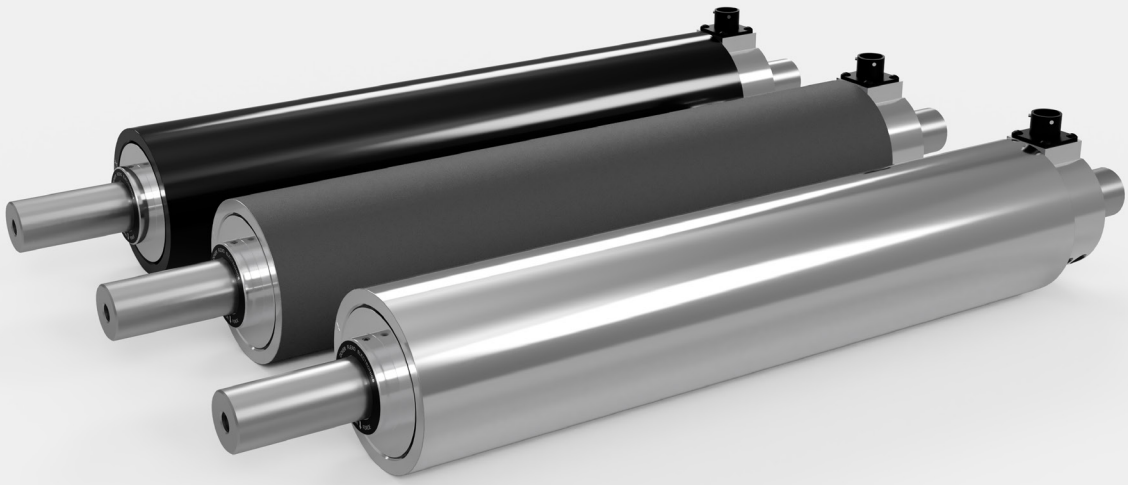
DATA SHEET

THE TENSION CONTROL SPECIALISTS

TENSION ROLL® TRANSDUCER



Ultimate performance and robust reliability set the Tension Roll® Transducer apart from other web sensing solutions on the market. A dead-shaft idler roller with tension sensors (load cells) integrated into each roll end, the Tension Roll® is ideal for installation on original equipment or for retrofits since it arrives pre-assembled and ready-to-install between the facing sides of a machine frame.

With the Tension Roll® the engineering time required to size the unit to the machine frame prior to installation is significantly less than installing standard shaft-end load cells onto an idler roll. A consolidated connector allows cable runs to be reduced to a single side of the machine frame, further simplifying installation.

For web presses and machines that run an extreme range of materials and tensions, the Tension Roll® can be mounted in a pair of Model C shaft-end tension transducers for extended performance. This allows one range of tension to be measured by the Tension Roll® sensors, while a higher load range can be measured using the externally mounted load cells. This feature is convenient in situations where the operating range must extend beyond the Tension Roll® load rating, or space is unavailable to install a second tension system.

Tension Roll® transducers are available with three standard roll materials - aluminum, carbon steel and stainless steel.

Roll face widths are available from 6 to 120 inches in length. Roll diameters from 3 inches (76.2 mm) to 6 inches (152 mm) are standard. Roll diameters larger than 6 inches can be special-ordered.

Tension Roll® Transducers are manufactured in the USA and trusted by printing press and converting machine OEM's worldwide, to deliver unparalleled stability, precision and reliability.

FEATURES & BENEFITS

- Tension transducers and idler roll are combined in one integral package.
- Quicker, simpler installation and alignment process.
- Cost savings vs. purchasing separate load cells plus idler roll.
- Only one transducer cable - no cable needs to cross the machine.
- High overload capacity provided by time-proven, shaft-centric design.
- Can be mounted in DFE dead shaft transducers to allow measurement of extremely wide tension range in one location without the need for additional idlers.
- Twin-beam design is able to measure each side of web independently.
- Measures actual web tension. Allows accurate and consistent display and control of tension.
- Installed the same as any dead shaft idler roll.
- Highly sensitive semiconductor strain gage measurement technology.

SPECIFICATIONS AND [SELECTION CODES]

Excitation: 5 VDC max

Output: 100 mV/V, nominal

Strain Gages: Semiconductor, 100 ohms, nominal

Non-Repeatability: ± 1/4% full span

Combined Non-Linearity and Hysteresis: ± 1/2% full span

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: (DFE P/N) 106-0050

Electrical Connector Positions: 6:00 (std); 12:00

Connector Pin Assignment:

A = Signal Output (-)	D = Signal Output (+)
B = Excitation (+)	E = Excitation (-)
C = Excitation (-)	F = Excitation (+)

Roll Material / Diameter:
6061 Aluminum: [3A] 3 inch Ø, [3ALI] 3 inch Ø Low Inertia, [4A] 4 inch Ø, [5A] 5 inch Ø, [6A] 6 inch Ø
1020 Series Steel: [3S] 3 inch Ø, [4S] 4 inch Ø, [5S] 5 inch Ø, [6S] 6 inch Ø
304 Stainless Steel: [3SS] 3 inch Ø, [4SS] 4 inch Ø, [5SS] 5 inch Ø, [6SS] 6 inch Ø

TIR: 0.002 in. (0.05 mm)

Balance: Quality Grade G2.5 per ISO 1940 and ANSI S2-19-75

Roll Finish: [RA4] 4 Ra, [RA8] 8 Ra, [RA16] 16 Ra, [RA32] 32 Ra

Roll Coating: [N] None, [HC] Black Hard Coat Anodize, [HCN] Natural Hard Coat Anodize, [PC915] PC915 Plasma Coated

Shaft Material: Stainless Steel

Drilled & Tapped Shaft Ends: [NT] None, [1/4T] 1/4-20 UNC, [5/16T] 5/16-18 UNC, [3/8T] 3/8-16 UNC, [1/2T] 1/2-13 UNC, [M8T] M8x1.25, [M10T] M10x1.5, [M12T] M12x1.75

Load Ratings:
Size 1: [12L] 12 lbs, [25L] 25 lbs, [50L] 50 lbs, [100L] 100 lbs, [150L] 150 lbs
(55, 110, 225, 450, 670 N)
Size 2: [25L] 25 lbs, [50L] 50 lbs, [100L] 100 lbs, [200L] 200 lbs, [400L] 400 lbs
(110, 225, 450, 900, 1800 N)

Overload Capacity:
Size 1: 880 lbs (3,914 N)
Size 2: 3,000 lbs (13,300 N)

ACCESSORIES

Shaft Hangers for *Size 1* - P/N: 601-3118
- Fits 1.0 in. diameter shaft

Shaft Hangers for *Size 2* - P/N: 601-1179
- Fits 1.125 in. diameter shaft

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.

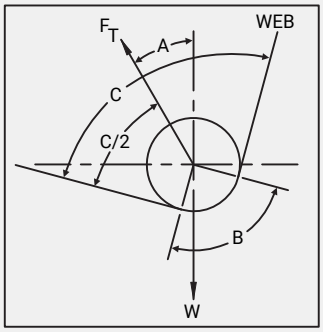
Sometimes, a roll is so heavy that its weight uses up most of the operating range of the transducer. When this happens, it may not be possible to adjust the tension indicating meter to read zero when tension is zero because the adjustment range of the electronic circuit has been exceeded.

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 *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:

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

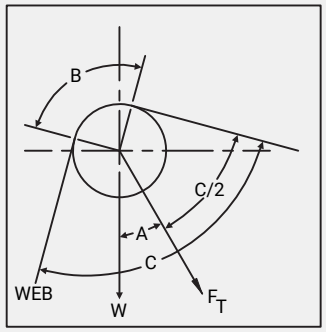
Tension Force (F_T) Above Horizontal



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

WRAP 2

Tension Force (F_T) Below Horizontal



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

W = Roll Shell + Bearing Weight
T = Maximum Web Tension
B = Wrap Angle = 180° - C°
A = Angle Between Tension Force F_T and Vertical

TABLE 1

ANGLE	SINE	COSINE
0°	0.000	1.000
5°	0.087	0.996
10°	0.174	0.985
15°	0.259	0.966
20°	0.342	0.940
25°	0.423	0.906
30°	0.500	0.866
35°	0.574	0.819
40°	0.643	0.766
45°	0.707	0.707
50°	0.766	0.643
55°	0.819	0.574
60°	0.866	0.500
65°	0.906	0.423
70°	0.940	0.342
75°	0.966	0.259
80°	0.985	0.174
85°	0.996	0.087
90°	1.000	0.000

MAXIMUM ALLOWABLE ROLL FACE WIDTH

Lengths listed in inches and (mm). Observe all specification notes below.

SIZE 1	ALUMINUM [3ALI][3]	ALUMINUM [3A]	STEEL [3S]	STAINLESS STEEL [3SS]
LOAD RATING lbs (N)	Roll Diameter 3 in. (76 mm)	Roll Diameter 3 in. (76 mm)	Roll Diameter 3 in. (76 mm)	Roll Diameter 3 in. (76 mm)
12 (55)	36 (914)	50 (1270)	50 (1270)	50 (1270)
25 (110)	36 (914)	50 (1270)	50 (1270)	50 (1270)
50 (225)	36 (914)	50 (1270)	50 (1270)	50 (1270)
100 (450)	36 (914)	44 (1118)	50 (1270)	50 (1270)
150 (670)	36 (914)	36 (914)	50 (1270)	50 (1270)
Roll Weight - lb/inch (kg/cm)	**0.20 (0.035)**	**0.30 (0.054)**	**0.88 (0.157)**	**0.88 (0.157)**
Weight of Bearing Assemblies	**0.3 lb (0.136 kg)**	**1.4 lbs (0.63 kg)**		

SIZE 2	ALUMINUM [4A] [5A] [6A]			STEEL & SS [4S] [4SS] [5S] [5SS] [6S] [6SS]		
LOAD RATING lbs (N)	Roll Diameter 4 in. (102 mm)	5 in. (127 mm)	6 in. (152 mm)	Roll Diameter 4 in. (102 mm)	5 in. (127 mm)	6 in. (152 mm)
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/inch (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	**4.3 lbs (1.9 kg)**					

- Some roll shells may be too heavy for selected load rating. Be sure to check the sizing criteria and formulas.
- In the formulas, "W" is equal to the roll weight plus the weight of the bearing assemblies.
- Maximum standard roll width is 84 inches. Wider rolls are available on special order for an additional cost.
- Contact the DFE sales department to review final roll and application specifications prior to ordering.

PRODUCT CODE

TRx - xxL - xxC - xx - RAxx - xx - xx.xxR - xx.xxS - xx.xxEC - xx.xxEF - xxT

SIZE	LOAD RATING	CONNECTOR POSITION	ROLL MATERIAL	ROLL FINISH	ROLL COATING	ROLL LENGTH	SHAFT LENGTH	CONN. END SHAFT EXT.	FREE END SHAFT EXT.	DRILL & TAP
TR1 TR2	12L[1] 25L 50L 100L 150L 200L[2] 400L[2]	6C 12C	3A[1] 3ALI[1] 3S[1] 3SS[1] 4A[2] 4S[2] 4SS[2] 5A[2] 5S[2] 5SS[2] 6A[2] 6S[2] 6SS[2]	RA4 RA8 RA16 RA32	N HC HCN PC915	xx.xx (inches)	xx.xx (inches)	xx.xx (inches)	xx.xx (inches)	NT 1/4T[1] 5/16T[1] 3/8T M8T M10T 1/2T M12T

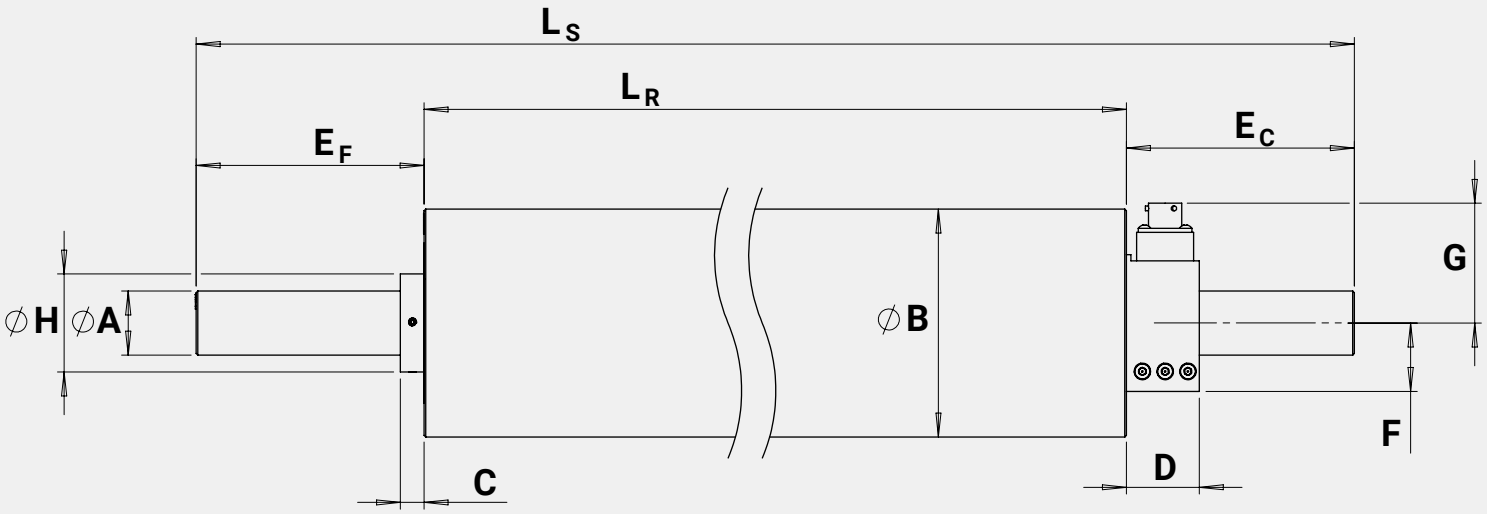
EXAMPLE: TR1-50L-6C-3ALI-RA16-N-24.00R-30.00S-3.00EC-3.00EF-5/16T

Tension Roll - Size 1, 50 lb Load Rating, 6:00 Connector Position, 3" OD Aluminum Low Inertia Roll Material, 16 Ra Roll Finish, No Roll Coating, 24.00" Roll Length, 30.00" Shaft Length, 3.00" Conn. End. Shaft Ext., 3.00" Free End Shaft Extension, Shaft Ends Drilled & Tapped 5/16-18 UNC.

Footnotes:

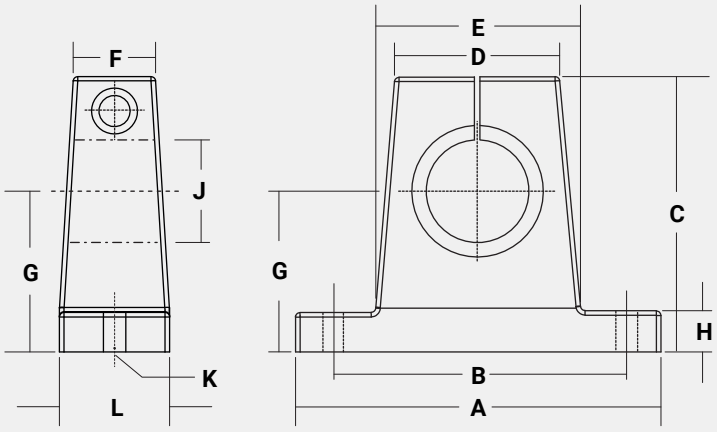
1. Only available with TR1 system.
2. Only available with TR2 system.
3. 39% to 53% less rotating mass than standard 3 inch Ø roll.

DIMENSIONS



SIZE		A	B			C	D	F	G	H
1	in	1.000	3.00			0.29	1.17	R 1.20	2.12	1.56
	mm	25.40	76.2			7.4	29.8	30.5	53.8	39.7
2	in	1.125	4.00	5.00	6.00	0.41	1.28	R 1.20	2.10	1.72
	mm	28.57	101.6	127.0	152.4	10.4	32.5	30.5	53.4	43.7

Note: To locate roll on center of shaft, dimensions specified for E_C and E_F must be equal.

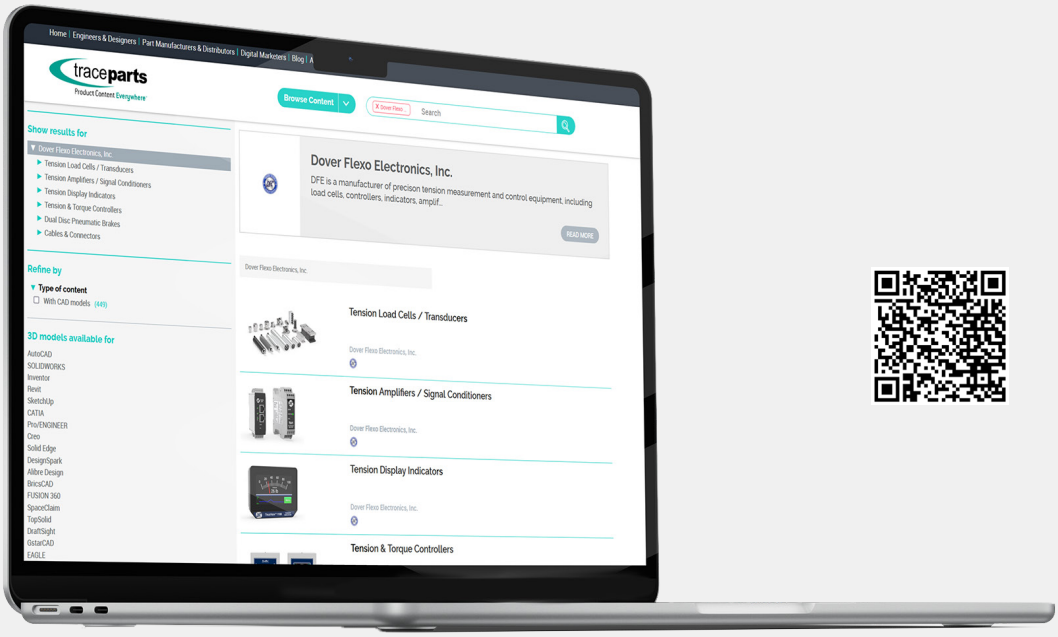


SHAFT HANGERS (OPTIONAL)

		A	B	C	D	E	F	G	H	J	K	L
SIZE 1 (P/N: 601-3118)	**in.**	**4.00**	**3.00**	**3.00**	**1.84**	**2.20**	**0.80**	**1.75**	**0.43**	**Ø 1.00**	**Ø 0.34**	**1.18**
	mm	101.6	76.2	76.2	46.7	56	20.3	44.45	10.9	Ø 25.4	Ø 8.6	29.9
SIZE 2 (P/N: 601-1179)	**in.**	**4.00**	**3.00**	**3.00**	**1.84**	**2.20**	**0.80**	**1.75**	**0.43**	**Ø 1.125**	**Ø 0.34**	**1.18**
	mm	101.6	76.2	76.2	46.7	56	20.3	44.45	10.9	Ø 28.58	Ø 8.6	29.9

CAD MODEL CONFIGURATOR

Download Tension Roll© models for free in over 60 native CAD formats with DFE's online configurator.
https://dfe.com/support-resources/knowledge-base/tension-roll-cad-configurator/



TYPICAL RUNNING TENSIONS OF COMMON WEB MATERIALS

Material	English		Metric		Material	English	Metric	Material	English	Metric
Paperboard	Weight (points)	Tension (lbs/lin. inch)	Weight (g/m2)	Tension (kg/cm)		Tension (lbs/in/mil)	Tension (kg/cm/mm)	Copper Wire (15,000 psi)	Tension (lbs)	Tension (kg)
	8	3.0	105	0.54	Aluminum Foils	0.5	3.52	#16 (.051 inches)	30.00	13.6
	12	4.0	157	0.72	Cellophanes	0.75	5.27	#20 (.032 inches)	12.00	5.5
	15	4.5	196	0.90	Acetate	0.5	3.52	#24 (.020 inches)	4.50	2.0
	20	5.5	260	1.26	Myler (Polyester)	0.75	5.27	#28 (.013 inches)	1.75	0.79
	25	6.5	326	1.62	Polyethylene	0.25	1.76	#30 (.010 inches)	1.25	0.57
	30	8.0	391	1.98	Polypropylene	0.25	1.76	#34 (.006 inches)	0.50	0.23
					Polystyrene	1.0	7.03	#36 (.005 inches)	0.25	0.11
Paper (based on 3,000 sq. foot ream)	15	0.40	25	0.135	Saran	0.15	1.05	#40 (.003 inches)	0.10	0.045
	20	0.50	30	0.180	Vinyl	0.25	1.76			
	30	0.75	50	0.270	Nylon	0.25	1.76			
	40	1.25	65	0.360	Wax Paper	1.0	7.03			
	60	2.00	100	0.540						
	80	3.00	130	0.720						

For laminated webs sum the tensions for the individual webs and add 0.1 lb/in. (0.018 kg/cm) of width.

Run aluminum wire at ½ - 2/3 these values. 15,000 psi = 103.42 MPa
1 mil = 25.4 microns = 0.0254 mm

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