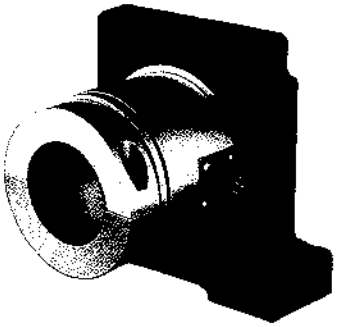
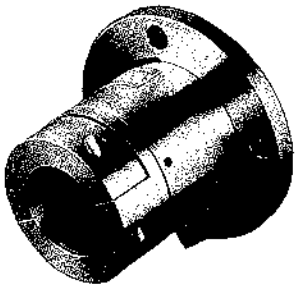
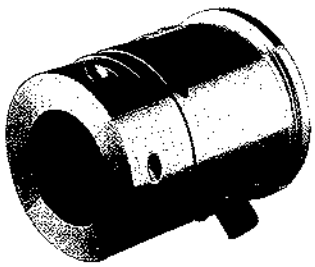
INSTRUCTION MANUAL



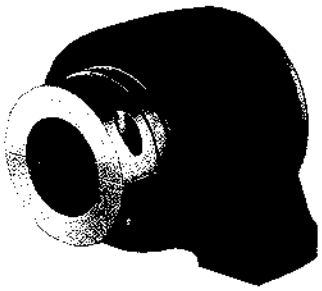
PB-SB



FL



S



PB

DEAD SHAFT TENSION TRANSDUCERS, MODEL DS

Patented

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SECTION ONE - DESCRIPTION and OPERATION

1.0 GENERAL DESCRIPTION

The Dead Shaft Transducer is an electro-mechanical device that converts web tension into a D.C. voltage which is proportional to tension. The voltage is amplified in external electronic circuitry and displayed on an analog or digital meter which is calibrated to indicate actual total web tension. It can also be supplied to a regulator circuit to control tension automatically.

The information in this Section will help give a clear understanding of the Dead Shaft Tranducer, how it works and how it is used.

1.1 CONSTRUCTION AND MECHANICAL OPERATION (see Figure 1.)

In a typical installation, a transducer is mounted on each end of a standard idler roll. The roll shaft must be stationary (non rotating). A split coupling clamps the shaft into the transducer. Several sizes of bushings are available for standard shaft diameters, both inch and metric.

The transducer is mounted on the machine frame by one of three methods; a single screw into the back end ("S" style), a four hole flange ("FL" style), or a pillow block type bracket ("PB" style). The mounting style may be changed easily in only a few minutes time without the need for re-calibration or return to the factory.

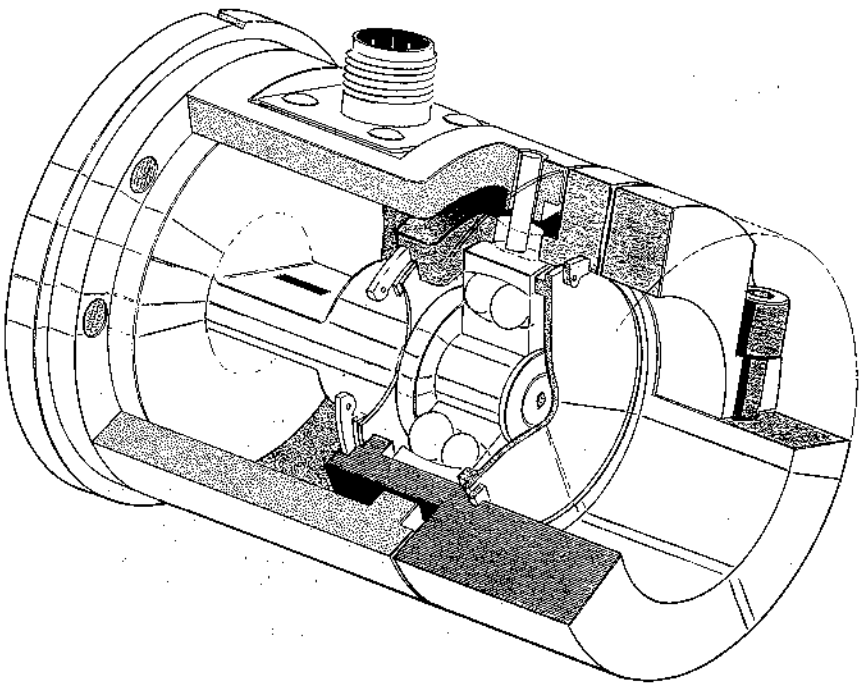


FIGURE 1

The shaft coupling assembly contains a self-aligning ball bearing which allows the coupling to compensate for mis-alignment and deflection of the idler roll shaft. This compensation is extremely important because it prevents mechanical preloading of the transducer which causes in-accurate tension measurement and may cause damage to the transducer. A small amount of axial movement is built into the shaft coupling to compensate for variations in shaft length caused by temperature fluctuations. the beam

Inside the transducer is a cantilever beam with strain gages mounted on the top and bottom surfaces.The shaft coupling is attached to the free end of the beam. When web tension is applied the beam deflects a small amount,causing an electrical output from the strain gages.

A mechanical stop prevents the beam from deflecting too much.The stop consists of a steel ring placed over the shaft coupling such that the force caused by web tension is applied over the center-line of the stop. The diameter of the shaft coupling is a few thousandths of an inch smaller than the inside diameter of the stop so there is normally no contact. When an overload occurs,the beam deflects enough to bring the shaft coupling into contact with the stop. The beam deflection then ceases.

1.2 ELECTRICAL OPERATION (see Figure 2.)

The Dead Shaft Transducer is used in pairs,one on each end of an idler roll shaft. Web tension exerts a force on the roll which is transmitted to the cantilever beam by the shaft coupling. Two semiconductor strain gages are mounted on the beam,one on the top and one on the bottom. As force is applied and the beam deflects,the top gage is stretched and the bottom gage is compressed. This increases the electrical resistance of the top gage and decreases the resistance of the bottom gage. The gages in both transducers are electrically connected together in a Wheatstone bridge configuration. The bridge produces double the output of a single transducer and averages the outputs so web position,width or tight edges do not affect the accuracy of the tension signal.

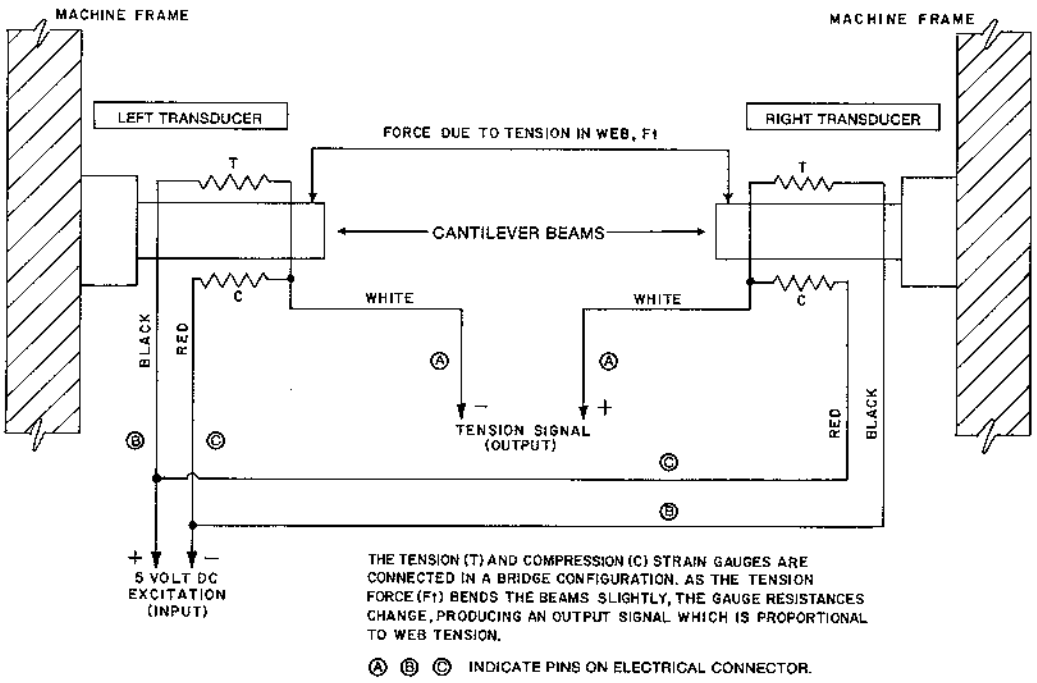


FIGURE 2

The physical location of the strain gages, on opposite sides of the beam, ensures that each gage experiences the same temperature variations. This, and the Wheatstone bridge configuration, provides automatic temperature compensation and a stable output.

TYPICAL TENSIONS FOR WEB MATERIALS

ACETATE		.5 lb per mil per inch of width
FOIL, Aluminum		.5 lb
Copper		.5 lb
CELLOPHANE		.75 lb
NYLON		.25 lb
PAPER	15 lb *	.4 lb per inch of width
	20 lb	.5 lb
	30 lb	.75 lb
	40 lb	1.25 lb
	60 lb	2.0 lb
	80 lb	3.0 lb
	100 lb	4.0 lb
PAPERBOARD	8 pt	3.0 lb per inch of width
	12 pt	4.0 lb
	15 pt	4.5 lb
	20 pt	5.5 lb
	25 pt	6.5 lb
	30 pt	8.0 lb
POLYETHYLENE		.12 lb per mil per inch of width
POLYESTER (Mylar)		.75 lb
POLYPROPYLENE		.25 lb
POLYSTYRENE		1.0 lb
SARAN		.15 lb
VINYL		.05 lb

* based on 3000 sq.foot ream

For laminated webs, sum the tensions for the individual webs and add 0.1 lb per inch of width.

FIGURE 3

SECTION TWO - SELECTION OF TRANSDUCER ROLL

2.0 THE TRANSDUCER ROLL

The Dead Shaft Transducers are used in pairs. One is mounted on each end of an idler roll shaft. The roll chosen is called the Transducer Roll.

1. THE TRANSDUCER ROLL MUST BE A TRUE IDLER! It can NOT be a driven roll! There can be NO brakes, clutches, belts, chains or gears attached to it or its shaft. It can not be a nip roll or be in contact with a nip roll. It can not be filled with water or have pipes or hoses attached to it. NOTHING MUST CONTACT THE ROLL OR ITS SHAFT EXCEPT THE WEB!

2. The Transducer Roll shaft must be stationary (not rotating).

3. The roll should be as light as practical so the load range of the transducers is not taken up by the weight of the roll.

4. The roll must be DYNAMICALLY BALANCED if web speed is over 400 FPM! Refer to Section Four (INSTALLATION) for specifications. An unbalanced roll will reduce the accuracy of the tension signal and may DAMAGE the transducers.

2.1 LOCATION OF TRANSDUCER ROLL

ZONE. The roll must be located in the tension zone which is to be monitored or controlled. The beginning or end of any tension zone is always at a nip (driven or braked), unwind shaft, rewind shaft or drag bar. Any element in the web path that can change web tension is at one end of a tension zone.

WRAP ANGLE. The web must always contact the transducer roll in exactly the same way. The wrap angle must not change as the unwind or rewind roll diameter changes. Therefore there must be at least one idler roll between the transducer roll and the unwind or rewind shaft. If the machine has more than one webbing path, be sure to choose a roll that is wrapped the same for each. Otherwise it will be necessary to install an additional pair of transducers, or dual calibration circuitry, or both. If the wrap angle is allowed to change, the transducer output will change with angle as well as tension, and accuracy will be reduced.

MOUNTING SURFACE. The structure on which the transducers are mounted MUST be very stable and strong. Any movement of the structure will be sensed by the transducers and will cause in-accurate tension readings.

SECTION THREE – SELECTION OF LOAD RATING

3.0 LOAD RATINGS

The Dead Shaft Transducer is available in eight standard load ratings, ranging from 10 lbs. to 800 lbs. The correct rating for any particular machine depends on web tension, transducer roll weight, wrap angle and the direction of the tension force on the transducer roll. Figure 4 contains mathematical formulae which use these factors to determine the correct load rating.

3.1 SELECTION PROCEDURE (see Figure 4.)

The correct load rating is found in four simple steps:

Step 1. OBTAIN DATA TO PLUG INTO THE SELECTION FORMULA

a. Weigh the transducer roll.

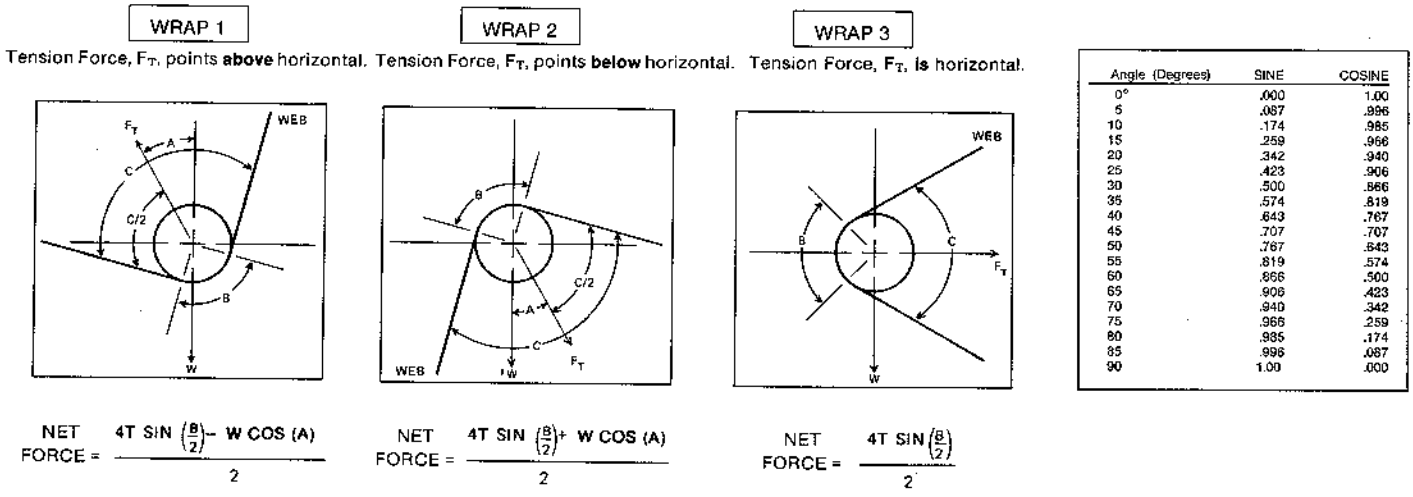
b. Estimate the maximum web tension. Use Figure 3 as a guide if necessary.

c. Determine the wrap angle.

d. Determine the angle of the tension force, Ft, with the horizontal. (NOTE: Ft bisects the wrap angle)

Step 2. COMPUTE NET FORCE USING THE SELECTION FORMULA

Refer to Figure 4. Select the appropriate wrap configuration as determined by the direction of the tension force (above, below or on horizontal). Compute the Net Force, using the formula below the wrap diagram.



Angle (Degrees)	SINE	COSINE
0°	.000	1.00
5	.087	.996
10	.174	.985
15	.259	.966
20	.342	.940
25	.423	.906
30	.500	.866
35	.574	.819
40	.643	.767
45	.707	.707
50	.767	.643
55	.819	.574
60	.866	.500
65	.906	.423
70	.940	.342
75	.966	.259
80	.985	.174
85	.996	.087
90	1.00	.000

FIGURE 4

Step 3. SELECT THE LOAD RATING FROM FIGURE 5

Use Figure 5 to select the correct load rating. In some cases, the load rating may be LESS than the computed Net Force. This is acceptable because the Net Force formula contains an oversizing factor of 2 which means that the actual force exerted on the transducer will not exceed its rating.

Load Rating Chart	
Net Force (lb)	**Load Rating (lb)**
up to 13	10
14 - 32	25
33 - 63	50
64 - 125	100
126 - 250	200
251 - 500	400
501 - 1000	800

FIGURE 5

Step 4. COMPARE LOAD RATING WITH EFFECTIVE TRANSDUCER ROLL WEIGHT

Sometimes, a transducer roll is so heavy that its weight uses up most of the operating range of the transducers. When this happens, it may not be possible to adjust the tension indicating meter to read zero when tension is zero because the adjustment range of the electronic circuit has been exceeded. To find out if the roll is too heavy, compare the load rating with the effective weight of the roll as follows:

Refer back to the Net Force formula used in Section 3.1 Step 2 above. The effective roll weight is the "W Cos(A)" term in the formula. If W Cos(A) is more than 95% of the load rating chosen, the tension meter will probably not be adjustable to zero. If this is the case, one or more of the following changes must be made to reduce W Cos(A) to less than 95% of the load rating:

A. Reduce the transducer roll weight.

B. Increase angle (A). (see Figure 4)

C. Use the next higher load rating. (This is the least desirable choice because it reduces transducer signal output)

SECTION FOUR - INSTALLATION

Dead Shaft Transducers are very easy to install. Normally, both transducers are mounted on the machine and the roll is then installed in them. Follow the simple steps below.

4.0 DETERMINE SHAFT LENGTH (see Figure 6.)

Measure the distance between the machine frames where the transducers will be mounted. Use the appropriate formula in Figure 6 to determine the correct shaft length. The formulae allow approximately 1/16 inch clearance between the shaft end and the bearing cover. This clearance is necessary for proper operation and for ease of installation and removal. DO NOT ALLOW THE SHAFT TO CONTACT THE BEARING COVER.

SHAFT LENGTH

SIZE	STYLE S, FL	STYLE PB	STYLE PB –SB
SIZE 2.25	L = D - 4 3/4 inches	L = d - 3 1/8 inches	——
SIZE 3.22	L = D - 6 1/8 inches	L = d - 4 3/8 inches	L = d - 4 3/8 inches

L = SHAFT LENGTH, INCHES
D = DISTANCE BETWEEN MOUNTING SURFACES, INCHES
d = DISTANCE BETWEEN PB BRACKET MOUNTING HOLE CENTERS, INCHES

FIGURE 6

4.1 BALANCE THE ROLL

The roll must be dynamically balanced if web speed is 400 FPM or more.

Rolls of 4 inch diameter or less should be balanced to within 0.5 oz-in.
Rolls exceeding 4 inch diameter should be balanced to within 0.75 oz-in.

4.2 MOUNT THE TRANSDUCERS ON THE MACHINE

Remove the cap from the shaft coupling. Mount the transducers on the machine, leaving the mounting bolts loose enough to allow the transducers to be turned easily by hand. Turn the transducers so the arrow on the coupling points straight down.

4.3 PLACE THE ROLL IN THE TRANSDUCERS

Position the roll in the transducers. Install the coupling caps but leave the screws loose. Adjust the shaft depth to the correct end clearance in ONE transducer, only. If a split bushing is being used to adjust shaft diameter, be sure the cut in the bushing lines up with the cut in the shaft clamp.(See Fig.7,next page). If it doesn't, the shaft will not be gripped tightly and the transducer output will not be linear or repeatable. Tighten the cap screws to lock the shaft into the transducer. DO NOT TIGHTEN the cap screws on the other transducer yet.

SHAFT BUSHING ALIGNMENT

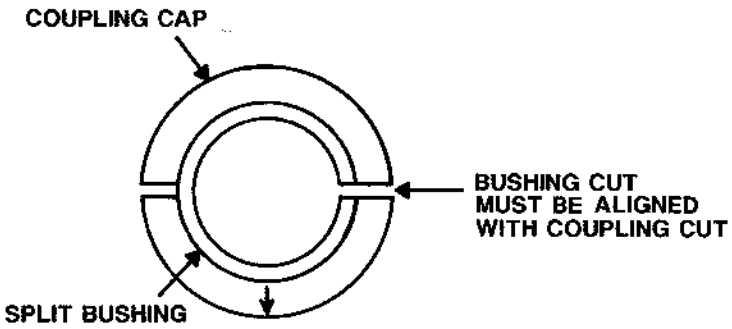


FIGURE 7

4.4 ORIENT THE TRANSDUCERS (see Figure 8.)

The transducers must be turned so the arrow on the coupling (or the notch on the rear edge) points in the same direction as the Tension Force.

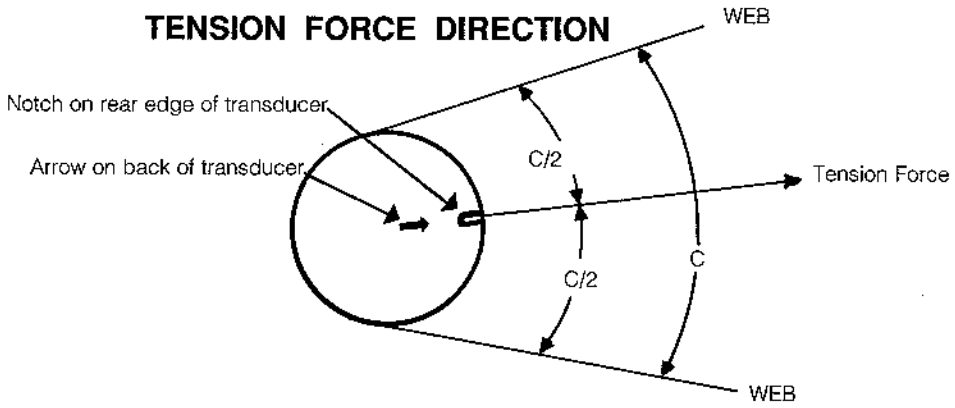


FIGURE 8

Turn both transducers by hand so the arrow (or notch) bisects the wrap angle. Tighten all mounting bolts. See special instructions below for PB style.

SPECIAL INSTRUCTIONS FOR "PB" STYLE

Remove the end covers from both transducers. Grip the round electrical connector block and turn the transducer inside the PB bracket so the arrow on the block bisects the wrap angle. You may need to gently lift the idler roll so the transducer will turn easily. Replace the end covers,being careful to tighten all screws securely so the transducer is clamped tightly in the PB bracket.

4.5 TIGHTEN THE LOOSE TRANSDUCER (follow the instructions below very carefully)

Grip the idler roll and gently push it toward the loose transducer as far as it will go. At the same time, push the shaft coupling away from the roll (toward the beam housing). Align the bushing cut with the shaft coupling cut and tighten the cap screws to lock the shaft into the transducer. THIS PROCEDURE IS VERY IMPORTANT! If it is done correctly you will be able to move the idler roll axially about .020 inch. THIS AXIAL MOVEMENT IS ESSENTIAL TO THE PROPER OPERATION OF THE TRANSDUCERS! VERIFY THE AXIAL MOVEMENT NOW. There must be at least .010 inch. Use a feeler gage placed in the gap between the shaft coupling and beam housing to measure the movement. If no movement can be detected, loosen the shaft coupling and follow the procedure above again. The axial movement eliminates the possibility of mechanically pre-loading the transducers. Pre-loading causes non-linearity, zero-drift and loss of calibration.

NOTE: It is important that the cap screws be tightened firmly and the shaft bushing cut aligned properly so the shaft is gripped tightly. See Figure 7, page 8.

4.6 CHECK THE GAP FOR EVENNESS

Measure the gap between the shaft coupling and the beam housing in at least four places equally spaced around the circumference of each transducer. Shim or repostion the transducers as necessary to equalize the gap. If the gap is unequal, the beam will not deflect the full amount, reducing signal output.

SECTION FIVE - REMOVAL

The transducers may be removed from the machine in either of two ways:

5.0 Remove the idler roll from the transducers. Then remove the transducers from the machine.

PROCEDURE --- Support the idler roll so it can not fall. Remove the two screws from the coupling cap on each transducer. Remove the caps. Remove the idler roll. Remove the transducers from the machine.

5.1 Remove the transducers and idler roll from the machine at the same time.

PROCEDURE --- Loosen the transducer mounting bolts and remove the roll, with transducers attached, from the machine. If the transducers had been installed correctly there will be enough axial movement to allow them to be slid easily out of the machine. To remove the shaft from the transducers, follow the procedure in 5.0 above.

SECTION SIX - HOW TO CHANGE MOUNTING STYLE

The Dead Shaft Tension Transducer is designed so the mounting style can be changed easily. See Figure 9. for part numbers of conversion kits.

6.0 CHANGE FROM STYLE "S" TO STYLE "FL"

1. Remove the four screws holding the electrical connector. Do NOT un-solder or cut the wires.

2. Place the transducer on a bench, with shaft coupling up. Gently pull the connector to the top of the transducer.

3. Hold the mounting flange with the groove side down and slide it over the transducer. Align the wires with the small notch and the nameplate with the large notch. Slide the flange all the way to the bottom of the transducer. The lip on the bottom will fit into the groove on the underside of the flange.

4. Place the connector back into position and install the four screws. Be careful not to pinch any of the wires under the connector.

6.1 CHANGE FROM STYLE "S" TO STYLE "PB"

1. Remove the foil covering the hole on the back of the beam.

2. Remove the electrical connector and un-solder the wires. Do not cut the wires.

3. Twist the wires together and pass them thru the hole in the back of the beam.

4. Place the transducer on the bench, with the shaft coupling down. Hold the connector mounting block over the transducer and pass the wires thru one of the small holes in the block so they extend into the large center hole. Mount the block to the transducer using the large set screw, being careful not to pinch the wires. Tighten the block by turning it clockwise by hand. Be careful not to pull the wires. If the wires are too short, remove the block and pass them thru the other small hole. Re-install the block as described above. Install the two small set-screws to prevent the block from turning. Be sure the wires pass between the set-screws and the block to hold them in place.

5. Solder the wires to the electrical connector as indicated below, and mount the connector on the block.
   pin A ----- white wires
   pin B ----- black wire
   pin C ----- red wire

6. Slide the transducer into the PB bracket and turn it so the arrow on the connector block bisects the wrap angle. See Figure 8.

7. Place the rubber gasket on the end cover and install the end cover on the PB bracket using the eight screws provided. Tighten the screws securely so the transducer is clamped firmly in the bracket.

(See Figure 9 on next page)

MOUNTING STYLE CONVERSION KIT PART NUMBERS

SIZE	2.25	3.22
FL	M 927C	M 830C
PB	M 1020A	M 1021A
PB - SB	———	M 1289A

FIGURE 9

SECTION SEVEN - HOW TO CHANGE THE ELECTRICAL CONNECTOR POSITION

7.0 DESCRIPTION

The electrical connector can be placed in any of four positions relative to the load direction. (types "S" and "FL" only). Using clock face numbers as a reference, the load direction is at 6 o'clock (straight down). Connector positions are; 12, 3, 6, and 9 o'clock. The standard position is 6. It may be changed easily by following the procedure below.

7.1 PROCEDURE

1. Remove all eight screws from the back of the transducer, being careful not to let it fall apart.

2. Hold the back end of the beam in one hand and rotate the beam housing with the other hand so the connector is in the desired position. DO NOT ROTATE THE HOUSING MORE THAN 1/2 TURN IN EITHER DIRECTION! The connector wires inside may be stretched or broken if the housing is turned too far.

3. Replace all screws and tighten them securely.

SECTION EIGHT - CALIBRATION

8.0 INTRODUCTION

There are no calibration adjustments on the Dead Shaft Transducer itself. The instructions below are for the electronic device which the transducers are connected to. All of the terminology and procedures following assume that the transducers are connected to a Dover Flexo Electronics tension controller or tension indicator. If some other device is being used, you should follow the instructions furnished with it.

These are general instructions which are correct for most DFE controllers and indicators, and are placed here for convenience. If there is any discrepancy between these instructions and those in the Instruction Manual for the indicator or controller, you should disregard these and follow the instructions in the indicator or controller Manual.

The transducers must be properly installed and oriented as directed in SECTION FOUR, pages 7,8.

8.1 ZERO THE TENSION METER

1. Turn the "POWER" switch off. If the meter does not read zero, turn the mechanical adjustment screw on the meter face so the needle indicates zero tension.

2. Find an object of some kind that weighs at least 25% of the maximum value on the tension meter scale. (Be sure you know the exact weight).

3. Find a rope, tape, or wire that will support the weight in 2. above.

4. Verify that there is no web contacting the Transducer Roll. Turn the "POWER" switch on. Wait for about five minutes for the electronics to warm up. Turn the "CALIBRATE" pot. to approximately 75%. Then, turn the "ZERO" pot. so the tension meter reads zero tension.

8.2 CALIBRATE THE TENSION METER

See Figure 10. Pass the rope over the Transducer Roll in exactly the same path as the web follows. Tie the end in the machine at least one idler roll beyond the Transducer Roll. Pass the other end by at least one idler roll before the Transducer Roll. Be sure the rope does not pass over any driven rolls, braked rolls or dead bars. (This will cause in-accurate calibration). Attach the weight to the free end of the rope and let it hang without touching anything. Turn the "CALIBRATE" pot. so the tension meter reads the same as the weight. Remove the weight and rope. This concludes the calibration procedure.

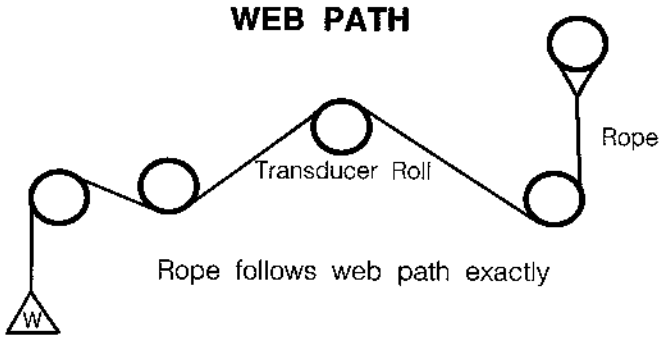


FIGURE 10

SECTION NINE - SPECIFICATIONS (Dead Shaft Transducer)

Excitation Voltage	5 volts DC
Output	250 mv, nominal, at 5V excitation
Strain Gages	semiconductor, 100 ohms nominal resistance
Repeatability	± 1/4% full span (FS)
Linearity and hysteresis combined	± 1/2% FS
Temperature range (degrees F)	-10 to +150
Temperature coefficient	.02% per deg.F typical
Material	303 stainless steel and aluminum
Minimum overload capacity	1200 lb (size 2.25) 2500 lb (size 3.22)
Deflection	.008" typical
Mis-alignment capacity (degrees)	2
Mating electrical connector	Amphenol MS3106A-10SL-3S
Standard connector position	6 o'clock (same as tension force)
Electrical connections:	pin A... white wire..output pin B... black wire ... 5V pin C... red wire 5V
Standard shaft sizes	1 1/4" (size 2.25) 2" (size 3.22)
Shaft size tolerance	nominal size ± .002"
Load ratings (lbs)	10, 25, 50, 100, 150 (size 2.25) 50, 100, 200, 400, 800 (size 3.22)

OPTIONS

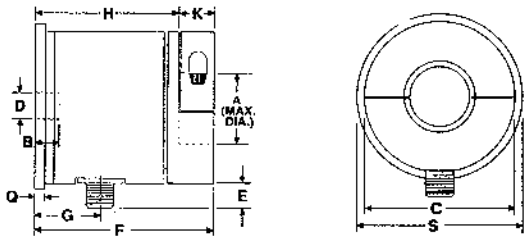
A. Shaft size: 1/2, 5/8, 3/4, 7/8, 1. Also 20mm, 25mm, 30mm (size 2.25)
3/4, 7/8, 1, 1 3/16, 1 1/4, 1 7/16, 1 1/2. Also 25mm, 30mm, 40mm (size 3.22)

B. Connector position: 3, 9, 12 o'clock. (types S, PB3.22-SB and FL only)

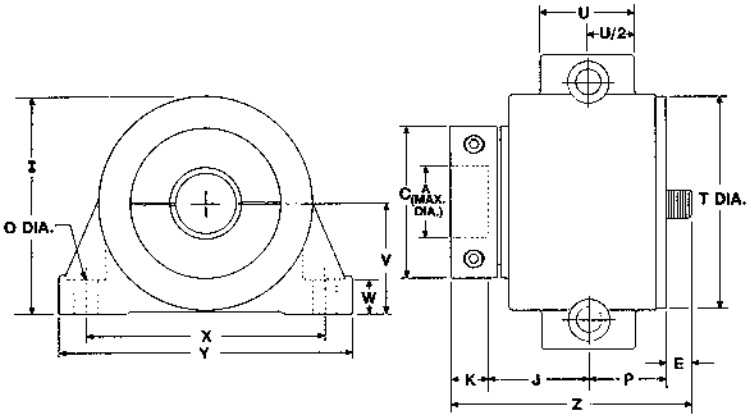
C. Short pillow block bracket (available on size 3.22 only)

SECTION TEN - DIMENSIONS

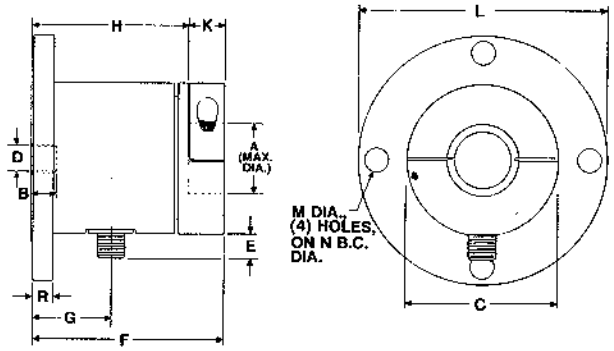
TYPE S



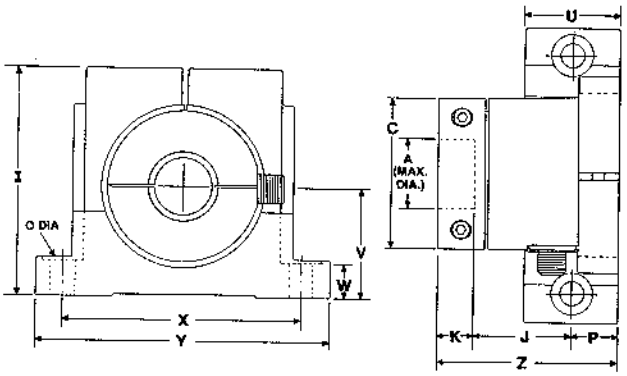
TYPE PB



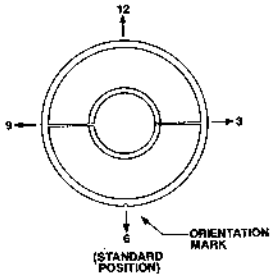
TYPE FL



TYPE PB3.22-SB



CONNECTOR POS.



SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M
2.25	1.25	.38	2.25	3/8-16	.66	2.95	1.10	2.31	3.45	1.50	.63	3.60	.33
3.22	2.00	.50	3.22	5/8-11	.66	4.00	1.40	3.00	4.60	2.11	1.00	5.23	.53
3.22-SB	2.00	- - -	3.22	- - -	.66	4.00	1.40	3.00	4.79	2.12	1.00	- - -	- - -

SIZE	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
2.25	3.05	.39	1.61	.20	.37	2.55	3.40	1.50	1.75	.45	3.50	4.50	4.41
3.22	4.30	.53	1.69	.20	.44	3.49	4.55	2.00	2.32	.75	5.00	6.20	5.46
3.22-SB	- - -	.53	.87	- - -	- - -	- - -	- - -	1.75	2.29	.75	5.00	6.20	4.00

SECTION ELEVEN - REPLACEMENT PARTS LIST (Dead Shaft Transducer)

PART	SIZE 2.25	SIZE 3.22
ELECTRICAL CONNECTOR screws(4)	AMPHENOL NUMBER MS3102A-10SL-3S 4-40 x 1/4 socket button head	
SHAFT COUPLING cap screws(2)	M1205C 10-32x7/8 SH	M1159C 1/4-20x1 SH
BEARING COVER ret.ring	M1185C IRR3000-X125	M1162C IRR3000-X200
COUPLING BEARING washer screw	13304 SKF M921C 8-32X1/4 SFH	1303 SKF M822C 1/4-20X1/2 SFH
SEAL spacer ret.ring	M922C M926C VH106S02	M826C M823C VH187S02
SHAFT BUSHING (specify bore)	M1213C	M1210C

NOTE: all screws are stainless steel socket head.

Call DOVER FLEXO ELECTRONICS for prices and for part numbers of items not listed.
Telephone 603-332-6150. FAX 603-332-3758. Ask for Customer Service Dept.

SECTION TWELVE - TROUBLESHOOTING GUIDE

This is a list of problems which could occur during initial start-up or afterwards. The probable causes are listed with the most likely one first and the least likely one last.

1. TRANSDUCER ROLL SHAKES, VIBRATES or BOUNCES

   a. Roll is not balanced. See Section 4.1 page 7 and Section 2.0 page 4
   b. Shaft is not clamped tightly in transducers. Coupling screws are loose or shaft diameter is undersize.
   c. Transducer mounting bolts are not tight.
   d. Shaft is too weak or there is too much shaft extension between the ends of the roll and the transducers.
   e. Roll is turning at its natural frequency. Call DFE for analysis of operating conditions and solution to problem.

2. CAN NOT ADJUST TENSION METER TO READ ZERO WHEN WEB IS SLACK

   a. Transducer roll is too heavy. See Section 3.1-4 page 6.
   b. Transducers are pre-loaded. See Section 4.0 page 7 and 4.4 page 8.

3. TENSION METER READS BACKWARDS

   a. Transducers are installed backwards with force arrow pointing in opposite direction. See Section 4.3 page 7.
   b. Transducer cables are connected wrong at controller/indicator terminal strip. White wires are reversed.

4. TENSION METER NEEDLE PEGS HIGH OR LOW

   a. Transducers are pre-loaded. See Section 4.0 page 7 and 4.4 page 8.
   b. Transducer cable has broken wire, poor connection or short circuit.
   c. A strain gage has failed. To verify: Unplug the transducer cable and use an ohm-meter to measure the resistance of the gages at the connector on the transducer. Measure between pins A,B and A,C. In each case, the resistance should be about 100 ohms. Measure the resistance between any pin and the outside of the transducer. The meter should read infinite resistance. Apply a force to the roll by hand or by using a rope and a weight, in the direction of the tension force and maintain it while again measuring between pins A,B and A,C. The resistance should be only a few ohms different from before.
   d. Failure in the tension amplifier circuit of the controller/indicator.

5. TENSION METER DOES NOT READ ZERO WHEN WEB IS SLACK AND READING DRIFTS WITH TIME.

   a. Meter is not calibrated. See Section 8 page 12.
   b. Transducers are pre-loaded. See Section 4.0 page 7 and 4.4 page 8.
   c. The structure the transducers are mounted on is weak. See Section 2.1 page 4.
   d. Transducer cable has a broken wire, poor connection or short circuit.
   e. A strain gage is cracked. Perform the test in 4c above.

6. TENSION METER DOES NOT READ THE SAME EACH TIME THE SAME FORCE IS APPLIED

   a. Transducers are pre-loaded. See Section 4.0 page 7 and 4.4 page 8.
   b. The structure the transducers are mounted on is weak. See Section 2.1 page 4.
   c. The shaft bushing cut is not properly aligned. See Section 4.3 page 7.
   d. The shaft coupling cap screws are loose.

7. TENSION METER READING DOES NOT CHANGE WHEN FORCE IS APPLIED TO ROLL. METER READS ZERO.

   a. Meter is not calibrated. See Section 8 page 12.
   b. Gap between shaft coupling and beam housing is not equal. See Section 4.6 page 9.
   c. Transducer roll is too heavy. See Section 3.1-4 page 6.
   d. Transducer cable has broken wire, poor connection or short circuit.
   e. Transducer cables connected incorrectly, or to wrong transducers.
   f. The coupling bearing has worn out. Bearing housing is resting on the overload stop.
   g. Failure of tension amplifier circuit in controller/indicator. Unit not turned on.

8. TENSION METER NEEDLE BOUNCES

   a. Web tension is fluctuating because of machine speed fluctuations, bent roll shafts, worn idler roll bearings, chattering unwind brake, flat spot in unwind or rewind roll, etc.
   b. Shaft is loose in the transducers. Shaft coupling cap screws are loose or shaft diameter is under-size.
   c. Shaft bushing cut is not aligned properly. See Section 4.3 page 7.
   d. Transducer mounting bolts are loose.
   e. Tension controller is not adjusted properly. See controller Instruction Manual.

SECTION THIRTEEN - WARRANTY

DOVER FLEXO ELECTRONICS,INC. warrants its' products to be free of defects in material and workmanship for one year from date of original shipment. During the warranty period DOVER FLEXO ELECTRONICS,INC. will repair or replace defective products free of charge if such products are returned with all shipping charges prepaid and, if upon examination, the product is shown to be defective. This warranty shall not apply to products damaged by abuse, neglect, accident, modification, alteration or mis-use.

All repairs and replacements under the provisions of this warranty shall be made at DOVER FLEXO ELECTRONICS,INC. or at an authorized repair facility. DOVER FLEXO ELECTRONICS,INC. shall not be liable for expenses incurred to repair or replace defective products at any other location or by unauthorized persons or agents.

This warranty contains all the obligations and warranties of DOVER FLEXO ELECTRONICS,INC. There are no other warranties whether expressed or implied. No warranty is given regarding merchantability or suitability for any particular purpose. DOVER FLEXO ELECTRONICS,INC. shall not be liable in either equity or law for consequential damages, losses or expenses incurred by use of or inability to use its' products or for claims arising from same.

No warranty is given for products of other manufacturers even though DOVER FLEXO ELECTRONICS,INC. may provide these products with its' own or by themselves.

The provisions of this warranty can not be changed in any way by any agent or employee of DOVER FLEXO ELECTRONICS,INC.

Notice of defects must be received by DOVER FLEXO ELECTRONICS,INC. within the one year warranty period or the warranty is void.

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