

FEATURES :

- Compact
- High output
- Standard models for bolts size no. 6 through 2" and up to 20mm
- Sensor and washers—carpenter 440C stainless steel, hardness R_c 58-60
- Sensitive to neither bolt or nut applied torque

The bolt force sensor is another unique transducer from Lebow® which is essentially a hollow-compression strain gage load cell. It is designed to be used with most strain gage indicators.

The bolt force sensor is a three-piece assembly consisting of:

1. A large hardened and ground flat washer with one side beveled.
2. The sensor
3. A small hardened and ground washer

NOTE: The use of both washers is mandatory. The three pieces are assembled for various applications as illustrated in figure 1. The large washer isolates the sensor from the force application tool. The beveled hole in this washer, which always faces away from the sensor, provides clearance for the bolt head radius. When a torque wrench is used, a torque vs. clamp force curve can be generated.

The 3711 bolt force sensor is designed for use in fastener testing where the compression loading of the sensor is induced by the tensile loading of the fastener. The bolt force sensor must be used with the size fastener for which it was designed.

The flat washers must be used to prevent damage to the sensor. If washers are substituted for those supplied with sensor, it is imperative that the factory be consulted prior to implementation.

Stress applied to the integral cable assembly will result in sensor damage. The installations illustrated are the recommended applications; other methods may result in reduced performance or damage to the sensor.

To implement correlation between calibration data supplied and the data obtained by the users, a calibration setup is described which illustrates a recommended testing method. Figure 2 partially illustrates a compression-tension testing machine setup which applies a compressive load to the bolt sensor. Note that the machine applies a tensile load to a test bolt and the inclusion of the factory-supplied large and small flat washers. The applied load is measured accurately by means of a hollow load cell which is loaded in compression.

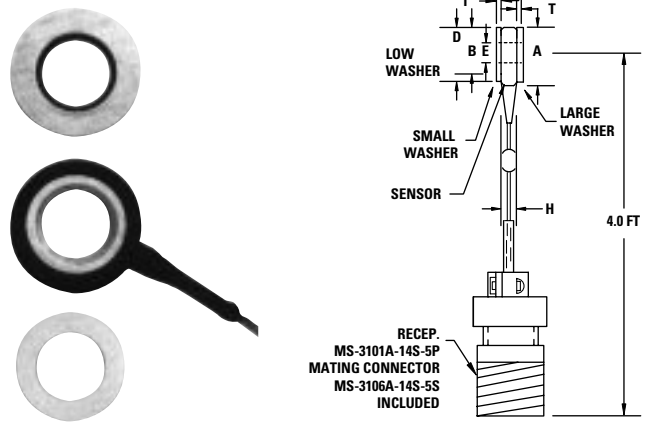
PERFORMANCE SPECS :

3711

SPECIFICATIONS

Sensor: <i>millivolts per volt, nominal</i>	4 arm strain gage bridge
Bridge resistance: <i>ohms nominal</i>	120
Bridge voltage: <i>volts maximum</i>	6
Output at rated capacity: <i>millivolts per volt, nominal depending on size</i>	2 to 5
Temperature range, usable: °F	-65 to +200
Effect of temperature on zero: <i>of full scale per °F</i>	±0.01%
Effect of temperature on output: <i>of reading per °F</i>	±0.02%
Accuracy-Typically: <i>of full range output</i>	5%

MODEL 3711



Consult factory for alternative models:
Model 3714—High Capacity
Model 3718—High Temperature
Model 3719—Auto ID/Higher Accuracy

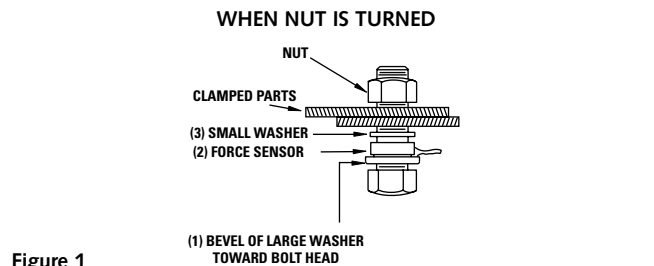


Figure 1

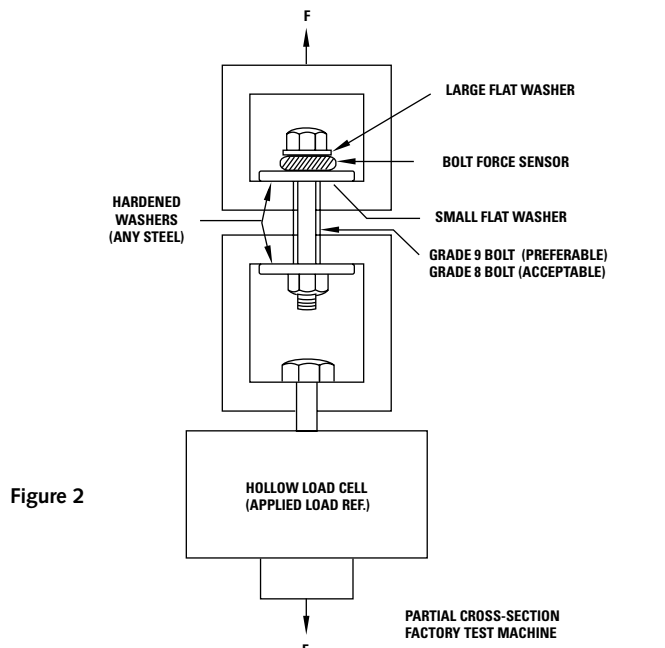
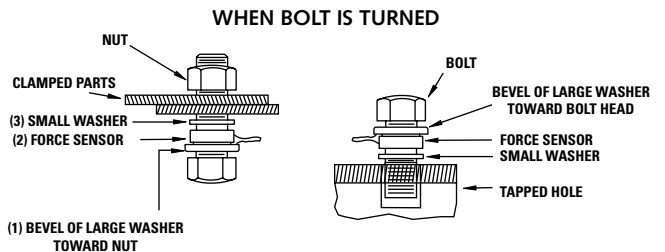


Figure 2

A pure compressive load applied equally across the large washer area will result in a different distribution of sensor internal stress, deflection and output signal. This is illustrated in Figure 3. Note particularly that a high degree of flatness and parallelism of the machine load faces does not improve the validity of the method. A similar conclusion is arrived at in the case of the application of uniform load across the area of the bolt head; the bolt head deflection is restrained and the sensor output may not correlate satisfactorily.

Although not recommended, it is possible to use a smaller size bolt than specified for a given sensor if the application permits an increase in height. Figure 4 illustrates an adapter which can be used to accommodate a smaller size bolt. It is important to note that the deflection of the adapter must be approximately equal to that obtained with the specified size bolt for the sensor. This is the limiting factor in terms of performance of the sensor. For example, for a 3711-750 (3/4"), the adapter deflection should be approximately equal to that of a 3/4" bolt head.

Nonlinearity and hysteresis specifications are not the same for all sizes of bolt force sensors. Each particular size has a characteristic curve which is not necessarily the same as for other sizes. Typically, nonlinearity may be 5% of full scale. A similar statement applies to the full-range output as well. Consult the factory for information on high-capacity (Model 3714) or high-temperature (Model 3718) models.

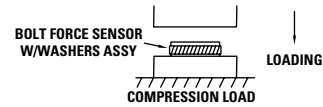


Figure 3

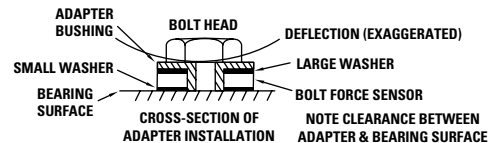


Figure 4

SENSOR CHARACTERISTICS: 3711

MODEL	BOLT SIZE in. (cm.)	CAPACITY lbs. N	DEFLECTION in. (cm.)	H in. (cm.)	BOLT FORCE SENSOR			LARGE & SMALL WASHERS		
					D in. (cm.)	E in. (cm.)	A in. (cm.)	B in. (cm.)	T in. (cm.)	
3711-138	No. 6	1,200	0.0012	0.15	0.44	0.14	0.44	0.28	0.04	
3711-164	No.8	1,800	0.0012	0.15	0.44	0.17	0.44	0.28	0.04	
3711-190	No. 10	2,400	0.0012	0.15	0.50	0.19	0.50	0.34	0.04	
3711-250	1/4	4,000	0.0014	0.15	0.63	0.26	0.63	0.50	0.06	
3711-312	5/16 (8MM)	7,000 (31,000)	0.0014 (0.0014)	0.15 (0.38)	0.75 (1.91)	0.33 (0.83)	0.75 (1.91)	0.56 (1.43)	0.06 (0.16)	
3711-375	3/8 (10MM)	10,000 (46,000)	0.0016 (0.0016)	0.19 (0.48)	0.75 (1.91)	0.40 (1.01)	0.75 (1.91)	0.66 (1.66)	0.06 (0.16)	
3711-437	7/16	14,000	0.0016	0.19	0.88	0.45	0.88	0.72	0.06	
3711-500	1/2	20,000	0.0020	0.25	1.00	0.52	1.00	0.84	0.08	
3711-562	9/16	25,000	0.0020	0.25	1.13	0.58	1.13	0.97	0.08	
3711-625	5/8 (16MM)	30,000 (135,000)	0.0020 (0.0020)	0.25 (0.64)	1.13 (2.85)	0.64 (1.64)	1.13 (2.85)	1.03 (2.62)	0.08 (0.20)	
3711-750	3/4	45,000	0.0028	0.38	1.50	0.77	1.50	1.22	0.09	
3711-875	7/8	60,000	0.0028	0.38	1.50	0.90	1.50	1.42	0.09	
3711-1000	1	80,000	0.0034	0.50	1.75	1.02	1.75	1.61	0.09	
3711-1125	1 1/8	80,000	0.0034	0.50	2.00	1.15	2.00	1.81	0.09	
3711-1250	1 1/4	125,000	0.0053	0.63	2.25	1.28	2.25	2.13	0.13	
3711-1500	1 1/2	190,000	0.0081	0.88	2.63	1.53	2.63	2.50	0.13	
3711-1750	1 3/4	260,000	0.0111	1.13	3.00	1.79	3.00	2.88	0.13	
3711-2000	2	300,000	0.0128	1.38	3.13	2.04	3.13	2.88	0.13	
3711-6MM	(6MM)	(16,000)	(0.0014)	0.15 (0.38)	0.63 (1.58)	0.24 (0.60)	0.63 (1.58)	0.44 (1.11)	0.06 (0.16)	
3711-7MM	(7MM)	(27,000)	(0.0014)	0.15 (0.38)	0.63 (1.58)	0.28 (0.71)	0.63 (1.58)	0.48 (1.23)	0.06 (0.16)	
3711-9MM	(9MM)	(36,000)	(0.0014)	0.15 (0.38)	0.75 (1.91)	0.36 (0.90)	0.75 (1.91)	0.59 (1.51)	0.06 (0.16)	
3711-12MM	(12MM)	(67,000)	(0.0016)	0.19 (0.48)	1.00 (2.54)	0.47 (1.20)	1.00 (2.54)	0.81 (2.06)	0.06 (0.16)	
3711-14MM	(14MM)	(102,000)	(0.0020)	0.25 (0.64)	1.13 (2.85)	0.55 (1.40)	1.13 (2.85)	0.94 (2.38)	0.08 (0.20)	
3711-18MM	(18MM)	(156,000)	(0.0027)	0.38 (0.95)	1.25 (3.17)	0.71 (1.81)	1.25 (3.17)	1.19 (3.01)	0.08 (0.20)	
3711-20MM	(20MM)	(230,000)	(0.0034)	0.38 (0.95)	1.50 (3.81)	0.79 (2.00)	1.50 (3.81)	1.25 (3.17)	0.09 (0.24)	