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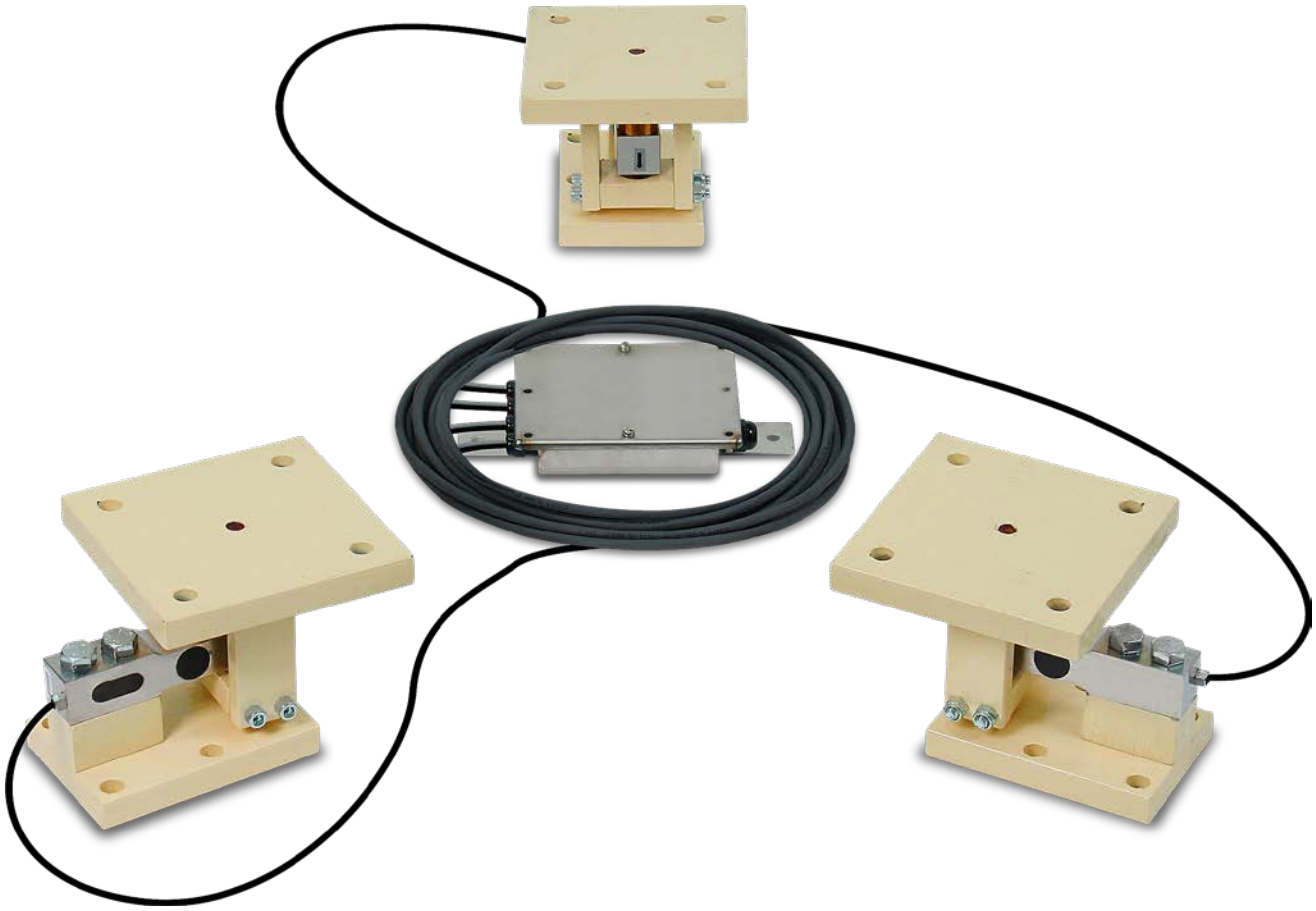


TBCS

Self-Checking Load Cell Kits

Technical Manual

TABLE OF CONTENTS

Serial Number_____

Date of Purchase _____

Purchased From_____

_____

_____

RETAIN THIS INFORMATION FOR FUTURE USE

PRECAUTIONS

Before using this product, read this manual and pay special attention to all "NOTIFICATION" symbols:

DANGER!
WARNING!
CAUTION!

Copyright

Disclaimer

While every precaution has been taken in the preparation of this manual, the Seller assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from use of the information contained herein. All instructions and diagrams have been checked for accuracy and ease of application; however, success and safety in working with tools depend largely upon the individual accuracy, skill and caution. For this reason, the Seller is not able to guarantee the result of any procedure contained herein. Nor can they assume responsibility for any damage to property or injury to persons occasioned from the procedures. Persons engaging the procedures do so entirely at their own risk.

FCC Compliance Statement

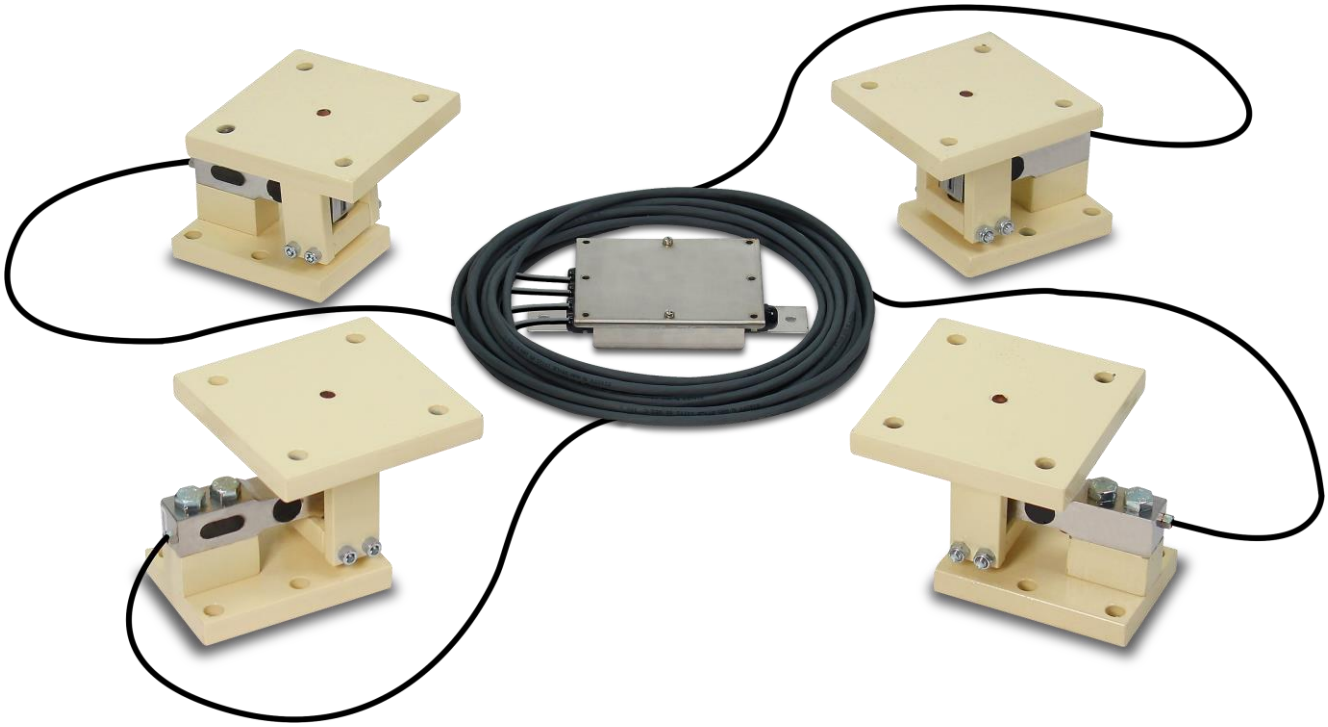
This equipment generates uses, can radiate radio frequency, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been designed within the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the user will be responsible to take whatever measures necessary to correct the interference.

You may find the booklet “How to Identify and Resolve Radio TV Interference Problems” prepared by the Federal Communications Commission helpful. It is available from the U.S. Government Printing Office, Washington, D.C. 20402. Request stock No. 001-000-00315-4.

INTRODUCTION

Cardinal Scale's TBCS self-checking electronic load cell kits are versatile weighing modules for wide-ranging applications such as tanks, hoppers, silos, bins, and mixers. They are ideal for new installations or existing conversions. System capacities vary based on the number of cells from 3,000 lb (1,360kg) to 16,000 lb (7,250 kg), and they are easy to install with a low-profile design.

The TBCS series uses stainless steel TB series shear beam load cells that are manufactured by Cardinal Scale and come with mild or stainless steel rugged, bolt-in-place stands. The kits include three or four stand assemblies, load cells, stainless steel junction box, and cables. Self-centering load buttons protect against offset loads to ensure reliable weighing.
The environmentally-sealed TB series load cells are NTEP, OIML, and VCAP certified, and are ideal for harsh conditions and unforgiving workloads. They are suited for indoor or outdoor applications and are resilient to temperature, moisture, and vibration fluctuations.



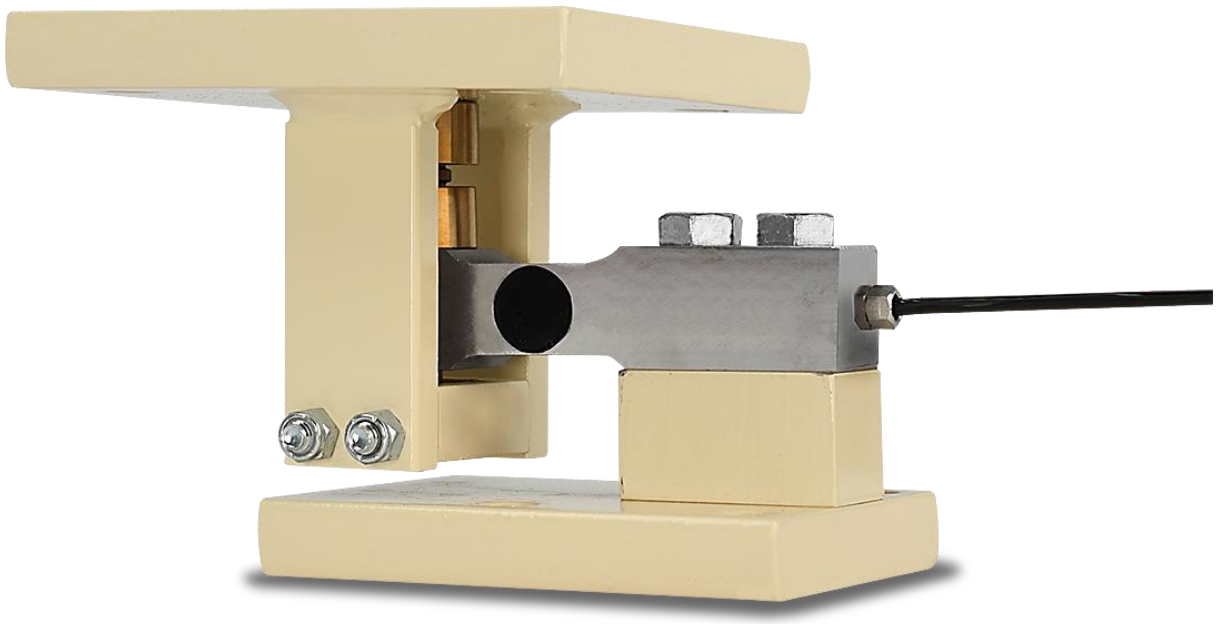
This manual should be studied thoroughly before attempting to install the load cell kit, and must be used in conjunction with certified drawings of the particular scale being installed.
In case of conflict, the certified drawings will govern.

Safety should always be the prime consideration during all phases of the installation. Failure to comply with the instructions in this manual will void all warranty implied or stated.

All systems need to be safety-checked or chained to prevent failure. A qualified engineer should be consulted that has determined that the vessel to be used is structurally sound and capable of being supported by three or four points when filled to capacity.

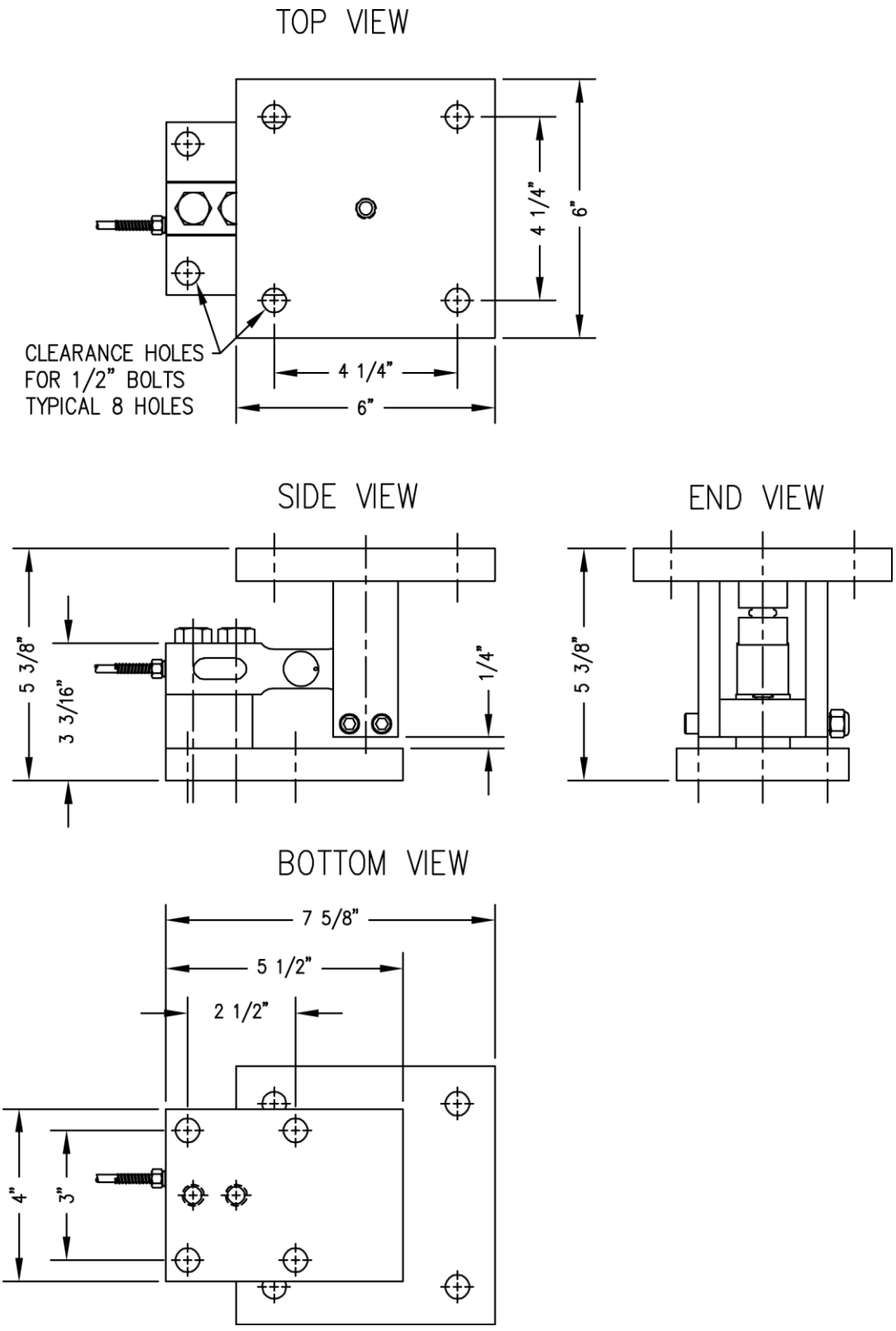
SPECIFICATIONS

Specification	Description
Model:	TBCS series
Load Cell Type:	Stainless steel TB series shear beam load cells
Load Cell Capacities:	1,000 lb (450 kg) up to 4,000 lb (1,800 kg)
Load Cell Cable:	20 ft / 6 m
Load Cell Button:	Hardened steel load cell button
Stand Type:	Self-checking, bolt-down design
Stand Construction:	Stainless steel or powder-painted mild steel
Stand Construction:	Mild or stainless steel, bolt-in-place stands
Junction Box Type:	Stainless steel 4-cell trim box
Junction Box Cable Length to Indicator:	30 ft / 9 m with 9-pin D connector
Included:	Each kit consists of three or four stand assemblies, load cells, self-checking load cell stands, stainless steel NEMA 4 junction box, and load cell cable. Bolts and lock washers are included
System Capacities:	3,000 lb (1,360 kg) to 16,000 lb (7,250 kg)
Indicators:	A wide selection of digital weight indicators are also available from Cardinal Scale
Weighing Applications:	Tanks, hoppers, silos, bins, and mixers scales. New installations or existing conversions



SPECIFICATIONS, CONT.

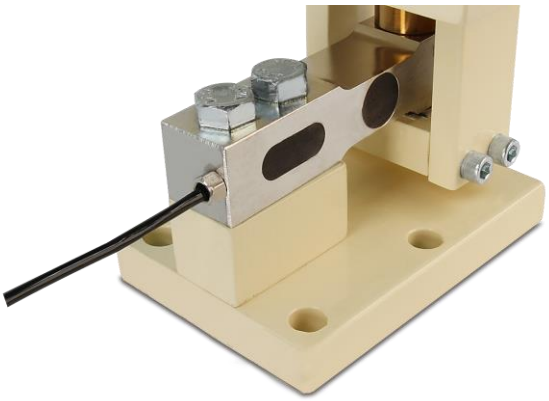
Dimensions

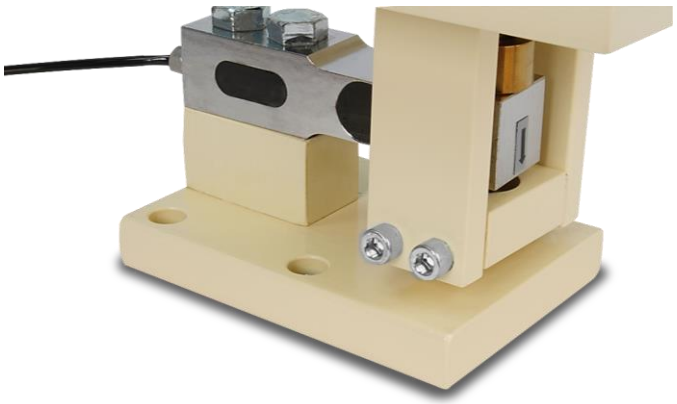


SPECIFICATIONS, CONT.

Capacities

			Cell Capacity	System Capacity	Shipping Weight
MILD STEEL	3-CELL	TBCS-1KM-3	1,000 lb – 455 kg	3,000 lb – 1,360 kg	69 lb
		TBCS-2.5KM-3	2,500 lb – 1,135 kg	7,500 lb – 3,400 kg	69 lb
		TBCS-4KM-3	4,000 lb – 1,815 kg	12,000 lb – 5,440 kg	69 lb
	4-CELL	TBCS-1KM-4	1,000 lb – 455 kg	4,000 lb – 1,815 kg	90 lb
		TCBS-2.5KM-4	2,500 lb – 1,135 kg	10,000 lb – 4,500 kg	90 lb
		TCBS-4KM-4	4,000 lb – 1,815 kg	16,000 lb – 7,250 kg	90 lb
STAINLESS STEEL	3-CELL	TBCSS-1KM-3	1,000 lb – 455 kg	3,000 lb – 1,360 kg	69 lb
		TCBSS-2.5KM-3	2,500 lb – 1,135 kg	7,500 lb – 3,400 kg	69 lb
		TCBSS-4KM-3	4,000 lb – 1,815 kg	12,000 lb – 5,440 kg	69 lb
	4-CELL	TCBSS-1KM-4	1,000 lb – 455 kg	4,000 lb – 1,815 kg	90 lb
		TCBSS-2.5KM-4	2,500 lb – 1,135 kg	10,000 lb – 4,500 kg	90 lb
		TCBSS-4KM-4	4,000 lb – 1,815 kg	16,000 lb – 7,250 kg	90 lb

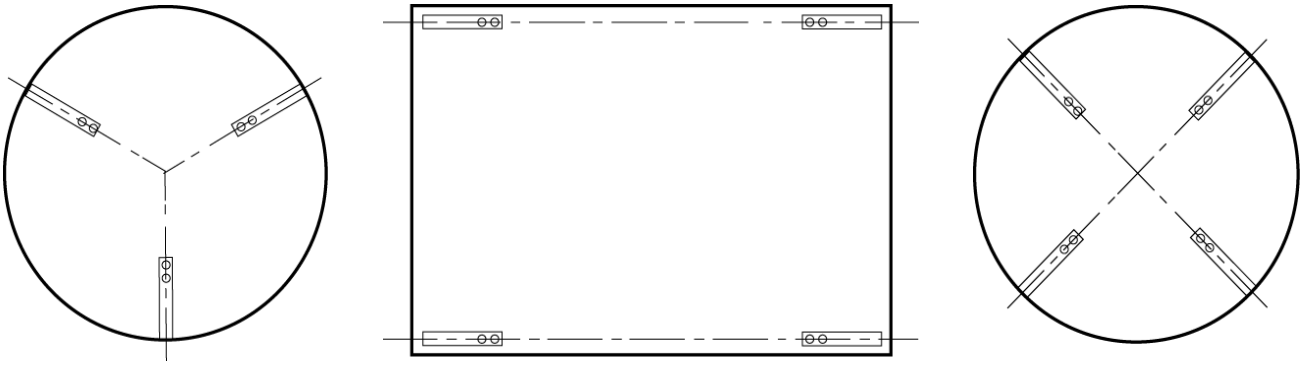




GENERAL INSTALLATION GUIDELINES

The mounting surface for base and top plate must be level, and clear of debris and rough spots. After installation, the top and bottom plates must be level within ±0.5 degree. If the mounting surfaces are not level, then shims and or grout may be used to level the mount.

1. The mounting surface for base plate and top plate must be level within ± 0.5 degree to minimize side loads and extraneous forces. If the mounting surfaces are not level, then shims or grout may be used to level the module. Because deflections in legs and supporting structures may cause additional side forces that greatly affect accuracy, check if level and plumb again when container is fully loaded. Cross bracing of legs or other support structures may need reinforcement to correct this. Deflections of the module's top or base plate due to loading should not exceed ± 0.5 degree.



2. Mounting systems use three or four mounts. The load on each mount assembly should vary by no more than 20 percent. Add shims where necessary to achieve correct load distribution.
3. During installation, dummy load cells can be used to prevent overload damage.

NOTE: If the actual load cells are used during the installation, extreme care must be taken to prevent overload damage. A tank or hopper weighing several tons can exert huge forces when dropped only a fraction of an inch.

4. All piping or conduit should be horizontal and flexible. If flexible piping is not used, make sure the distance from tank to the first pipe support is 20-30 times pipe diameter. In smaller, lower capacity tanks and hoppers, isolating resultant forces becomes extremely critical. When possible, flexible conduit piping should be used close to the tank instead of the rigid variety.
5. Load cells should not be installed in the modules until all welding is completed. If possible, use a dummy load cell when welding to maintain finished height. If welding is unavoidable after load cell installation, ground in such a manner as to prevent welding current from passing through the load cell. Ground the welder as closely as possible to the point of welding.

INSTALLATION

The type of installation, structure of the tank supports, and strength of the mounting surface governs the method of locating, attaching, and installing the load cell assembly. Carefully consider three areas that commonly cause accuracy problems:

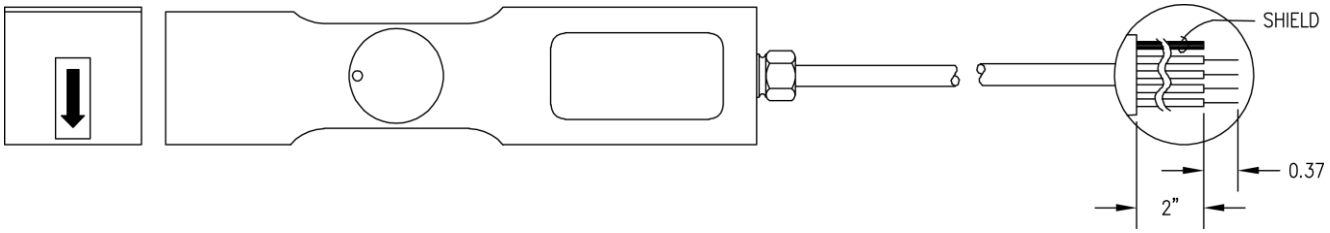
- Are the supporting legs adequately braced so they will not spread when the system is fully loaded?
- Does the supporting structure have the necessary strength to prevent flexing when the system is fully loaded?
- Is there attached equipment such as skirting, venting, or piping which is likely to cause binding or lack of flexibility?

1. Determine where to position the load cell assembly, as well as which direction it should be orientated.
2. Make necessary preparations to the mounting surfaces.
3. Lift and block the vessel to the same height as the load cell assembly.
4. Lift one corner or side of the vessel enough to slide the load cell assembly into place.
5. If the load cell assembly is being fitted under the leg of the vessel, verify that the leg's centerline passes through the center of the top plate (through the center of the load cell's load hole).
6. Attach the top plate by bolting. Do not fully tighten because shimming may be necessary to level.
7. Repeat steps 4, 5, and 6 for the remaining load cell assemblies. The vessel should now be supported on the load cell assemblies alone.
8. If necessary, move the vessel to its final position. Verify that there is no initial misalignment between the base plate and top plate by lifting the vessel slightly at each support point in turn. This will also indicate if the load is evenly distributed on all load cell assemblies. Install shims if necessary.
9. Attach the base plates to the foundation using anchor bolts for concrete, or by bolting or welding to a steel structure. Verify that the base plates are no more than ±0.5 degree out of level. Install shims if necessary.
10. Check that the top plates are no more than ±0.5 degree out of level. Shim if necessary and fully tighten the bolts.
11. The load distribution can be more accurately checked by connecting each load cell to the junction box and indicator and measuring the output with a voltmeter. To verify wiring, check the load cell and junction box wiring section of this manual. The variation in the load among the cells should be no more than 20%. Install shims if necessary.

LOAD CELL WIRING

NOTE: Cardinal Scale Mfg. Co. recommends that the customer install protective conduit/cover for the load cell cables whenever the condition is present that can result in damage or abrasion to the load cell cables.

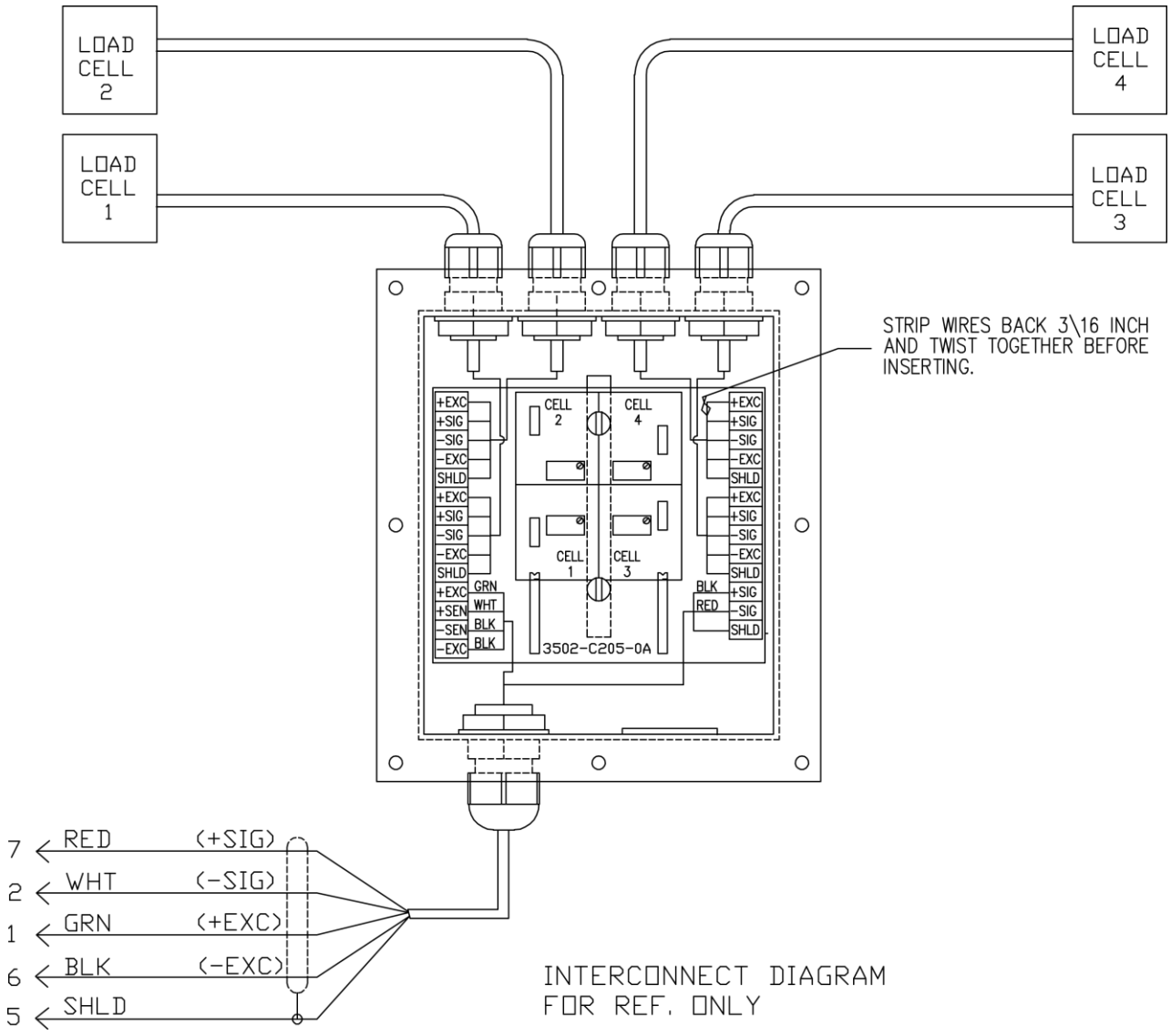
1. Route the load cell cables so they will not be damaged or cut. Cable should not be routed near heat sources. Do not shorten any load cell cable. The load cell is temperature compensated with the supplied length of cable. Cutting the cable will affect temperature compensation. Coil excess cable and protect it so it will not be damaged or sitting in water.
2. Provide a dip loop in all cables so that water or other liquids will not run directly down the cables onto either the load cells or the junction box. Attach load cell cable to the structure, not the tank.
3. If conduit protection is necessary against mechanical or rodent damage to the load cell cables, use flexible conduit and conduit adapters at the load cells.
4. Connect cables to the summing board in the junction box according to the illustration shown on the next page and the labels on the terminal strips of the junction box. To verify the wiring, refer to the documentation shipped with each load cell.



TB Series Wiring Color Code

FUNCTION	WIRE COLOR
+EXC	GREEN
-EXC	BLACK
+SIG	RED
-SIG	WHITE
SHIELD	

JUNCTION BOX WIRING



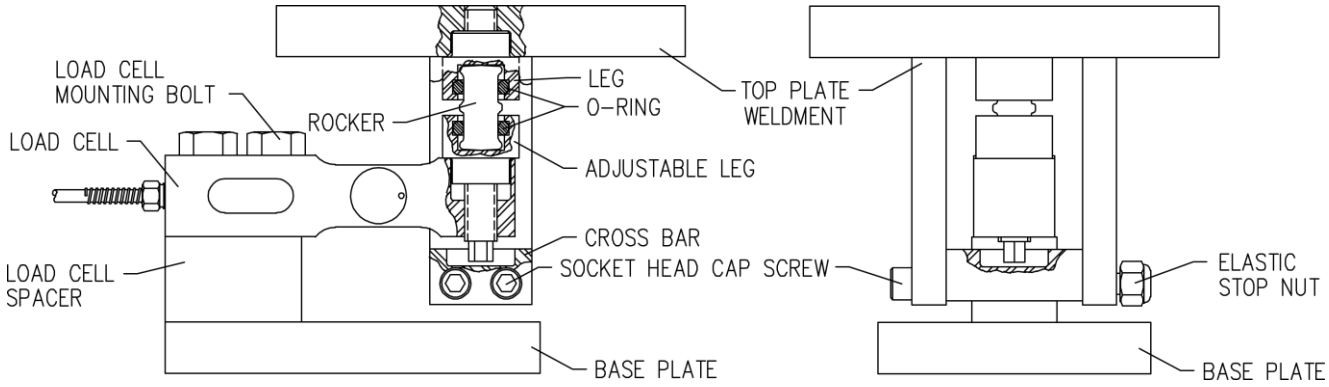
Load Cell Wiring Color Code

FUNCTION	CARDINAL COLOR CODE	WEST COAT COLOR CODE
+EXC	GREEN	RED
-EXC	BLACK	BLACK
+SIG	RED	GREEN
-SIG	WHITE	WHITE

NOTE: For 2 to 4 load cell trimming, connect 2, 3, or 4 load cells to trim board as shown. There are no jumpers that need to be set or additional terminations to be made.

LOAD CELL REPLACEMENT

The following procedure describes changing a load cell. The procedure can also be used when changing the rocker, an O-ring, leg, or adjustable leg.



DANGER! TO PREVENT TIPPING OF THE VESSEL, SUPPORT THE VESSEL WITH BLOCKS OR BY OTHER MEANS TO ENSURE THE STABILITY OF THE VESSEL, BEFORE LIFTING IT OFF THE LOAD CELL ASSEMBLY.

1. Disconnect the load cell from the junction box. Refer to the JUNCTION BOX WIRING section of this manual for wiring information.
2. Remove the bolts, washers, and nuts securing the top plate weldment to the vessel.
3. **ONLY** if the vessel is empty, using a chain or cable slings, lift and block the vessel to the same height as the load cell assembly to remove the load off the load cell assembly.

   NOTE: If emptying the vessel is impractical, it can be raised with external jacks to remove the load off the load cell assembly.
4. Remove the load cell mounting bolts, and then slide the load cell spacer and load cell assembly from under the vessel and away from the base plate.
5. Remove the two elastic stop nuts from the socket head cap screws, and then remove the socket head cap screws and cross bar from under the load cell.
6. Apply pressure between the load cell and top plate weldment to disengage the leg from the rocker and set the top plate weldment to the side.
7. Unscrew and remove the adjustable leg from the load cell.
8. To reinstall the load cell, insert the adjustable leg into the load cell and tighten in place.
9. Place a small amount of grease on the rocker, and insert it into the adjustable leg. Align the greased rocker with the leg in the top plate weldment, and press together.
10. Position the cross bar under the load cell, and align with the two holes in the top plate weldment. Insert the two socket head cap screws through the top plate weldment and cross bar, and then install and tighten the two elastic stop nuts removed earlier.

LOAD CELL REPLACEMENT, CONT.

11. Position the load cell assembly and load cell spacer so it is centered on the base plate, and then fasten in place with the load cell mounting bolts removed earlier.

12. Torque the load cell mounting bolts to the values given in the table below. First, torque the mounting bolt nearest the rocker and legs, and then torque the mounting bolt at the cable end of the load cell.

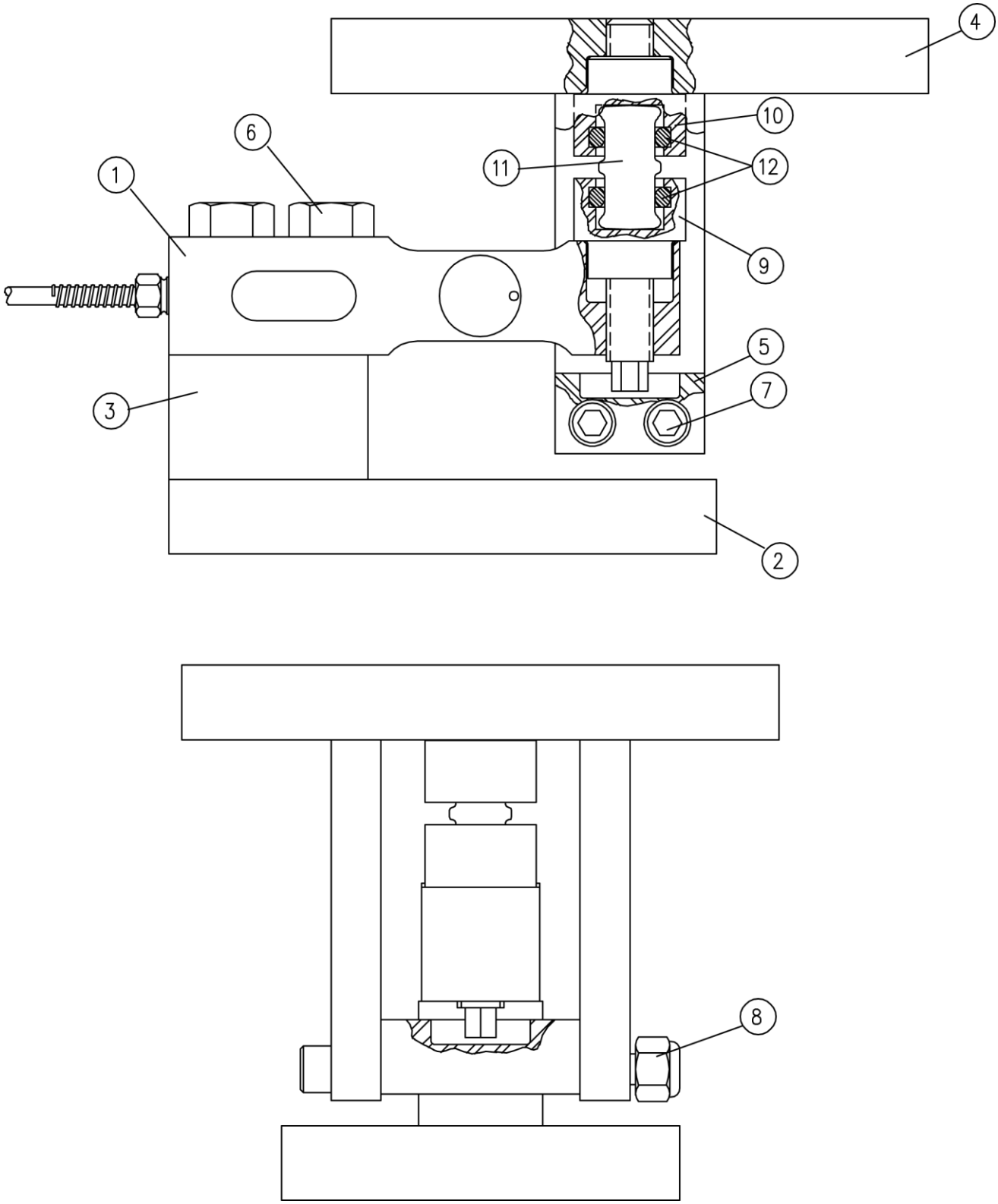
NOTE: Insufficient torque may allow the rear of the load cell to lift; too much torque may cause bolt failure.

STAND MODEL	LOAD CELL MODELS	TORQUE
TBCS-NC4	TB-1K / 2.5K / 4K	100 ft/lb
TBCSS-NC4	TB-1K / 2.5K / 4K	100 ft/lb

13. Lower the vessel onto the top plate weldment and install bolts, washers, and nuts removed earlier to secure the vessel to the top plate weldment.

14. Reconnect the load cell to the junction box. Refer to the LOAD CELL WIRING and JUNCTION BOX WIRING sections of this manual for wiring information.

PARTS IDENTIFICATION



PARTS IDENTIFICATION, CONT.

SELF-CHECKING STAND FOR TB CELLS
MODEL TBCS-NC4, ASSEMBLY 3500-D137-0A

ITEM	QTY	PART NUMBER	DESCRIPTION
1	REF	TB-1K/2.5K/4K	LOAD CELL ASSEMBLY
2	1	3500-C138-08	BASE PLATE
3	1	3500-B139-08	SPACER
4	1	3500-C140-0A	TOP PLATE WELDMENT
5	1	3500-B142-08	CROSS BAR
6	2	6007-0151	HEX HEAD BOLTS, 1/2-13UNC-2A X 3” GR8
7	2	6021-1491	SOCKET HEAD CAP SCREWS 5/16-18UNC-2A X 3 1/2”
8	2	6013-0410	ELASTIC STOP NUTS, 5/16-18UNC-2B
9	1	1930-B354-08	ADJUSTABLE LEG
10	1	3500-B143-08	LEG
11	1	1932-B015-08	ROCKER
12	2	6650-1049	O-RING

STAINLESS STEEL SELF-CHECKING STAND FOR TB CELLS
MODEL TBCSS-NC4, ASSEMBLY 3500-D137-1A

ITEM	QTY	PART NUMBER	DESCRIPTION
1	REF	TB-1K/2.5K/4K	LOAD CELL ASSEMBLY
2	1	3500-C138-18	BASE PLATE, STAINLESS STEEL
3	1	3500-B139-18	SPACER, STAINLESS STEEL
4	1	3500-C140-1A	TOP PLATE WELDMENT, STAINLESS STEEL
5	1	3500-B142-18	CROSS BAR, STAINLESS STEEL
6	2	6007-0160	HEX HEAD BOLTS, 1/2-13UNC-2A X 3” GR8, STAINLESS STEEL
7	2	6021-1494	SOCKET HEAD CAP SCREWS 5/16-18UNC-2A X 3 1/2”, STAINLESS STEEL
8	2	6013-0058	ELASTIC STOP NUTS, 5/16-18UNC-2B, STAINLESS STEEL
9	1	1930-B354-08	ADJUSTABLE LEG
10	1	3500-B143-08	LEG
11	1	1932-B015-08	ROCKER
12	2	6650-1049	O-RING

STATEMENT OF LIMITED WARRANTY

WARRANTY TERMS

Cardinal Scale Manufacturing Company warrants the equipment we manufacture against defects in material and workmanship. The length and terms and conditions of these warranties vary with the type of product and are summarized below:

PRODUCT TYPE	TERM	MATERIAL AND WORKMAN-SHIP	LIGHTNING DAMAGE See note 9	WATER DAMAGE See note 7	CORROSION See note 4	ON-SITE LABOR	LIMITATIONS AND REQUIREMENTS
WEIGHT INDICATORS	90 DAY REPLACEMENT --- 1 YEAR PARTS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
LOAD CELLS (Excluding Hydraulic)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased with Guardian Vehicle Scale)	LIFETIME	YES	YES	YES	YES	90 DAYS	1, 5, 6, 8 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased separately)	10 YEARS	YES	YES	YES	YES	NO	1, 5, 6, 8, 9 A, B, C, D
VEHICLE SCALE (Deck and Below Excl. PSC Series)	5 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6 A, B, C, D, E
LSC SCALE (Deck and Below)	3 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6, 11 A, B, C, D
GUARDIAN FLOOR SCALES	10 YEARS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6, 9, 10 A, B, C, D
ALL OTHER CARDINAL PRODUCTS	1 YEAR	YES	YES	YES	YES	NO	1, 2, 5, 6 A, B, C, D, E
REPLACEMENT PARTS	90 DAYS	YES	YES	YES	YES	NO	1, 2, 4, 5, 6 A, B, C, D
SWIM AND 760 SERIES VEHICLE SCALES	1 YEAR	YES	YES	YES	YES	90 DAYS	1, 2, 5, 6 A, B, C, D
SOFTWARE	90 DAYS	YES	N/A	N/A	N/A	NO	1, 6 B, C, D
CONVEYOR BELT SCALES (including Belt-Way)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D, E, F

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APPLICABLE LIMITATIONS AND REQUIREMENTS

1. This warranty applies only to the original purchaser. The warranty does not apply to equipment that has been tampered with, defaced, damaged, or had repairs or modifications not authorized by Cardinal or has had the serial number altered, defaced or removed.
2. This warranty is not applicable to equipment that has not been grounded in accordance with Cardinal's recommendations.
3. This equipment must be installed and continuously maintained by an authorized Cardinal / Belt-Way dealer.
4. Applies only to components constructed from stainless steel.
5. This warranty does not apply to equipment damaged in transit. Claims for such damage must be made with the responsible freight carrier in accordance with freight carrier regulations.
6. Warranty term begins with date of shipment from Cardinal.
7. Only if device is rated NEMA 4 or better or IP equivalent.
8. Lifetime warranty applies to damages resulting from water, lightning, and voltage transients and applies only to the hydraulic load cell structure itself (does not include pressure transducers, rubber seals, o-rings, and associated wiring).
9. 10-Year prorated warranty on hydraulic load cells.
10. 1-Year warranty for scale structure.
11. PSC models' warranty coverage applies only to agricultural installations on farms up to 3,000 acres (LSC models not limited in this manner).
12. Load cell kits MUST be installed in accordance with Cardinal Scale instructions. Failure to follow these instructions will void the warranty.

EXCLUSIONS

A.) This warranty does not include replacement of consumable or expendable parts. The warranty does not apply to any item that has been damaged due to unusual wear, abuse, improper line voltage, overloading, theft, fire, water, prolonged storage or exposure while in purchaser's possession or acts of God unless otherwise stated herein.

B.) This warranty does not apply to peripheral equipment not manufactured by Cardinal. This equipment will normally be covered by the equipment manufacturer's warranty.

C.) This warranty sets forth the extent of our liability for breach of any warranty or deficiency in connection with the sale or use of our product. Cardinal will not be liable for consequential damages of any nature, including but not limited to loss of profit, delays or expenses, whether based on tort or contract. Cardinal reserves the right to incorporate improvements in material and design without notice and is not obligated to incorporate said improvements in equipment previously manufactured.

D.) This warranty is in lieu of all other warranties expressed or implied including any warranty that extends beyond the description of the product including any warranty of merchantability or fitness for a particular purpose. This warranty covers only those Cardinal products installed in the forty-eight contiguous United States and Canada.

E.) This warranty does not cover paint coatings due to the variety of environmental conditions.

F.) Do not cut load cell cables on load cells returned for credit or warranty replacement. Cutting the cable will void the warranty.

G.) Software is warranted only for performance of the functions listed in the software manual and/or the Cardinal proposal.

H.) The software warranty does not cover hardware. Warranties on hardware are provided from the hardware vendor only.

I.) The software warranty does not cover interfacing issues to non-Cardinal supplied hardware.

J.) The software warranty does not include automatic software upgrades unless purchased separately.

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