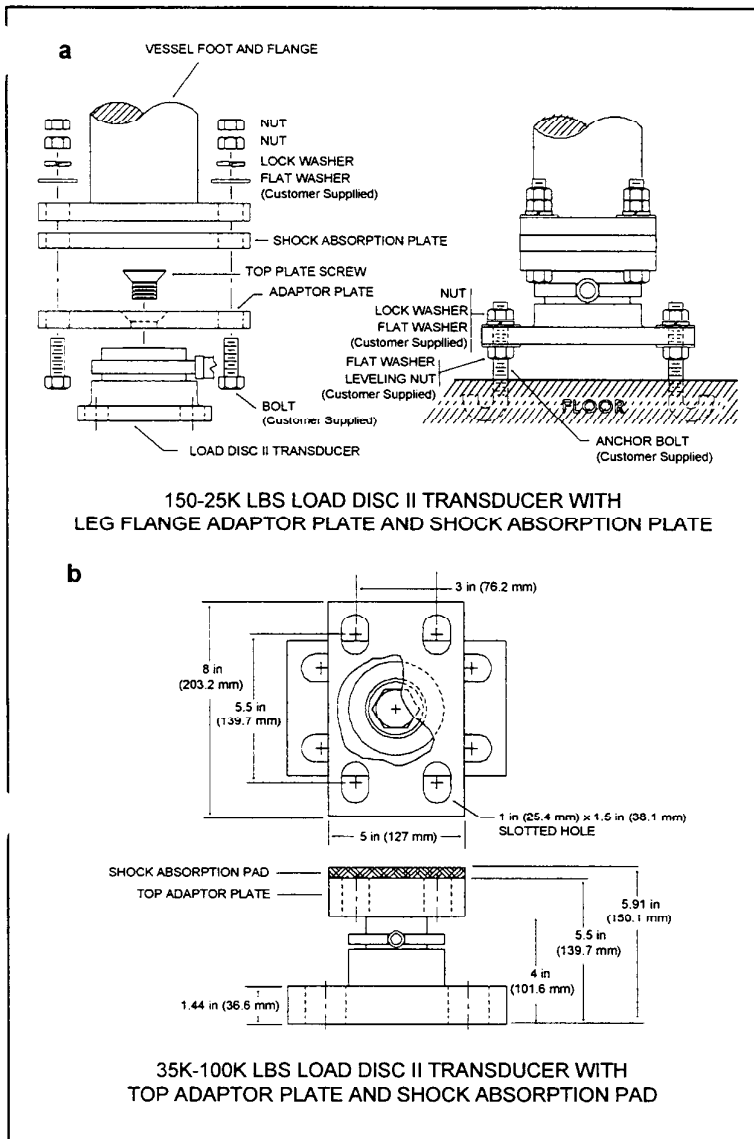
### Option A

This option has no hardware kit. The Load Disc II transducer (shown in Figure 1-3) comes with a base plate that has four holes for bolting it down to the floor. Also, a threaded blind hole is on the top so gusseted legs can be bolted to it.

### Option B

This option has a Universal Top Adaptor Plate hardware kit (Figure 1-4). In this configuration, an adaptor plate (similar in mounting hole dimensions to the Load Disc II base plate) is secured to the top of





the Disc with a screw and spring washer. The top plate has four holes to allow bolting to a vessel leg that has a flat plate or gusset. The Load Disc II transducer can be bolted to the floor through the base plate holes. This hardware is used for standard applications. The top plate is free to turn 360° and also accommodates up to 5° tilt in the floor or vessel legs.

**NOTE**

For best results in weighing, it is important that the vessel imposes no side loading on the Load Disc II transducers. If legs splay during loading, bracing them will prevent side loading.

**Option C**

This option has a top adaptor plate with a shock absorption pad assembly hardware kit (Figure 1-5). The adaptor plate (similar in hole pattern to the Load Disc II base plate) is secured to the top of the Load Disc II transducer with a screw. The shock absorption pad is sandwiched between the top adaptor plate and vessel leg flange or gusset. The adaptor plate has four holes through which it is bolted to the vessel leg. The Load Disc II transducer can be bolted to the floor through the base plate holes.

Figure 1-5. Load Disc II Transducer and Leg Flange Adaptor Hardware Kits

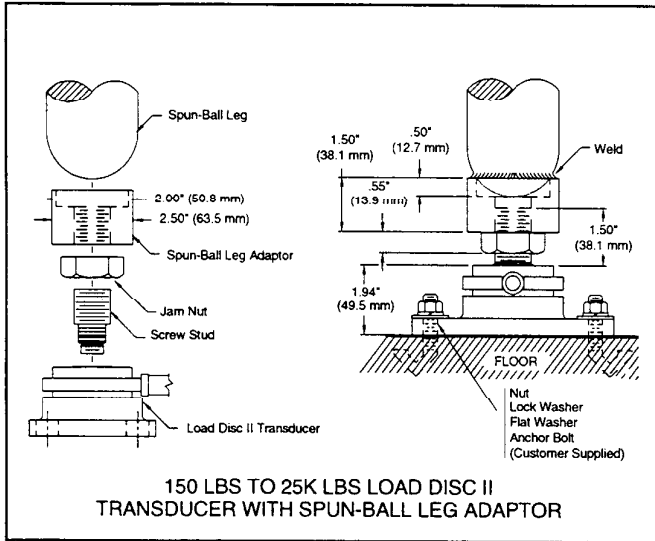


Figure 1-6. Option D Hardware Configuration.

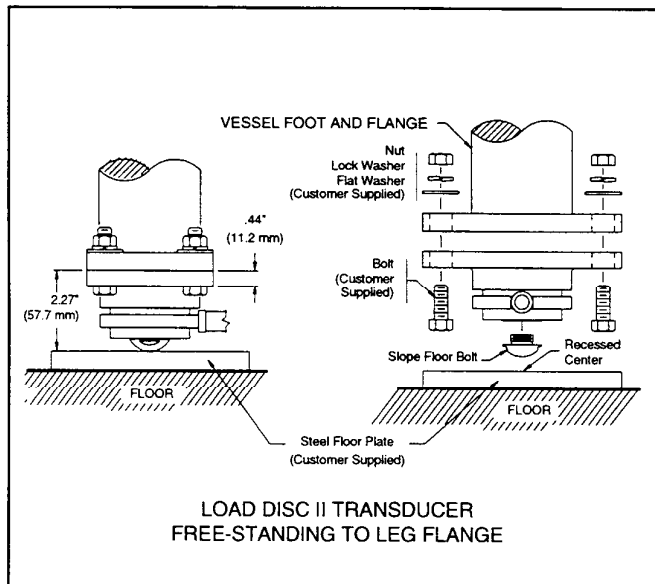


Figure 1-7. Option E Hardware Configuration.

## Option D

Option D, shown in Figure 1-6, has a spun-ball leg adaptor hardware kit. This hardware kit has a leveling stud that screws onto the top of the Load Disc II transducer and an adaptor that screws onto the stud. The stud/adaptor accommodates a spun-ball leg. Vessel legs are leveled by turning the adaptor. A hex jam nut secures the adaptor position. The vessel leg can then be welded to the adaptor. The Load Disc II transducer can be bolted to the floor through the holes in its base plate.

## Option E

Option E, shown in Figure 1-7, has a slope floor hardware kit. This hardware kit has a single screw with a curved head. The curved head screw installs on to the top of the Load Disc II transducer. The transducer, with base plate, is then turned upside-down and attached to the bottom of a vessel leg that has a flat plate or gusset. When the vessel is lowered, the curved head of the top screw is in contact with the floor. It is recommended that a steel plate be placed underneath the top screws to protect the floor.

## Option F

Option F (shown in Figure 1-8) has a free-standing-to-spun-ball leg hardware kit. This hardware kit has an adaptor plate that is welded to the spun-ball leg to provide a leg flange. A curved-head screw is screwed into the top of the Load Disc II transducer and the transducer is bolted to the leg flange. When the vessel leg is lowered, the curved-head screw makes contact with the floor. Kistler-Morse recommends a steel plate be placed underneath the top screw to protect the floor.

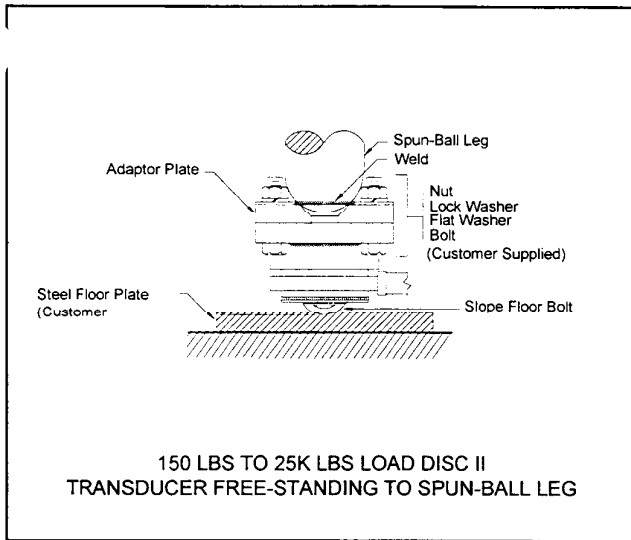


Figure 1-8. Option F Hardware Configuration.

## Option G

Option G (Figure 1-9) is the Leg/Floor Tilt Adaptor installation kit. It has a stainless steel housing that contains a ball, also made of stainless steel. The housing screws into the top of the load disc. The top of the ball has a 5/8-18 tapped hole to allow the leg of a vessel to be bolted onto it. The ball will rotate up to 25° in any direction to accommodate any combination of sloped floor and tilted vessel legs. This hardware kit can be used by itself or in conjunction with other installation kits. Bolting the Load Disc II to the floor and the vessel leg to the tilt adaptor keeps the vessel from moving or tipping over.

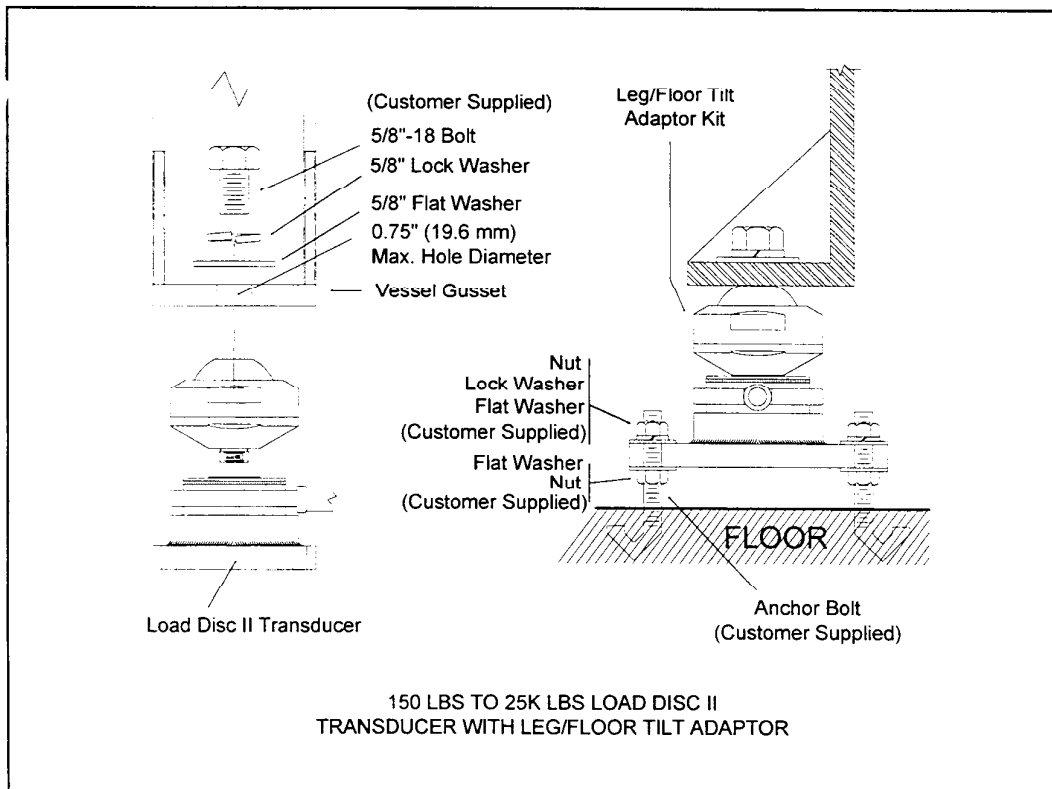


Figure 1-9. Option G Hardware Configuration.

## Option H

Option H (Figure 1-10) is the Omnislide installation kit. This hardware kit has a sliding plate that secures to the floor or foundation. The top adaptor plate secures to the Load Disc II. A UHMW (ultra-high molecular weight nylon) sliding pad bolts to the top adaptor plate and slides on the sliding plate. Two retainer blocks and four spacers allow the Load Disc II transducer limited sliding movement and at the same time keep the vessel leg secured to the floor. In this application, the Load Disc II transducer is installed upside down with its base plate bolted to the vessel leg flange.

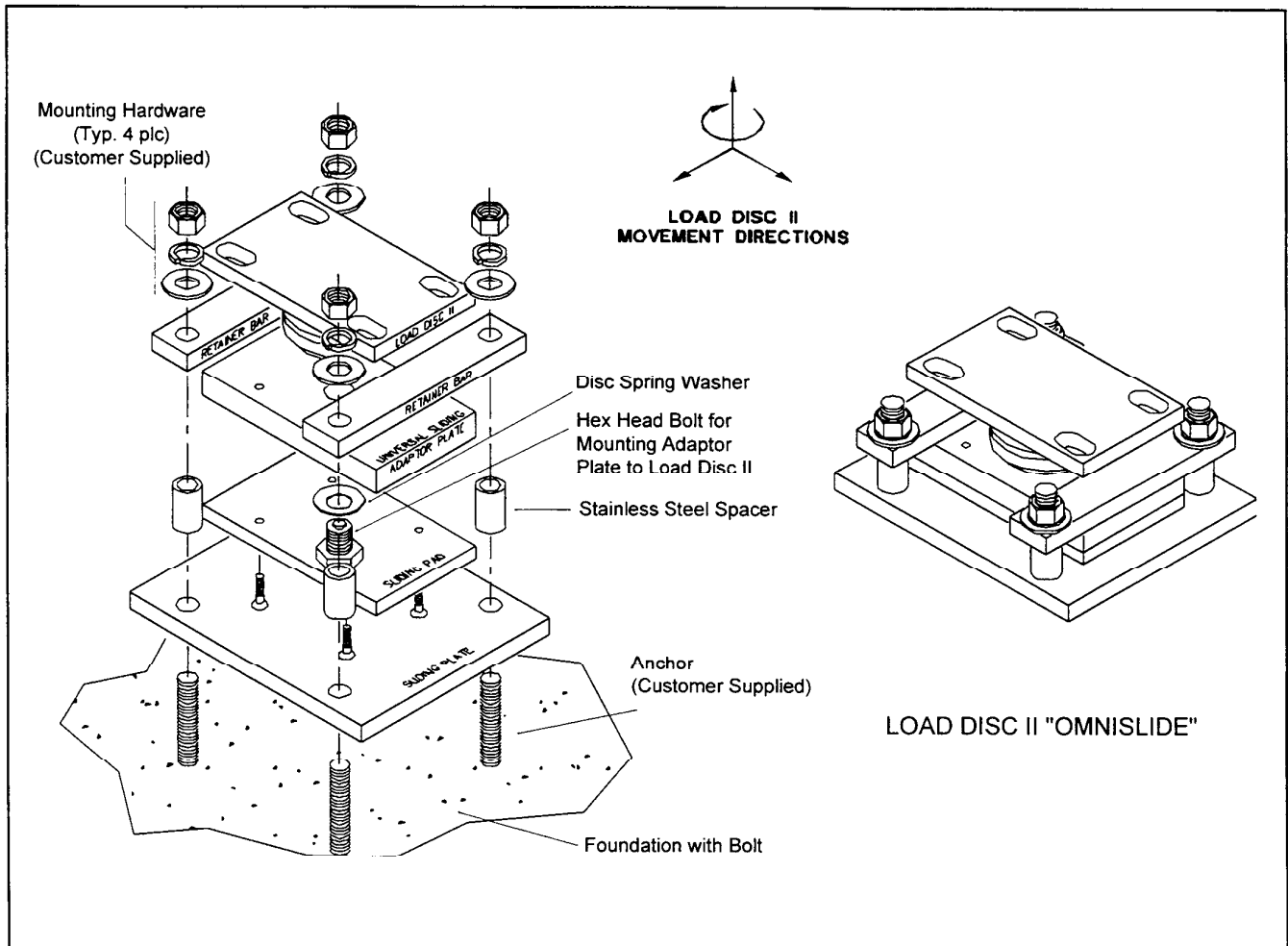


Figure 1-10. Option H Hardware Configuration.

## Option I

Option I (Figure 1-11) is the Weldable Adaptor Gusset and Leveling Base Adaptor Plate. This hardware kit has two sections. The first section is a leveling base adaptor plate that the Load Disc II transducer bolts onto. The leveling base adaptor plate can be raised or lowered by turning the leveling nuts under it and can raise the vessel legs without using a crane or hydraulic jack. The second section is a gusset that either is welded or bolted to the vessel leg. The gusset rests on top of the Load Disc II transducer and bolts to it. This hardware kit is used when the vessel cannot be raised enough to accommodate the height of the Load Disc II transducer or when a crane or hydraulic jack is not available for raising the vessel.

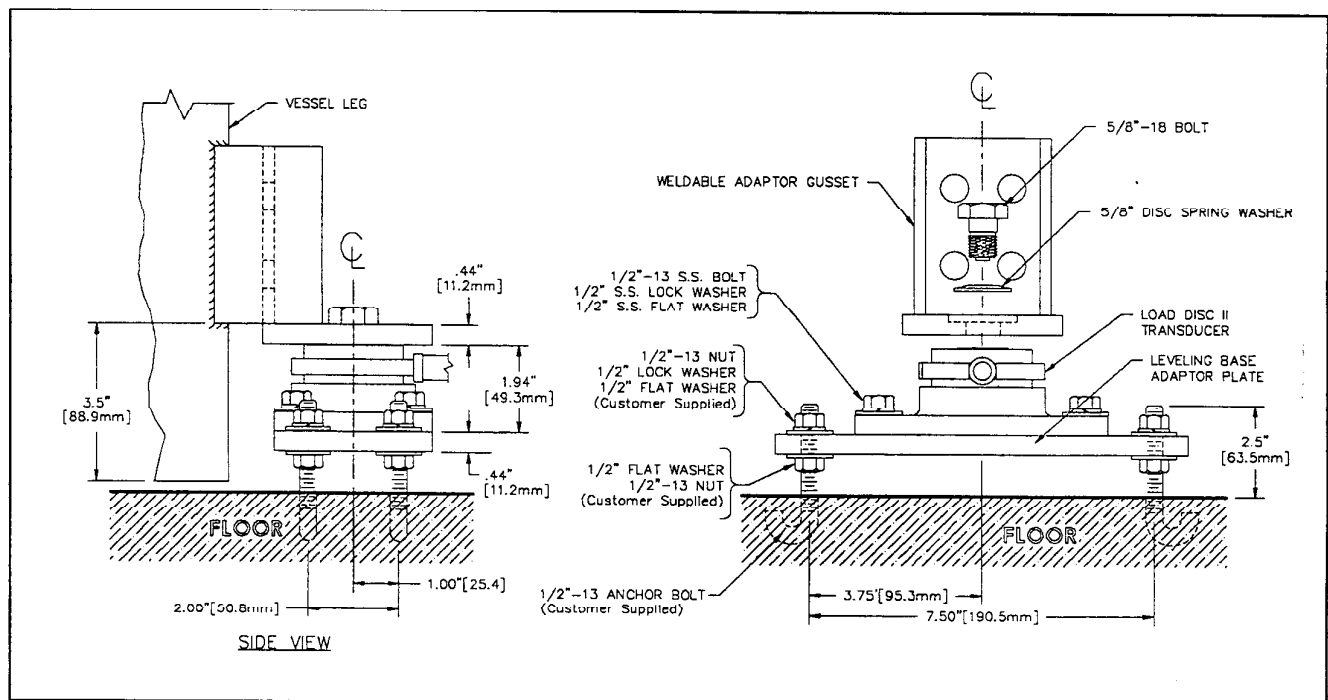


Figure 1-11. 150-25K lb Load Disc II Transducer with Weldable Adaptor Gusset and Leveling Base Adaptor Plate.

### Option J

Option J (Figure 1-12) is the Leveling Base Adaptor Plate. This hardware kit has a flat plate and four bolt and washer assembly. The Load Disc II transducer bolts onto the leveling base adaptor plate. The base adaptor plate rests on four leveling nuts/washers screwed onto anchor bolts that are installed in the foundation. By turning the leveling nuts, the height of the transducers and thus the vessel can be adjusted for proper installation and load distribution. This hardware can be used in combination with any other hardware kit that attaches the Load Disc II transducer to the vessel leg.

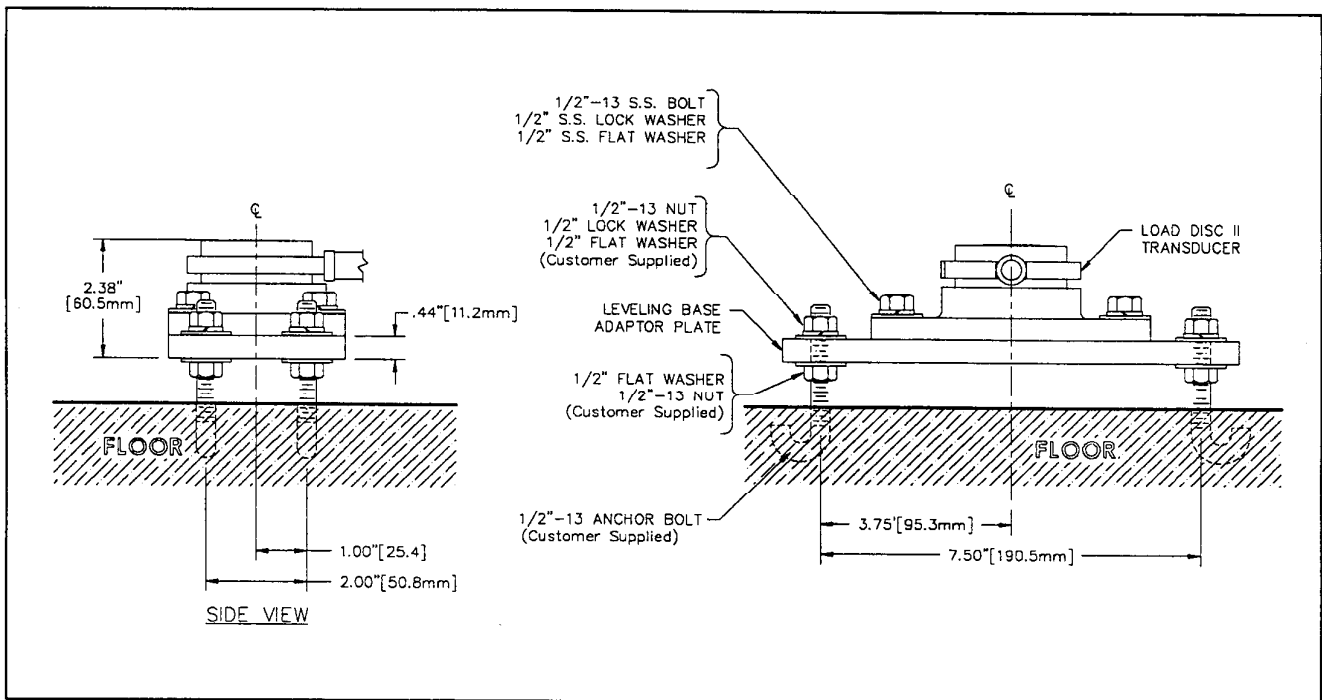


Figure 1-12. 150-25K lb Load Disc II Transducer with Leveling Base Adaptor Plate.

# Chapter 2. Hardware Installation

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## INTRODUCTION

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This chapter describes how to install Load Disc II transducers under a vessel, how to wire the transducers to a junction box, and how to wire junction boxes together. Wiring the junction boxes to a signal processor is covered in the signal processor manual. Factors to consider before installation are also discussed. Be sure to read this section carefully before installing the Load Disc II transducers.

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## FACTORS TO CONSIDER BEFORE INSTALLATION

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To achieve the most accurate weight measurement from the Load Disc II transducers, there are factors to consider before installation.

- a. The surfaces where the base plates bolt down must be flat and horizontal with less than one degree of slope in any direction. Also, the surface must be clean and smooth. In cases where the floor is sloped and/or vessel leg gussets are not horizontal/parallel to the mounting surface, shims, leveling nuts on anchor bolts, or the Leg/Floor Tilt Adaptor hardware kit must be used for leveling the vessel. Universal Top Adaptor Plate hardware kit can accommodate up to 5° of slope.
- b. The upper and lower surfaces to which the adaptor plate and Load Disc II base plate will be bolted cannot have any holes in the plate areas other than the plate bolt holes.
- c. Hidden load bearing structures, such as discharge chutes or plumbing supported by the floor, can cause sizable errors. Flexible couplings can eliminate this problem.
- d. Cross-connecting structures, such as catwalks and manifolds, can transfer loads from adjacent vessels. Install slip joint or flex couplings to solve this problem.

TRANSDUCER No.	LOAD RATING	MODEL NUMBER	SERIAL NUMBER	OFFSET MILLIVOLTS	VESSEL LEG No.	VESSEL NUMBER
1						
2						
3						
4						
5						
6						
7						
8						

Table 2-1. Load Disc II Transducer Information Chart.

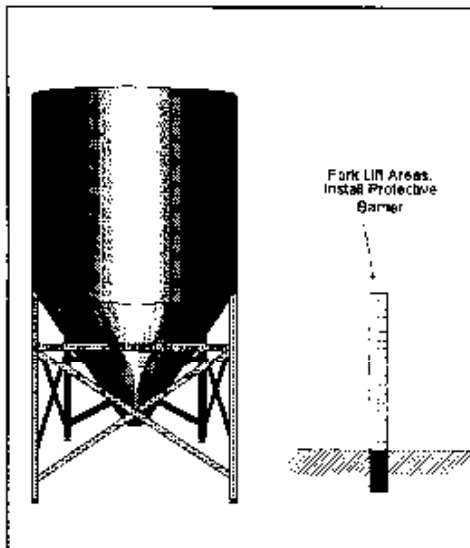


Figure 2-1. Shock Load Protection.

- e. The foundation on which a vessel rests must be of concrete or steel so that it does not allow excessive movement when the weight in the vessel changes.
- f. Shock loads can damage Load Disc II transducers. If the transducer-equipped leg can be struck by forklifts, trucks, etc., install protective barriers or stops to prevent vehicles from hitting the leg.

## IMPORTANT INSTALLATION NOTES

- Read the technical drawing in Appendix E before transducer installation.
- Make sure vessel legs/gussets are flat and level. If not, use a Leg/Floor Tilt Adaptor hardware kit. (Note: Some weighing error may occur if combined leg and floor tilt is more than 6°. For slopes up to 5°, a Universal Top Adaptor Plate can be used.
- During installation do not put all of the vessel load on one transducer.



- Check the transducers before installation by measuring the resistance between the WHITE and RED wires and the WHITE and BLACK wires. The resistance readings should be between 8K and 9K ohms. With no load on the transducers, the two resistance readings should not differ from each other by more than 400 ohms.
- When raising the vessel for transducer installation, use proper support to prevent the vessel from tipping or falling over.
- Use recommended hardware and bolt sizes. Using larger than recommended sizes may cause the transducer to be over stressed during installation and can lead to transducer breakage. Recommended hardware sizes are chosen to provide adequate strength while maintaining room for bolt hole tolerances.
- Position transducers so that the transducer cable cannot be snagged or chafed, and can be easily routed to the junction box.
- When installing transducers, put all of the transducers in place and finger tighten the bolts. connect the transducers to the signal processor and zero the digital readout (tare). With no material added to the vessel, torque the transducer bolts while observing the display. If the readout exceeds +/- 100 mV, Stop torquing the bolts and inspect the vessel legs/gussets for flatness, levelness, or other mechanical restraints.
- If the vessel is raised or one vessel leg jacked up for any reason after the transducers are installed, first loosen the bolts on ALL of the transducers to prevent overloading.

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## **INSTALLING THE LOAD DISC II TRANSDUCER**

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There are several different ways of installing a Load Disc II transducer to a vessel leg or gusset. some of the installations involve securing the Load disc II transducer to the floor. These installations are designed to prevent the legs of an agitated vessel from moving. Other available hardware kits are used for vessels that are located on a sloped floor, or have gusset legs that are not level. Of these hardware kits, the Leg/Floor Tilt Adaptor kit will secure the vessel leg to the floor through the Load Disc II. In applications where vessel legs expand or contract due to thermal effects, the Omnislid hardware kit will provide for vessel leg movement while keeping the vessel secure to the floor or foundation. Write the information from the label of your Load Disc II transducers in Table 2-1. This information is required when installing and calibrating the transducers. The sections that follow describe these Load Disc II transducer installations. Locate the section that describes your specific transducer installation and follow the procedures.

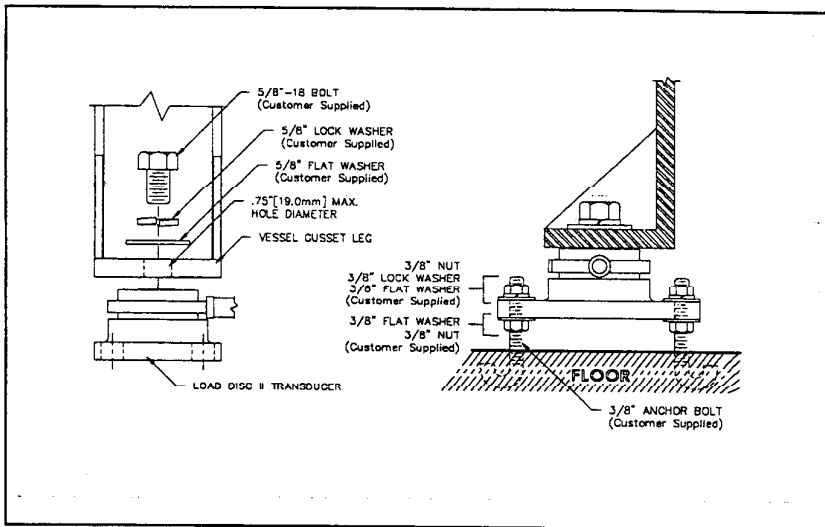


Figure 2-2. Load Disc II Transducer with No Hardware Kit.

## Load Disc II Transducer Installation (No Hardware Kit)

This Load Disc II transducer configuration does not have a hardware kit. The transducer bolts to a vessel gusset (Figure 2-2) or a vessel leg that has a flat plate welded to it. The customer must supply a bolt (ASTM-A325 or stronger), lock washer, and flat washer to secure the transducer to the leg or gusset. 25K lbs and lower Load Disc II transducers use 5/8"-18 bolts. 35K lbs and higher transducers use 1"-12 bolts. The depth of the tapped hole on top of the transducer is 0.3 inch (7.6 mm) for 25K lbs and lower transducers. Hole depth for 35K lbs and higher transducers is 0.62 inch

(15.7 mm). When choosing the length of bolt to use, consider the thickness of the flat plate or gusset, thickness of the lock washer and flat washer, and the depth of the tapped hole. Follow this procedure to install transducers.

1. Raise the vessel.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

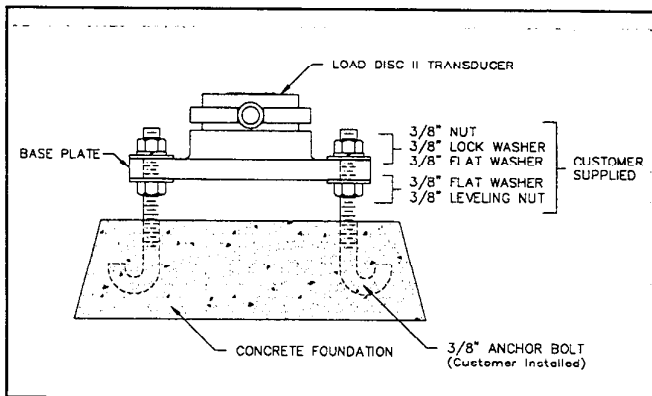


Figure 2-3. Load Disc II Transducer on Concrete Foundation with Anchor Bolts.

2. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the transducer and leg/gusset.
3. Mark the mounting hole location on the leg/gusset and drill a hole large enough to insert the appropriate bolt. The hole should not be any larger than 3/4 inch (19.1 mm) in diameter for 5/8"-18 bolts and not larger than 1-1/4 inches (31.7 mm) in diameter for 1"-12 bolts. Deburr the hole and ensure that the surface is smooth.
4. Bolt the Load Disc II transducer to the leg or gusset with the bolt and lock washer (Figure 2-2). Follow Steps 1 - 4 to install all of the transducers to legs or gussets.
5. Slowly lower the vessel. Use a pencil to mark the hole pattern of each Load Disc II base plate on the floor and then raise the vessel again. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.

- \* For transducers rated 10K lbs and lower
- \*\* For transducers rated over 10K to 25K lbs
- \*\*\* For transducers rated 35K to 100K lbs

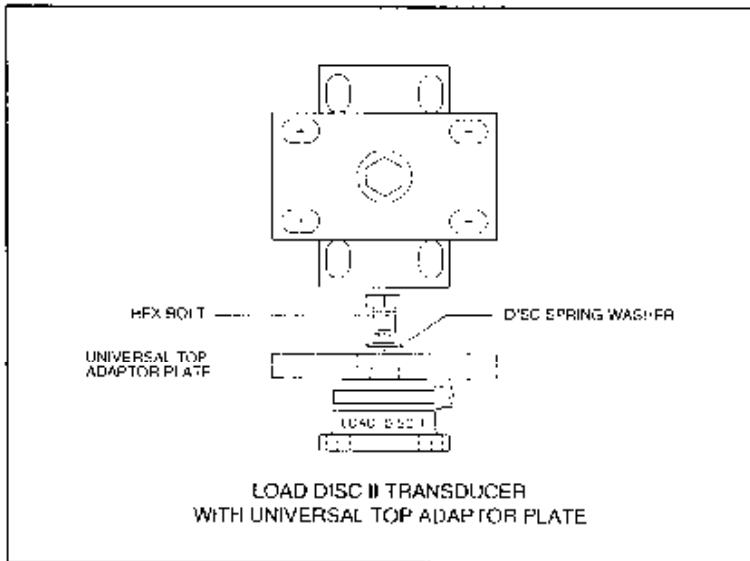


Figure 2-4. Load Disc II Transducer with Universal Top Adaptor Plate Hardware Kit.

6. Drill holes in the floor and install four anchor bolts (customer supplied) per base plate. Be sure that anchor bolts match the hole pattern and that they are straight. Kistler-Morse recommends using 3/8"-24 UNF\*, 7/16"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* anchor bolts that are grade ASTM-A325 or stronger. The threaded length of the anchor bolts should provide enough length for the thickness of the base plate, the thickness of the leveling nut and flat washer under the base plate, and the thickness of the lock washer, flat washer, and nut on top of the base plate (Figure 2-3).

#### NOTE

The length of the anchor bolts must not interfere with the top hardware or vessel leg once the Load Disc II transducers are completely installed.

7. Place the leveling nuts and flat washers on the anchor bolts.
8. Lower the vessel until the transducer on each leg rests on the leveling nuts and washers of the anchor bolts. Put the nut, lock, and flat washers on the anchor bolts and proceed to LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCERS.

### ***Load Disc II Transducer Installation (Universal Top Adaptor Plate Hardware Kit)***

This Load Disc II transducer configuration has a hardware kit that consists of a Universal Top Adaptor Plate, a hex head screw, and a disk spring washer. The Universal Top Adaptor Plate is secured to the Load Disc II transducer using the screw and washer. (For washer orientation and required torque on the screw, refer to Appendix E.) The Adaptor Plate then bolts to a vessel gusset or leg that has a flat plate welded to it (Figure 2-4). The customer must supply the hardware to secure the Universal Adaptor Plate to the leg or gusset. Follow this procedure to install the Load Disc II transducer.

1. Raise the vessel.

#### **CAUTION**

**Use proper supports to prevent the vessel from falling over.**

2. Place the adaptor plate against the bottom of the vessel leg flat plate or gusset. Use a pencil to mark the hole pattern of the adaptor plate on the leg or gusset. The hole pattern of the adaptor plate is the same as the transducer base plate. (Refer to the drawing in Appendix E.)

3. Drill holes in the vessel leg or gusset per the hole pattern marked in Step 2 (5/8" diameter holes for 150 lbs to 25K lbs transducers or 1.0 inch diameter holes for 35K to 100K transducers). Deburr the holes when done.
4. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the Universal Top Adaptor Plate and leg/gusset.
5. Secure the Universal Top Adaptor Plate to the top of the Load Disc II transducer with the supplied screw. Orient the adaptor plate so it is at right angles to the base plate. This will prevent top hardware from contacting the bottom hardware.
6. Bolt the Load Disc II transducer assembly to the leg or gusset using 3/8"-24 UNF\*, 7/16"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* bolts (ASTM-A325 or stronger), lock washers, flat washers, and nuts. Orient the bolts so that the heads face down and the nuts and washers are on top (Figure 2-4). Follow Steps 1 through 6 to install all of the transducers to the vessel legs or gussets.
7. Slowly lower the vessel. Use a pencil to mark the hole pattern of each Load Disc II base plate on the floor and then raise the vessel again. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.
8. Drill holes in the floor and install four anchor bolts (customer supplied) per base plate. Be sure that anchor bolts match the hole pattern and that they are straight.

Kistler-Morse recommends using 3/8"-24 UNF\*, 7/16"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* anchor bolts that are grade ASTM-A325 or stronger. The threaded length of the anchor bolts should provide enough length for the thickness of the base plate, the thickness of the leveling nut and flat washer under the base plate, and the thickness of the lock washer, flat washer, and nut on top of the base plate (Figure 2-4).

#### NOTE

The length of the anchor bolts should not be so long that they interfere with the top plate or vessel leg once the Load Disc II transducers are completely installed.

9. Place the leveling nuts and flat washers on the anchor bolts.
10. Lower the vessel until the transducer on each leg rests on the leveling nuts and washers of the anchor bolts. Put the nut, lock, and flat washers on the anchor bolts and proceed to LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCERS.

\* For transducers rated 10K lbs and lower

\*\* For transducers rated over 10K to 25K lbs

\*\*\* For transducers rated 35K to 100K lbs

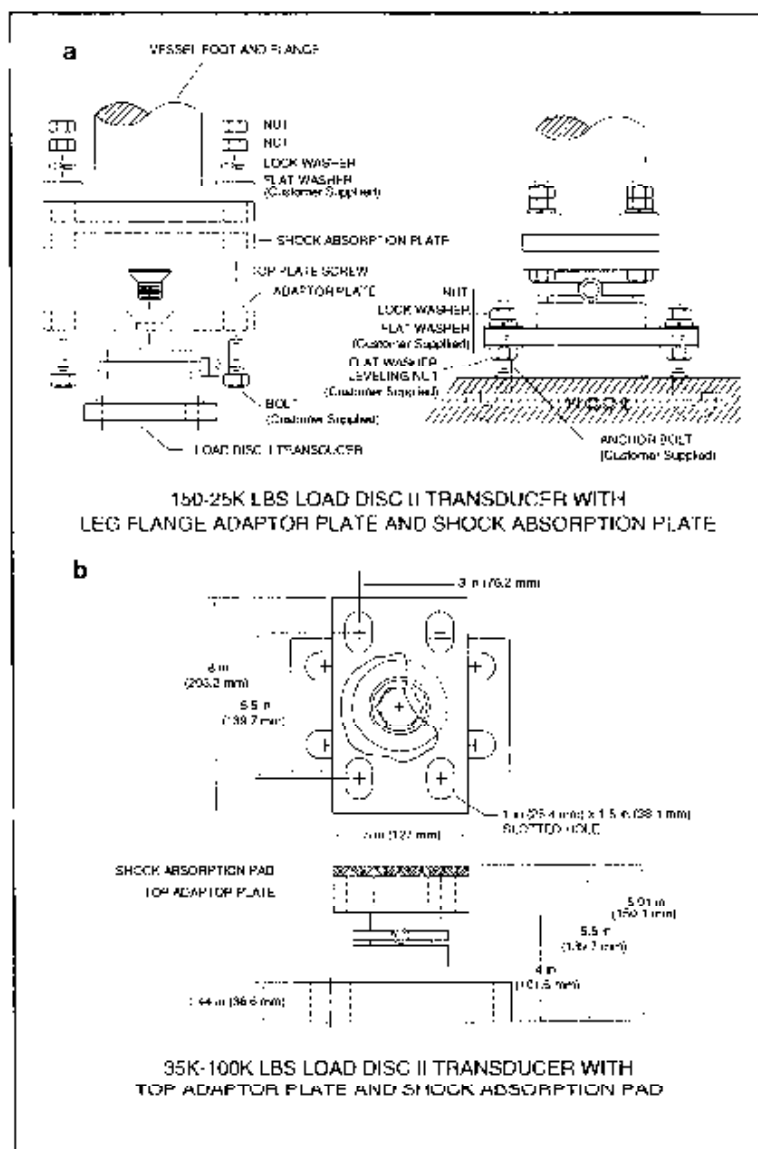


Figure 2-5. Load Disc II Transducer and Leg Flange Adaptor Hardware Kits

## Load Disc II Transducer Installation (Leg Flange Adaptor Plate and Shock Absorption Pad Hardware Kit)

This Load Disc II transducer configuration has a hardware kit that consists of a leg flange adaptor plate, a shock absorption pad, and a top screw to secure it to the transducer. The adaptor plate bolts to a vessel gusset (Figure 2-5) or a vessel leg that has a flat plate welded to it. The customer must supply the hardware to secure the adaptor plate to the leg or gusset. Follow this procedure to install the Load Disc II transducer.

1. Raise the vessel.

### CAUTION

Use proper supports to prevent the vessel from falling over.

2. Place the adaptor plate against the bottom of the vessel leg flat plate or gusset. Use a pencil to mark the hole pattern of the adaptor plate on the leg or gusset. The dimensions and hole pattern of the adaptor plate is the same as the transducer base plate. (Refer to the drawing in Appendix E.)
3. Drill holes in the vessel leg or gusset per the hole pattern marked in Step 2 (5/8" diameter holes for 150 lbs to 25K lbs transducers or 1.0 inch diameter holes for 35K to 100K transducers). Deburr the holes when done.
4. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the leg flange adaptor plate and leg/gusset.
5. Secure the leg flange adaptor plate to the top of the Load Disc II transducer with the supplied screw. Orient the adaptor plate so that is at right angles to the base plate. This will prevent top hardware from contacting the bottom hardware.

\* For transducers rated 10K lbs and lower

\*\* For transducers rated over 10K to 25K lbs

\*\*\* For transducers rated 35K to 100K lbs

6. With the shock absorption pad between the transducer top adaptor plate and the vessel leg or gusset, bolt the Load Disc II transducer assembly to the leg (or gusset) using 3/8"-24 UNF\*, 7/16"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* bolts (ASTM-A325 or stronger), lock washers, flat washers, and nuts. Orient the bolts so that the heads face down and the nuts and washers are on top (Figure 2-5). Follow Steps 1 through 6 to install all of the transducers to the vessel legs or gussets.
7. Slowly lower the vessel. Use a pencil to mark the hole pattern of each Load Disc II base plate on the floor and then raise the vessel again. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.
8. Drill holes in the floor and install four anchor bolts (customer supplied) per base plate. Be sure that anchor bolts match the hole pattern and that they are straight.

Kistler-Morse recommends using 3/8"-24 UNF\*, 7/16"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* anchor bolts that are grade ASTM-A325 or stronger. The threaded length of the anchor bolts should provide enough length for the thickness of the base plate, the thickness of the leveling nut and flat washer under the base plate, and the thickness of the lock washer, flat washer, and nut on top of the base plate (Figure 2-5).

**NOTE**

The length of the anchor bolts should not be so long that they interfere with the top plate or vessel leg once the Load Disc II transducers are completely installed.

9. Place the leveling nuts and flat washers on the anchor bolts.
10. Lower the vessel until the transducer on each leg rests on the leveling nuts and washers of the anchor bolts. Put the nut, lock, and flat washers on the anchor bolts and proceed to **LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCERS**.

### ***Load Disc II Transducer Installation (Spun-Ball Leg Adaptor Hardware Kit)***

This Load Disc II transducer configuration has a hardware kit that is available for transducers with a load range of up to 25K lbs. The hardware kit consists of a spun-ball leg adaptor cup, a threaded adaptor stud, and a hex jam nut. The adaptor cup welds to a vessel leg after the vessel has been leveled (Figure 2-6).

The adaptor stud screws into the adaptor cup and into the Load Disc II transducer. The jam nut secures the stud in place once the vessel has been leveled. Follow this procedure to install the Load Disc II transducer to a spun ball leg.

- \* For transducers rated 10K lbs and lower
- \*\* For transducers rated over 10K to 25K lbs
- \*\*\* For transducers rated 35K to 100K lbs

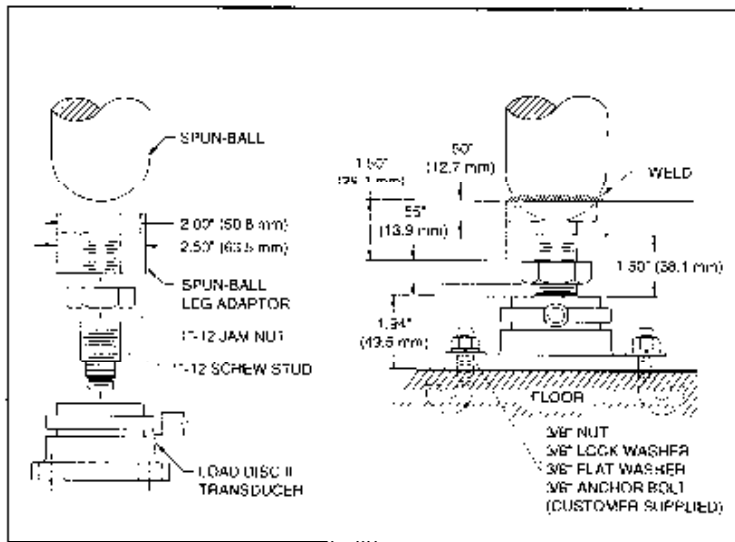


Figure 2-6. 150 lb to 25K lb Load Disc II Transducer with Spun-Ball Leg Adaptor Hardware Kit.

1. Apply a thread-locking compound to the bottom half of the adaptor studs and screw them into the tops of the Load Disc II transducers as far as they will go. Clean off any compound on the threads above the tops of the transducers.
2. Apply a lubricant to the threads of the adaptor studs. Screw jam nuts onto studs as far as they will go. Screw the adaptor cups onto the studs.
3. Raise the vessel high enough to slide a transducer/adaptor cup beneath each leg.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

4. Lower the vessel legs onto the spun-ball leg adaptor cups while carefully aligning the transducers to achieve the most optimum fit in

the cups. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.

5. Use a pencil to mark the hole pattern of each Load Disc II base plate on the floor and then raise the vessel again.
6. Drill holes in the floor and install four anchor bolts (customer supplied) per base plate. Be sure that anchor bolts match the hole pattern and that they are straight. Kistler-Morse recommends using 3/8"-24 UNF\* or 7/16"-20 UNF\*\* anchor bolts that are grade ASTM-A325 or stronger. The threaded length of the anchor bolts should provide enough length for the 1/2-inch thickness of the base plate, the thickness of the leveling nut and flat washer under the base plate (optional), and the thickness of the lock washer, flat washer, and nut on top of the base plate (Figure 2-6).

### NOTE

The length of the anchor bolts should not be so long that they interfere with the vessel leg once the Load Disc II transducers are completely installed.

7. If desired, leveling nuts and flat washers can be used for additional leveling capacity and should be screwed onto the anchor bolts at this time. Skip this step if leveling nuts are not used.
8. Place the transducers onto the anchor bolts and secure in place with a nut, lock washer, and flat washer on each bolt.
9. Slowly lower the vessel legs into the transducer adaptor cups. Put the nut, lock, and flat washers on the anchor bolts and proceed to **LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCERS**. Once the vessel has been leveled on the transducers, tighten the jam nuts against each adaptor cup and weld the adaptor cups to the vessel legs.

\* for transducers rated 10K lbs and lower  
 \*\* for transducers rated over 10K to 25K lbs  
 \*\*\* for transducers rated 35K to 100K lbs

### ***Welding of Spun Ball Leg Adaptor Hardware Kit to Vessel Legs Installed on Load Disc II Transducers***

Installation of the Spun Ball Leg Adaptor kit and leveling of the vessel legs should be completed before welding. Once the hardware is welded, all flexing and movement of the tank will be transferred to the transducer. The best situation for welding the cup to the vessel leg is when the vessel is fully loaded so that all possible vessel leg deflections are incorporated in the positioning of the transducer with respect to the vessel leg and the foundation where the Load Disc II is located. Points to consider before welding are:

- Any and all height adjustments and shimmings should be completed prior to welding.
- The transducer should be secured to the foundation and the spun ball leg adaptor hardware should be secured to the transducer. Its jam nut should be tight against the cup.
- Cycle (load and unload) the tank several times prior to welding to prevent additional settling of the tank once welding is complete.
- All input and output connections (pipes, etc.), and all additions (e.g. agitator) to the tank should be in place before welding.

Follow this procedure:

1. Connect the Load Disc II transducers to the signal processor. Test them to make sure there is no problem with the transducers or the wiring.
2. Disconnect the transducers from the signal processor before welding.
3. Connect the welding ground strap to the vessel leg as close to the welding area as possible. Be sure that no current can pass through the transducer.
4. The welding of the cup portion of the hardware kit to the vessel spun ball leg should be a complete, round, and full penetration weld per Uniform Building Code (UBC) specification AWS B2.1.009-90. Note that the material of the cup is 17-4 PH900 stainless steel.

### ***Load Disc II Transducer Installation (Free-Standing Hardware Kit)***

This Load Disc II transducer configuration has a hardware kit that consists of a top screw with a curved head (Figure 2-7). This installation is free-standing and is recommended for vessels that do not agitate and preferably are supported on three legs. This hardware kit is also used on vessels located on a sloped floor. Follow this procedure.

1. Apply a thread-locking compound to the threads of the top screw and screw it into the top of the Load Disc II transducer.
2. Raise the vessel.

\* For transducers rated 10K lbs and lower

\*\* For transducers rated over 10K to 25K lbs

\*\*\* For transducers rated 35K to 100K lbs



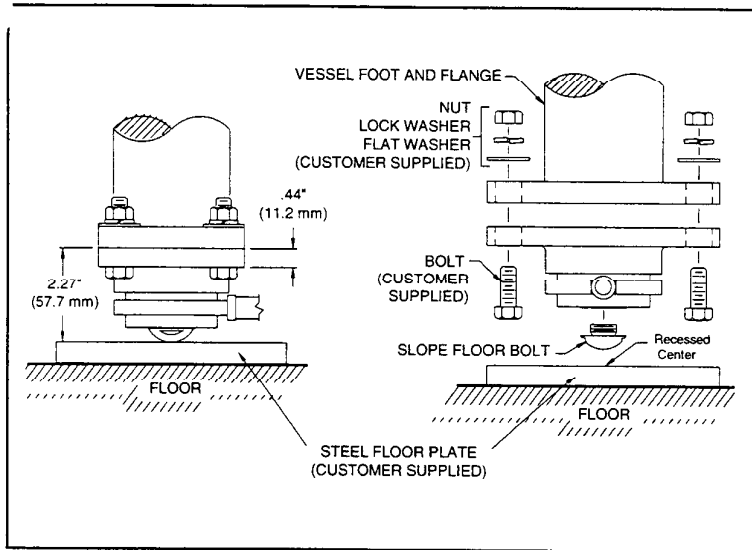


Figure 2-7. Load Disc II Transducer with a Free-Standing Hardware Kit.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

3. Place the transducer base plate against the bottom of the vessel leg flat plate or gusset. Use a pencil to mark the hole pattern of the adaptor plate on the leg or gusset. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.
4. Drill holes through the vessel leg or gusset per the hole pattern marked in Step 3 (5/8" diameter holes for 150 lbs to 25K lbs transducers or 1.0" diameter holes for 35K lbs to 100K lbs transducers). Deburr the holes when done.
5. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the transducer base plate and leg/gusset.
6. Secure the Load Disc II transducer to the bottom of the vessel leg or gusset using 3/8"-24 UNF\*, 7/16-20 UNF\*\*, or 3/4"-10 UNC\*\*\* bolts (ASTM-A325 or stronger), lock washers, flat washers, and nuts. Orient the bolts so that the head faces down and the nuts and washers are on top (Figure 2-7). Follow Steps 1 through 6 to install all of the transducers to the vessel legs or gussets.
7. Slowly lower the vessel to the floor. Kistler-Morse recommends using steel plates under the vessel legs to prevent the curved-head top screws from damaging the floor.

### NOTE

This particular installation does not have a height adjustment. When following the vessel leveling procedures in the next section, shims will have to be added and removed from underneath the legs to adjust the height and level. The shims can be placed between the transducer base plate and vessel leg or between the floor and customer-supplied steel plate.

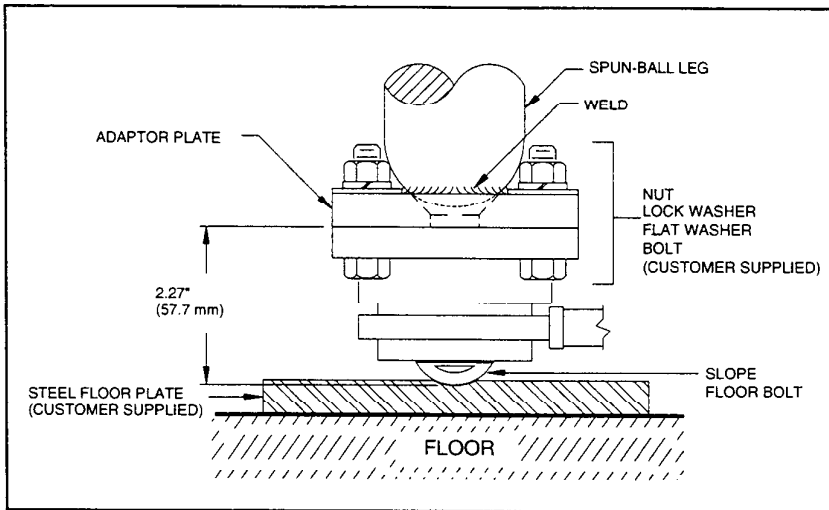


Figure 2-8. Load Disc II Transducer with a Free-Standing-to-Spun-Ball Leg Hardware Kit.

## Load Disc II Transducer Installation (Free-Standing-to-Spun- Ball Leg Hardware Kit)

This Load Disc II transducer configuration has a hardware kit that consists of an adaptor plate with a curved-head top screw (Figure 2-8). This installation is free-standing and is recommended for spun-ball legged vessels that do not agitate (and preferably are supported on three legs). This hardware kit is also used on vessels located on sloped floors.

Follow this procedure.

1. Apply a thread-locking compound to the threads of the top screw and screw it into the top of the Load Disc II transducer.
2. Raise the vessel.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

3. Place the adaptor plate underneath the leg with the wide-diameter center hole facing up.
4. Lower the leg into the wide-diameter center hole of the adaptor plate. Make sure that the leg is seated perpendicular to the adaptor plate.
5. Weld the leg to the adaptor plate.
6. Raise the leg. Bolt the base plate of the Load Disc II transducer to the adaptor plate. Slowly lower the vessel to the floor. K-M recommends using steel plates under the vessel legs to prevent the curved-head top screws from damaging the floor.

### NOTE

This particular installation does not have a height adjustment. When following the vessel leveling procedures in the next section, shims will have to be added and removed from underneath the legs to adjust the height and level. The shims can be placed between the transducer base plate and vessel leg or between the floor and customer-supplied steel plate.

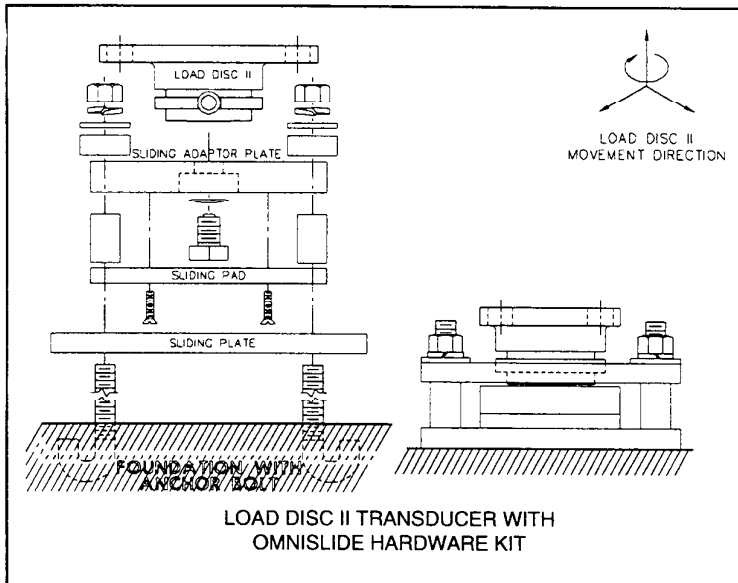


Figure 2-9. Load Disc II Transducer with Omnislide Expansion, Sliding Hardware Kit.

## Load Disc II Transducer Installation (Omnislide Expansion, Sliding Hardware Kit)

This Load Disc II transducer configuration (Figure 2-9) has a hardware kit that consists of a sliding adaptor plate that is secured to the Load Disc II transducer by a disk spring washer and hex head screw. A UHMW (ultra high molecular weight plastic material) sliding pad is bolted on the sliding adaptor plate by several small stainless steel screws. The sliding pad rests and slides on a smooth stainless steel sliding plate which has four holes on it and is secured to the foundation through customer supplied anchor bolts. The sliding adaptor plate is limited in movement by four stainless steel spacer tubings and two stainless steel retainer blocks which are

secured to the sliding plate by customer supplied nuts and washers and the anchor bolts. The Load Disc II transducer (which is attached to the sliding adaptor plate and is capable of limited sliding movement) is bolted to the vessel leg gusset through its base plate. Thermal expansion and contraction and other causes of limited leg movement can now take place without affecting the transducer's performance. Follow this procedure to install the Load Disc II transducer.

1. Using the disk spring washer and hex head screw, attach the sliding adaptor plate to the top of the Load Disc II transducer. (Refer to Appendix E for screw torque requirement.)
2. Using the small stainless steel screws, attach the UHMW sliding pad on the sliding adaptor plate.

### NOTE

During final installation, position the long side of the sliding adaptor plate in the same direction as the long side of the transducer base plate. The Omnislide hardware kit is designed to provide the most freedom of movement in the direction of sliding adaptor plate's long side.

3. Raise the vessel.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

4. Place the base plate of the transducer against the bottom of the vessel leg flat plate or gusset. Use a pencil to mark the base plate hole pattern on the leg or gusset. (Refer to the drawings in Appendix E for dimensions and hole patterns.)

5. Drill holes in the vessel leg or gusset per the hole pattern marked in Step 4 (5/8 inch diameter holes for 150 lbs to 25K lbs transducers, and 1.0 inch diameter holes for 35 K to 100K lbs transducers). Deburr the holes when done.
6. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the Load Disc II base plate and leg/gusset.
7. Bolt the Load Disc II assembly base plate to the leg or gusset using 3/8"-24 UNF\*, 7/8"-20 UNF\*\*, or 3/4"-10 UNC\*\*\* bolts (ASTM-A325 or stronger), lock washers, flat washers, and nuts. Orient the bolts so that the heads face down and the nuts and washers are on top. Follow Steps 1 through 7 to install all of the transducers to the vessel legs or gussets.
8. Slowly lower the vessel. Place the stainless steel sliding plates (smooth surface up) under each of the legs. Make sure that the sliding pad centers between the four mounting holes on the sliding plate on the floor and then raise the vessel again. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.
9. Drill holes in the floor and install four anchor bolts (customer supplied) per sliding plate. Be sure that anchor bolts match the hole pattern and that they are straight. Kistler-Morse recommends using anchor bolts that are grade ASTM-A325 or stronger, 1/2"-13 UNC for up to 25K lbs transducers or 3/4"-10 UNC for 35K to 100K lbs transducers. The threaded length of the anchor bolts should provide enough length for the sliding plate, spacer tubes, retainer block, flat washer, lock washer, and nut. Also, if a custom leveling plate (customer supplied), leveling nuts, and washers are used, their thickness should also be considered in the overall length of the anchor bolts. (Refer to the drawings in Appendix E.)

**NOTE**

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The length of the anchor bolts should not be so long that they interfere with the Load Disc II base plate or vessel leg once the Load Disc II transducers are completely installed.

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10. If leveling plate and leveling nuts and washers are used, place them on the anchor bolts.
11. Place the sliding adaptor plate on the anchor bolts (on top of the leveling plate if one is used).
12. Put spacer tubes on the anchor bolts and slowly lower the vessel until the transducers on each leg rest on the sliding adaptor plate.
13. Put the retainer block on the anchor bolts over the sliding adaptor plate. Put a flat washer, lock washer, and nut on the anchor bolts and proceed to **LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCER**. Once the vessel has been leveled on the transducers, tighten the nuts on the retainer blocks.

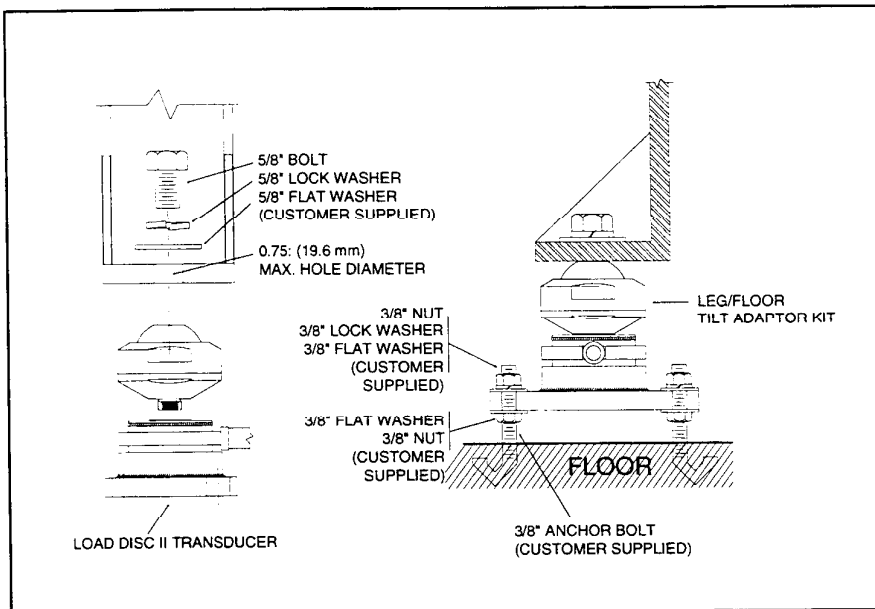


Figure 2-10. 150 lbs to 25K lbs Load Disc II Transducer with Leg/Floor Tilt Adaptor Hardware Kit.

## Load Disc II Transducer Installation (Leg/Floor Tilt Adaptor Hardware Kit)

The Leg/Floor Tilt Adaptor Hardware Kit consists of a stainless-steel ball that rotates within a stainless-steel housing. The housing screws onto the top of the Load Disc II. The stainless-steel ball has a 5/8"-18 tapped hole that accepts the hardware (customer supplied) used to secure the vessel leg to the tilt adaptor. The depth of the tapped hole is 0.75 inch (19

mm). When choosing the length of the bolt to use, consider the thickness of the flat plate or gusset, thickness of the lock and flat washers, and the depth of the tapped hole. The stainless-steel ball can rotate up to 25° in any direction. This will accommodate any combination of vessel leg tilt and/or sloped floor. Follow this procedure to install the Load Disc II transducer.

1. Slightly loosen the upper part of the tilt adaptors to allow for ball rotation.
2. Apply a thread locking compound to the threads of the tilt adaptors and screw the adaptors into the tops of the Load Disc II transducers as far as they will go.
3. Raise the vessel.

### CAUTION

**Use proper supports to prevent the vessel from falling over.**

4. Inspect the bottom of the leg or gusset to ensure that it is perfectly flat. Remove any debris from the mounting surface that would otherwise be sandwiched between the transducer and leg/gusset.
5. Mark the mounting hole location on the leg/gusset and drill a hole large enough to insert a 5/8"-18 bolt. The hole should not be any larger than 3/4 inch in diameter. Deburr the hole and ensure that the surface is smooth.
6. Bolt the Load Disc II transducer with tilt adaptor to the leg or gusset with the 5/8"-18 bolt and lock washer (Figure 2-10). Follow Steps 3 through 6 to install all of the transducers to the vessel legs or gussets.

7. Slowly lower the vessel. Use a pencil to mark the hole pattern of each Load Disc II base plate on the floor and then raise the vessel again. Be sure that the transducer cables can be easily routed to the junction boxes without being snagged or chafed.
8. Drill holes in the floor and install four anchor bolts (customer supplied) per base plate. Be sure that anchor bolts match the hole pattern and that they are straight.

Kistler-Morse recommends using 3/8" 24 UNF\*, or 7/16"-20 UNF\*\* anchor bolts that are grade ASTM-A325 or stronger. The threaded length of the anchor bolts should provide enough length for the 1/2-inch thickness of the base plate, the thickness of the leveling nut and flat washer under the base plate, and the thickness of the lock washer, flat washer, and nut on top of the base plate (Figure 2-10).

**NOTE**

The length of the anchor bolts must not interfere with the top hardware or vessel leg once the Load Disc II transducers are completely installed.

9. Place the leveling nuts and flat washers on the anchor bolts.
10. Lower the vessel until the transducer on each leg rests on the leveling nuts and washers of the anchor bolts. Put the nut, lock, and flat washers on the anchor bolts and proceed to **LEVELING THE VESSEL ON THE LOAD DISC II TRANSDUCERS**. Once the vessel has been leveled on the transducers, tighten the upper part of the tilt adaptor to provide a tight grip on the rotating ball.

### ***Load Disc II Transducer Installation (Weldable Gusset Adaptor Plate with Leveling Base Adaptor Plate)***

This hardware kit consists of one weldable gusset adaptor plate, one 5/8"-18 hex bolt, one spring washer, one leveling base adaptor plate, four 1/2"-13 hex bolts, and four sets of flat and lock washers.

1. Initially bolt the Load Disc II on the leveling base adaptor plate using the four 1/2"-13 bolts and the flat and lock washers. Bolt the weldable gusset adaptor plate on top of the Load Disc II transducer using the 5/8"-18 hex bolt and the spring washer. Orient the gusset perpendicular to the base plate (Figure 2-11).
2. Configure the location of this assembly against the vessel leg such that the transducer cable can be easily routed to the junction box without being snagged or chafed and without excessively bending the blue rubber hose on the cable. The installed transducer should be out of harms way, e.g. being hit by a fork lift.

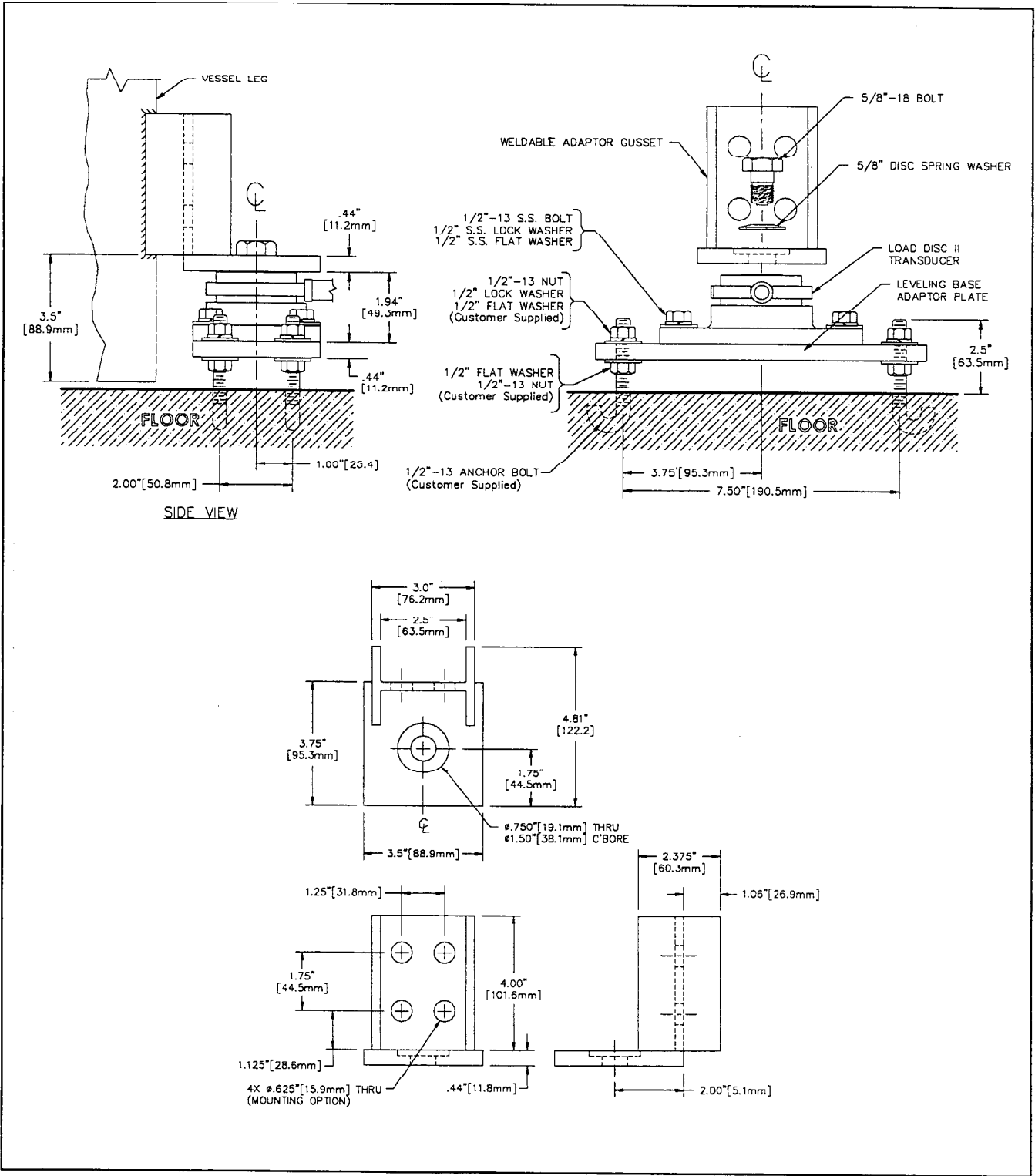


Figure 2-11. 150-25K lb Load Disc II Transducer with Weldable Adaptor Gusset and Leveling Base Adaptor Plate.

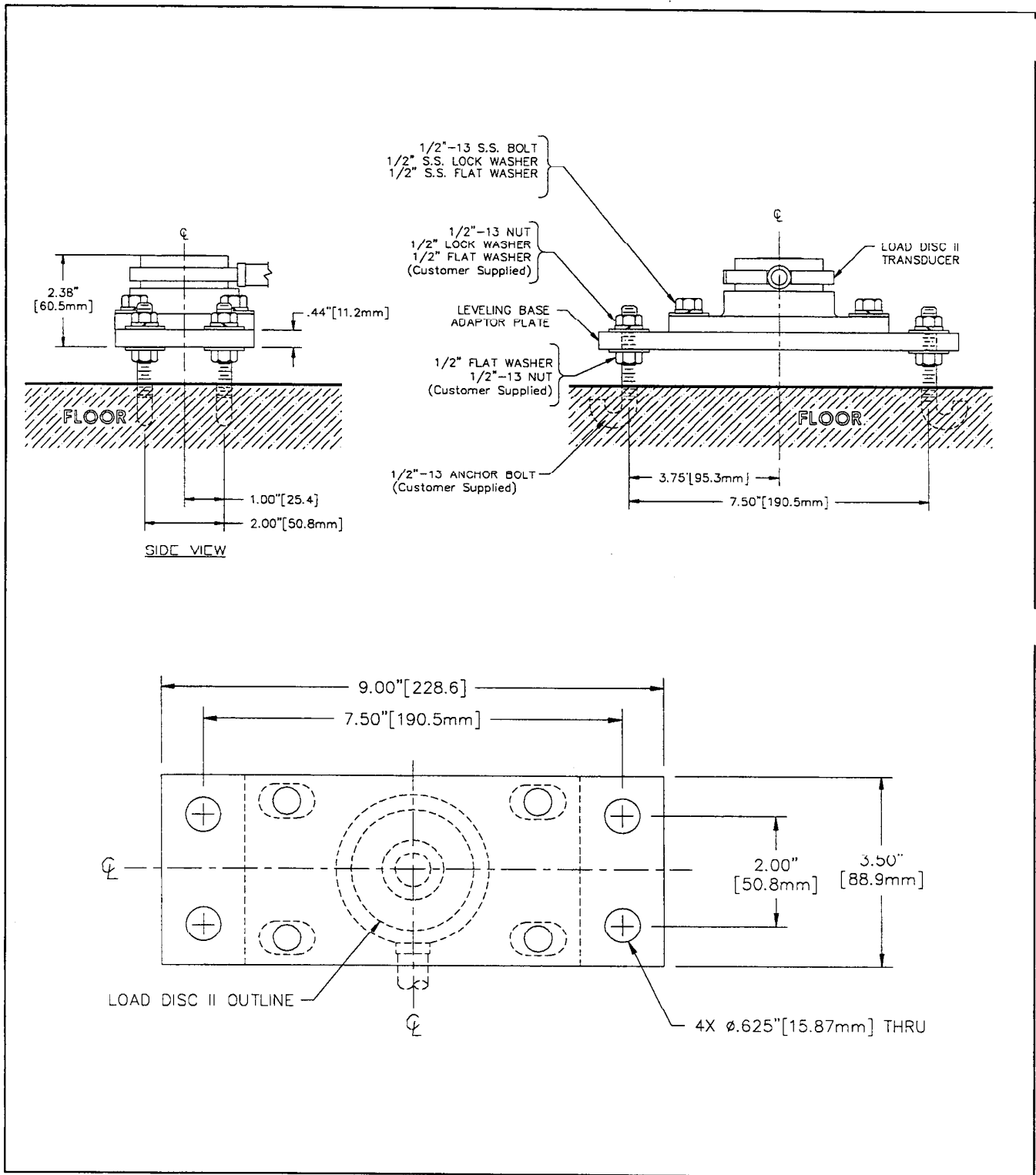


Figure 2-12. 150-25K lb Load Disc II Transducer with Leveling Base Adaptor Plate.



3. Position the assembly against the vessel leg and mark the outer edges of the H-beam of the weldable gusset adaptor plate on the vessel leg. Also mark the center of the holes of the leveling base adaptor plate on the foundation.
4. Install four anchor bolts in the foundation and put the leveling nuts and washers on them.
5. Place the Load Disc II assembly on the leveling nuts and turn the leveling nuts until the bottom of the gusset H-beam is 3 1/2 inches off the foundation. Note that this 3 1/2 inch height will provide about 1 1/2 inches of grout space under the base leveling adaptor plate. If more grouting space is required, the additional height should be duplicated both in the exposed length of the anchor bolts and also the height at which the gusset is attached to the vessel leg. For example, to have a two inch grouting space the exposed length of anchor bolt should be 3 inches and the height at which the gusset is attached to the vessel leg should be 4 inches.
6. Tag weld the gusset adaptor plate H-beam on the vessel leg. Make sure the grounding path for welding is through the vessel leg and close to the welding point and not through the transducer. If the gusset adaptor is to be bolted on the vessel leg through the four bolt holes on the H-beam of the gusset adaptor, mark the holes on the vessel leg.
7. Remove the Load Disc II transducer. Complete the welding of the gusset adaptor on the vessel leg. If the gusset adaptor is to be bolted onto the vessel leg, drill and tap the marked holes on the vessel leg for 1/2"-13 (or M-12 metric size) screws, and bolt the gusset adaptor on the leg. Remember to use flat and lock washers.
8. Lower the leveling nuts that are holding the base leveling adaptor plate. Install the Load Disc II transducer on the base leveling adaptor plate. Turn the leveling nuts and raise the transducer until it is under the gusset adaptor. Bolt the gusset adaptor onto the Load Disc II transducer.
9. Repeat Steps 1 through 8 for all legs then start turning the leveling nuts until the vessel legs are raised slightly off the ground and are supported by the Load Disc II assembly.
10. Proceed to VESSEL LEVELING PROCEDURE. Once the vessel has been leveled on the transducer, tighten the nuts on top of the leveling base adaptor plate on the anchor bolt. Remember to use flat and lock washers. Pack grout under the leveling base adaptor plate.

### ***Load Disc II Transducer Installation (Leveling Base Adaptor Plate Hardware Kit)***

This hardware kit consists of one flat base plate, four 1/2"-13 screws, and four sets of flat and lock washers.

1. Install the Load Disc II on the leveling base adaptor plate using the four 1/2"-13 screws and washer sets (Figure 2-12).

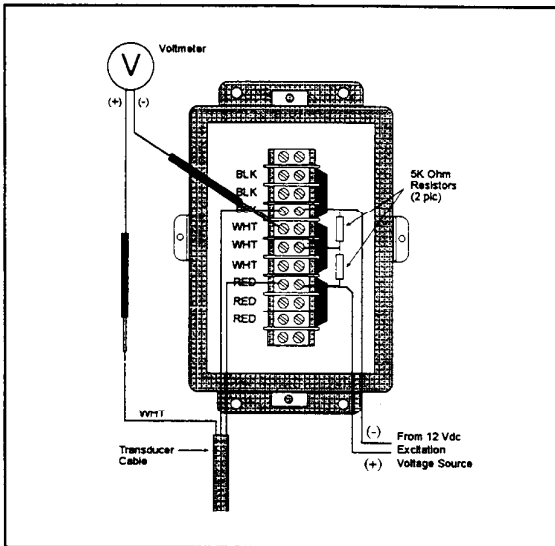


Figure 2-13. Load Disc II Wiring and Voltmeter Connection to a Stainless Steel Junction Box.

2. Follow the installation steps specified for Load Disc II installation with any other installation hardware kit (or no hardware kit if that is the case). Consider the leveling base adaptor plate as the base plate of the Load Disc II transducer.

**NOTE**

If there is a need for removing a Load Disc II transducer from under a vessel leg, this configuration will facilitate the process by removing the 1/2-13" screws and sliding the transducer out as oppose to raising vessel legs to clear the installation anchor bolts.

## VESSEL LEVELING PROCEDURES

Leveling the vessel requires using a voltmeter, a 1000/1020 Weight Indicator, or one of the 1200 Series batchers. If your signal processor is something other than the above mentioned, follow the procedures in Vessel Leveling Procedure Using a Voltmeter. If you are using a 1000/1020 Weight Indicator or 1200 Series batcher, follow the procedures in Vessel Leveling Procedure Using a Signal Processor.

### Vessel Leveling Procedure Using a Voltmeter

This section describes how to use a voltmeter to perform the vessel leveling procedure. If you are going to use a K-M signal processor to perform this procedure, disregard this section and refer to Vessel Leveling Procedure Using a Signal Processor.

The main purpose of leveling the vessel is to distribute the weight evenly on all of the Load Disc II transducers. Uneven weight distribution on the transducers will reduce the accuracy of the weight measurement system as a whole. In

addition to a voltmeter, a 12 Vdc source to apply excitation voltage to the transducers and the junction box that came with the system will be needed.

### Junction Box Preparation

There are two types of junction boxes that can be used with Load Disc II transducers: a stainless steel junction box with a terminal strip inside (Figure 2-13) and a Noryl plastic junction box with a PCB inside (Figure 2-14). The

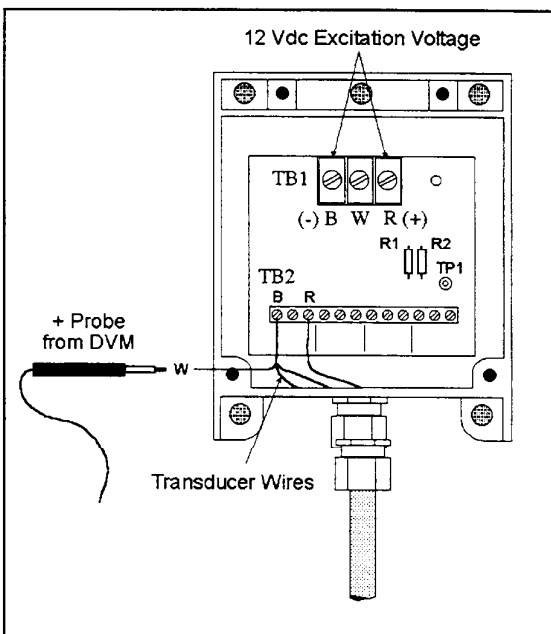


Figure 2-14. Load Disc II Wiring and Voltmeter Connection to a Plastic Junction Box.

procedure is the same regardless of which junction box you have. The wiring of the two junction boxes is slightly different and is clearly noted in the procedure.

If you have a stainless steel junction box, you will need to connect two 5K ohm resistors to the terminal strip to form a bridge completion circuit as shown in Figure 2-13.

#### NOTE

If you have a stainless steel junction box, punch holes only in the BOTTOM surface of the box for Load Disc II cable entry. K-M recommends using conduiting for all transducer and interconnect cabling. Select high-quality watertight seals where the conduits enter the j-box.

After all transducers are adjusted and wiring is complete, seal the area between the cable and the conduit at the j-box entry with either Sikaflex 190 or RTV 738 to prevent moist air from flowing into the j-box.

1. **For Stainless Steel Junction Boxes**, connect the red wire and black wire of the Load Disc II transducer cable to the terminals shown in Figure 2-13. Leave the white wire loose.

**For Plastic Junction Boxes**, connect the red wire of the transducer to the R (red) terminal and the black wire to the B (black) terminal on terminal block TB2 (Figure 2-14). Leave the white wire loose.

2. **For Stainless Steel Junction Boxes**, connect the positive (+) lead of a 12 Vdc excitation voltage source to the terminal strip at the red transducer wire and the negative (-) voltage source lead at the black transducer wire (Figure 2-13).

**For Plastic Junction Boxes**, connect a 12 Vdc excitation voltage source to the R (red) and B (black) terminals on terminal block TB1: positive (+) lead to red terminal, negative (-) lead to black terminal.

3. Set the voltage scale on the voltmeter to +/- 1 volt.
4. **For Stainless Steel Junction Boxes**, connect the signal probe (+) of the voltmeter to the white transducer wire and the common probe (-) to the terminal where the two resistor leads connect to the terminal strip (Figure 2-13). Observe the transducer's millivolt output.

**For Plastic Junction Boxes**, connect the signal probe (+) of the voltmeter to the white transducer wire and the common probe (-) to TP1 as shown in Figure 2-14. Observe the transducer's millivolt output.

5. Perform Steps 1 through 4 on all of the Load Disc II transducers.

**NOTE**

When load is applied on the transducers, their output increases. When under tension, their output decreases. Each transducer shows some output when no load is applied. This is called transducer offset and is marked on the label of each unit. Anytime you take a voltage reading from a transducer, the difference between offset and the voltage reading corresponds to the load on the unit. This difference is what needs to be compared between transducers to make sure all of them are under equal loading condition (given that there is no internal mechanism in a vessel that puts extra loading on one side of the vessel). This difference is called the absolute millivolt output of the transducer.

**Adjusting the Leveling Nuts**

In an ideal application, each leg of the vessel carries the same amount of weight. The leveling nuts (or spun-ball leg adaptor cups) can then be adjusted until the absolute output of all the Load Disc II transducers are within 10 to 15 mV of each other. In the real world, however, every application is different. Many vessels will have additional equipment attached to one side (e.g., mixers). This means that the Load Disc II transducers on the equipment-side of the vessel will carry more weight than the ones on the opposite side and therefore will have a higher voltage output.

In this situation, the equipment-side Load Disc II transducers should be adjusted so that their absolute output is within 10 to 15 mV of each other and the opposite-side Load Disc II transducers adjusted so that their absolute output is within 10 to 15 mV of each other. The difference in absolute voltage output between the equipment-side transducers and the opposite-side transducers can be greater than 15 mV

The actual millivolt output of your Load Disc II system depends on the weight of your vessel. Since no two vessels weigh the same, this procedure cannot tell you what the output of each Load Disc II transducer will be. What is important, however, is the differences in the absolute voltage outputs form the transducers. Look for situations where the absolute output of three transducers will be within 10 to 15 mV of each other (which is within tolerance) and the fourth transducer less by a considerable amount. This will tell you that the bulk of the vessel weight is distributed on three transducers and adjustments must be made to bring the absolute voltage output of the fourth transducer within tolerance.

Another procedure to follow in order to check if each transducer is carrying the proper amount of weight is to hook up the voltmeter to a leg and observe the voltage output reading. Stand on the leg and write down how much the voltage increases when your weight is applied. Do this at each of the four legs and compare the results. Despite what the voltage output of each transducer is before you stand on the leg, the voltage should increase approximately the same amount for each transducer when you apply your weight.

Adjusting the transducers to distribute the vessel weight evenly will mean loosening and tightening all of the transducer leveling nuts systematically, and not just the leveling nuts of the one transducer out of tolerance.

**NOTE**

For spun-ball leg adaptor installation, the adaptor cup is turned to adjust the loads on the transducers to achieve equal loading.

Follow this procedure.

1. Use a wrench to loosen the nuts that secure the base plate.

**NOTE**

Two wrenches the same size may be needed to hold the leveling nut while loosening the nut on top of the base plate.

2. Loosen or tighten the leveling nuts (or spun-ball leg adaptor cup) as required to adjust the distribution of weight on the transducer.

**NOTE**

Adjusting the leveling nuts on one transducer will probably affect the weight distribution on the transducer located on the opposite side. Keep this in mind while making your adjustments.

3. Check the voltage output of all the transducers each time you make an adjustment to one transducer to see how they are affected.
4. Continue performing Steps 1 through 3 until you have achieved the desired voltage output from all the transducers.
5. Tighten the nuts on top of the base plate (or the jam nut under the spun-ball leg adaptor cup) after all adjustments have been made.
6. Pack grout or cement under the transducer base plate. Do not grout past the bottom edges of the base plate.

### ***Vessel Leveling Procedure Using a Signal Processor***

This section describes how to use a Kistler-Morse signal processor to perform the vessel leveling procedure. The K-M signal processors that can be used for this procedure are the 1000 and 1020 Weight Indicators and the 1200, 1220, and 1240 Batch Controllers. If you are going to use a voltmeter to perform this procedure, disregard this section and refer to Vessel Leveling Procedure Using a Voltmeter.

The main purpose of leveling the vessel is to distribute the weight evenly on all of the Load Disc II transducers. Uneven weight distribution on the transducers will reduce the accuracy of the weight measurement system as a whole. Follow this procedure.

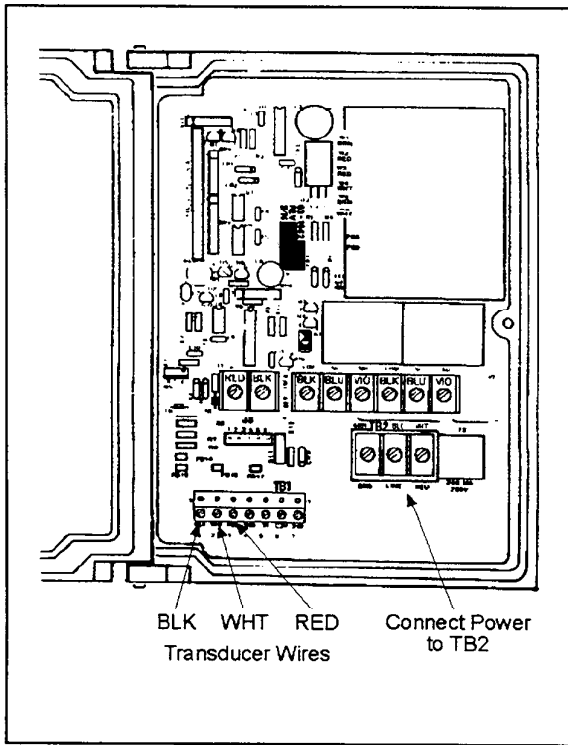


Figure 2-15. Wiring the 1000/1020 Weight

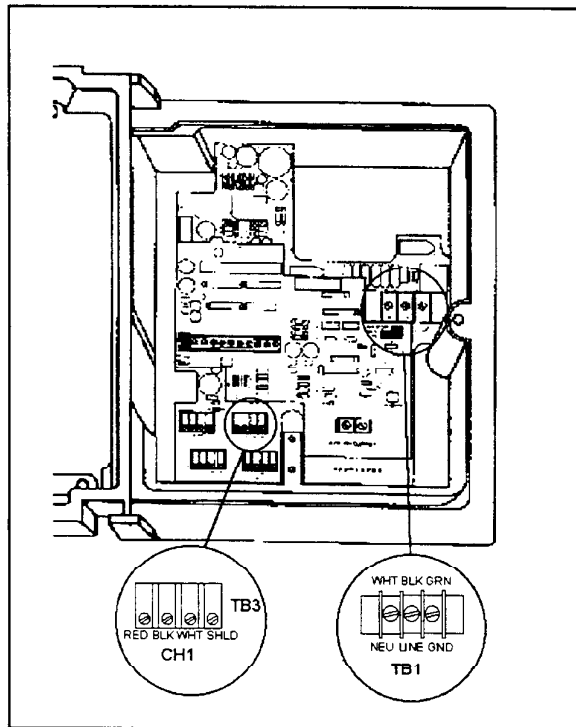


Figure 2-16. Wiring the 1200 Series Batch Controller.

**NOTE**

If your Load Disc II transducers and signal processor are already wired together through junction boxes, disregard Steps 1 and 2 and continue with Step 3.

1. Connect the Load Disc II transducer wires to TB1 as shown in Figure 2-15 if you are using a 1000/1020 Weight Indicator or TB3 as shown in Figure 2-16 if you are using a 1200 Series Batch Controller.
2. Connect power to TB2 in a 1000/1020 or TB1 in a 1200 Series batcher as shown in the figures.

**NOTE**

Refer to the manual that came with your signal processor for a more detailed explanation of wiring the Load Disc II transducers and power to the unit.

3. For 1000/1020s, open the front cover. Hold down the GREEN Scroll Down key and press the RED Function key to get into the Function Mode.

For 1200 Series, press the FUNCTN key to get into the Function Mode.

4. For 1000/1020, use the YELLOW Scroll Up key to scroll to Function 44. The voltage output of the transducer wired to the unit will appear on the display.

If your weight measurement system is completely installed, disconnect the white (WHT) wire of all but one transducer in the junction box(es). The voltage output of the one remaining transducer wired to the junction box will appear on the display.

For 1200 Series, press the 9 and 4 keys and then the ENTER key. This puts you in Function 94. Press the ENTER key a second time and the voltage output of the transducer wired to the unit will appear on the display.

If your batching system is completely installed, disconnect the white (WHT) wires of all but one transducer in the junction box(es). The voltage output of the one remaining transducer wired to the junction box will appear on the display.

5. Perform Steps 1 through 4 on all of the Load Disc II transducers. Write down and compare the absolute millivolt output (the difference between offset and output) of each one. Once you have done that, perform the procedure in Adjusting the Leveling Nuts.

## **Shimming the Load Disc II Transducers**

For installations where leveling nuts are not used, load balancing on the transducers must be achieved by adding and removing shims underneath the transducers. Adjusting the transducers to distribute the vessel weight evenly will probably require adding shims under all of the base plates systematically, and not just under the base plate of the one transducer out of tolerance.

Follow this procedure.

1. Raise the vessel again.

### **NOTE**

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It is the customer's responsibility to supply shimming material suitable for the particular application

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2. Cut and place shims under the base plates as required to adjust the distribution of weight on the transducers.

### **NOTE**

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Shimming the base plate of one transducer will probably affect the weight distribution on the transducer located on the opposite side. Keep this in mind while shimming the base plates.

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3. Lower the vessel and check the absolute voltage output of all the transducers to see how they are affected.
4. Continue performing Steps 1 through 3 until you have achieved the desired absolute voltage output of all the transducers. If you are going to secure the base plates to the floor, continue with Step 5. If not, skip the rest of this procedure and continue with MOUNTING THE JUNCTION BOX.
5. Raise the vessel again.
6. Drill holes in the floor and install anchor bolts. Be sure to sink the anchor bolts deep enough so that they will not touch the top hardware or the top hardware bolts once the Load Disc II transducers are completely installed.
7. Slowly lower the vessel. Secure the base plates to the floor.
8. Place the Load Disc II transducers such that the cable tubing cannot be snagged or chafed and can be routed easily to the junction boxes. Continue with MOUNTING THE JUNCTION BOX.

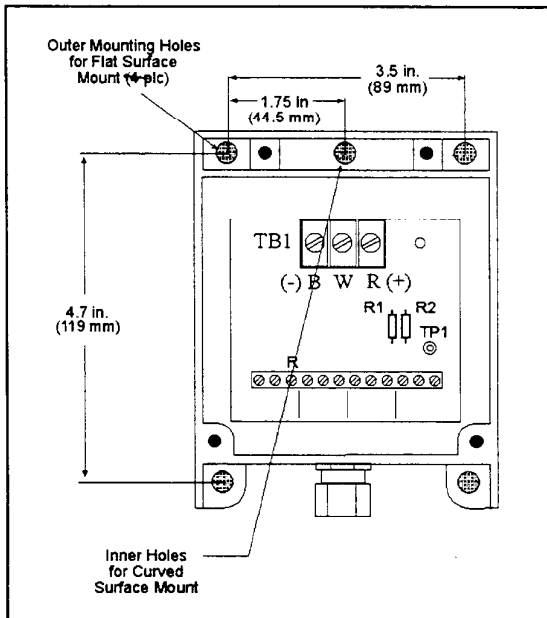


Figure 2-17. Plastic Junction Box Mounting Holes.

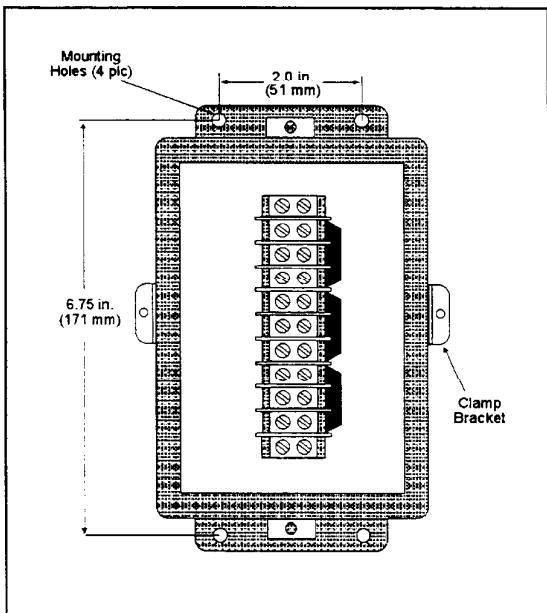


Figure 2-18. Stainless Steel Junction Box Mounting Holes.

## MOUNTING THE JUNCTION BOX

Junction boxes should be mounted in a convenient location that will easily accommodate wiring and conduit installation. Hardware to mount the junction boxes must be supplied by the customer. K-M recommends using #8-32 socket head screws and washers. Follow this procedure to mount the junction box.

1. If mounting a plastic junction box (Figure 2-17), remove the cover. This is not necessary if mounting a stainless steel junction box (Figure 2-18).
2. Hold the junction box on the desired mounting location. Use a pencil to mark the four outer junction box mounting holes on the flat surface. If you are mounting a plastic junction box on a pipe leg or curved surface, use the two center mounting holes to mount the j-box (Figure 2-17).
3. Set the junction box down in a safe place. Drill and tap the holes with a #29 drill bit and #8-32 tap.
4. Secure the junction box in place with #8-32 screws and washers.

## SPLICING THE LOAD DISC II CABLE

A cable splicing kit can be purchased from Kistler-Morse to lengthen the cable to 20, 60, or 100 feet. Watertight butt splices are provided in the kit to seal out moisture from the splices. Follow this procedure for each wire in the cable.

### NOTE

Use 18-gage three conductor cable, butt splices, and watertight heat shrink sleeves to splice the cable if you do not use a Kistler-Morse cable splicing kit.

1. Strip 0.3 inch (7.6 mm) of insulation off the end of the wires.
2. Crimp the wires in the butt splices white-to-white, red-to-red, and black-to-black.



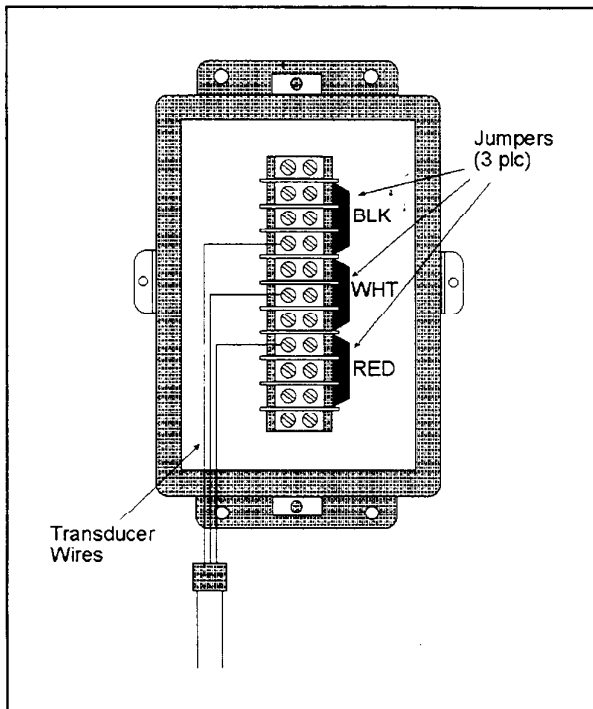


Figure 2-19. Wiring Transducers to a Stainless Steel Junction Box.

3. Use a heat gun to shrink the heat-shrink sleeves over the butt splices.
4. When routed through conduit, be sure that the splices do not rest in a low point where moisture can accumulate.

## WIRING LOAD DISC II TRANSDUCERS TO A STAINLESS STEEL JUNCTION BOX

The stainless steel junction boxes are different only with respect to the number of cable entry holes punched in the bottom surface. (The customer cuts these holes.) All of them have the same terminal strip inside, so the procedure for wiring the transducers to the j-box is similar for all variations. Carefully lay out your conduiting configuration before cutting these holes. For example, several Load Disc II cables may enter the box through the same conduit.

Note that Load Disc II cables connect to the terminal on the left side. The signal processor cable connects on the right side. Use a good quality fork lug to terminate the Load Disc II and interconnect cables.

It is the customer's responsibility to install conduit to route the transducer wires through so this procedure describes how to wire the transducers once the wires have already been routed to the junction box. The junction box will accommodate up to six transducers. The three terminals designated for black wires are jumpered together, as are the three terminals for white wires and three for red. Follow this procedure.

1. Remove the cover of the junction box.
2. Terminate each individual wire with a fork lug.
3. Route a black wire to one of the three terminals designated for black wires on the terminal strip as shown in Figure 2-19. Secure in place with the terminal screw.
4. Route and secure a white wire to one of the three white terminals and a red wire to one of the three red terminals.
5. Perform Steps 2 and 3 until all of the transducers are wired to the junction box.

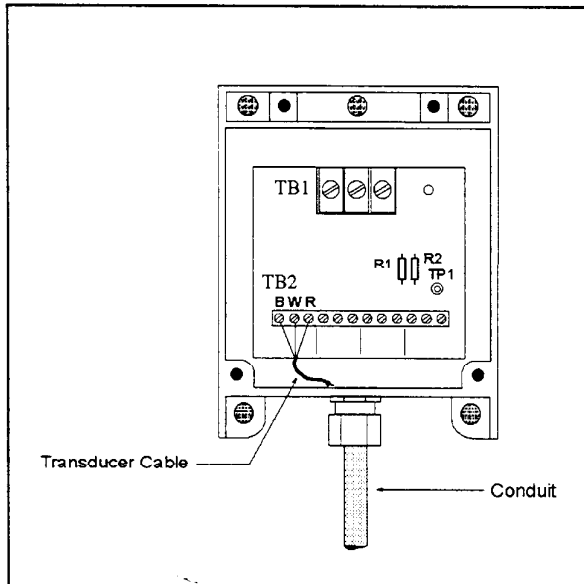


Figure 2-20. Wiring Transducers to a Plastic Junction Box.

## WIRING LOAD DISC II TRANSDUCERS TO A PLASTIC JUNCTION BOX

There are two types of plastic junction boxes. One junction box comes with four small holes and one large hole in the bottom. The other type of junction box comes with four small holes and two large holes in the bottom. The one large hole model accommodates a 3/4-inch conduit fitting. Be sure to select a good quality watertight fitting if this type of j-box is used. The two-hole model is equipped with interconnect cable fittings for nonconducted installations. The four small holes of both models will have watertight fittings for the transducer wires if conduit is not used or plugs to seal the holes if conduit is used. Kistler-Morse strongly recommends using conduit.

### NOTE

It is the customer's responsibility to install conduit for routing the transducer wires.

Although the hole configuration on the bottom is slightly different, the wiring of the transducers and signal processor to the two types of junction boxes are the same. This procedure references the conduited version in its description of the wiring procedure.

1. Remove the cover of the junction box.
2. Thread the transducer wires through the conduit as shown in Figure 2-20.
3. The TB2 terminal block has 12 terminals that will accommodate four transducers. Wire the black wire of the transducer to a 'B' terminal, the white wire to a 'W' terminal, and the red wire to a 'R' terminal.
4. Perform Steps 2 and 3 for all of the transducers you are wiring to the junction box.

## WIRING STAINLESS STEEL JUNCTION BOXES TOGETHER AND TO THE SIGNAL PROCESSOR

A shielded three-conductor cable is used to wire the junction boxes together and to the weighing system signal processor. K-M recommends using Belden

8/91 18-gage cable or equivalent and routing it through conduit. The conduit and cable must be supplied by the customer.

**NOTE**

Seal all conduit fittings against water entry. Seal the conduit entry holes into the j-box with Sikaflex or RTV 738. **USE NO OTHER SEALANT.**

Conduit used in high humidity areas may have drains installed to allow condensation to drain if desired. The drain hole must be at the conduit's lowest elevation.

Follow this procedure.

1. Route the three-conductor cable through conduit and into the junction box.
2. Connect the black wire to one of the three terminals designated for black wires, the white wire to one of the white terminal, and red wire to one of the red terminals as shown in Figure 2-21. Use fork lugs to terminate the Load Disc II cable wires.

**NOTE**

All wire routed between junction boxes and the signal processor must be continuous (no splices).

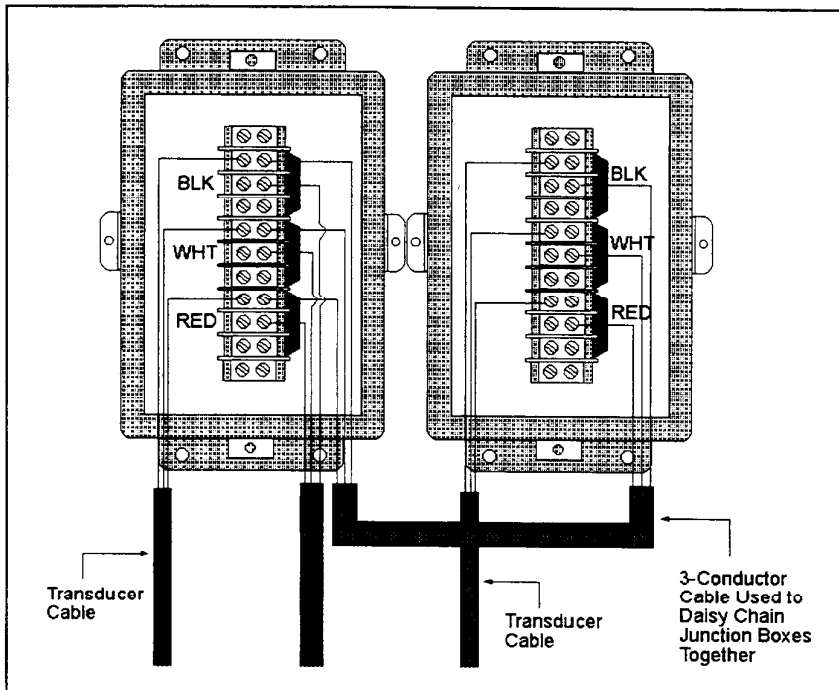


Figure 2-21. Wiring Stainless Steel Junction Boxes Together.

3. Route the cable through the conduit to the next junction box or to the signal processor.

**NOTE**

Ground the cable shield **ONLY** at the signal processor.

4. Connect the wires to the terminals, black to black, white to white, red to red as shown in Figure 2-21.

## WIRING PLASTIC JUNCTION BOXES TOGETHER AND TO THE SIGNAL PROCESSOR

A shielded three-conductor cable is used to wire the junction boxes together and to the weighing system signal processor. K-M recommends using Belden 8791 18-gage cable or equivalent and routing it through conduit. The conduit and cable must be supplied by the customer.

### NOTE

Seal all conduit fittings against water entry. Conduit used in high humidity areas must have drains installed to allow condensation to drain. The drain hole must be at the conduit's lowest elevation.

Follow this procedure.

1. Route the three-conductor cable through conduit and into the junction box.
2. Connect the black wire to the black terminal, white wire to the white terminal, and red wire to the red terminal on the TB1 terminal block (Figure 2-22).

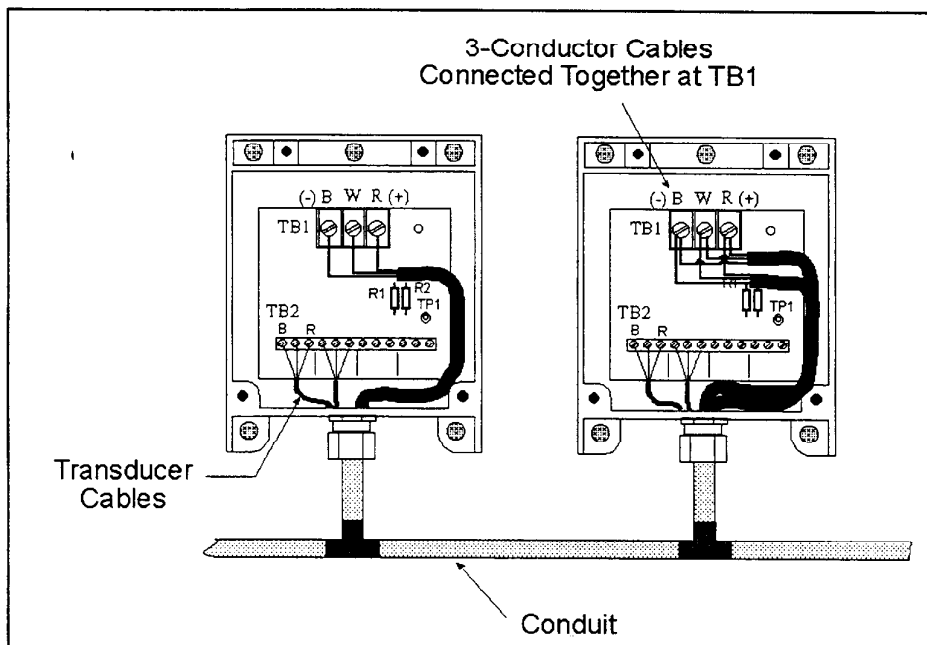


Figure 2-22. Wiring Plastic Junction Boxes Together.

### NOTE

All wire routed between junction boxes and the signal processor must be continuous (no splices).

3. Route the cable through the conduit to the next junction box or to the signal processor.

### NOTE

Ground the cable shield ONLY at the signal processor.

4. connect the wires to the terminals, black to black, white to white, red to red. Figure 2-22 illustrates two junction boxes wired together.

# Appendix A. Product Specifications

## Mechanical

### Mechanical Integrity

Compression .....	4 x Rated Load (150 lbs to 25K lbs units) 2.5 x Rated Load (35K lbs to 100K lbs units)
Tension .....	1 x Rated Load (all load ranges)
Shear .....	0.5 x Rated Load (all load ranges)
Functional Integrity .....	2.0 x Rated Load (all load ranges)
Maintain Rated Accuracy .....	1.5 x Rated Load (all load ranges)

## Electrical Excitation Voltage

Excitation Voltage .....	Standard 12 Vdc; Maximum 30 Vdc
Excitation Current at 12 Vdc .....	4 mA at 0° F (-17.8° C) to 2.7 mA at 100° F (38° C)

## Output (12 Vdc excitation)

Standardized Output .....	360 mV $\pm$ 5 mV (30 mV/V) standard/mid-temperature range 240 mV $\pm$ 3 mV (20 mV/V) high temperature range
Output Impedance .....	7.5K ohms, $\pm$ 1%
Nonlinearity/Hysteresis Combined	
0.2% Performance .....	0.2% Standardized Output
0.1% Performance .....	0.1% Standardized Output
	(Consult factory for batching accuracy, typically 0.05% to 0.01% full scale)
Return to Zero .....	$\pm$ 0.1% Standardized Output

## Environmental

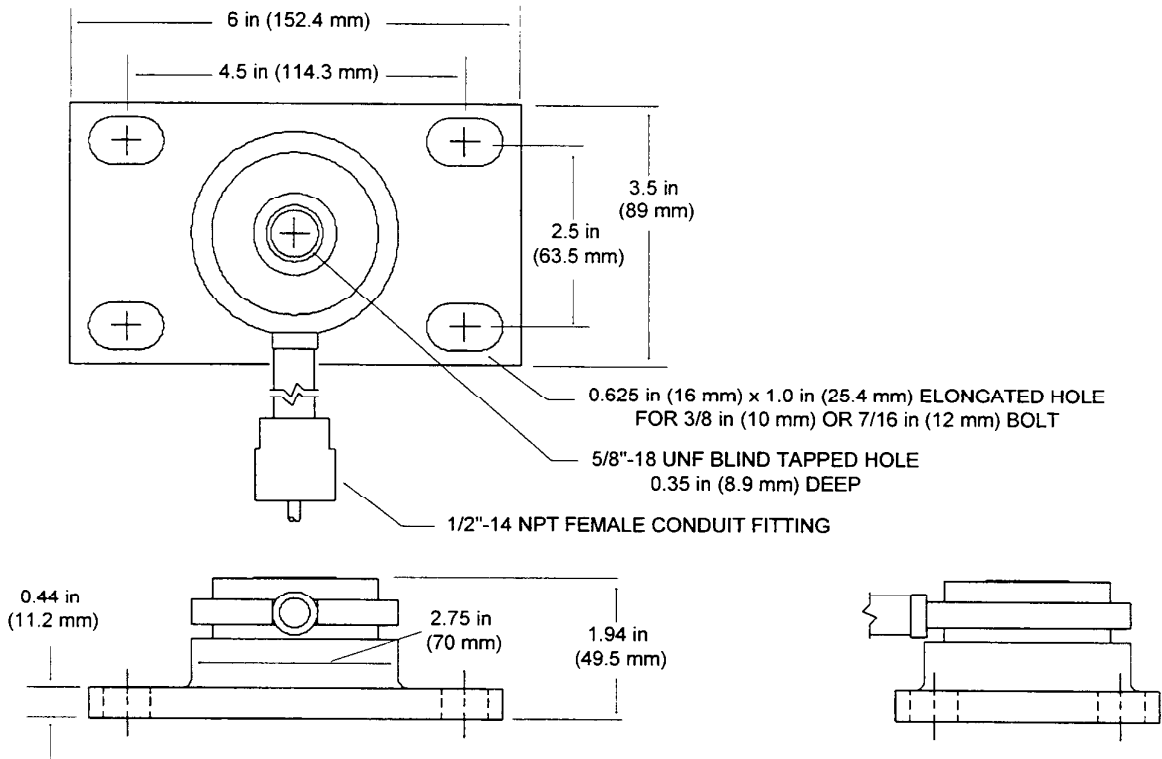
Rating .....	NEMA-6P (includes NEMA-4, NEMA-4X, and NEMA-6). Hermetically sealed for high-pressure caustic washdown and prolonged submergence in water (with watertight conduiting provided by customer)
Temperature Range .....	0° to 100° F (-17.8° to 37.8° C) standard temperature range 50° to 150° F (10° to 66° C) mid-temperature range* 150° to 250° F (66° to 121° C) high temperature range* *Up to 300° F (-149° C) during CIP/SIP
Temperature Sensitivity Shift .....	$\pm$ 0.015%/°F, 0° to 100° F ( $\pm$ 0.03%/°C), -18° to 38° C
Temperature Zero Shift .....	0.008%/°F (0.015%/°C) standard/mid-temperature ranges 0.012%/°F (0.022%/°C) high temperature range
Humidity .....	100%

## Physical

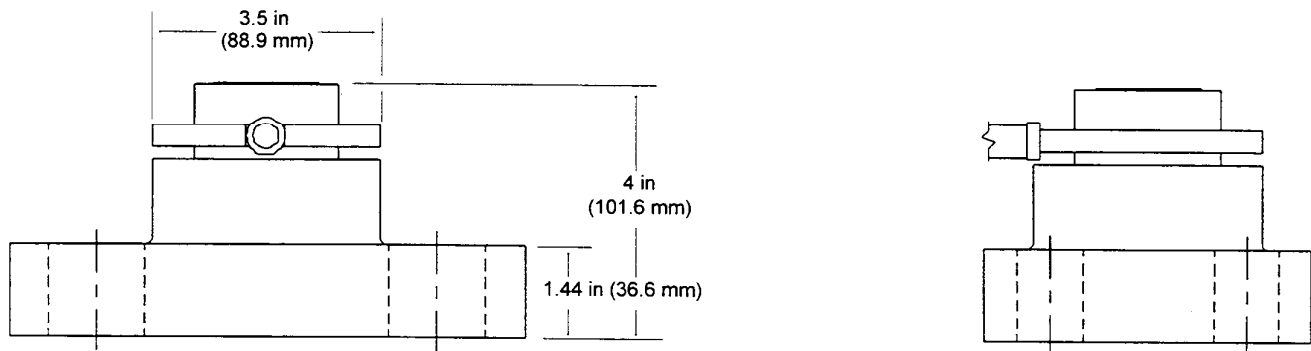
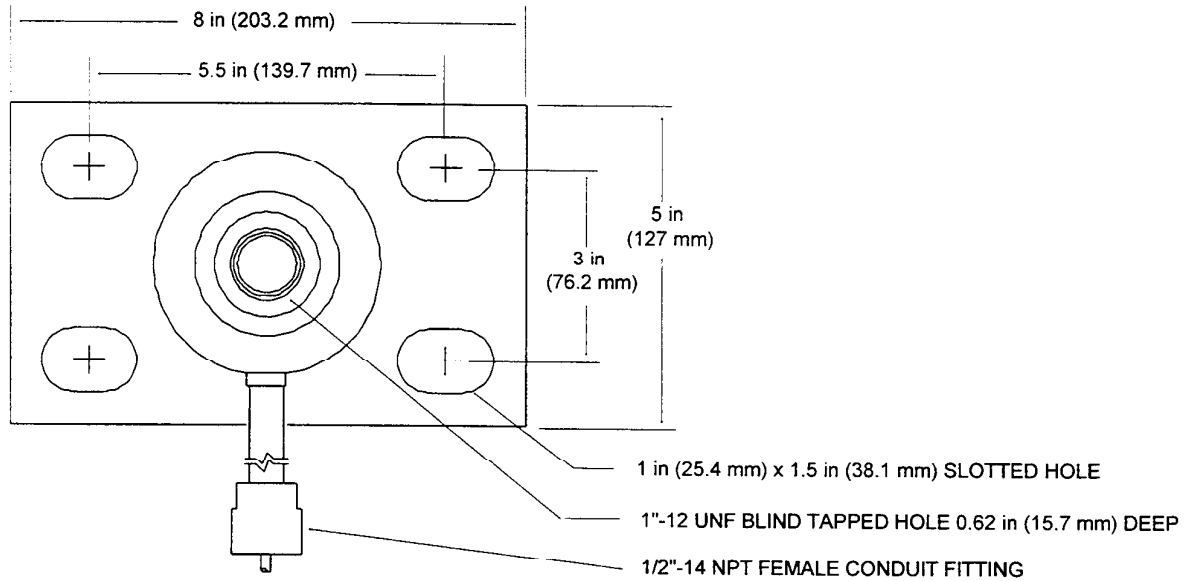
Construction .....	17-4 PH 900 heat-treated stainless steel
Weldment .....	Full penetration weldment in accordance with Uniform Building Code (UBC) criteria per specification AWS B2.1.009-90
Installed Height .....	See Mounting Dimensions
Signal Cable .....	3-conductor, 22 gage unshielded, 10' (3 m) long, with tinned pigtail termination. Consult factory for longer lengths.
Signal Cable Protection	
Cable Armor .....	12" (305mm) sanitary food-grade tubing
Conduit Fitting .....	304 stainless steel 1/2" female NPT
Sensor .....	High output silicon semiconductor strain gage based expansion cell (X-Cell)
Shipping Weight .....	8.5 lbs (3.9 kg) for 150 lbs to 25K lbs units 17 lbs (7.7kg) for 35K lbs to 100K lbs units

## Accessories

Electronics .....	Kistler-Morse weight signal processors and batch controllers
Stainless Steel Interconnect	
Junction Box .....	61-4018-00



**150-25Klb LOAD DISC II TRANSDUCER MOUNTING DIMENSIONS**



**35K-100Klb LOAD DISC II TRANSDUCER  
MOUNTING DIMENSIONS**

# Appendix B. Glossary of Terms

## ***Absolute Voltage Output***

The increase in transducer voltage output (above the offset) due to applied load.

## ***Accuracy***

A measure of how closely the indicated or measured value of a quantity (such as weight) approximates the true or actual value of that same quantity. Some specific types of accuracy are used to describe the nature of the deviation between measured and true values. These specific terms invariably quantify the amount of error and is expressed as a percentage of the full-scale response. Occasionally it is expressed as a percent of reading, but it is then qualified by restricting the reading to some minimum percent of the full-scale value.

## ***Calibration***

The process of presenting a known quantity of the material to be routinely measured to the instrumentation system for the purpose of developing a functional relationship between the output of an instrument and its input: namely, the weight of the material to be measured.

There are two steps to the calibration process: zero calibration (zero live load) and scale factor calibration (sometimes called "span").

## ***Dead Load***

The weight of the vessel, hopper, silo, etc. which unavoidably must be supported by the weight transducers.

## ***Digital Sensitivity***

If transducers are built with an on-board analog-to-digital converter, its output is a numerical value. This type of output is often described by a "count" value. The sensitivity of this type of transducer is expressed in "counts per pound" (also "counts per kilogram") rather than millivolts per pound.

An analog transducer (one that produces a continuously variable signal, usually a voltage or a current) when connected to an analog-to-digital converter may have its equivalent sensitivity expressed in terms of counts per lb. This value is found by multiplying the transducer sensitivity in mV/lb by the converter sensitivity in counts/mV.



Even though the A/D converter is physically located inside the signal processor enclosure, it is useful to think of the combined sensitivity of the transducer and A/D converter. This combined sensitivity is called digital sensitivity.

### ***Full-Scale Live Load***

The maximum weight of material that will be presented to the array of weight transducers, such as the contents of a silo when it is completely full. In most cases the rated load will exceed the full-scale live load because the transducers must have enough capacity to support not only the full-scale live load but the dead load as well. But because Kistler-Morse weight transducers can withstand substantial overloading without destruction, some weighing applications can have a full-scale live load that is equal to or greater than the rated load.

### ***Full-Scale Output***

The response of an instrument when it is presented with its full-scale input. For example, when a level indicator reads 100%, it is said to be at "fullscale". Note that "full-scale" applies to the user's maximum conditions and may differ from the above "rated" conditions.

### ***Live Load***

The quantity of material to be measured, the contents of the vessel, etc.

### ***Local Display***

An electronic display located "local to the process" or "local to the signal processor/indicator". A local display may refer to the display on-board the signal processor. Be sure to establish a reference location before using this term.

### ***Offset***

The voltage output of the transducer when no load is applied.

### ***Rated Load***

The value of the load that is considered to be the "100%" loading on the transducer by the manufacturer of the measuring equipment, not the user. Note that the rated load can be made up of any combination of live and dead loads, and the sum of the live and dead loads can in fact exceed the rated load.

### ***Standardized Load***

The specified load rating of any given Load Disc transducer.

### ***Rated Output***

The output of the sensor or transducer when the input is at the rated load specified by the manufacturer for the particular sensor or transducer. Note that the term "rated" applies to the manufacturer's stated capacity and may differ from the "full -scale" as described above.

### ***Resolution***

The smallest change in the input to the device being described that produces a measurable response.

### ***Scale Factor***

The adjustable parameter in a signal processor that creates the match between an actual input and an indicated output. The process of scale factor (also called "span") calibration results in determination of the scale factor.

It is also the slope of the signal processor output (indicated weight) versus signal processor input (mV or counts). The transducer output, measured in mV or counts, is the signal processor input.

### ***Sensitivity***

The ratio of output to input. For example, if a load cell produces 360 mV when a 2,000 lb load is applied, its sensitivity is  $360 \text{ mV}/2,000 \text{ lb} = 0.18 \text{ mV/lb}$ .

### ***Signal Processor***

The electronic "box" connected to a sensor/transducer array. It may be augmented with software. If so, the first stage of the signal processor is an A/D converter. A signal processor generally has provisions for most if not all of the following:

1. Excitation voltage applied to each of the transducers in the network.
2. Adjustable zero calibration.
3. Adjustable scale factor (span calibration).
4. A long-distance signal transmission option, such as a 4-20 mA analog current and/or RS-232C or RS-422 serial.

5. Two or three discrete thresholds used to signal an alarm. (KM calls these thresholds "setpoints" but the process control industry reserves "setpoint" for an entirely different function.)
6. Usually some type of indication or display, such as numerals, needle movement, discrete optical array, etc.

### ***Span Voltage***

The voltage change that occurs when a transducer cycles from zero input (zero live load) to full-scale live load.

### ***Temperature Sensitivity Shift***

The measureable effect on a transducer's sensitivity by the temperature of the environment. It is usually expressed as "percent per degrees F (degrees C)". Since the indicated value of the measurement is directly proportional to the transducer's sensitivity, this specification also expresses the relationship between the reading and changes in the temperature.

# Appendix C.

# Calculating Material Weight

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## INTRODUCTION

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This appendix contains block diagrams that describe pictorially how a Load Disc II measurement system works. Also included is a method to calculate the weight of material in a vessel using the installed Load Disc II transducers, a voltmeter, and a 12 Vdc source.

### NOTE

If available, a KM text meter can be used in place of the voltmeter and 12 Vdc source.

The block diagrams provide an overview of the effects of the mechanical structure, sensitivity of the Load Disc II transducers, purpose, and function of the signal processor in a Load Disc II measurement system.

Symbol	Definition
SLD	Sensitivity of a single Load Disc II transducer
S	System sensitivity in mV/lb
n	Number of Load Disc II transducers in the array
d	Number of dummy Load Disc II blocks in the measurement system
ScF	Scale factor (pertains to signal processor)
W <sub>TOTAL</sub>	Vessel weight + material weight
W <sub>IND</sub>	Indicated weight by signal processor
W <sub>DL</sub>	Weight of dead load (vessel)
W <sub>LL</sub>	Weight of live load (material)
e <sub>o</sub>	Total voltage output (e <sub>LL</sub> + e <sub>DL</sub> )
e <sub>LL</sub>	Live load voltage output (e <sub>o</sub> - e <sub>DL</sub> )
e <sub>DL</sub>	Dead load voltage output (e <sub>o</sub> - e <sub>LL</sub> )

Table C-1. Definitions of Symbols in Block Diagrams.

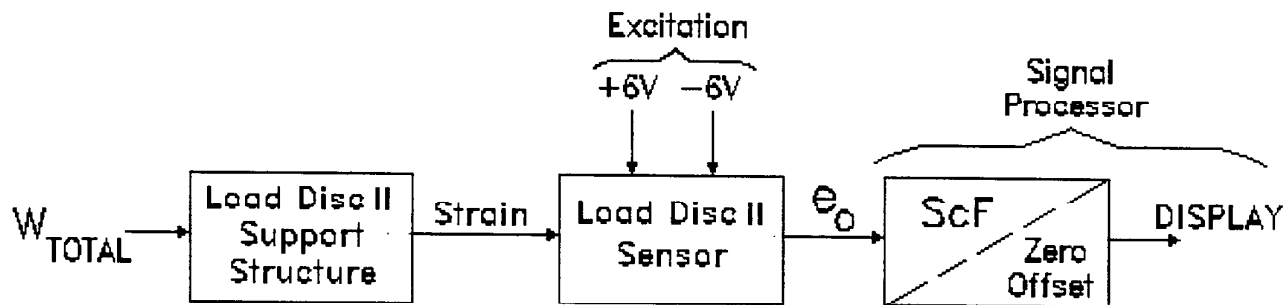


Figure C-1. Block Diagram of a Load Disc II Transducer Measurement System Working Sequence.

The method of calculating material weight provides a relatively easy way to measure the material in a vessel before the system is on line with a KM signal processor. Checks can be made throughout the installation process to ensure that the wiring is error-free and that the Load Disc II transducers are in proper working order. Also, this method provides a way to measure material weight if the signal processor ever fails to operate.

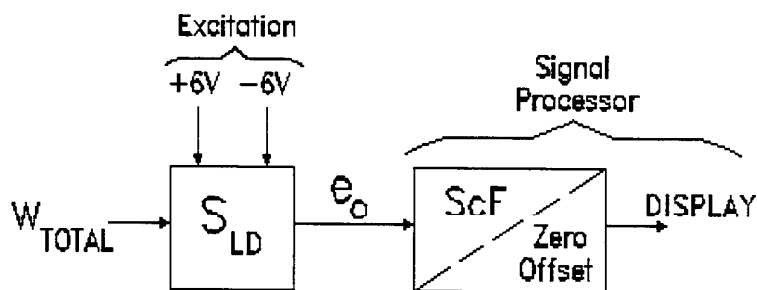


Figure C-2. Block Diagram of a Load Disc II Transducer Measurement System Working Sequence - One Transducer.

## TECHNICAL DESCRIPTION OF A LOAD DISC II MEASUREMENT SYSTEM

The following block diagrams in Figures C-1 through C-7 provide a technical description of the working sequence of a Load Disc II measurement system.

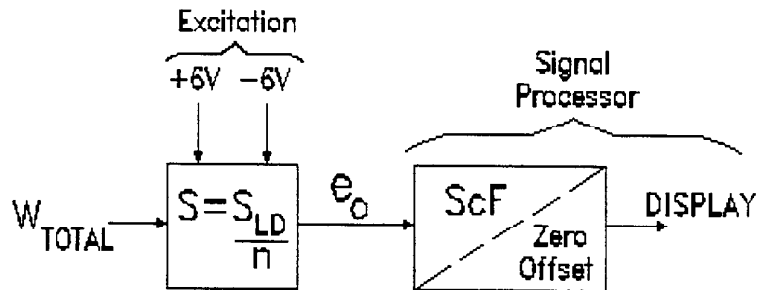


Figure C-3. Block Diagram of a Load Disc II Transducer Measurement System Working Sequence - Several Transducers.

As shown in Figure C-1 for a single Load Disc II transducer, the total weight of the material and the vessel holding the material ( $W_{TOTAL}$ ) combine to create strain in the Load Disc II support structure. When an excitation voltage of 12 Vdc is applied to the Load Disc II transducer by the signal processor, the transducer outputs a voltage proportional to the material and vessel weight ( $e_o$ ). The signal processor receives the voltage output from the transducers, applies a scale factor and zero offset, and provides some type of display. When a digital signal processor is used, the transducer output ( $e_o$ )

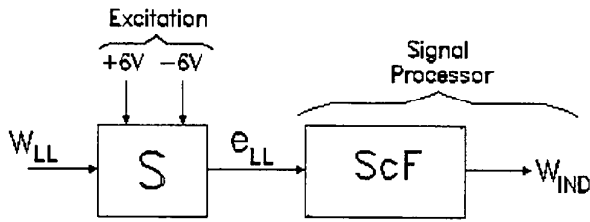


Figure C-4. Block Diagram of a Load Disc II Measurement System Working Sequence with Dead Load Subtracted Out.

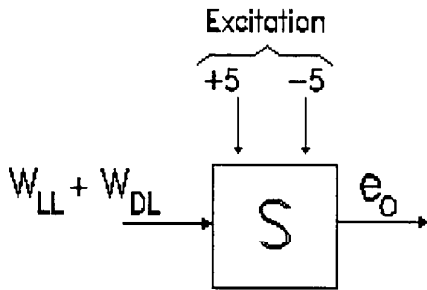


Figure C-5. Block Diagram of a Load Disc II Transducer Array Working Sequence without a Signal Processor.

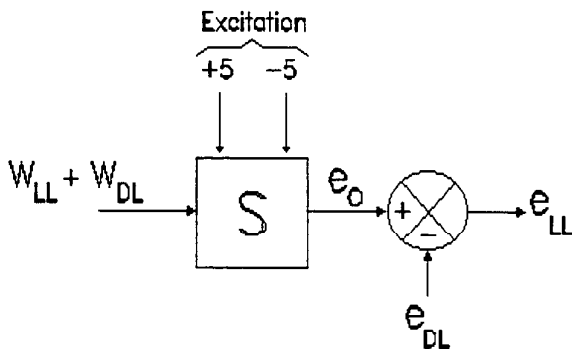


Figure C-6. Subtracting Out the Dead-Load Voltage.

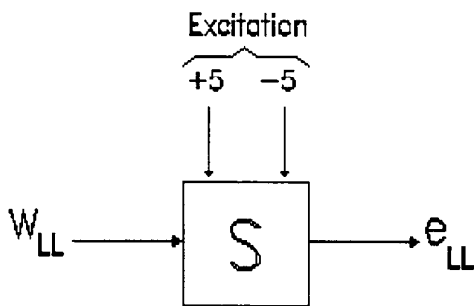


Figure C-7. Block Diagram of a Load Disc II Transducer Array Working Sequence with Dead Load Factored Out.

is converted to a numerical value (count) before subtracting the zero offset. Additionally, a weight measurement system generally consists of several Load Disc II transducers. The output voltage ( $e_o$ ) is simply the average value of all Load Disc II transducers that support the vessel.

Figure C-1 reduces to the block diagram shown in Figure C-2. Here the value of  $S_{LD}$  is the value taken from Table C-2.

A typical measurement system consists of more than one Load Disc II transducer, normally one transducer per leg. (A lower performance, lower cost system may include several Load Disc II transducers and several dummy spacers. (See page C-7.) The value of the transducer array sensitivity is the individual sensitivity divided by the number of transducers in the array:  $S = S_{LD}/n$  (Figure C-3). The output voltage  $e_o$  is the average of all Load Disc II transducers in the array.

The zero offset of the signal processor subtracts out the dead load (vessel weight or installed sensor array offset). Figure C-4 shows only the material weight ( $W_{LL}$ ) putting stress on the vessel support structure. A 12 Vdc excitation voltage is applied to the Load Disc II transducers which outputs a voltage ( $e_{LL}$ ) proportional to only the live load (material weight). The signal processor indicates the live load weight as determined by the scale factor operating on the live load voltage.

The block diagram in Figure C-5 shows the working sequence of the Load Disc II measurement system without a signal processor. The combined weight ( $W_{LL} + W_{DL}$ ) is multiplied by  $S$  to get the Load Disc II transducer array voltage output ( $e_o$ ) caused by the combined effects of live load and dead load.

The block diagram in Figure C-6 is the same as the diagram in Figure C-3 except that the effects of vessel weight are subtracted out, leaving just the live-load voltage output ( $e_{LL}$ ).

The block diagram in Figure C-7 describes the working sequence of the transducers with the dead load weight already subtracted out. Live load weight ( $W_{LL}$ ) causes the transducer array to output a proportional voltage ( $e_{LL}$ ).

The following section explains how to put the working sequence described with the block diagrams to practical use.

## CALCULATING THE MATERIAL WEIGHT IN A VESSEL

This section describes how to calculate the weight of the material in a vessel by using the block diagram in Figure C-6. The calculating material weight formula is:

$$W_{LL} \times (SLD/n) - e_{LL}$$

(See Table C-1 for definitions of symbols.)

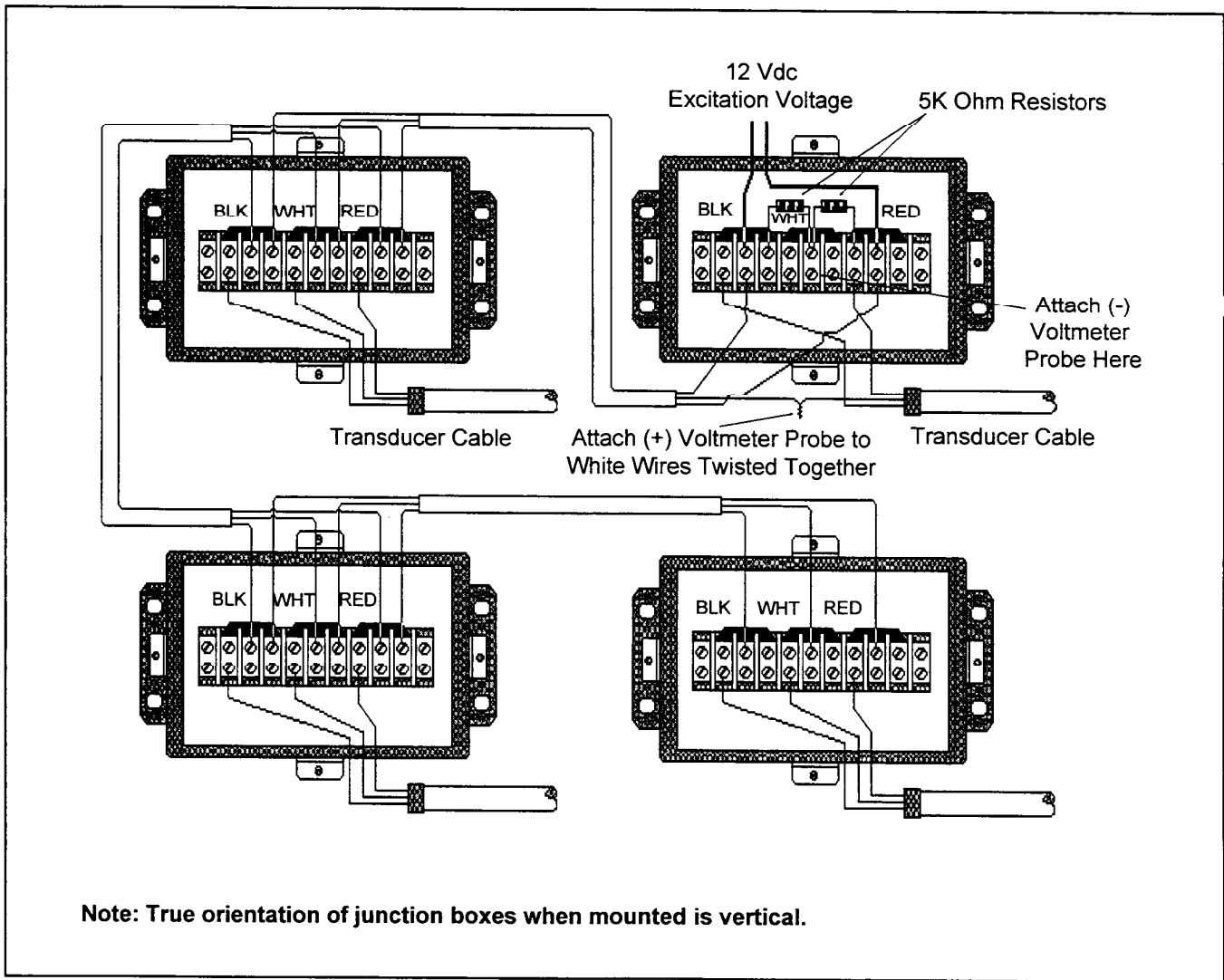


Figure C-8. Taking a Voltage Reading from a Load Disc II Transducer Array Wired to Stainless Steel Junction Boxes.

A voltage reading must be taken when the vessel is empty to find the voltage output of the transducer arrays when there is no material in the vessel. This reading is referred to as dead load voltage ( $e_{DL}$ ). Once you know what  $e_{DL}$  is, you can take a voltage reading any time when material is in the vessel ( $e_o$ ), subtract  $e_{DL}$  from the reading, and get the voltage output ( $e_{LL}$ ) caused by material only ( $e_o - e_{DL} = e_{LL}$ ). The value of  $e_{LL}$  can be inserted into the formula to calculate material weight. Follow this procedure.

- 1. Stainless Steel Junction Boxes.** Attach two 5K ohm resistors to the terminal strip in any of the Load Disc II junction boxes as shown in Figure C-8.

**Plastic Junction Boxes.** Plastic junction boxes have a test point on the pcb so the 5K ohm resistors are not needed.

Load Disc II Rated Load lb (kg)	Load Disc II Sensitivity $S_{LD}$ mV/lb (mV/kg)	System Sensitivity 'S' (mV/lb)		
		Number of Legs		
		3	4	6
150 (68)	360/150 (360/68)	360/450	360/600	360/900
250 (113)	360/150 (360/113)	360/750	360/1,000	360/1,500
500 (227)	360/500 (360/227)	360/1,500	360/2,000	360/3,000
1,000 (454)	360/1,000 (360/454)	360/3,000	360/4,000	360/6,000
2,000 (907)	360/2,000 (360/907)	360/6,000	360/8,000	360/12,000
3,000 (1,361)	360/3,000 (360/1,361)	360/9,000	360/12,000	360/18,000
5,000 (2,250)	360/5,000 (360/2,250)	360/15,000	360/20,000	360/30,000
7,500 (3,402)	360/7,500 (360/3,402)	360/22,500	360/30,000	360/45,000
10,000 (4,500)	360/10,000 (360/4,500)	360/30,000	360/40,000	360/60,000
15,000 (6,804)	360/15,000 (360/6,804)	360/45,000	360/60,000	360/90,000
20,000 (9,072)	360/20,000 (360/9,072)	360/60,000	360/80,000	360/120,000
25,000 (11,250)	360/25,000 (360/11,250)	360/75,000	360/100,000	360/150,000
35,000 (16,000)	360/35,000 (360/16,000)	360/105,000	360/140,000	360/210,000
50,000 (22,600)	360/50,000 (360/22,600)	360/150,000	360/200,000	360/300,000
75,000 (34,020)	360/75,000 (360/34,020)	360/225,000	360/300,000	360/450,000
100,000 (45,360)	360/100,000 (360/45,360)	360/300,000	360/400,000	360/600,000

Table C-2. Load Disc II Transducer Array Sensitivities.



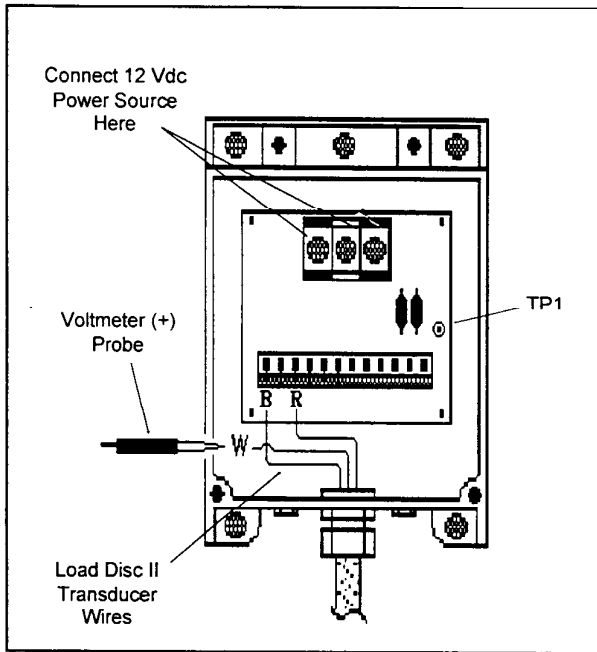


Figure C-9. Connecting 12 Vdc Excitation Voltage and Voltmeter to the Junction Box

**2. Stainless Steel Junction Boxes.** Disconnect from the terminal strip the white wire of the transducer and the white wire of the cable that daisy chains the junction boxes together. Twist the ends of the two white wires together as shown in Figure C-8.

**3. Stainless Steel Junction Boxes.** With the vessel empty, connect a 12 Vdc excitation voltage source to the terminal strip across the red and black transducer wires (Figure C-8).

**Plastic Junction Boxes.** Connect a 12 Vdc excitation voltage source to the R (red) and B (black) terminals on terminal block TB1: positive (+) lead to red terminal, negative (-) lead to black terminal (Figure C-9).

**4. Stainless Steel Junction Boxes.** Connect the signal (+) probe of the voltmeter to the white wires that are twisted together and the common (-) probe to the terminal where the two resistor leads connect on the terminal strip (Figure C-8).

**Plastic Junction Boxes.** Attach the (+) probe of a voltmeter to the white terminals of TB1 in the junction box and the (-) probe to the test point TP1 or to the lower end of either of the two resistors near TP1.

**5.** Set the voltage scale on the voltmeter to  $\pm 1$  volt and check the voltage reading of the transducer array. If the vessel is empty, this value represents  $e_{DL}$  which is the dead-load voltage output.

**6.** Insert the value of  $SLD/n$  that applies to your vessel in the equation below:

$$W_{LL} \times (SLD/n) = e_{LL}$$

**7.** Look up the approximate sensitivity of the sensor array installed on your vessel in Table C-2. For example, for a Load Disc II transducer rated at 500 lbs under each leg of a 4-legged vessel, the equation looks like this:

$$W_{LL} \times (360 \text{ mV}/2,000 \text{ lb}) = e_{LL}$$

**8.** Multiply each side of the equation by 2,000 lb/360 mV. The equation now looks like this:

$$W_{LL} = e_{LL} \times 2,000 \text{ lb}/360 \text{ mV}$$

**9.** Add material to the vessel and take another voltage reading. The voltage reading value will be  $e_o$  (the combined live load and dead load response).

- 10.** We know that  $e_{LL} = e_o - e_{DL}$ . Subtract the  $e_{DL}$  value from Step 5 from  $e_o$  to get the value for  $e_{LL}$ . For demonstration purposes we will say that  $e_o = 520$  mV and  $e_{DL} = 250$  mV. There fore:

$$e_{LL} = 520 \text{ mV} - 250 \text{ mV}$$

$$e_{LL} = 270 \text{ mV}$$

- 11.** Insert the value of  $e_{LL}$  into the formula. The equation looks like this:

$$W_{LL} = 270 \text{ mV} \times (2,000 \text{ lb}/360 \text{ mV})$$

equates to:

$$W_{LL} = (270/360) \times 2,000 \text{ lbs}$$

equates to:

$$W_{LL} = 3/4 \times 2,000 \text{ lbs}$$

equates to:

$$W_{LL} = 1,5000 \text{ lbs}$$

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## CALCULATING MATERIAL WEIGHT IN A VESSEL WITH BOTH LIVE AND DUMMY TRANSDUCERS

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Some measurement applications lend themselves to using a combination of live and dummy Load Disc II transducers. The block diagram for such a system is shown in Figure C-10. The letter 'd' represents the number of vessel legs supported by dummy transducers. Note that the scale factor ScF is calculated on the basis of the number of live Load Disc II transducers 'n'. Then it is multiplied by the ratio [(n+d)/n]. The value of  $W_{LL} \times [n/(n+d)]$  represents the amount of live load supported by the live transducers.

If it is necessary to determine the error as a percent of rated load for this type of system, it must be recognized that the measurement error is not that error read by  $W_{IND}$ , but rather the error in the indicated weight  $W_{IND}$  multiplied by  $[n+(n+d)]$ . This reduced error is then divided by  $(n \times \text{rated load of one Load Disc II transducer})$ .

Error as a percent of rated load =

$$\frac{100 \times (\text{absolute error at } W_{IND})}{(n+d) \times \text{Rated Load}}$$

where:

Rated Load is the load rating of a single Load Disc II transducer

where:

$$\frac{n}{n+d} \times \frac{S_{LD}}{n} \times ScF = 1$$

$$ScF = \frac{n+d}{S_{LD}}$$

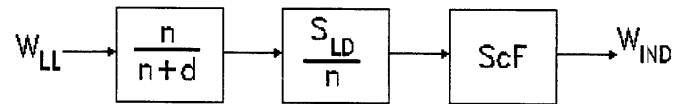


Figure C-10. Block Diagram of a Load Disc II Transducer Measurement System Using a Combination of Live and Dummy Transducers.

# Appendix D.

## Kistler-Morse Service

Kistler-Morse (K-M) maintains a fully trained staff of field service personnel who are capable of providing you with complete product assistance. Based in offices located in Bothell, Washington (corporate headquarters) and Antwerp, Belgium (European office) our Field Service staff can provide:

Technical assistance by telephone via our toll free number.

Application assistance on-site or by telephone. Start-up assistance on-site.

Troubleshooting on-site or by telephone.

Warranty (replacement) or spare parts assistance.

Training on-site or at our corporate K-M service center.

Equipment updates to our latest configuration.

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### START-UP AND TRAINING

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Kistler-Morse will install the Microcell sensors, which includes the preparation of the vessel supports where they will be attached, i.e. drilling, surface preparation, mounting, and termination of wiring. All field wiring will be checked for errors.

**NOTE**

Field wiring and conduit installation must be performed by the user.

The system will be powered up and checked out for proper electrical operation. The signal processor should be mounted by the user, with AC power connected, but not energized. The junction boxes should also be mounted.

Calibration will be performed in those cases where actual material or weight devices can be moved. Simulated calibration will be introduced in the case where weight cannot be added or removed.

Recommendations for the optimum performance of the system will be given. Instruction to plant personnel will be offered to cover maintenance and operation of the system.

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## **TROUBLESHOOTING**

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Our staff will troubleshoot systems for mechanical, electrical, calibration, and wiring errors. Normal component repair and wiring errors will be corrected, including replacement of nonrepairable printed circuit boards.

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## **RETURN MATERIAL AUTHORIZATION**

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If a part needs to be sent to the factory for repair, contact Kistler-Morse and ask for an RMA (Return Material Authorization) number. The RMA number identifies the part and its owner and must be included with the part when it is shipped to the factory.

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## **SERVICE CALLS**

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Service calls by a qualified Kistler-Morse Field Service person can be scheduled but are not covered in the product warranty. Contact Kistler-Morse at the corporate office or the European office for scheduling and rate information.

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## **PRODUCT WARRANTY**

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Kistler-Morse warrants equipment of its own manufacture to be free from defects in material and workmanship for one year from date of shipment to original user, subject to the terms and conditions of this warranty. Kistler-Morse will replace or repair, at our option, any part found to be defective. Buyer must return any part claimed defective to Kistler-Morse, transportation prepaid.

A complete, unabridged explanation of our product warranty is available from Kistler-Morse on request.

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## ADDRESS AND TELEPHONE NUMBERS

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### *Corporate Office*

All mail sent to the corporate office should be addressed:

**Kistler-Morse Corporation**  
19021 120th Avenue N.E.  
Bothell, WA 98011-9511

Telephone: 206/486-6600  
Toll Free: 800/426-9010  
Fax: 206/402-1500  
Internet: KMCorp@AOL.Com

### *European Office*

**Kistler-Morse Europe**  
Rucaplein 531  
B2610 Antwerp, BELGIUM

Phone: 32.3.218.99.99  
Fax: 32.3.230.78.76



# Appendix E. Technical Drawings

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## INTRODUCTION

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This appendix contains the following technical drawings of the Load Disc<sup>®</sup> II transducers.

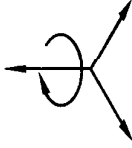
- Installation Arrangements 150 - 25K lb Load Disc II (Sheets 1-6)
- Installation Arrangements 35K - 100K lb Load Disc II (Sheets 1-5)
- Installation Illustration Load Disc II (150 lb - 25K lb) on "Omnislide" (1 Sheet)
- 35K - 100K Load Disc II Transducer with Universal Top Adaptor Plate (1 Sheet)
- Installation Illustration Load Disc II (35K lb - 100K lb) on "Omnislide" (1 Sheet)

Use these drawings for reference when installing the transducers.

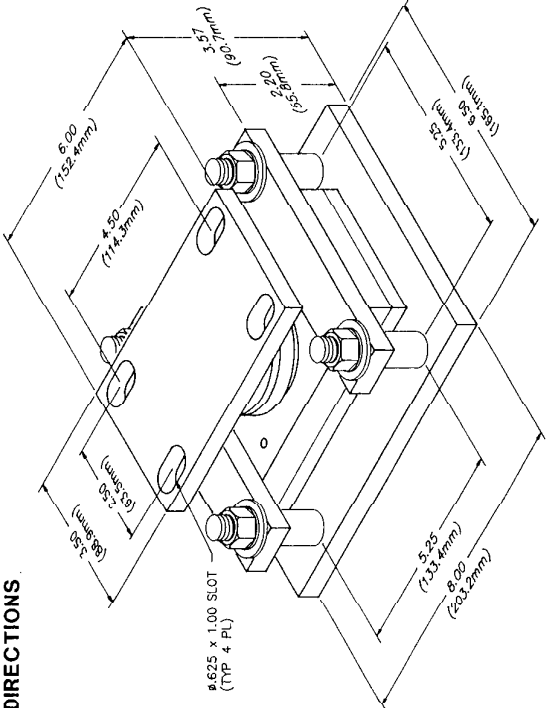
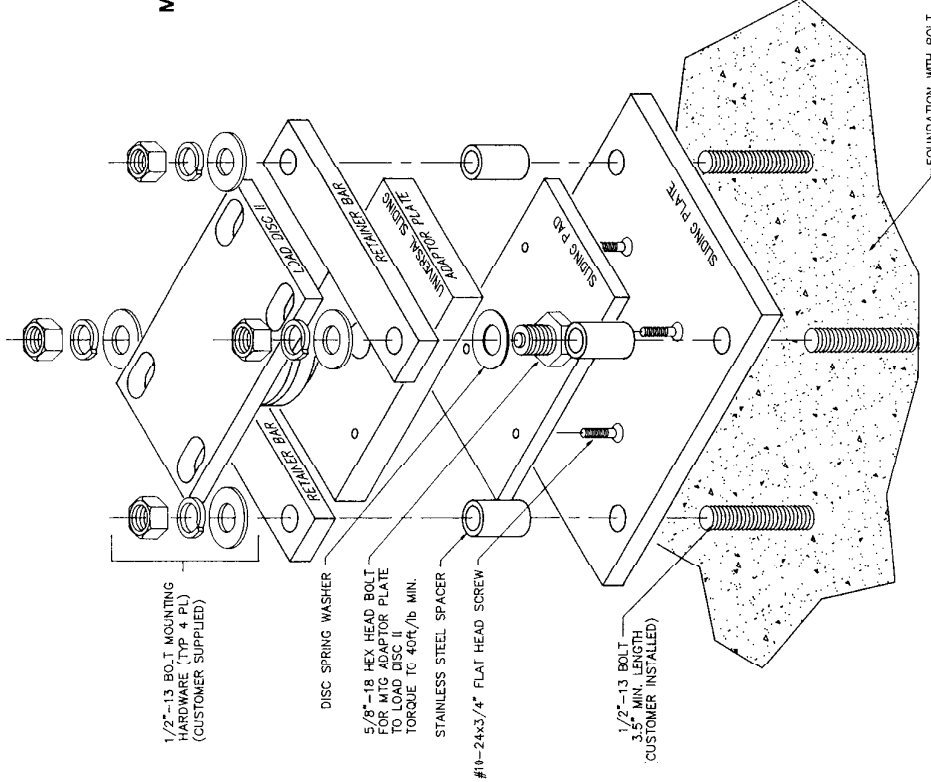




REVISIONS			
LTR	DESCRIPTION	CHECKED	APPROVED
NEW	INITIAL RELEASE	R.M. COHRS	T.K.M.
A	PER DOW C442	J.M. PALON	F.P.
			DATE
			12/11/92
			3/26/93



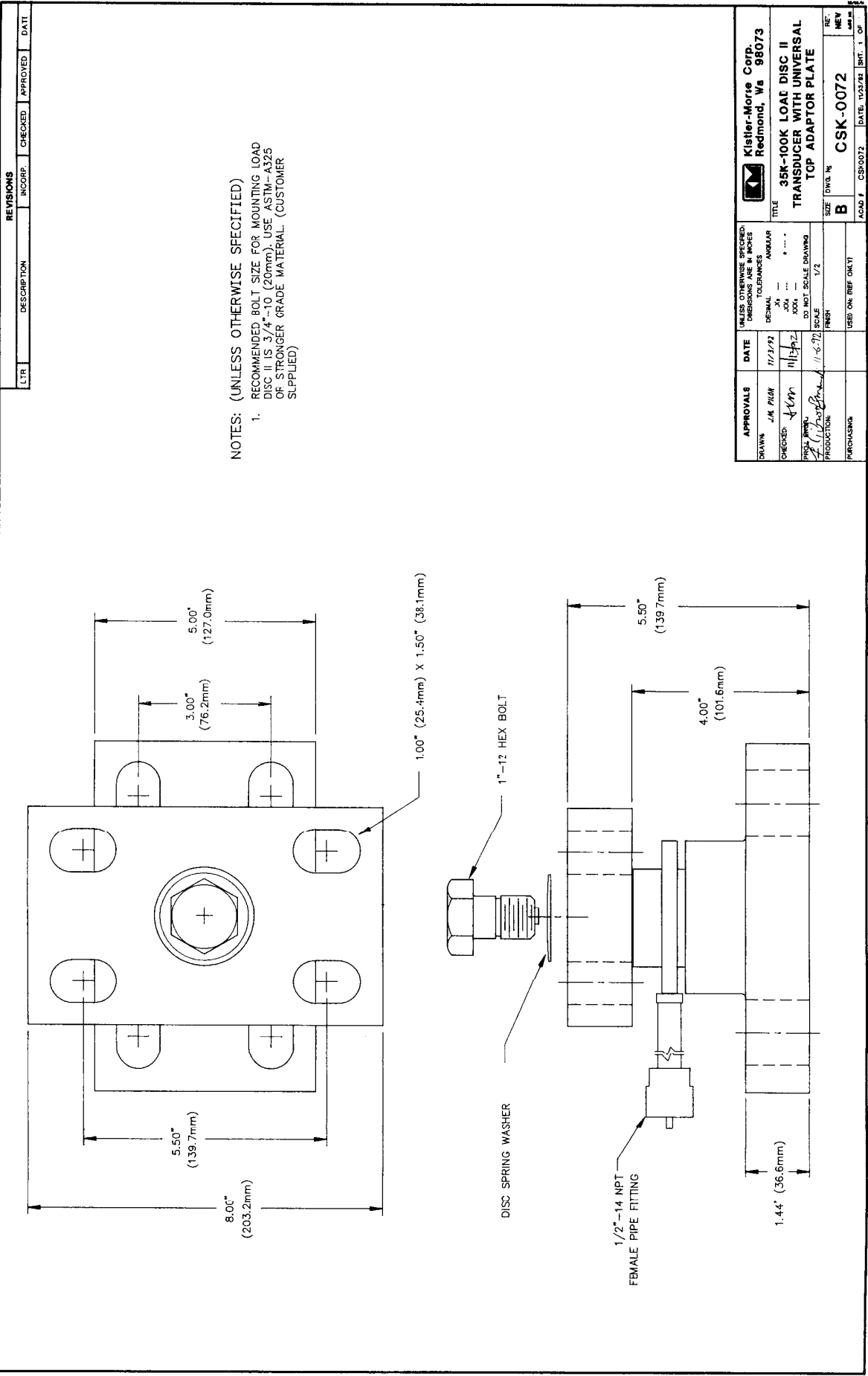
LOAD DISC II  
MOVEMENT DIRECTIONS



LOAD DISC II ON "OMNISLIDE"  
DIMENSIONAL REFERENCE

ECO ACCUMULATION	APPROVALS	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
ECO No. 1	DRAWN: Raul M. Cillado	06/13/92	TOLERANCES
ECO No. 2	CHECKED: T.K.K.	12/11/92	ANGULAR
ECO No. 3	PROJ. ENGR: F. PIEROZZI-MANDI	12/11/92	DO NOT SCALE DRAWING
ECO No. 4	PRODUCTION:		SCALE 1:1
ECO No. 5	PURCHASING:		FINISH
ECO No. 6			USED ON REF ONLY

Kistler-Morse Corp. Redmond, Wa 98073	
TITLE INSTALLATION ILLUSTRATION LOAD DISC II (150lb-25Klb) ON "OMNISLIDE"	
SIZE DWG: W	REV: A
ACAD 1 CSK-0063	DATE: 07/03/93
SHT. 1 OF 1	



NOTES: (UNLESS OTHERWISE SPECIFIED)  
 1. RECOMMENDED BOLT SIZE FOR MOUNTING LOAD DISC II IS 3/4"-10 (20mm). USE ASTM-A325 OF STRONGER GRADE MATERIAL (CUSTOMER SUPPLIED)

REVISIONS		DESCRIPTION		INCORP.	CHECKED	APPROVED	DATE
LTR							

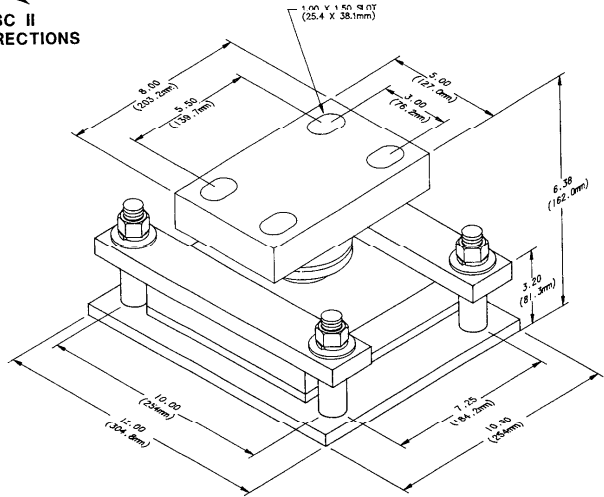
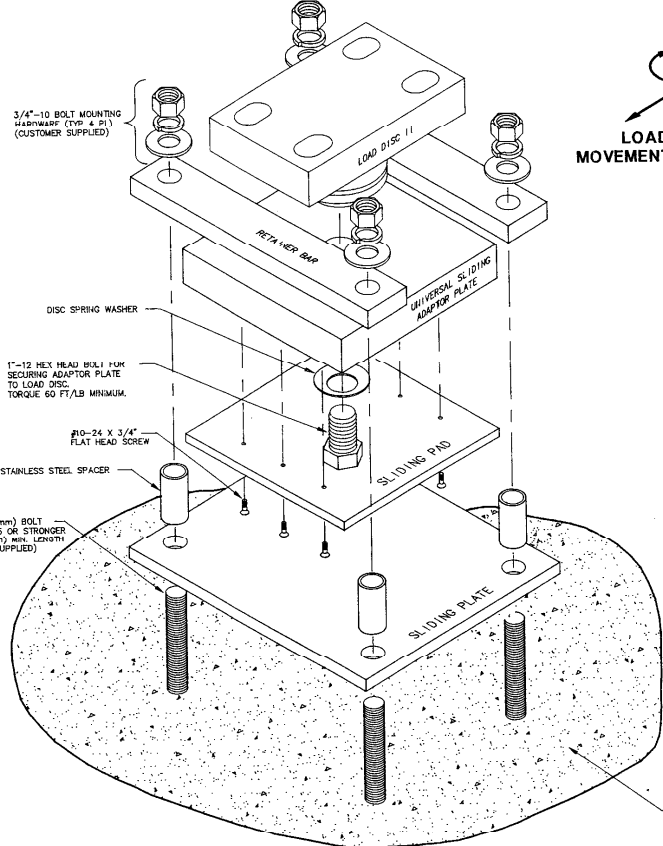
  

APPROVALS	DATE	UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
DRAWN: J.A. PEAR	11/27/92	TOLERANCES UNLESS SHOWN
CHECKED: J.M.	11/27/92	FRACTIONS: 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, 2, 3, 4
DESIGNED: J.M.	11/27/92	DECIMALS: .005, .01, .02, .05, .1, .2, .5, 1, 2, 5, 10, 20, 50, 100
PRODUCTION:	11/27/92	DRAWING SCALE: AS SHOWN
PURCHASING:		ISO METRIC SCALE: 1:2
		FINISH: UNLESS OTHERWISE SPECIFIED
		USE ON: REF ONLY

Kistler-Morse Corp. Redmond, Wg 98073	
TITLE	35K-100K LOAD DISC II TRANSDUCER WITH UNIVERSAL TOP ADAPTOR PLATE
SIZE	DWG. NO. B
REV.	NEW
ACAD #	CSK-0072
DATE	11/27/92
BRT.	1 OF 1

REVISIONS					
LTR	DESCRIPTION	INCRP.	CHECKED	APPROVED	DATE



**DIMENSIONAL REFERENCE  
35KLb TO 100KLb LOAD DISC II  
ON "OMNISLIDE"**


<b>APPROVALS</b>		<b>DATE</b>	<b>UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES</b>		<b>Kistler-Morse Corp.</b> Redmond, Wa 98073
DRAWN T.M. PILLON	11/30/92	DECIMAL .XX	ANGULAR S...	TOLERANCES	
CHECKED T.K.M.	12/4/92	DO NOT SCALE DRAWING	SCALE 1/4"	TITLE <b>INSTALLATION ILLUSTRATION          LOAD DISC II (35KLb-100KLb)          ON "OMNISLIDE"</b>	REV. NEW
PROJ. ENGR. E. FRODOGMANDI	12/1/92	FINISH	USED ON REF. ONLY	SIZE D	CSK-0071
PURCHASE	DATE 12/08/92	SHEET 1 OF 1	ACAD # CSK0071	DATE 12/08/92	SHEET 1 OF 1

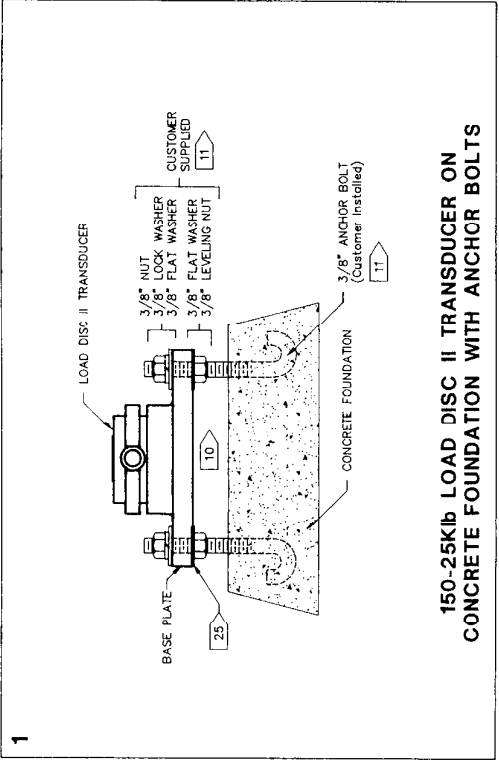
**NOTES: (UNLESS OTHERWISE SPECIFIED)**

1. DURING INSTALLATION, DO NOT PUT ALL THE VESSEL LOAD ON ONE SENSOR. SENSOR GAGE INTEGRITY IS ONLY RATED AT TWICE THE RATED LOAD. AN EVEN DISTRIBUTION OF LOAD ON ALL VESSEL LEGS IS DESIRABLE.
2. WHEN RAISING VESSEL FOR TRANSDUCER INSTALLATION, USE PROPER SUPPORTS TO PREVENT THE VESSEL FROM TIPPING OR FALLING OVER.
3. VESSEL LOAD SHOULD BE CONCENTRATED ON LOAD RING OF LOAD DISC II TRANSDUCER AND NOT ON ANY MOUNTING SCREW.
4. ALL BOLTS AND SCREWS TO BE OF ASTM-A325, SAE GRADE 8 MATERIAL OR STRONGER.
5. FOR HEIGHT ADJUSTMENT AND BALANCING LOAD ON TRANSDUCER, TURN THE LEG ADAPTER TO DESIRED HEIGHT BEFORE WELDING TO VESSEL.
6. THE MAXIMUM AVAILABLE DEPTH FOR 5/8"-18 SCREW ON LOAD DISC II TOP IS .30" [7.6mm].
7. IN PLACE OF LEVELING NUT, SHIMS MAY BE USED TO ADJUST HEIGHT OF VESSEL LEGS.
8. COMPATIBLE WITH SLOPE FLOOR WHERE VESSEL LEGS DO NOT NEED TO BE BOLTED DOWN TO FLOOR. TO HELP PREVENT THE VESSEL FROM MOVING, STEEL FLOOR PLATE CENTER SHOULD BE RECESSED WHERE THE LOAD DISC II TRANSDUCER IS RESTING.
9. LEVELING NUTS MAY BE USED ON ANCHOR BOLTS FOR SPUN-BALL LEG ADAPTER INSTALLATION IF NECESSARY.
10. WHEN USING LEVELING NUTS, AFTER LEVELING AND LOAD BALANCING OF TRANSDUCERS IS COMPLETED AND TRANSDUCERS ARE SECURED IN PLACE (BOTH TO FLOOR AND VESSEL LEG) PACK GROUT OR CEMENT UNDERNEATH THE BASE PLATE.
11. FOR OVER 10K TO 25Klb LOAD DISC II TRANSDUCERS, K-M RECOMMENDS USING 7/16"-20 [12mm] ANCHOR BOLTS AND NUTS (ASTM-A325 GRADE OR STRONGER). FOR 10K Lb AND LOWER LOAD DISC II TRANSDUCERS, K-M RECOMMENDS USING 3/8"-24 [10mm] ANCHOR BOLTS AND NUTS (ASTM-A325 GRADE OR STRONGER).
12. ALWAYS POSITION LOAD DISC II TRANSDUCERS SO THAT TRANSDUCER CABLE MAY NOT BE SNAGGED OR CHAFED AND MAY BE EASILY ROUTED TO THE JUNCTION BOX.
13. I-BEAM SHOULD BE RIGID ENOUGH NOT TO DEFLECT MORE THAN .062" [1.57mm] OR TILT OVER 1/2" UNDER FULL LOAD; OTHERWISE CUSTOMER SHOULD WELD STIFFENERS INTO THE WEB AND ALSO WELD STIFFENER PLATES ON TOP OF I-BEAM WHERE LOAD DISC II IS TO BE INSTALLED.
14. ADAPTOR PLATE OVERALL DIMENSIONS AND HOLE PATTERNS ARE SIMILAR TO BASE PLATE.
15. K-M SUPPLIED INSTALLATION HARDWARE IS AVAILABLE SEPARATELY AS KITS.
16. TO INSTALL SENSORS ON VESSEL LEGS, THE FOLLOWING PROCEDURE MUST BE OBSERVED:
  1. HAVE ALL THE SENSORS IN PLACE WITH THEIR BOLTS FINGER TIGHT AGAINST THE VESSEL LEGS.
  2. CONNECT SENSORS TO THE ELECTRONICS, AND ZERO THE ELECTRONIC READOUT (TARE).
  3. TIGHTEN SENSORS BOLTS AFTER ZEROING. IF ELECTRONIC READOUT EXCEEDS ±100mv WHILE TORQUING THE BOLTS, STOP TORQUING. INSPECT VESSEL LEGS AND GUSSET FOR FLATNESS AND LEVELNESS.
  4. AFTER CORRECTING VESSEL LEGS AND GUSSETS FOR FLATNESS AND LEVELNESS, PROCEED WITH TIGHTENING SENSOR BOLTS.

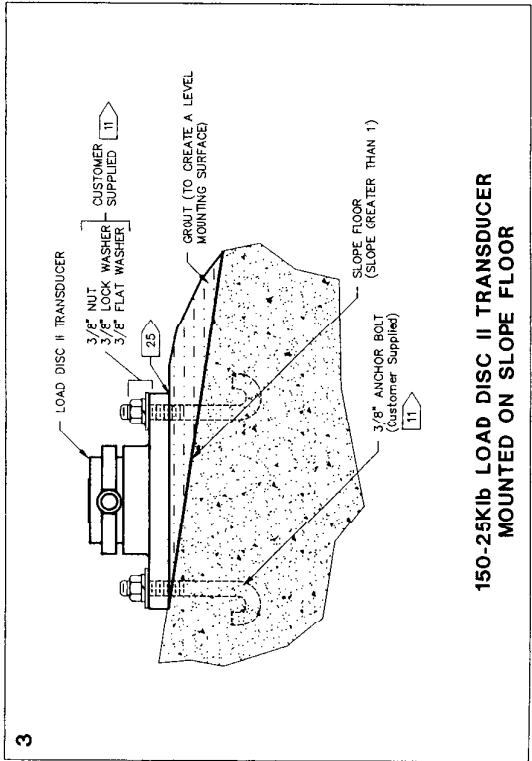
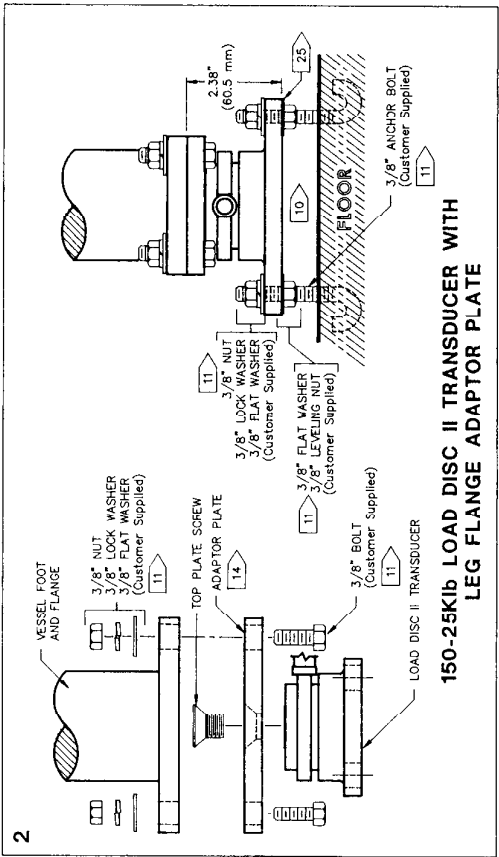
17. IF VESSEL IS TO BE RAISED OR ONE VESSEL LEG IS TO BE JACKED UP FOR REPLACING A SENSOR, MAKE SURE THAT BOLTS ON ALL OTHER SENSORS ARE LOOSENED TO AVOID OVERLOADING THE SENSOR(S).
18. LEG/FLOOR TILT ADAPTOR INSTALLATION KIT MAY BE USED WITH OR WITHOUT ANY OTHER INSTALLATION KIT TO PROVIDE FOR A COMBINED FLOOR AND LEG TILT OF UP TO 25° IN ANY DIRECTION. DEPENDING ON MATERIAL THAT IS BEING MEASURED AND VARIATION BETWEEN THE TILT OF THE VESSEL LEGS, SOME MEASURING ERROR MAY OCCUR IF COMBINED LEG/FLOOR TILT IS MORE THAN 10°.
19. THE MAXIMUM AVAILABLE DEPTH FOR 5/8"-18 BOLT ON LEG/FLOOR TILT ADAPTOR KIT IS .75" [19mm].
20. ON INSTALLATIONS WHERE COMBINATION OF "OMNISLIDE" AND UNIVERSAL TOP ADAPTOR PLATE KITS ARE USED, SPACER PLATE (P/N 39-1102-01) SHOULD BE USED WITH UNIVERSAL TOP ADAPTOR PLATE TO COMPENSATE FOR HEIGHT DIFFERENCE BETWEEN THE LOAD DISCS FITTED WITH THE "OMNISLIDE" KIT AND THE LOAD DISC FITTED WITH THE UNIVERSAL TOP ADAPTOR PLATE KIT.
21. REFER TO DRAWING CSK-0063 FOR ADDITIONAL "OMNISLIDE" INSTALLATION ILLUSTRATIONS.
22. TORQUE THE 5/8"-18 SCREW 40FT-LB MINIMUM.
23. THE SPRING WASHER MUST BE ORIENTED WITH ITS CONVEX SIDE TOWARD THE SCREW HEAD. REFER TO INSTALLATION DRAWING NUMBER 15 (UNIVERSAL ADAPTOR PLATE SCREW AND SPRING WASHER INSTALLATION).
24. FIRST NUT (WHICH A SHOCK ABSORPTION PAD IS INSTALLED) SHOULD BE TORQUED AT 15 FT-LB, SECOND NUT SHOULD BE TORQUED AT 20FT-LB AGAINST THE FIRST NUT.
25. WHEN GROUTING UNDERNEATH THE STEEL PLATE, DO NOT GROUT PAST THE BOTTOM EDGES OF THE STEEL PLATE TO FACILITATE REMOVAL OF LOAD DISC II.

REVISIONS					
LTR	DESCRIPTION	INCOPI.	CHECKED	APPROVED	DATE
NEW	Initial release	R.M. Colado	F.P.	F.P.	11-26-91
A	Added Notes 16 and 17.	R.M. Colado	F.P.	F.P.	12-16-92
B	Added Illustration No. 10 (Load Disc II Installation with Leg/Floor Tilt Adaptor Kit).	R.M. Colado	F.P.	F.P.	01-10-92
C	Added Illustration Nos. 11, 12 and 13.	R.M. Colado	F.P.	F.P.	7-16-92
D	Added .50" and 2.20" dimensions to Illustration No. 11.	J.M. Pilon	F.P.	F.P.	7-16-92
E	Added Note 21, 22 & 23. Added Illustration Nos. 14 & 15. Format change. Added sheet 3. Note 21 was drawing 11-LC.LD-06. Load Disc II load range was 500-2500b.	J.M. Pilon	F.P.	F.P.	10-16-92
F	Added Note 24. Illustration No. 12, rotated Load Disc II 90°. Illustration No. 13, added (4) 3/8" nuts	J.M. Pilon	F.P.	F.P.	12-8-92
G	Dimensions of Load Disc II base plate and top adaptor plate changed from .50" to .44" in Illustrations Nos. 2, 4, 5, 7, 9, 11, 12, 13 & 14. Added dimensions to Illustration No. 10.	J.M. Pilon	F.K.M.	F.P.	3-26-93
H	Added Illustration Nos. 16, 17, 18 and 19.	R.M. Colado	F.K.M.	F.P.	8-8-98
J	Added note 25.	R.M. Colado	F.P.	F.P.	12-12-98
K	Added Sht. 7 (LDII w/Spacer Plate Adaptor Kit)	C.Blackburn	F.P.	F.P.	8-14-99

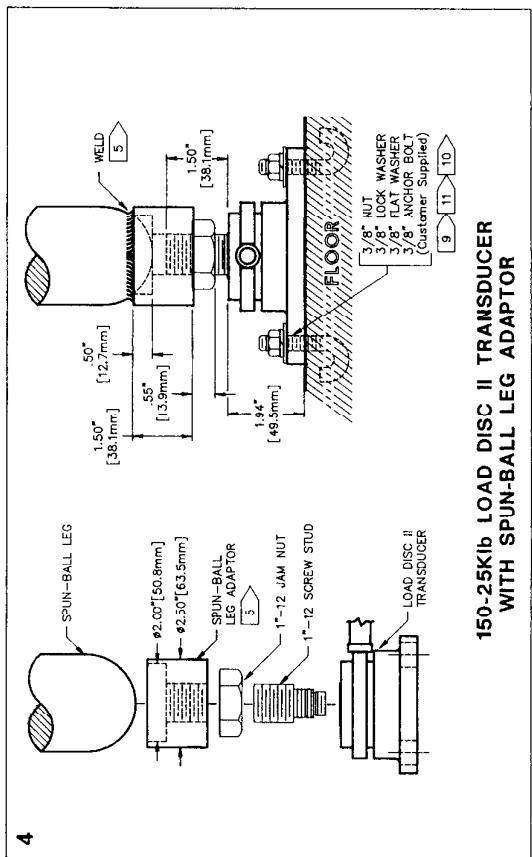
APPROVALS	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	 <b>Kistler-Morse Corp.</b> Bothell, WA 98011
DRAWN	11/26/91	DECIMAL ANGULAR	
CHECKED	11/26/91	TOLERANCES	TITLE <b>INSTALLATION ARRANGMENTS.</b> <b>150lb-25klb LOAD DISC II</b>
PROJ. ENGR.	11/26/91	DO NOT SCALE DRAWING	
PRODUCTION		SCALE NONE	SIZE DWG. NO. <b>B CSK-0033</b>
PURCHASING		USED OR (REF. ON LY)	ACAD # CSK0033A DATE 08/12/96 (SIT. 1 OF 1)

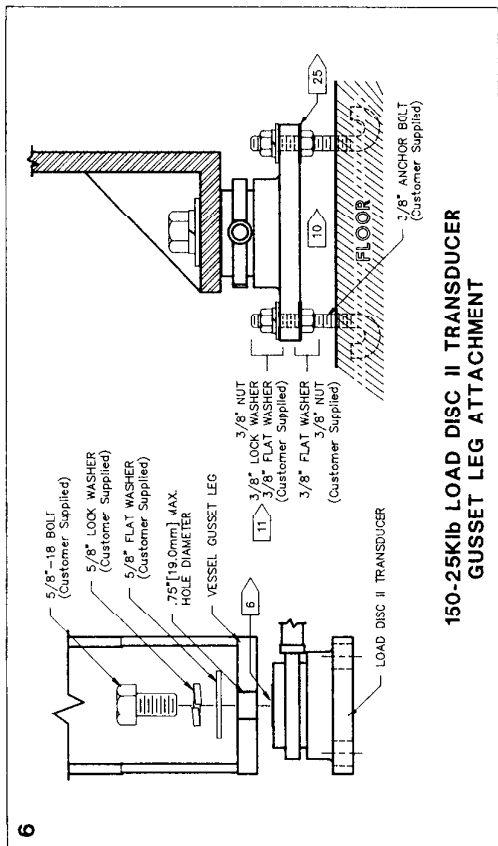


**150-25Klb LOAD DISC II TRANSDUCER ON CONCRETE FOUNDATION WITH ANCHOR BOLTS**

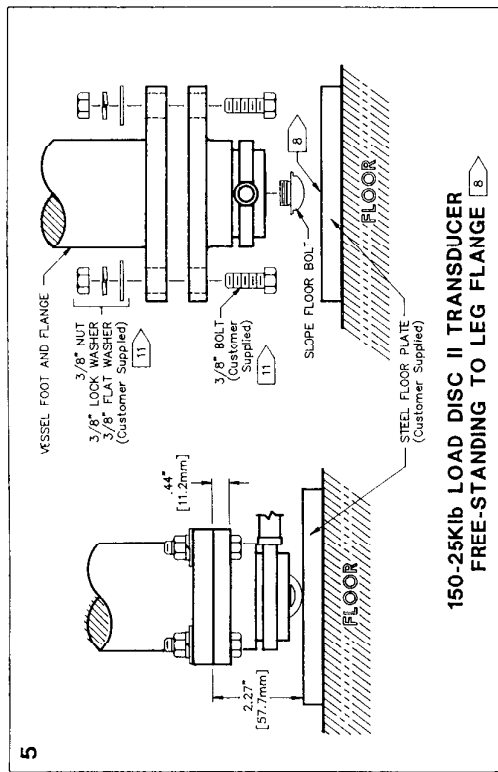


**150-25Klb LOAD DISC II TRANSDUCER MOUNTED ON SLOPE FLOOR**

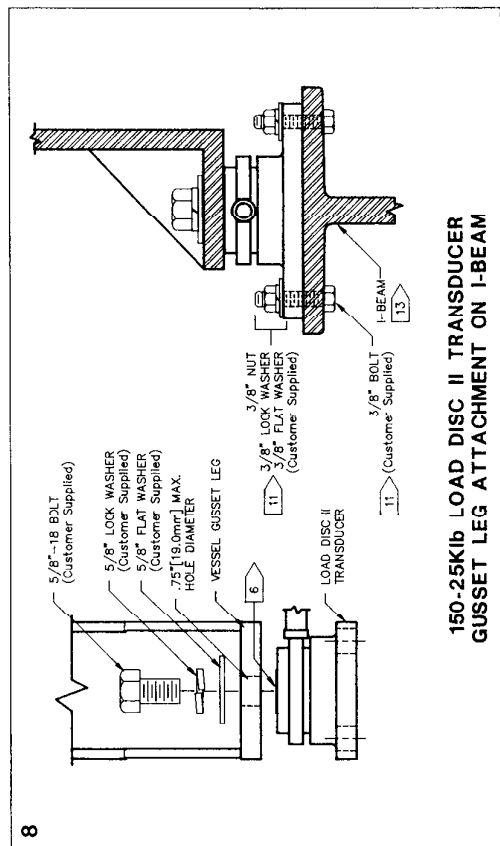




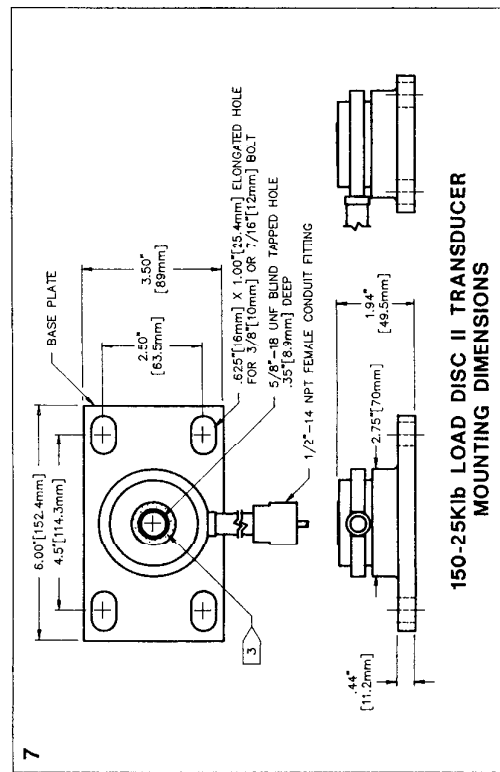
**150-25Klb LOAD DISC II TRANSDUCER  
GUSSET LEG ATTACHMENT**



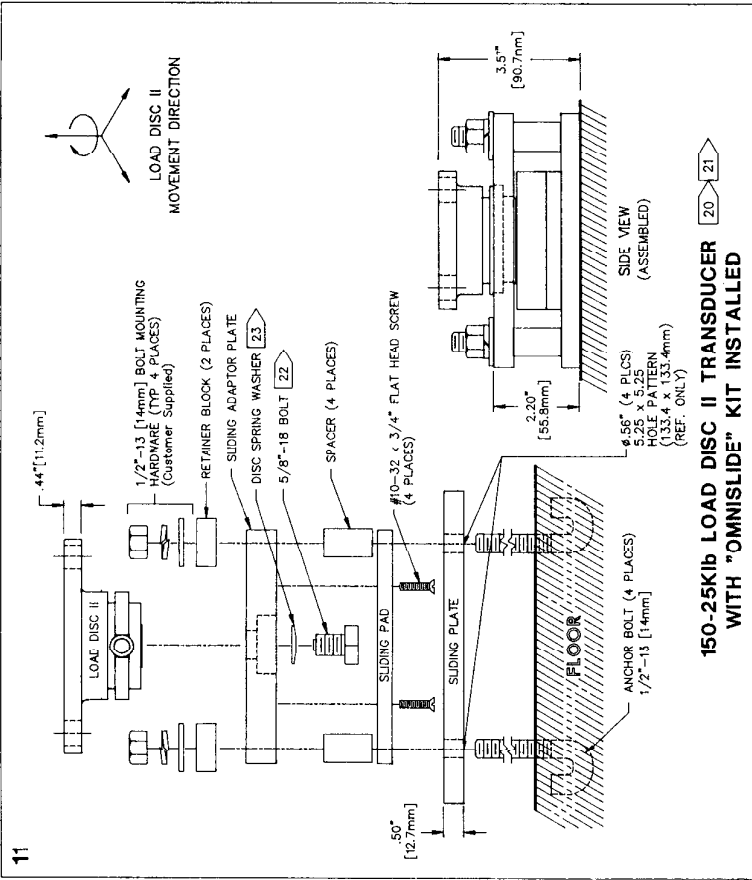
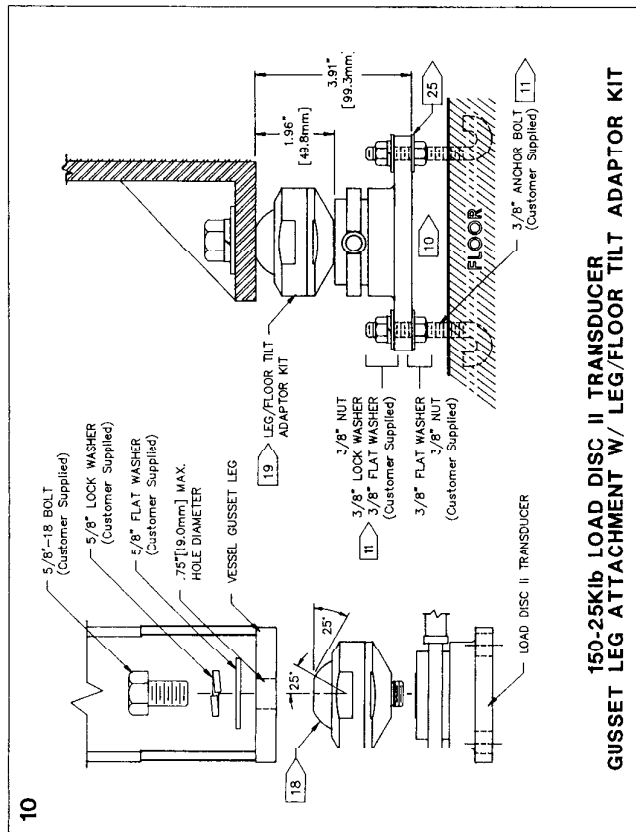
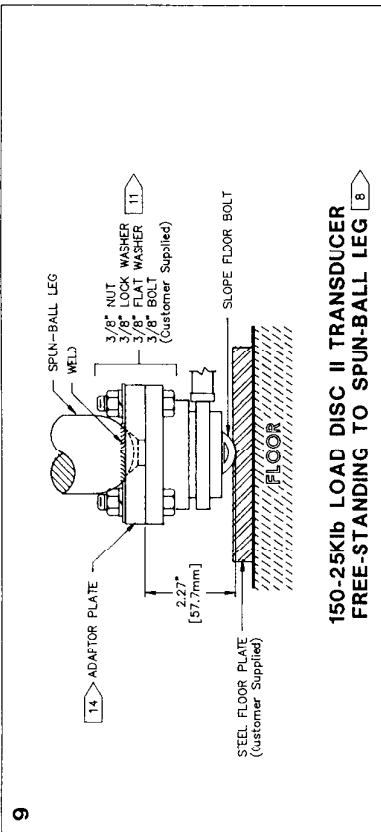
**150-25Klb LOAD DISC II TRANSDUCER  
FREE-STANDING TO LEG FLANGE**



**150-25Klb LOAD DISC II TRANSDUCER  
GUSSET LEG ATTACHMENT ON I-BEAM**



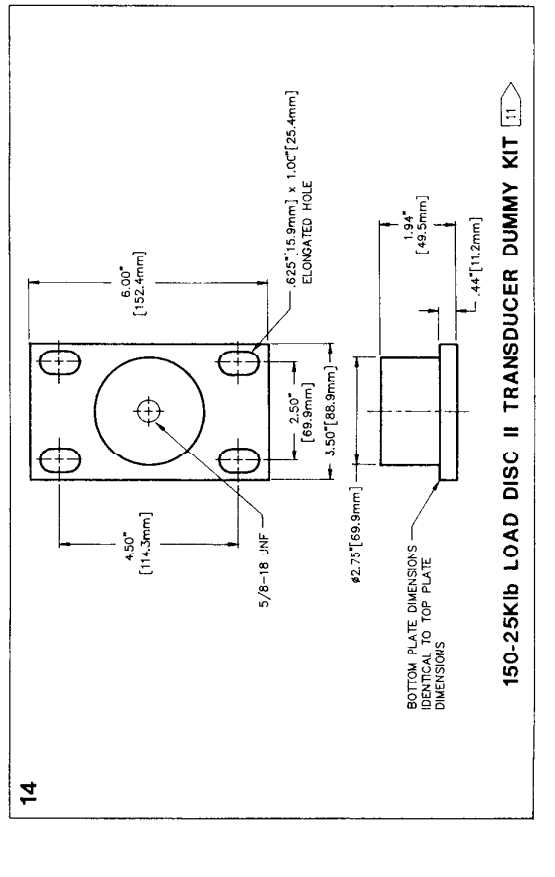
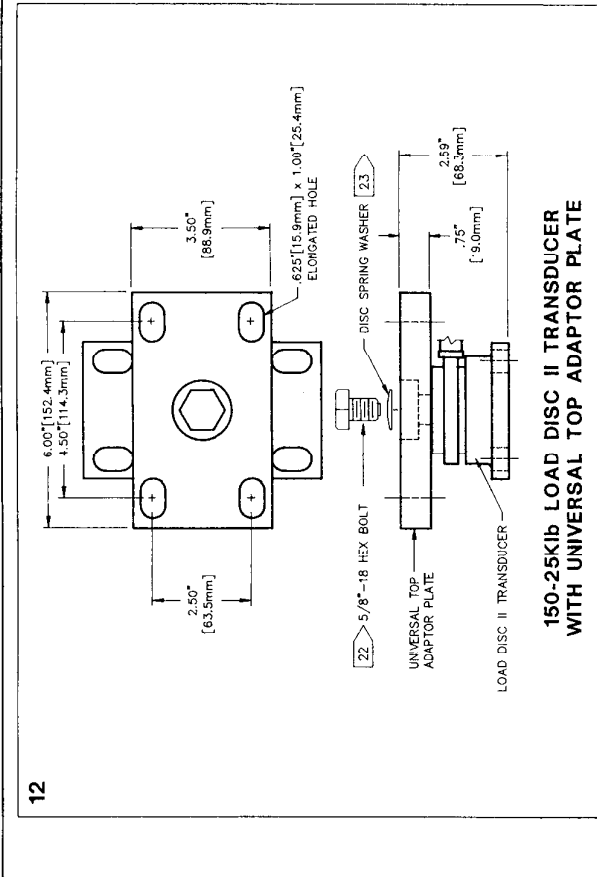
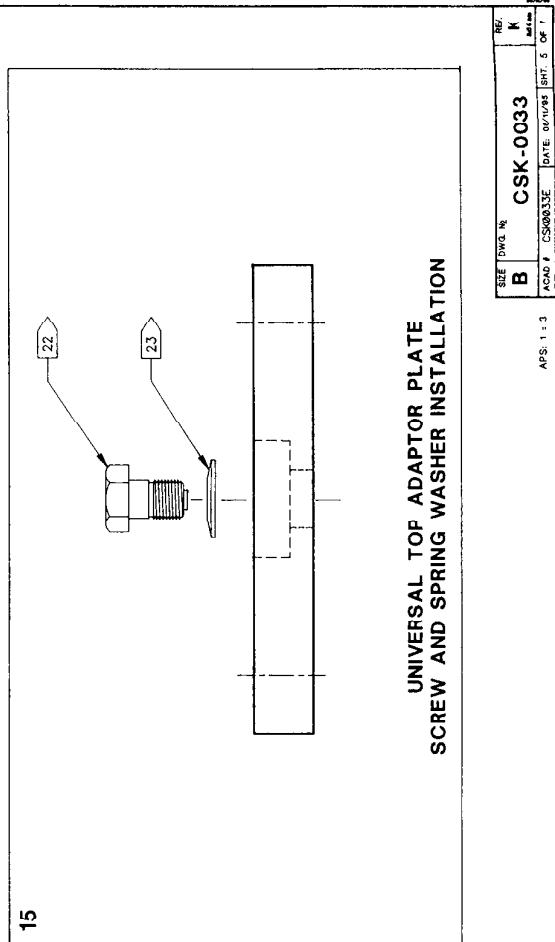
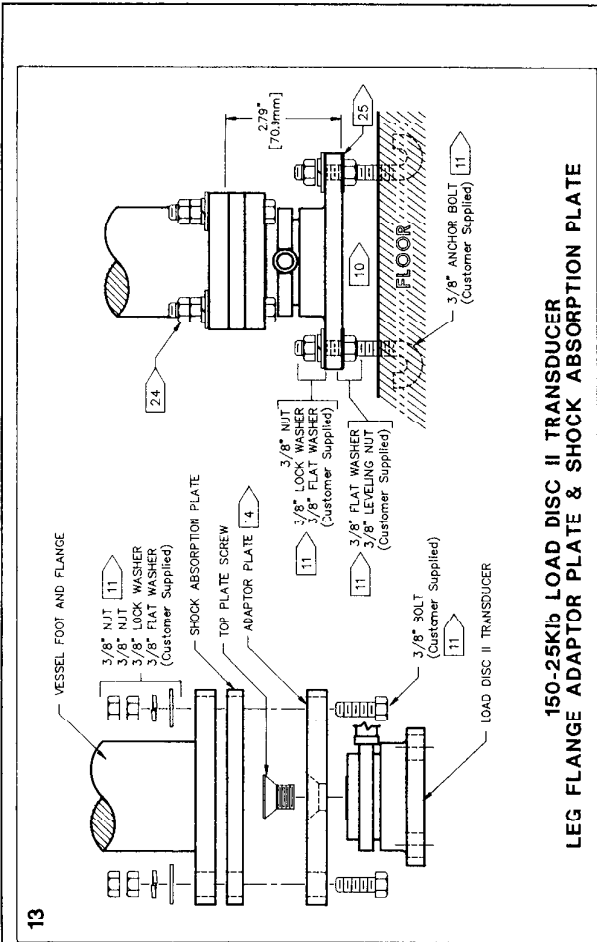
**150-25Klb LOAD DISC II TRANSDUCER  
MOUNTING DIMENSIONS**



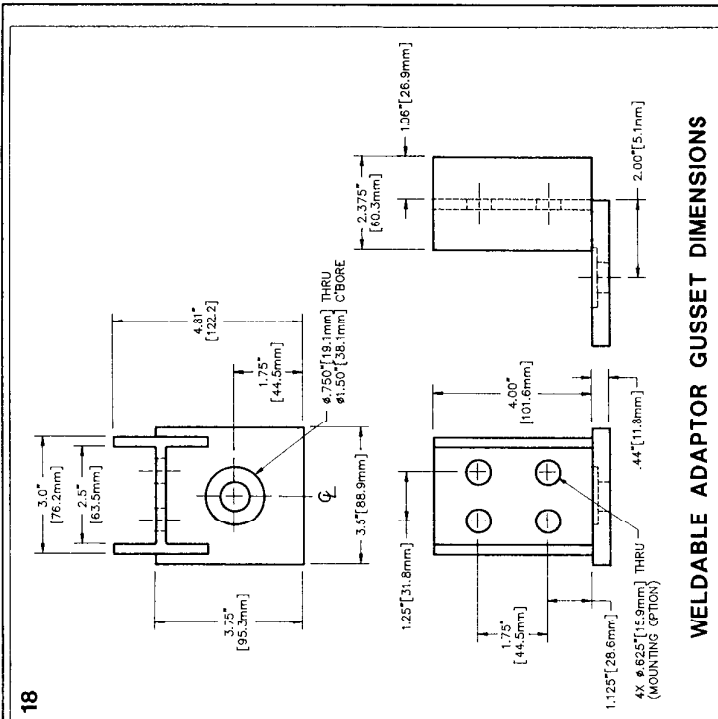
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B	CSK-0033		
ADAD 1	CSK0033D	DATE: 08/15/95	BRT. 4. OF 1

APS: 1:1

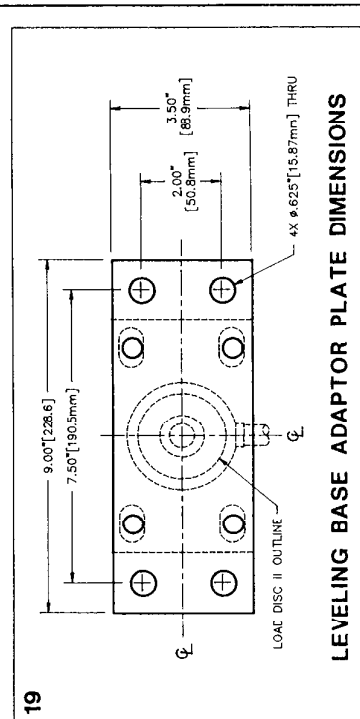




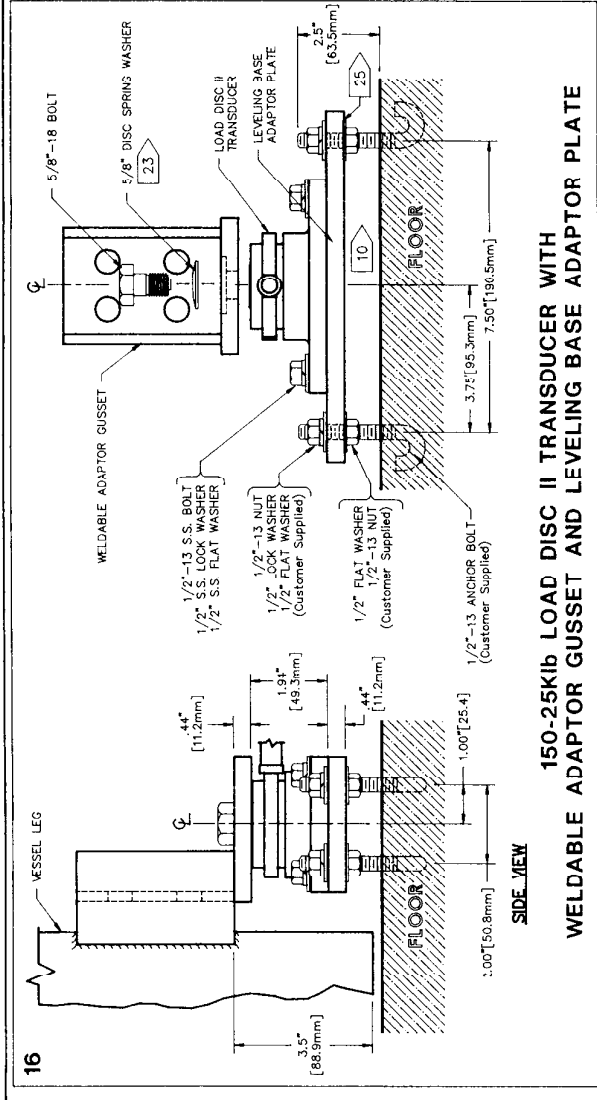
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DATE	06/19/85
SHEET	5 OF 7
ACAD #	CSK0033E
SIZE	DWG. N.
	B
	CSK-0033
APS: 1-13	



18

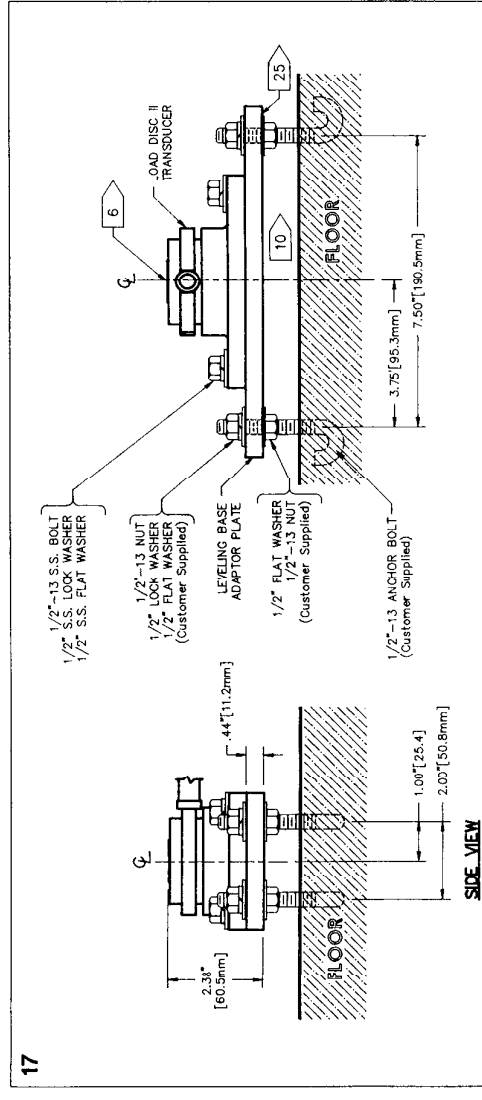


19



16

150-25Kib LOAD DISC II TRANSDUCER WITH WELDABLE ADAPTOR GUSSET AND LEVELING BASE ADAPTOR PLATE



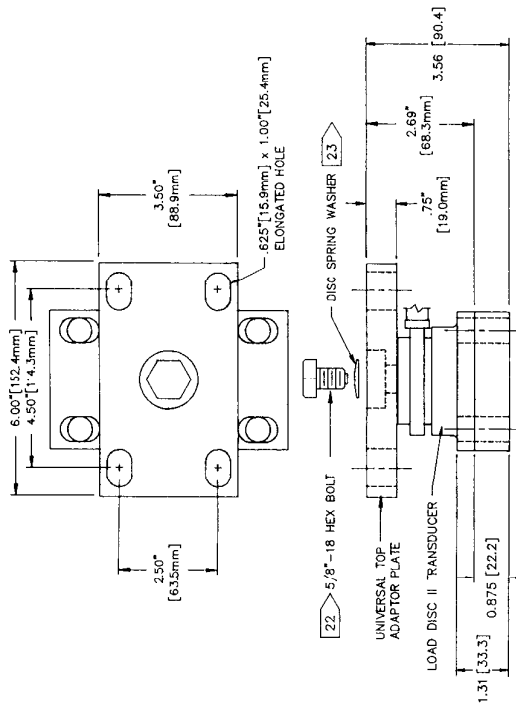
17

150-25Kib LOAD DISC II TRANSDUCER WITH LEVELING BASE ADAPTOR PLATE

REV.	DATE	BY	CHK
B	CSK-0033		
SIZE	DWG. NO.	ACAD. #	DATE
B	CSK-0033	CSK-0033	01/19/88
SHEET			SHT. 6 OF 7

APS: 1-1-3

20



150-25Kib LOAD DISC II TRANSDUCER  
WITH SPACER PLATE AND UNIVERSAL TOP ADAPTOR PLATE

SEE DWG. IN	REV.
<b>B</b>	<b>K</b>
CSK-0033	304
ACAD / CSK0033G	DATE: 08/17/91
	SHT. 7 OF

AFS: 1 + 3

LTR	DESCRIPTION	INCORP	CHECKED	APPROVED	DATE
A	Added Leveling Base Adaptor Plate dimensions	R.M. Collins	---	F.P.	7-2-74
B	Added Note 19.	R.M. Collins	---	F.P.	7-12-74
C	Added Frame #14	C. Buckhorn	---	F.P.	7-14-74

REVISIONS

16 REFER TO DRAWING CSK-0071 FOR ADDITIONAL "OMNISLIDE" INSTALLATION ILLUSTRATION.

17 ON INSTALLATIONS WHERE COMBINATION OF "OMNISLIDE" AND UNIVERSAL TOP ADAPTER PLATE KITS ARE USED, SPACER PLATE (PART NUMBER 39-1108) SHOULD BE USED WITH UNIVERSAL TOP ADAPTER PLATE TO COMPENSATE FOR HEIGHT DIFFERENCE BETWEEN LOAD DISC II TRANSDUCCERS FITTED WITH THE "OMNISLIDE" KIT AND LOAD DISC II TRANSDUCCERS FITTED WITH THE UNIVERSAL TOP ADAPTER PLATE KIT.

18 WHEN USING SHOCK ABSORPTION PAD, ASSEMBLY SHOULD BE DOUBLE NUTTED. FIRST NUT TO BE TORQUED TO 15FT-LB AND THE SECOND NUT TO BE TORQUED TO 20 FT-LB MINIMUM AGAINST THE FIRST NUT.

19 WHEN GROUTING UNDERNEATH THE STEEL PLATE, DO NOT GROUT PAST THE BOTTOM EDGES OF THE STEEL PLATE TO FACILITATE REMOVAL OF LOAD DISC II.

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DURING INSTALLATION, DO NOT PLACE ALL THE VESSEL LOAD ON ONE LOAD DISC II TRANSDUCCER. TRANSDUCCER GAGE INTEGRITY IS ONLY RATED AT TWICE THE RATED LOAD. AN EVEN DISTRIBUTION OF LOAD ON ALL VESSEL LEGS IS DESIRABLE.

2. WHEN RAISING VESSEL FOR TRANSDUCCER INSTALLATION, USE PROPER SUPPORTS TO PREVENT THE VESSEL FROM TIPPING OR FALLING OVER.

3. VESSEL LOAD SHOULD BE CONCENTRATED ON LOAD RING OF LOAD DISC II TRANSDUCCER AND NOT ON ANY MOUNTING SCREW.

4. ALL BOLTS AND SCREWS TO BE OF ASTM-A325, SAE GRADE 8 MATERIAL OR STRONGER.

5. THE MAXIMUM AVAILABLE DEPTH FOR 1"-12 UNF SCREW ON LOAD DISC II TOP IS .62" (15.7mm).

6. IN PLACE OF LEVELING NUT, SHIMS MAY BE USED TO ADJUST HEIGHT OF VESSEL LEGS.

7. WHEN USING LEVELING NUTS, AFTER LEVELING AND LOAD BALANCING OPERATIONS, THE COVERED TRANSDUCCERS ARE SECURED IN PLACE (BOTH TO FLOOR AND VESSEL LEG) PACK GROUT OR CEMENT UNDERNEATH THE STEEL PLATE.

8. FOR LOAD DISC II TRANSDUCCERS RATED AT 35K TO 100K LB, Kistler-Morse RECOMMENDS USING 3/4"-10 UNC (20mm) ANCHOR BOLTS AND NUTS ASTM-A325 GRADE OR STRONGER.

9. ALWAYS POSITION LOAD DISC II TRANSDUCCERS SO THAT TRANSDUCER CABLE MAY NOT BE SNAGGED OR CHAFED AND MAY BE EASILY ROUTED TO THE JUNCTION BOX.

10. I-BEAM SHOULD BE RIGID ENOUGH NOT TO DEFLECT MORE THAN .082" (1.57mm) OR TILT OVER 1/2" UNDER FULL LOAD. OTHER ALIAS CUSTOMER WELD STIFFENERS INTO THE WEB AND ALSO WELD STIFFENER PLATE TO THE OUTSIDE OF I-BEAM WHERE LOAD DISC II TRANSDUCCER IS TO BE INSTALLED.

11. Kistler-Morse SUPPLIED INSTALLATION HARDWARE KITS ARE PROVIDED SEPARATELY AS KITS.

12. TO INSTALL TRANSDUCCERS ON VESSEL LEGS, THE FOLLOWING PROCEDURE MUST BE OBSERVED:

1. HAVE ALL THE TRANSDUCCERS IN PLACE WITH THEIR BOLTS TIGHT AGAINST THE VESSEL LEGS.
2. CONNECT TRANSDUCCERS TO THE ELECTRONICS, AND ZERO THE ELECTRONIC REAROUT (TABE).
3. TIGHTEN TRANSDUCCER BOLTS AFTER ZEROING. IF ELECTRONIC REAROUT EXCEEDS 4% OVER THE ZEROING THE BOLTS, STOP TIGHTENING. INSPECT VESSEL LEGS AND GUSSET FOR FLATNESS AND LEVELNESS.
4. AFTER CORRECTING VESSEL LEGS AND GUSSETS FOR FLATNESS AND LEVELNESS, PROCEED WITH TIGHTENING SENSOR BOLTS.

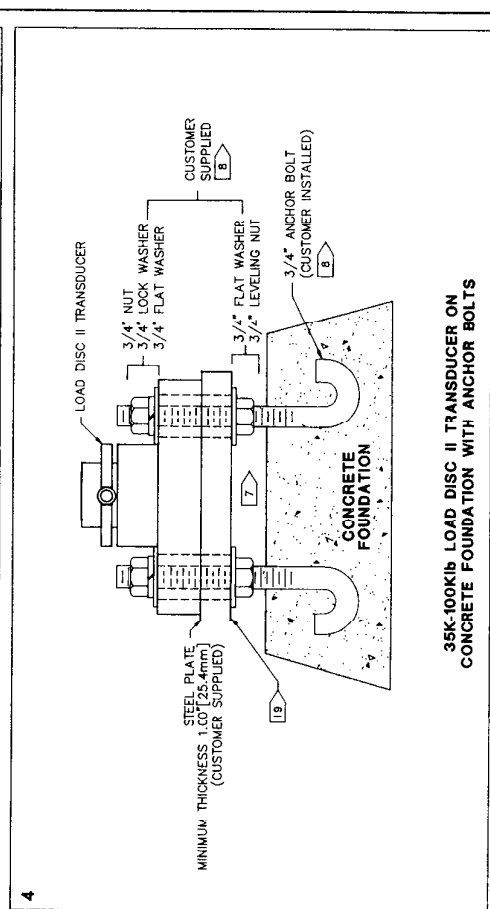
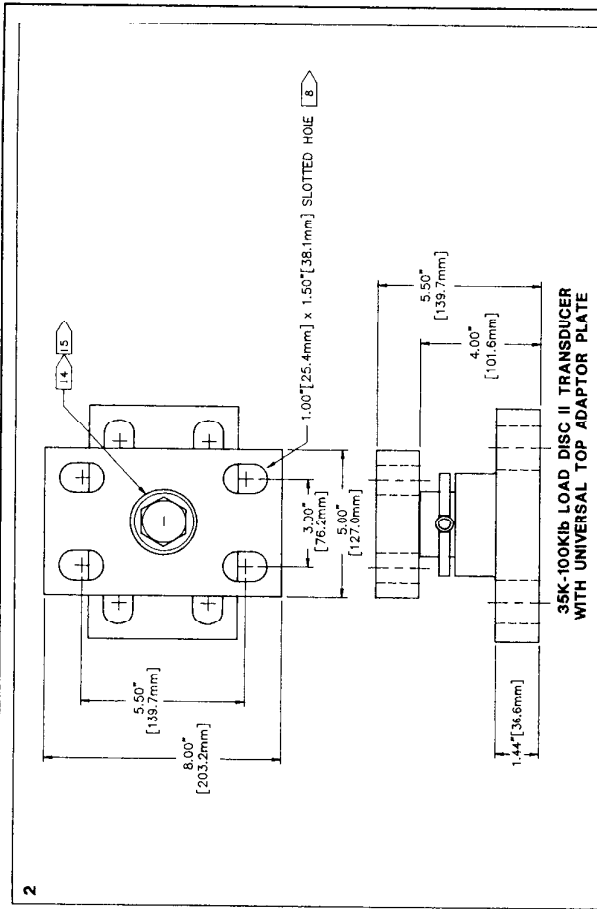
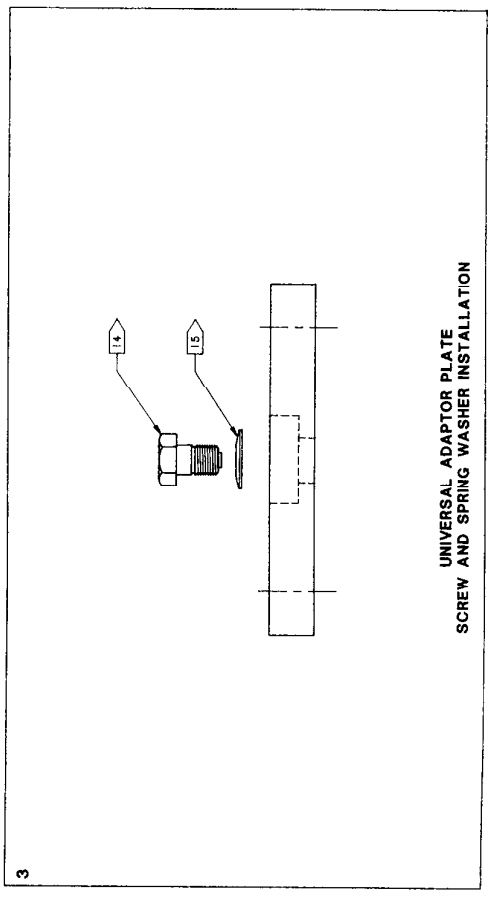
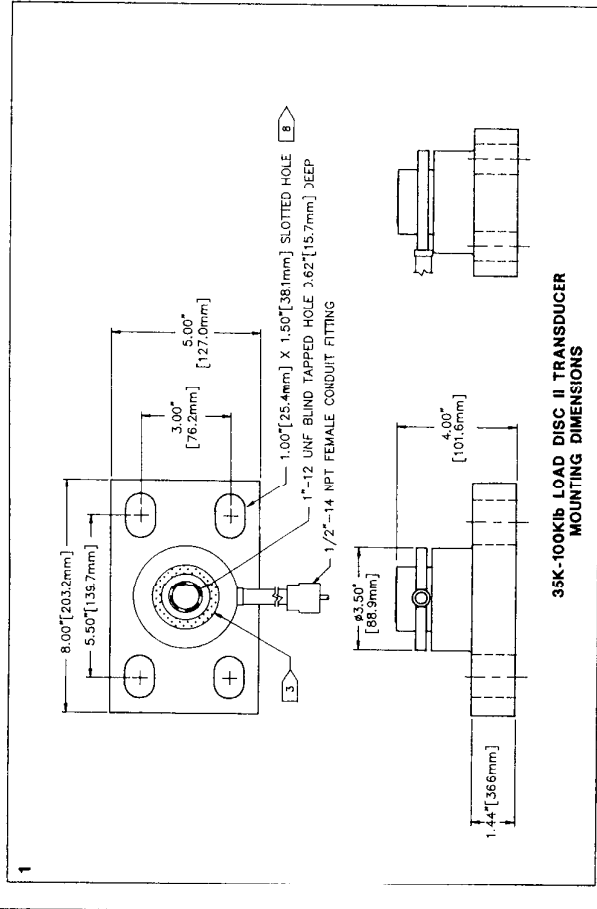
13. IF VESSEL IS TO BE RAISED OR ONE VESSEL LEG IS TO BE JACKED UP FOR REPLACING A LOAD DISC II TRANSDUCCER, MAKE SURE THAT BOLTS ON ALL OTHER TRANSDUCCERS ARE LOOSENED TO AVOID OVERLOADING THE TRANSDUCCER(S).

14. TORQUE THE 1"-12 UNF SCREW 60FT-LB MINIMUM.

15. THE SPRING WASHER MUST BE ORIENTED WITH ITS CONVEK SIDE TOWARD THE SCREW HEAD. REFER TO INSTALLATION DRAWING NO. 3 (UNIVERSAL ADAPTER PLATE SCREW AND SPRING WASHER INSTALLATION).

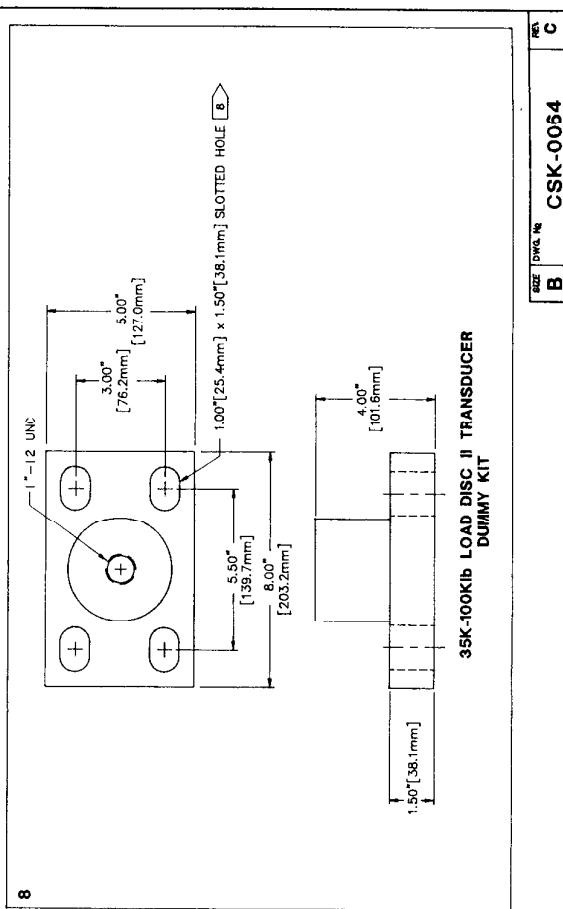
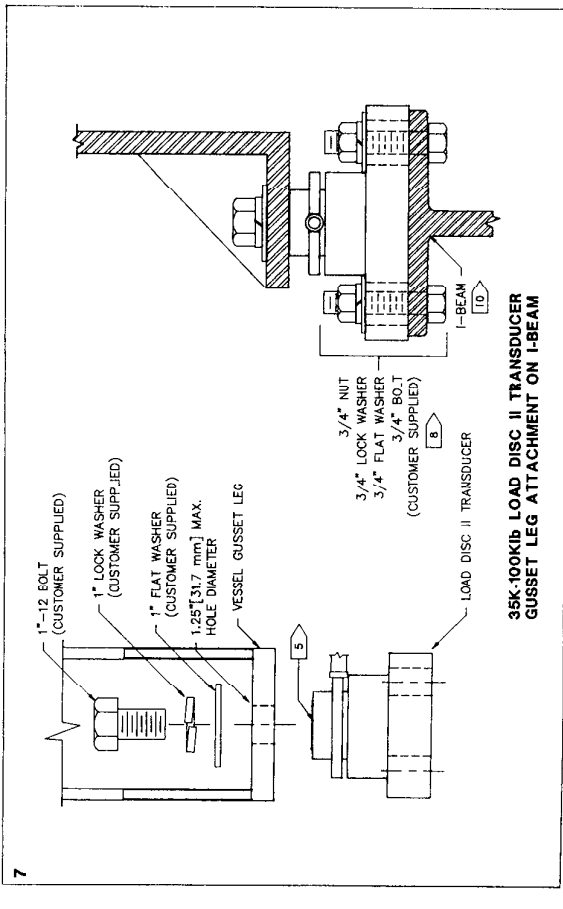
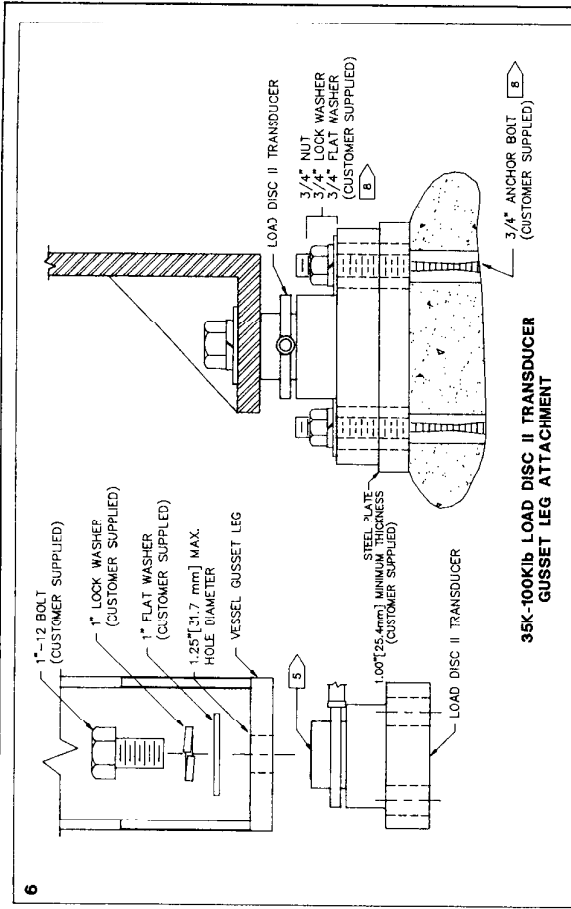
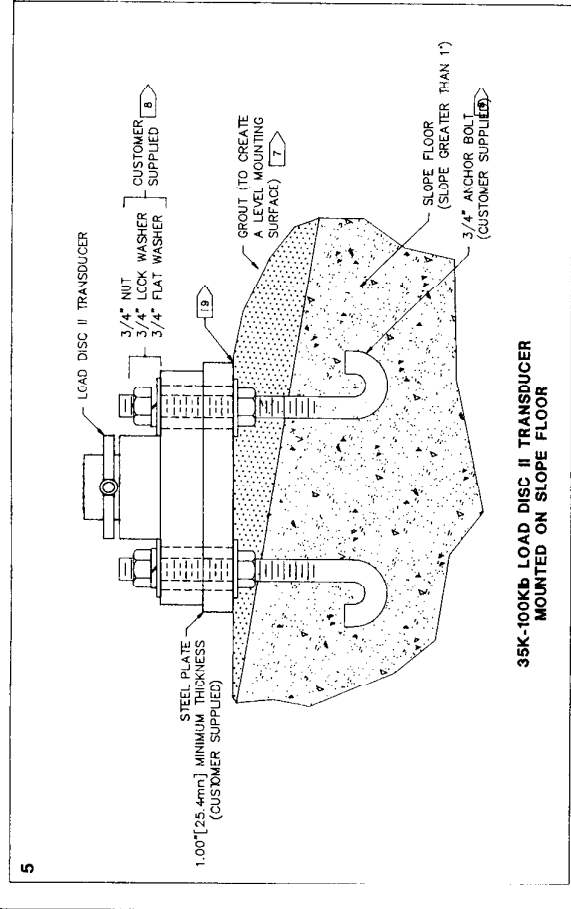
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CHECKED: T.K.M.	7-2-72	XX	±.001	±.001	
PROJ. ENGR. F. Pirostremf	7-2-72	DO NOT SCALE DRAWING	SCALE	NONE	
PRODUCTION	7-2-72	FINISH	SCALE	NONE	
PURCHASING		USED ON REF ONLY			ACAD # CSK0684A
		LD II			DATE REVISED
					SIZE DWG. NO.
					B
					CSK-0064
					C
					REL.
					3

INSTALLATION ARRANGEMENTS,  
35Klbs - 100Klbs  
LOAD DISC II



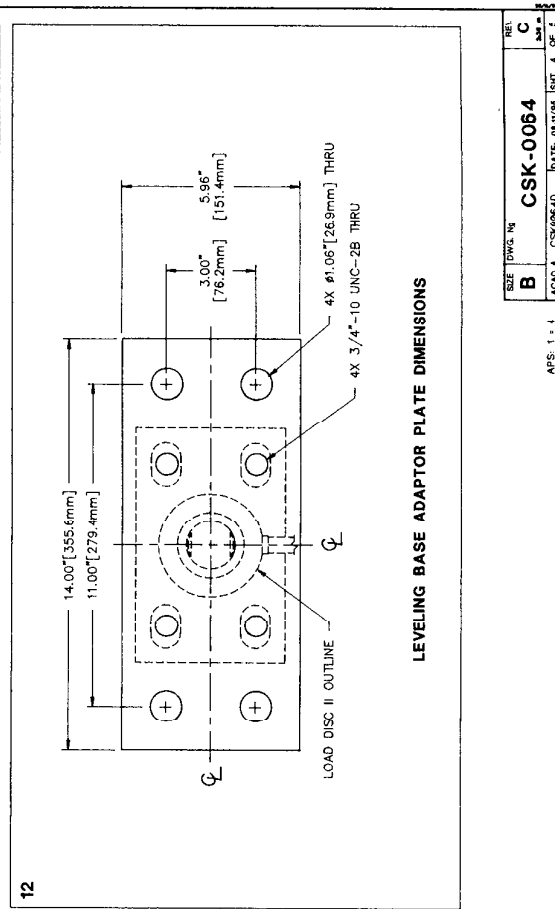
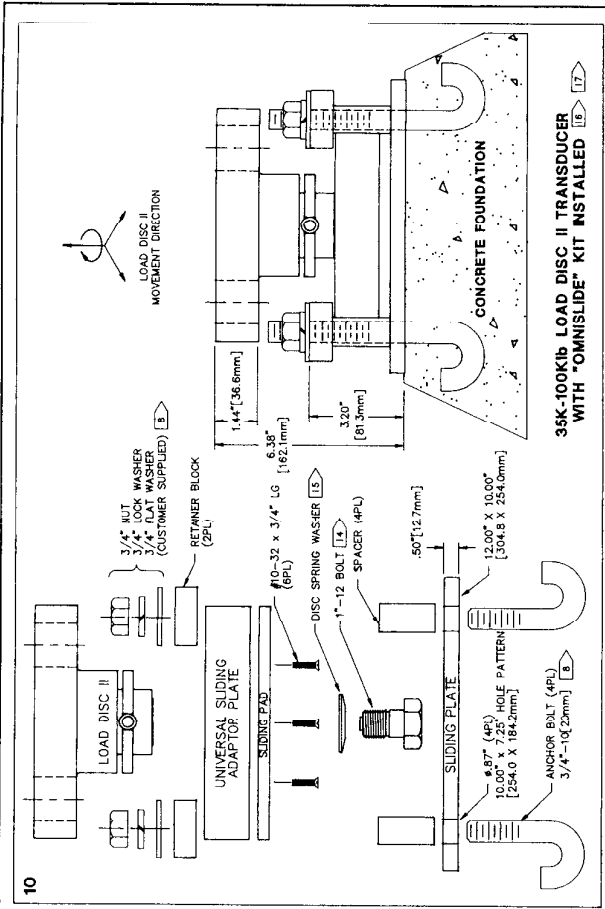
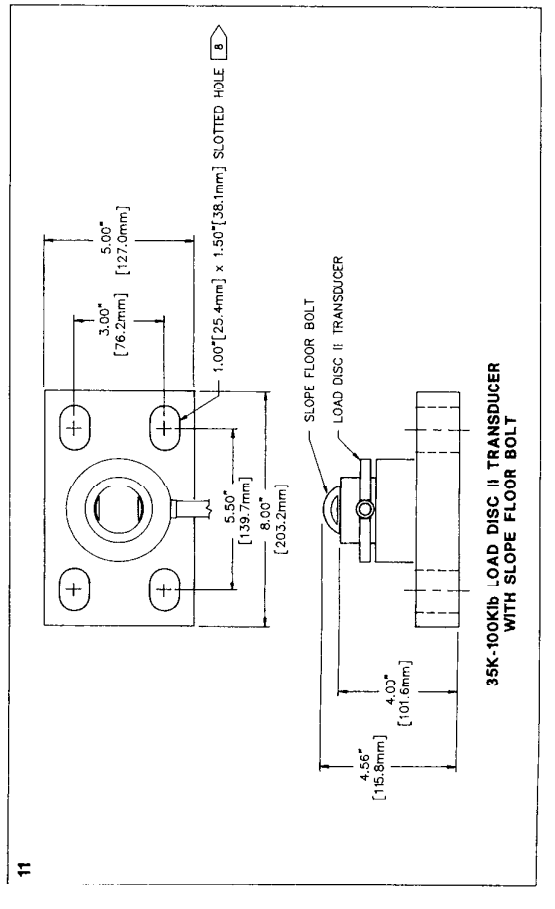
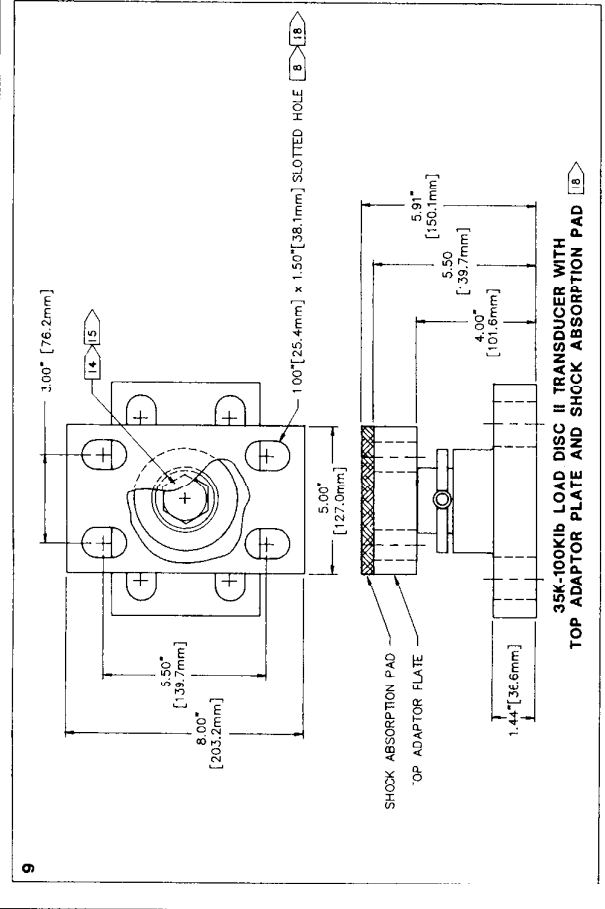
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B	CSK-0064	C

APP. 1-1-4  
 MOD. 1 CSK0064B  
 DATE 08/19/96  
 SHEET 2 OF 3



SIZE	DWG. NO.	REV.
B	CSK-0054	C
ADD 1	DATE	REV. 3 OF 3

APS 1-1-1



SIZE	DWG. NO.	REV.
B	CSK-0064	C
APP'D	DATE	DATE
	CSK-0064	08/11/04

APS-11-1

DATE 08/11/04

DATE 08/11/04

DATE 08/11/04

DATE 08/11/04

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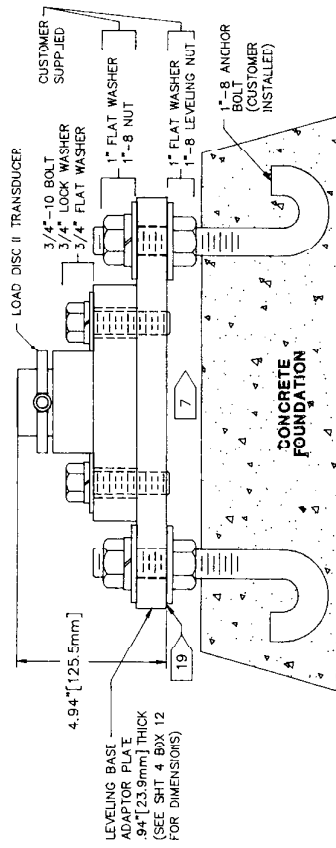
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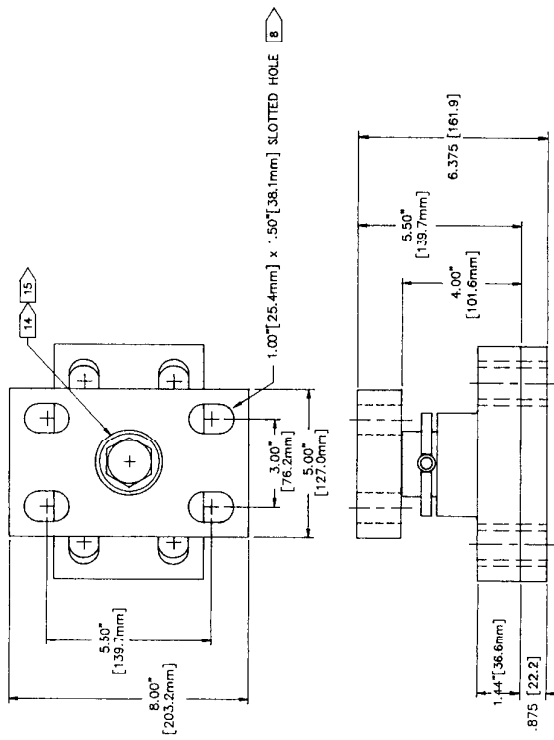
DATE 08/11/04

13



35K-100Klb LOAD DISC II TRANSDUCER WITH LEVELING BASE ADAPTOR PLATE

14



35K-100Klb LOAD DISC II TRANSDUCER WITH SPACER PLATE AND UNIVERSAL TOP ADAPTOR PLATE

SIZE	DWG. NO.	REV.
B	CSK-0054	C
ADD. 1	CSK(82)4E	DATE REVISED
		REV. 3 OF 5

APS-1-1-1