# TENSION ROLL® TRANSDUCER

The Tension Roll® Transducer accurately measures tension in any continuous web of paper, film, foil, textile or other material. It consists of a dead shaft idler roll with tension sensors built into each end. This integrated construction makes the Tension Roll® quick and easy to install on any dual-frame web press or machine.

## BENEFITS/FEATURES

- Tension transducers and idler roll are combined in one integral package. No assembly required.
- Faster and easier to install than separate roll and transducers. Requires no more space than an ordinary idler roll.
- Costs less than separate transducers and idler roll.
- Only one transducer cable. No cable need cross the machine.
- Grease fittings for bearings
- Can be mounted in DFE dead shaft transducers to allow measurement of extremely wide tension range in one location without the need of an extra idler roll.
- Minimal transducer deflection allows unaffected web travel.
- Measures actual web tension. Allows accurate display and control of tension.
- High overload capacity provided by time-proven "through-shaft" design.

## OPTIONS

- **90 Degree Grease Fitting (90GF)**. Grease fitting located at end of roll rather than on OD. For 5" OD or larger rolls.
- **Counterbore, Drill, and Tap (CDT)**. Shaft ends are counterbored, drilled and tapped.
- **Drill and Tap (D&T).** Drill and tap ends of shaft. **Size 1**: 5/16-18 (8mm), **Size 2**: 1/2-13 (12mm)
- **Environmental Connector (EC).** Seals with mating cable electrical connector to protect against contact oxidation; especially useful in corrosive environments.
- **Extended Range Output (XR).** Extra sensitive at low tensions. Electronics must also have extended range
- **Milled Flats (MF).** Shaft with milled flats and a through hole at each end.
- **Non-standard Shaft Extensions (NSE).** Shaft extends unequal lengths on ends. Specify lengths.
- **Oiled Bearings (OB).** Oil instead of grease for lubrication. Not recommended by DFE and may void warranty.
- **Steel Roll (SR)**, or **Stainless Steel (SSR)** instead of standard aluminum roll.
- **Wet Environment Cable (WEC).** Attached sealed cable for Tension Roll transducers.

## SPECIFICATIONS:

ELECTRICAL

**Excitation:** 5 Vdc, regulated
**Output:** 500mVdc, nominal
**Strain Gage Resistance:** 100 ohms, nominal
**Non-Repeatability:** ± 1/4% Full Span (FS)
**Combined Non-Linearity and Hysteresis:** ± 1/2% (FS)
**Temperature range:** -10°F to 200°F (-23°C to 93°C)
**Temperature Coefficient:** 0.02% per F° typical (0.036% per C°)
**Mating Electrical Connector:** Amphenol MS3116F10-6S for Size 1, MS3106A-14S-6S for Size 2.
**Electrical Connector Position:** 6 o'clock
**Connector Pin Assignment:** **A** = output; far end, **B** =5V+, **C** = 5V-, **D** = output; connector end, **E** = 5V-, **F** = 5V+

MECHANICAL

**Overload Capacity:** Size 1 = 660 lbs. (2,940 N), Size 2 = 3,000 lbs. (13,300 N)
**Deflection of Sensor Beam:** 0.008 in. max. (0.2 mm)
**Roll - Material:** 6061 Aluminum; 304 Stainless Steel (option); 1020 Series Steel (option)
**TIR:** 0.002 in. (0.05mm)
**Balance:** Quality Grade G2.5 per ISO 1940 and ANSI S2-19-75
**Finish:** 32µ **inch**
**Shaft:** Stainless Steel, plain ends
**Basic Dynamic Load Rating of Bearings:**
Size 1 - 3,510 lbs. (15,600N)
Size 2 - 4,480 lbs. (19,913N)

## PRODUCT CODE

You may order by description or by specifying the code below by matching each labeled digit with your choice. Please specify Roll Length and Shaft Length (in inches).

***Example:*** **TR2-4-100-6-EC,SR Roll Length = 32.5", Shaft Lengh = 42.5"**

**TRX - X - XXX - X - X,X,X**

| SIZE | ROLL DIAMETER | LOAD RATING | CONNECTOR POSITION |
|---|---|---|---|
| 1 | 3 (std Sz 1 only) | 12 lb. | 12:00 |
| 2 | 4 (std Sz 2) | 25 lb. | 1:30 |
| | 5 | 50 lb. | 3:00 |
| | 6 | 100 lb. | 4:30 |
| | OTHER (Specify) | 150 lb.[1] | 6:00 (Std) |
| | | 200 lb.[2] | 7:30 |
| | | 400 lb.[2] | 9:00 |
| | | | 10:30 |

**OPTIONS (Separated by commas)**

90GF = 90° Grease Fitting
CDT = Counterbore, Drill and Tapp
D&T = Drill & Tap
EC = Environmental Connector
MF = Milled Flats
NSE = Non-std Shaft Extensions
OB = Oiled Bearings[5]
SR = Steel Roll
SSR = Stainless Steel Roll
WEC = Wet Environment Cable
XR = Extended Range[4]
Z = Special (SPR)

**NOTES:**
1. Size 1 only
2. Size 2 only
3. Load direction is assumed at 6 o'clock.
4. XR option requires that electronics have XRE option.
5. May void warranty. Contact DFE for more information.

## ACCESSORIES

- Shaft Hangers for Size 1, PN# 140-0005.
- Shaft Hangers for Size 2: PN# 601-1179 Small, or PN# 601-1181 Large.
- Shaft Mounting Adapter. Single bolt mount (Size 1 = PN# 601-1201, Size 2 = PN# 601-1178)
- Flanged Shaft Mounting Adapter (Size 1 = PN# 601-1203, Size 2 + PN# 601-1202)

## SELECTION OF LOAD RATING

The correct transducer load rating for your application is determined by maximum web tension, wrap angle, and roll weight. Choose the appropriate wrap configuration from the diagrams below. Then compute the Net Force using the formula below the diagram. (The direction of the tension force determines which diagram and formula to use).

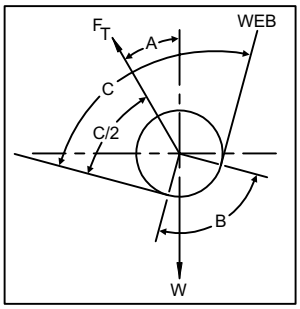
In some cases, the load rating, may be less than the computed Net Force. This is acceptable because the Net Force formula contains an oversizing factor of 2, which means that the actual force exerted on the transducer will not exceed its load rating.

Sometimes, a roll is so heavy that its weight uses up most of the operating range of the transducer. 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: The effective roll weight is the "WCOS(A)" term in the formula. If WCOS(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 WCOS(A) to less than 95% of the load rating:

1. Reduce the transducer roll weight
2. Increase angle (A)
3. Use the next higher load rating (This is the least desirable choice because it reduces transducer signal output).

**WRAP 1**

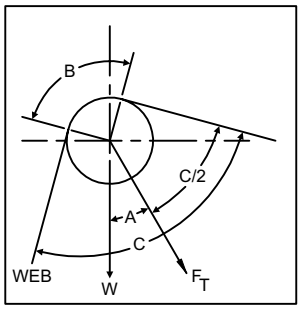
Tension Force $F_T$ **above** horizontal




$$\text{NET FORCE} = \frac{4T \sin\left(\frac{B}{2}\right) - W \cos(A)}{2}$$

**WRAP 2**

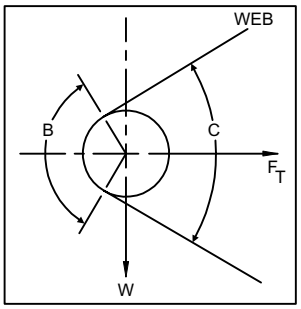
Tension Force $F_T$ **below** horizontal




$$\text{NET FORCE} = \frac{4T \sin\left(\frac{B}{2}\right) + W \cos(A)}{2}$$

**WRAP 3**

Tension Force $F_T$ **is** horizontal




$$\text{NET FORCE} = \frac{4T \sin\left(\frac{B}{2}\right)}{2}$$

W = idler roll weight, T = Maximum web tension, B = Wrap angle = 180° - C°, A = Angle between Tension Force $F_T$ and vertical

**TABLE 1**

| Angle (Degrees) | SINE | COSINE |
|---|---|---|
| 0 | .000 | 1.000 |
| 5 | .087 | .996 |
| 10 | .174 | .985 |
| 15 | .259 | .966 |
| 20 | .342 | .940 |
| 25 | .423 | .906 |
| 30 | .500 | .866 |
| 35 | .574 | .819 |
| 40 | .643 | .766 |
| 45 | .707 | .707 |
| 50 | .766 | .643 |
| 55 | .819 | .574 |
| 60 | .866 | .500 |
| 65 | .906 | .423 |
| 70 | .940 | .342 |
| 75 | .966 | .259 |
| 80 | .985 | .174 |
| 85 | .996 | .087 |
| 90 | 1.000 | .000 |

## MAXIMUM ALLOWABLE ROLL WIDTH inches (mm), see Note 1.

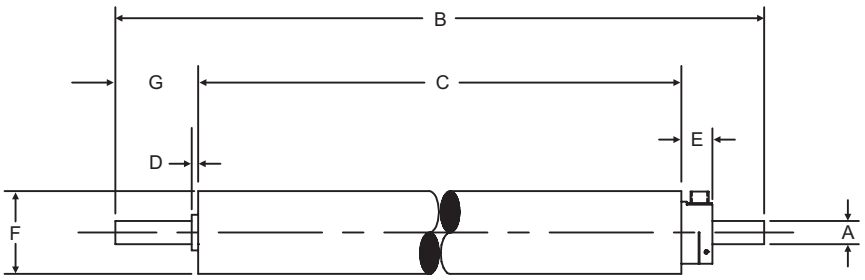
| SIZE 1 | ALUMINUM | STEEL | STAINLESS STEEL |
|---|---|---|---|
| LOAD RATING lb. (N) | Roll Diameter inch (mm) 3 (76) | Roll Diameter inch (mm) 3 (76) | Roll Diameter inch (mm) 3 (76) |
| 12 (55) | 48 (1219) | 48 (1219) | 48 (1219) |
| 25 (110) | 48 (1219) | 48 (1219) | 48 (1219) |
| 50 (225) | 48 (1219) | 48 (1219) | 48 (1219) |
| 100 (450) | 42 (1067) | 48 (1219) | 48 (1219) |
| 150 (670) | 34 (864) | 48 (1219) | 48 (1219) |
| **Roll Weight lb/in (kg/cm)** | 0.30 (0.054) | 0.88 (0.157) | 0.88 (0.157) |
| Weight of Bearing Assemblies is 1.4 lbs. (0.63 kg.) total. Minimum width of roll is 6 inches (152 mm). | | | |

| SIZE 2 | ALUMINUM | | | STEEL or STAINLESS STEEL | | |
|---|---|---|---|---|---|---|
| LOAD RATING lb. (N) | Roll Diameter inch (mm) 4 (102) | 5 (127) | 6 (152) | Roll Diameter inch (mm) 4 (102) | 5 (127) | 6 (152) |
| 12 (55) | 112 (2845) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) |
| 25 (110) | 112 (2845) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) |
| 50 (225) | 100 (2450) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) |
| 100 (450) | 84 (2134) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) | 120 (3048) |
| 200 (900) | 69 (1753) | 95 (2413) | 120 (3048) | 96 (2438) | 120 (3048) | 120 (3048) |
| 400 (1800) | 51 (1295) | 73 (1854) | 95 (2413) | 79 (2007) | 100 (2540) | 120 (3048) |
| **Roll Weight lb/in (kg/cm)** | 0.54 (0.096) | 0.69 (0.124) | 0.85 (0.152) | 1.56 (0.279) | 2.00 (0.357) | 2.44 (0.437) |
| Weight of Bearing Assemblies is 4.3 lbs. (1.9 kg.) total. Minimum width of roll is 7 inches (178 mm). | | | | | | |

1. Roll may be too heavy for the load rating. Be sure to check the sizing criteria and formulas
2. Use the std. sizing formulas to determine the correct load rating. In the formulas, "W" is equal to the roll weight plus the weight of the bearing assemblies.
3. Standard maximum roll width is 120 inches. Wider rolls are available on special order at an additional cost. Consult factory. Shorter widths limit roll deflection.

# DIMENSIONS

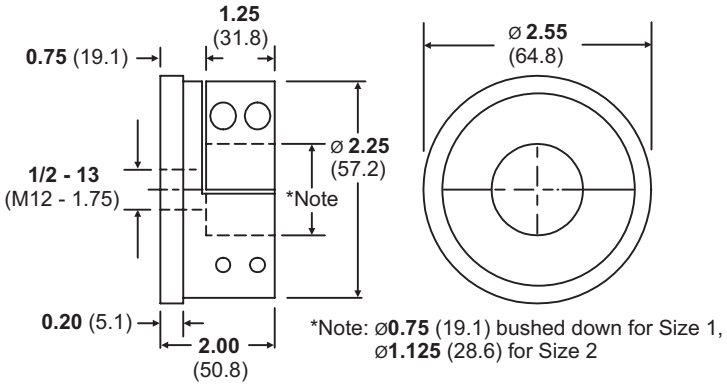
**inches** (mm)



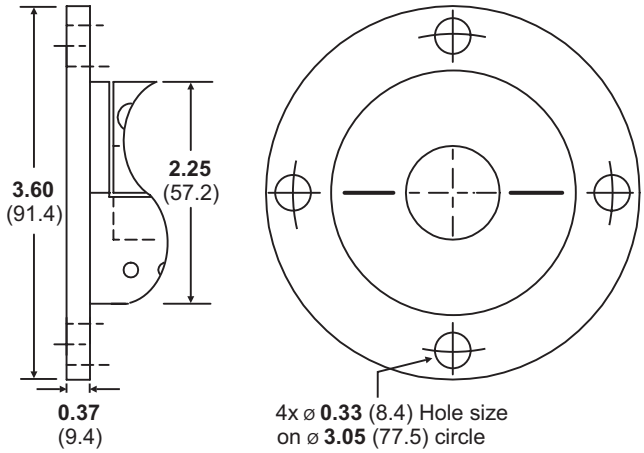

TENSION ROLL® TRANSDUCER

| | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| **SIZE 1** | in | **ø 0.75** | * | * | **0.31** | **1.12** | **ø 3.0** | **3.0** |
| | mm | ø 19.05 | * | * | 7.87 | 28.45 | ø 76.20 | 76.20 |
| **SIZE 2** | in | **ø 1.125** | ++ | ++ | **0.31** | **1.50** | **ø 4.0** | **4.0** |
| | Mm | ø 28.58 | ++ | ++ | 7.87 | 38.10 | ø 101.6 | 101.60 |

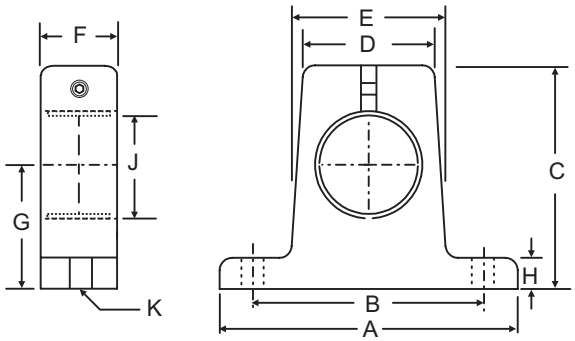
** Specified at time of order, B-C = 6.00 (152.4), ++ Specified at time of order, B-C = 8.00 (203.2)*




SHAFT ADAPTER- Single Bolt Mount
(Size 1: #601-1201, Size 2: #601-1178)




SHAFT ADAPTER- Flange Mount
(Size 1: #601-1203, Size 2: #601-1202)




SHAFT HANGERS FOR TRANSDUCERS

| MODEL | | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SIZE 1** (#140-0005) | in | **2.75** | **2.00** | **2.12** | **1.00** | **1.38** | **0.75** | **1.25** | **0.31** | **Ø 0.75** | **Ø 0.22** |
| | mm | 69.85 | 50.80 | 53.85 | 25.4 | 35.05 | 19.05 | 31.75 | 7.87 | Ø 19.05 | Ø 5.59 |
| **SIZE 2 -SM** (#601-1179) | in | **4.00** | **3.00** | **3.00** | **1.62** | **2.12** | **1.12** | **1.75** | **0.43** | **Ø 1.125** | **Ø 0.34** |
| | mm | 101.60 | 76.20 | 76.20 | 41.15 | 53.85 | 28.45 | 44.45 | 10.92 | Ø 28.58 | Ø 8.63 |
| **SIZE 2 - LG** (#601-1181) | in | **6.00** | **4.50** | **4.50** | **2.62** | **3.30** | **1.50** | **2.50** | **0.62** | **Ø 2.00** | **Ø 0.41** |
| | mm | 152.40 | 114.30 | 114.30 | 66.55 | 83.82 | 38.10 | 63.50 | 15.75 | Ø 50.80 | Ø 10.41 |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