

C30 Single Range Tensioncells

P-2012-5
819-0405

Installation Instructions



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⚠ WARNING Failure to follow these instructions may result in product damage, equipment damage, and serious or fatal injury to personnel.

Description

General Information

Warner Electric Series 30 Type C Tensioncells are force transducers especially designed to measure and control web tension on continuous strip processing lines. They are normally installed in matched pairs at each end of a measuring roll. (See Figure 1)

A Tensioncell consists of a unique combination of two integral systems (one mechanical, the other electrical) for converting the mechanical force of strip tension into an electrical signal which is directly proportional to the strip tension.

Type "C" Tensioncells are intended for ROTATING shaft installations. They are supplied with self-aligning ball bearings to assure positive alignment of the measuring roll. Type "C" Tensioncells are supplied in matched pairs, one to be mounted at each end of the tension measuring roll. Note that the cell marked "W2" is a mirror image of "W1". The "W2" cell allows for thermal expansion of the rotating shaft. (See Figure 1)

The Mechanical System

The mechanical system consists of a Patented "C-Flexure Pivot Assembly" which incorporates a mounting Base Block, frictionless elastic pivot (or hinge), and Load Plate. (See Figure 2) When a mechanical force is applied to the Load Plate, the pivot permits its deflection toward or away from the Base Block.

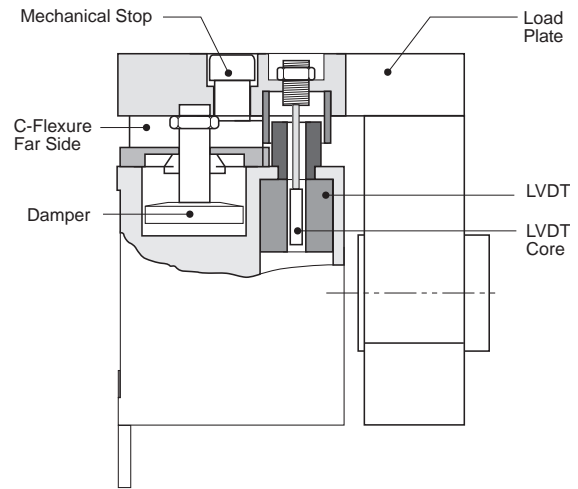
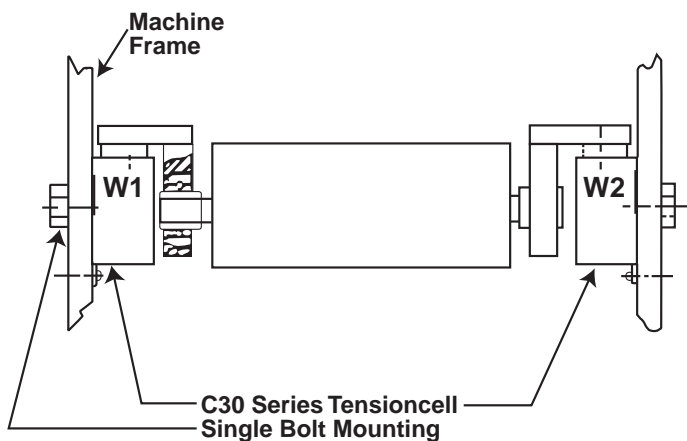


Figure 2



Self-Aligning Bearings in Tensioncell - Rotating Shaft

Figure 1

For our discussion here, deflection of the Load Plate toward the Base Block is defined as the "Compression Mode", while the opposite is defined as the "Tension Mode". Tensioncells are designed to operate equally well in either mode.

The Base Block contains an integral Mechanical Stop to limit the amount of deflection in either direction, and a Viscous Damper to allow control of the tensioncell response to rapid changes in apparent tension loads. (See Page 3, Figure 2)

The Electrical System

The electrical system consists of a Linear Variable Differential Transformer (LVDT) which converts the mechanical deflection of the Load Plate into a useful electrical output signal. (See Figure 2) The movable core of the LVDT is mechanically coupled to the Load Plate by means of the Core Adjust Assembly. (See Figure 3) This adjustment is factory set and is not accessible.

Type "K" DC LVDT

As illustrated in Figure 4, a DC LVDT consists of the following components:

- An oscillator network, which converts the DC input voltage into a high frequency alternating current for exciting the primary coil (P1).
- A Primary Coil (P1)
- A movable, permeable metallic core
- Two Secondary Coils (S1 and S2)
- A demodulator and summing network to rectify and integrate the currents from the Secondary Coils

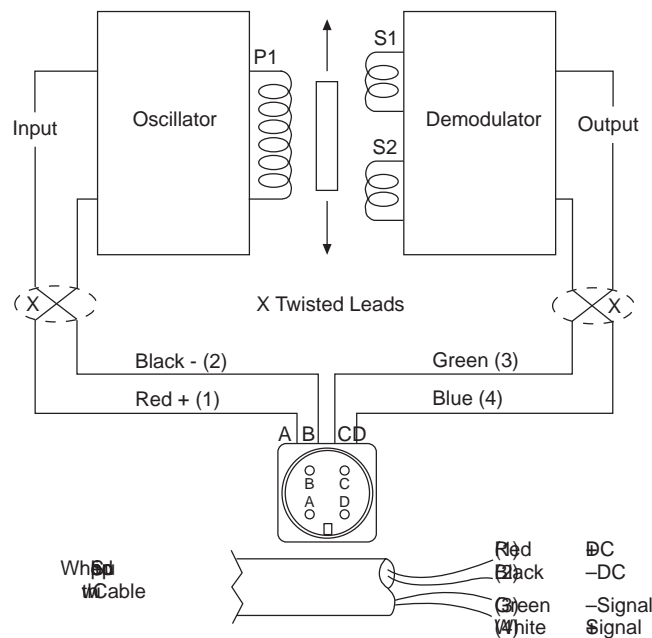


Figure 3

With Warner Electric LVDTs, the input and output circuits are electrically isolated from each other and from the mechanical structure of the tensioncell. Thus, they may be used in "floating ground" or "ground return" systems. This eliminates the need for extra circuit boards which are required for most straining loadcells.

Tensioncells are factory adjusted to provide an offset voltage with no load applied (no deflection). Using an input of 24 volts DC, the LVDT is set to provide an output of 3.5 volts into a resistive load of not less than 100,000 ohms. The voltage resulting from the maximum rated deflection then adds to or subtracts from the 3.5 volt offset. This results in an output voltage of 3.5 to 6.5 volts in the Compression Mode and 3.5 to 0.5 volts in the Tension Mode. (See Figure 4)

While acceptable performance may be obtained over an input voltage range of 6.0 to 30.0 volts DC, the output voltage will vary in direct proportion to the input voltage. Because of this, the use of a well regulated constant voltage power supply is essential for accurate and repeatable tension measurement.

In standard applications, where two Tensioncells are used, the inputs may be connected in parallel allowing the Tensioncells to be excited from the same power supply. The LVDT outputs are then summed to obtain a signal representing the strip tension and tare loads distributed across the roll.

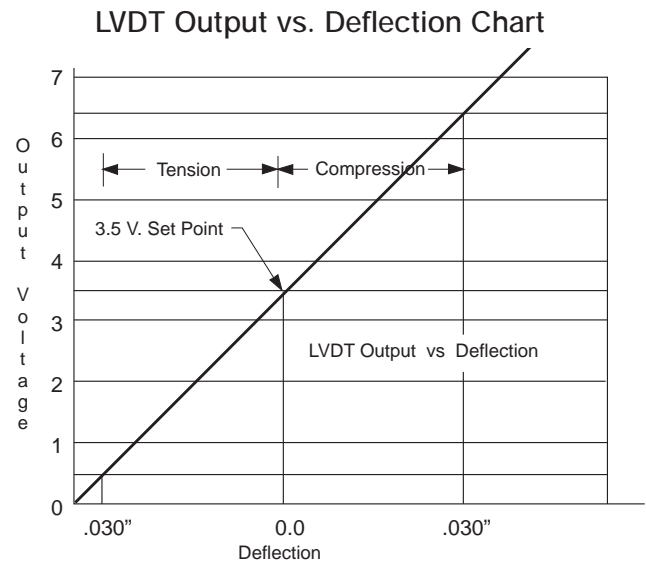
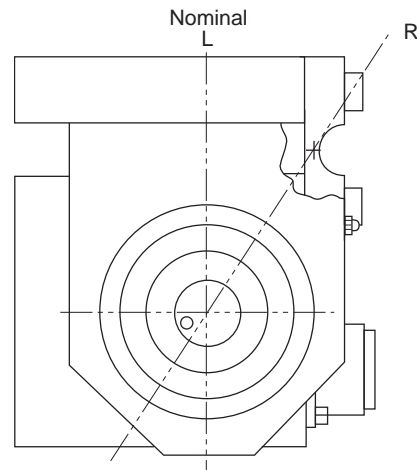


Figure 4

Description of Operation

The total resultant load per cell (RF) is calculated by resolving all force vectors acting upon the Tensioncell, with respect to the Loading Line (OL). (RF) is the resultant of both TENSION and TARE loads, PER CELL!! (See Figure 5)



(Figure 5)

The intrinsic design of Warner Electric Tensioncells allows the location of the Resultant Load of Strip Tension (H) on any angle with respect to the Load Line (OL). Note, however, that the Total Force vector (RF) must always be calculated on the line (OL).

Any force vector falling on the line (OR) (through the pivot point of the C-Flexure) will produce no deflection, and thus no change in electrical output.

Rotating the Tensioncell on its mounting bolt changes the force vectors on the cell. This feature makes it possible to minimize the tare component and maximize the load signal output.

The resultant tare is minimized by mounting the Tensioncell so that (N) is 149° (See Figures 6A and 6B) or so that (N) is 329° (See Figures 7A and 7B).

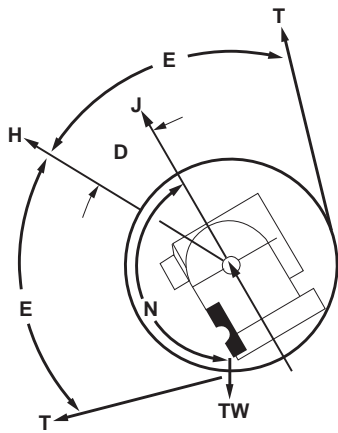


Figure 6A

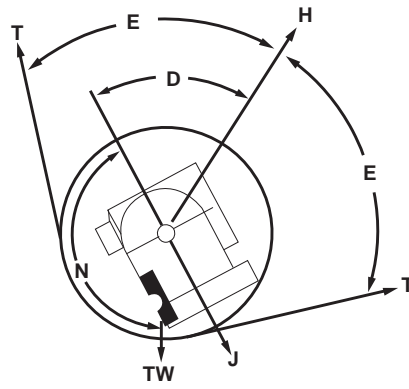


Figure 6B

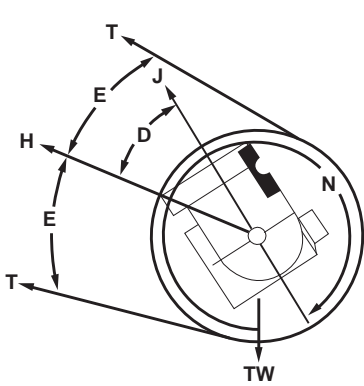


Figure 7A

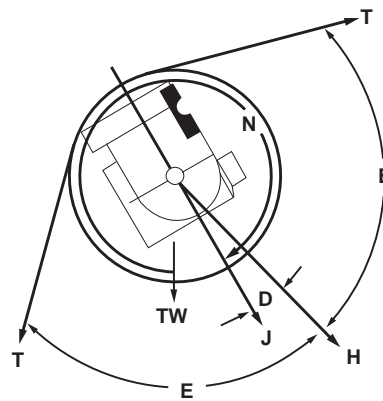


Figure 7B

Installation and Operation

Inspection Upon Delivery

Warner Electric Tensioncells are carefully packaged in sturdy reinforced cartons or wooden boxes and are securely blocked or bolted in place.

1. Upon receipt, examine the exterior of the container for obvious damage or tampering.
2. Check the contents against the packing list.
3. Promptly report any damage or shortage to both the carrier and Warner Electric.

Handling

Tensioncells can be handled manually.

Long Term Storage

While Warner Electric loadcells are plated, exposure to weather, dirt, or moisture should be avoided when they are stored.

Mechanical Installation

Note: Refer to the Dimension Drawing Pages 11 and 12 of this manual for detailed identification of all parts.

Tensioncells are designated as W1 and W2, one being the mirror image of the other to provide for mounting between two fixed walls. (See Figure 8)

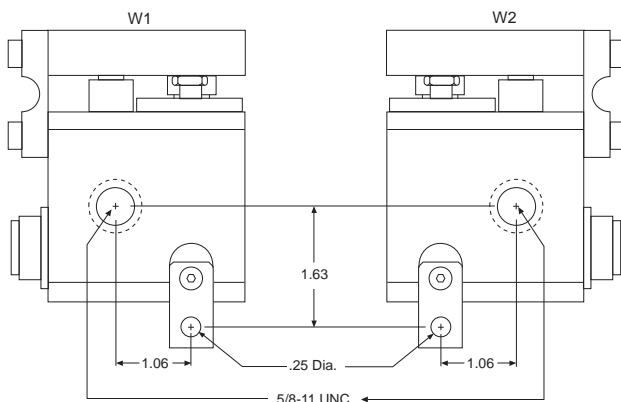


Figure 8

Warner Electric Wall Mounted Tensioncells are mounted to the machine frame by a 5/8-11 UNC bolt which is in line with the centerline of the measuring roll shaft. This allows the Tensioncell to be rotated around the centers of the measuring roll and mounting bolt to achieve the proper mounting angle (Description of Operation on Page 5).

The locating tab prevents the Tensioncell from rotating and secures it in a permanent location. It also provides a means of repeating rotary position when the Tensioncell needs replacement.

Note: Remove the 1/4" locking screw and the 5/8" mounting bolt. This permits the roll assembly with Tensioncells to be lifted out of the machine.

To install Tensioncells:

1. Make sure a 5/8" diameter hole is drilled through the machine frame in line with the centerline of the measuring roll shaft for the 5/8-11 UNC mounting bolt.
2. Fasten the Tensioncell to the machine frame with the mounting bolt.
3. Rotate the Tensioncell to the proper mounting angle and tighten the mounting bolt. (Refer to N on the calibration sheet for the proper mounting angle.)
4. Drill a #6 (.204) hole concentric with the 1/4" hole in the locating tab.
5. Remove the Tensioncell and tap the hole for a 1/4-20 thread.
6. Repeat steps 1 through 5 for the Tensioncell to be mounted at the other end of the measuring roll.
7. Assemble the tensioncells onto the ends of the measuring roll shaft.

- 8. Position the roll with the Tensioncells on the machine and fasten with the mounting bolts.
- 9. Rotate the Tensioncells to the proper mounting angle and tighten the mounting bolts.
- 10. Lock the locating pad for each Tensioncell against the machine frame using the 1/4-20 x 1/2 socket head capscrew.
- 11. Tighten the shaft in the mounting block on the W1 unit. (The shaft end at W2 is left free to allow it to move as the shaft expands with temperature changes).

Mechanical Alignment

Align the sectional measuring roll to avoid any mechanical binding or friction. The measuring roll must be level and perpendicular to the path of the strip material for accurate measurement.

The Mechanical Stops are fixed for the required travel of the Load Table.

Electrical Installation

(Read the entire electrical wiring procedure before proceeding.)

- 1. Turn off all electrical power to the loadcell.
- 2. Use twisted four conductor signal cable, Belden 9402 or equivalent, in grounded steel conduit from the LVDTs to the control panel.
- 3. Observing correct polarity, connect the positive (+) input lead to Pin A and the negative (-) input lead to Pin B. (See Figure 9)
- 4. Connect the positive (+) output lead to Pin D and the negative (-) output lead to Pin C. (See Figure 9)
- 5. Repeat Steps 1 through 4 of the electrical wiring procedure for the Tensioncells mounted on the other end of the measuring roll.

Specifications

| Type "K" 24 volt DC LVDT Specifications | |
|---|---|
| Input |6-30 volts DC |
| Output | ...0.5-6.5 volts DC (nominal, open circuit) |
| Output Impedence |2.5K ohms |
| Current Consumption |40 mA |
| Recommended Load |100K ohms or greater |
| Max. Operating Temp |250°F |

Note: Warner Electric loadcells are calibrated for 24 volt DC input voltage to provide a 0.5 to 6.5 volts DC output signal.

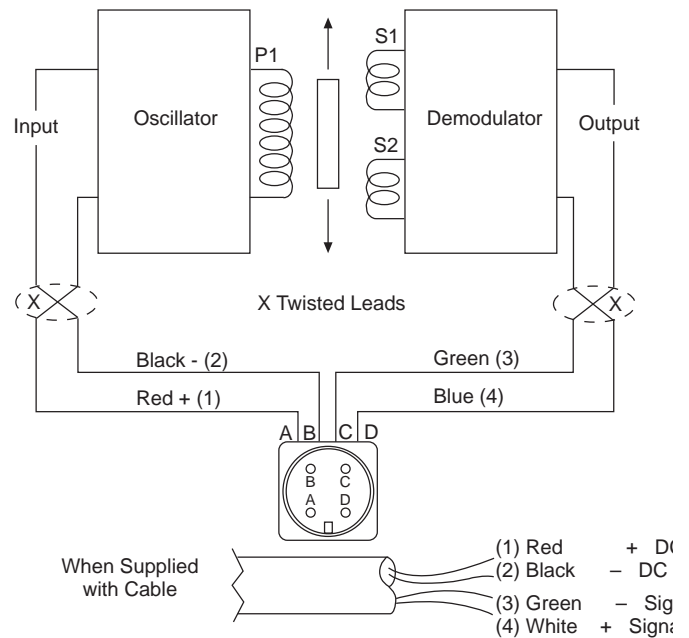


Figure 9

Electrical Zero Adjustment

(Read the complete Electrical Zero Adjustment procedure before proceeding with the adjustment.)

- 1. Disengage strip from the measuring roll so that no tension force is applied to the loadcell.
- 2. Connect a voltmeter to Pins C and D (See Figure 9)

- 3. Apply 24 volt DC electrical power to the loadcell observing the correct polarity. [Plus (+) to Pin A and minus (-) to Pin B.] Do not exceed the maximum rated input voltage.

Note: Allow 20 minutes for the loadcell to warmup before taking first readings to insure accurate readings.

- 4. Measure the output voltage of the LVDT between the Green and Blue leads for each tensioncell with a volt meter with a sensitivity of at least 100,000 ohms per volt. The output voltage should be between 0.5 and 6.5 volts.
- 5. Since Warner Electric Tensioncells cannot be mechanically zeroed, refer to the Control Manual for zeroing out the tare weight voltage.

Full Load Adjustment

After the loadcell has been zeroed, a pull test can be made to check the output voltage of the loadcell at full load. (See calibration sheet for voltage output.)

- 1. Run a non-stretchable rope over the center of the tension roll simulating the web path. (**Note:** The rolls should be free to turn.)
- 2. With one end of the rope secured, hang a known weight equally over the roll so that the total tension is equal to the maximum strip tension specified on the calibration sheet, at the other end. (See Figure 10)

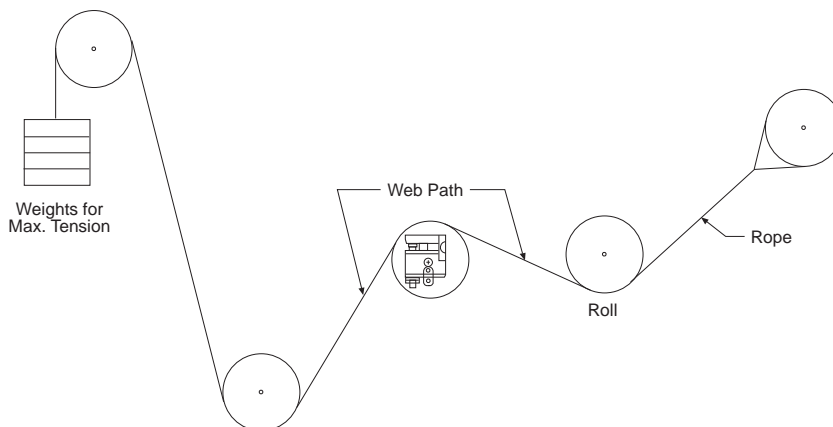


Figure 10

- 3. With a voltmeter connected to Pins C and D of the connector, an output voltage will be observed.
- 4. Repeat Step 3 for the Tensioncell mounted on the opposite end of the measuring roll.

Warner Electric loadcells instrumentation provides the required signal conditioning and a reliable high level output signal for use as feedback control of a tension drive system. The feedback signal is directly proportional to the strip tension applied. If a Warner Electric control is used, refer to the control manual for further calibration.

Although the electrical output of Warner Electric tensioncells are sufficient to drive most electrical indicators, substantial signal conditioning is normally required for effective tension instrumentation system control. Refer to the documentation available from the instrumentation supplier for more information.

Trouble Shooting

When properly installed in accordance with the original design specifications Warner Electric tensioncells should require little or no regular maintenance or service.

Certain conditions, however, can impair their inherently accurate and reliable performance. Therefore, if trouble should arise, the following conditions should be checked. (Continued on next page)

Mechanical

1. Has the tension measuring system been changed?
 - a. An increase or decrease in strip tension (Refer to A on the calibration sheet for specified strip tension.)
 - b. An increase or decrease in the wrap angle. (Refer to B on the calibration sheet for the specified wrap angle.)

If the above parameters have been changed enough to prevent the unit from operating within the limits of the fixed. Mechanical Stops, replacement of the tensioncells required. For this modification, the Tensioncell should be returned to the factory with complete specifications.

2. Are the loadcells mounted securely?
3. Is tension measuring roll in proper alignment and does it turn freely?
4. Are bearings and seals free of all binding and stickiness? Are they worn?

Electrical

1. Are LVDTs receiving correct input voltage?
Check line voltage, fuses or circuit breakers, and power switches. Check power supply output and voltage to LVDTs.
2. Are all connections secure?
Check for continuity. Retighten all connections. Recheck operation.
3. Are LVDTs open or shorted?
To check, turn off power and disconnect the input and output leads. Check coil continuity and resistance. (Refer to Figure 11)
 - a. Pin A to Pin B (Primary Coil) should be in excess of 2 megohms.
 - b. Pin A or Pin B to LVDT shell should be in excess of 5 megohms.

- c. Pin C to Pin D (Secondary Coil) should be approximately 20,000 ohms.
- d. Pin C or Pin D to LVDT shell should be in excess of 5 megohms.

If LVDT circuits are open or shorted, replace the Tensioncell LVDT. Contact Warner Electric with Tensioncell model number and serial number.

Recalibration after Installation

Wall Mounted Tensioncells can be relocated around the center of the measuring roll. The theory of this operation is explained in the Description of Operation on Page 5. If this procedure cannot accomplish the necessary changes because the tension requirements are extremely different than the original application, it will be necessary to return the Tensioncells to the factory for a different Tensioncell.

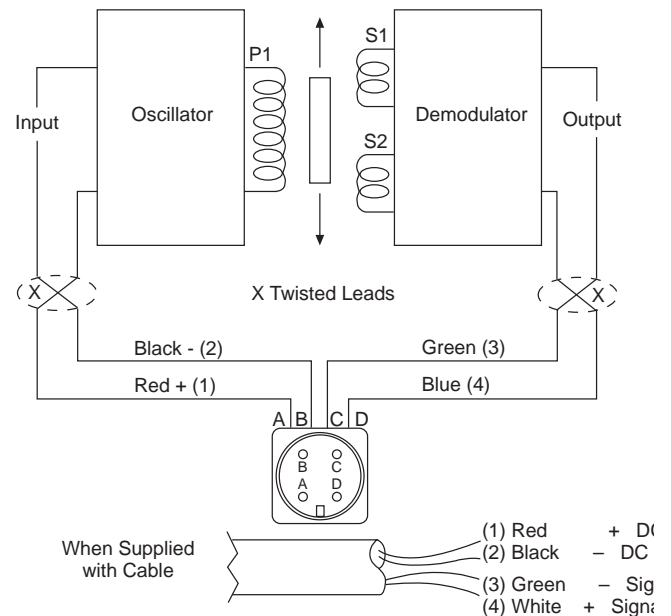
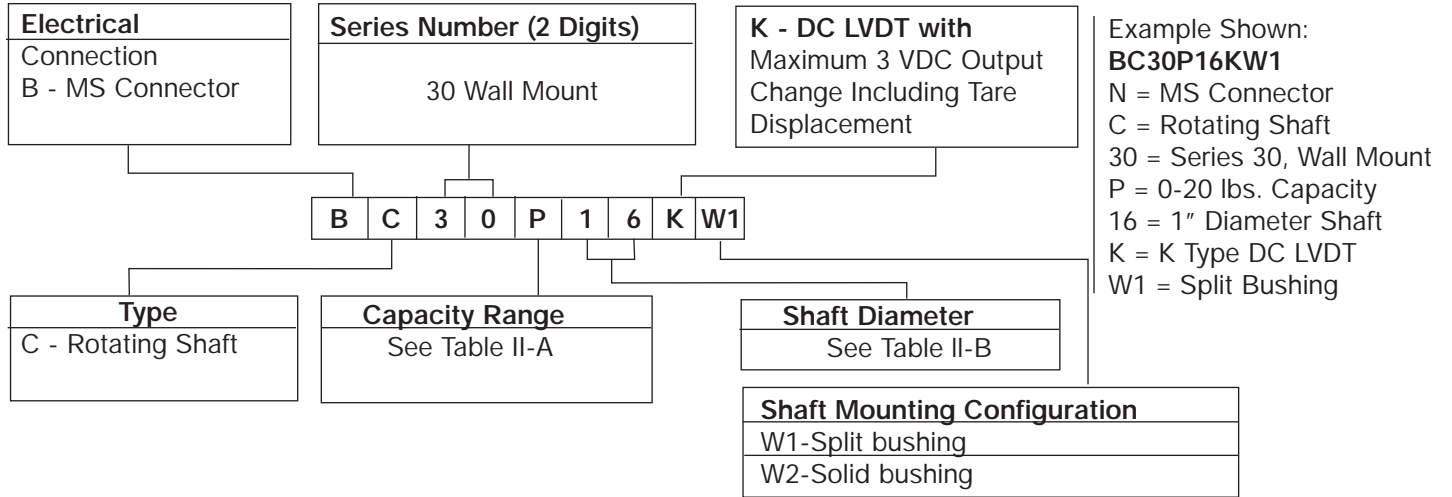


Figure 11

Model Number Nomenclature Example

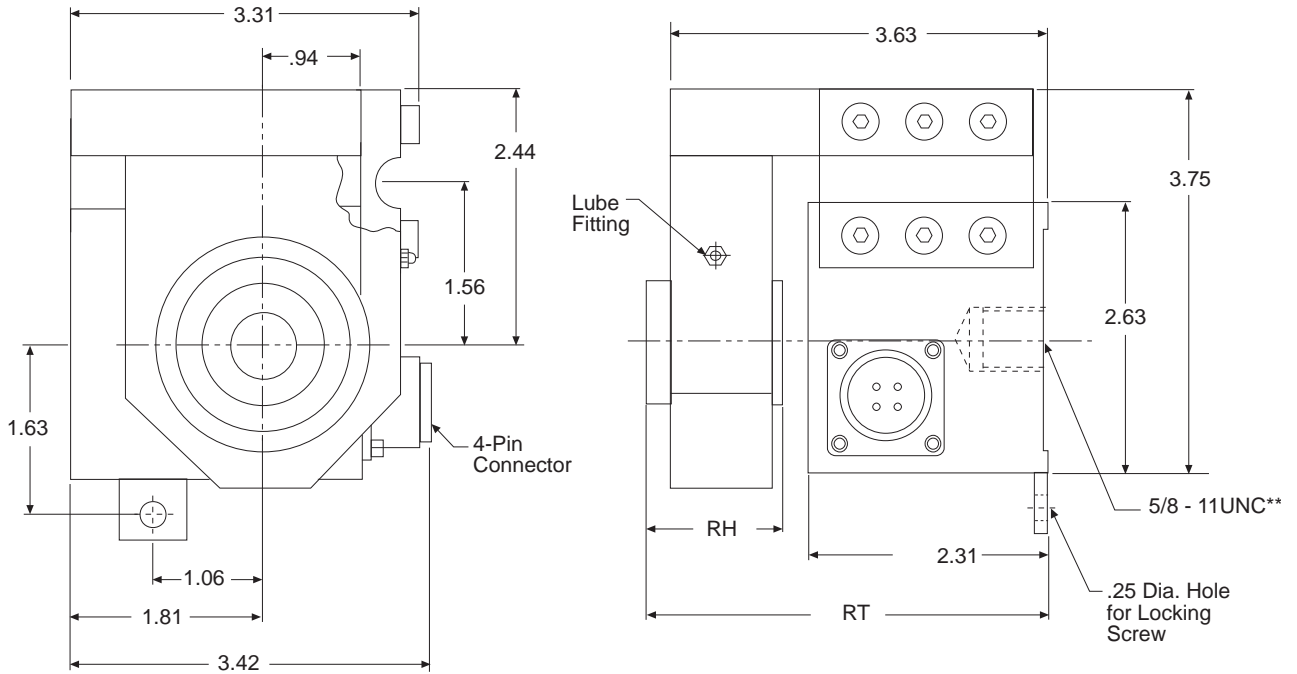


Series 30, Type C Specifications – Rotating Shaft Mounting

| Series 30, Type C – Nominal Capacity Ranges | | | | | |
|---|------|------|------|-------|-------|
| Code | P | T | U | X | Z |
| Pounds | 0-20 | 0-50 | 0-90 | 0-200 | 0-500 |

Table II-A

Note: Other load ratings are available as special order.
 Contact Warner Electric for ratings and availability.



**Warner wall mounted tensioncells are located by a 5/8-11 bolt at the roll centerline and locating tab which maintains rotational position of the tensioncell. (See Page 6.)

Notes:

- W1 unit shown here.
- W2 unit is applied at the opposite end of the roll.
- W1 unit clamps the shaft while W2 allows for temperature expansion of the roll.
- Both units have self-aligning feature.

| Series 30, Type C Shaft Diameter Code | | | | |
|---------------------------------------|------|------|----------|--------|
| Code | 12 | 16 | 20 | 23 |
| Inches | 3/4 | 1.0 | 1-1/4 | 1-7/16 |
| RH | 1.31 | 1.38 | 1.69 | |
| RT | 3.81 | | 4.131.00 | 1.13 |

Table II-B

Note: Other shaft diamters are available as special order. Contact Warner Electric for ratings and availability.

Warranty

Warner Electric LLC warrants that it will repair or replace (whichever it deems advisable) any product manufactured and sold by it which proves to be defective in material or workmanship within a period of one (1) year from the date of original purchase for consumer, commercial or industrial use.

This warranty extends only to the original purchaser and is not transferable or assignable without Warner Electric LLC's prior consent.

Warranty service can be obtained in the U.S.A. by returning any defective product, transportation charges prepaid, to the appropriate Warner Electric LLC factory. Additional warranty information may be obtained by writing the Customer Satisfaction Department, Warner Electric LLC, 449 Gardner Street, South Beloit, Illinois 61080, or by calling 815-389-3771.

A purchase receipt or other proof of original purchase will be required before warranty service is rendered. If found defective under the terms of this warranty, repair or replacement will be made, without charge, together with a refund for transportation costs. If found not to be defective, you will be notified and, with your consent, the item will be repaired or replaced and returned to you at your expense.

This warranty covers normal use and does not cover damage or defect which results from alteration, accident, neglect, or improper installation, operation, or maintenance.

Some states do not allow limitation on how long an implied warranty lasts, so the above limitation may not apply to you.

Warner Electric LLC's obligation under this warranty is limited to the repair or replacement of the defective product and in no event shall Warner Electric LLC be liable for consequential, indirect, or incidental damages of any kind incurred by reason of the manufacture, sale or use of any defective product. Warner Electric LLC neither assumes nor authorizes any other person to give any other warranty or to assume any other obligation or liability on its behalf.

WITH RESPECT TO CONSUMER USE OF THE PRODUCT, ANY IMPLIED WARRANTIES WHICH THE CONSUMER MAY HAVE ARE LIMITED IN DURATION TO ONE YEAR FROM THE DATE OF ORIGINAL CONSUMER PURCHASE. WITH RESPECT TO COMMERCIAL AND INDUSTRIAL USES OF THE PRODUCT, THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Changes in Dimensions and Specifications

All dimensions and specifications shown in Warner Electric catalogs are subject to change without notice. Weights do not include weight of boxing for shipment. Certified prints will be furnished without charge on request to Warner Electric.



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