

BoltSafe

Load Measuring Systems



Product sheet | PMS Bolt Load Sensor

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How does the PMS bolt load sensor work?

The BoltSafe bolt load cell is a load cell (load sensor) that is specifically designed to monitor the residual bolt load in bolted joints. PMS stands for Periodic Monitoring System, which allows for monitoring the bolt load at any given time provided that the handheld reader and a probe are used. The PMS load sensors have a non-contacting interface and do not require a cable connection. During service, the unit is powered over an inductive interface connected to a handheld instrument. The residual bolt load can be monitored directly on the handheld reader using a probe. Using a BoltSafe load cell eliminates any uncertainties about the bolt load. This gives the structure enhanced safety and control and makes the joints more dependable. Besides the safety benefits, there is also a cost reduction during installation and throughout the joint's service life.



How is the PMS bolt load cell used?

Our load cell is used and shaped as a regular washer and is available in sizes M30 to M64 and 1-1/4" to 2-1/2". The BoltSafe bolt load sensor is placed on the non-driven side of a bolted connection, preferably under a nut. While tightening the bolt, force is being applied to the load washer, which will result in minor deformation of the stainless steel washer. The sensor constantly measures changes in electrical resistance caused by these deformations. This data is used to determine the (residual) bolt load at any given moment.



Because the design of our load cells is so rugged, they are able to withstand harsh conditions, such as heavy industrial environments. The load sensors can be used in contact with oil, rain, seawater, ice and temperatures up to 80 degrees Celsius (176°F). Using the washers in conditions where the temperature is above 80 or below -40 degrees Celsius is not recommended. Each sensor utilizes an ASIC (Application Specific Integrated Circuit), which takes care of all signal conditioning and digital communication. Therefore, each BoltSafe load cell has a unique serial number so that it can be individually identified and traced.

The digital monitoring system is not only capable of measuring the residual bolt load, but can also monitor the sensor temperature. After the one-time calibration of the sensor by BoltSafe, there is no need for recalibration of the load cells in their service life - not even when different readout methods are used - provided they are used according to their specifications and requirements. Another application of the load cells is in temporary construction. In this case the sensors are used as washers to check the load in the construction to prevent the temporary construction from collapsing.



Benefits of a periodic monitoring bolt load sensor

BoltSafe PMS load cells can be used in small spaces where cables do not fit. Narrow spaces are the specialty of the PMS washer, because it doesn't require a cable connection. The PMS bolt load cells can be read without any cable connections using a probe. The user can monitor the residual bolt load directly on the handheld reader. Because of this, it is easy to quickly readout multiple sensors with the same reader one after the other. The data from 256 different load cells can be stored onto the handheld reader. The data can be transferred from the handheld reader to a computer.



Readout methods that are compatible with the PMS sensor

The PMS load cell can be read only by the handheld reader SM-200, in combination with a PMS probe. The probe touches the sensor and data is acquired through infrared. This probe energizes the BoltSafe load cell (which is not battery powered) and reads all data through the non-contacting interface. The probe is in turn connected to the SM-200 handheld reader with a connector. If you connect the handheld reader to a PC with a USB cable, you can transfer the measured bolt load data to a PC with the "Report Generator" software.



Technical data

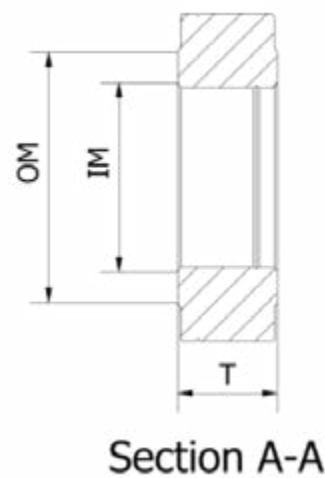
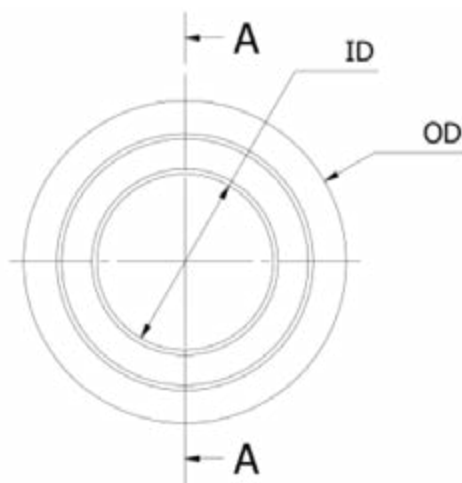
Sizes	To fit bolt size from M30 to M64 (1 3/4" to 2 1/2")
Full Scale Load (FS)	From 385 kN to 1794 kN (86551 lbf to 403307 lbf) depending on sensor size
Maximum Load at ambient temperature	FS range x 1.3 (without affecting the validity of the calibration)
Temperature range	-20°C to 70°C (-4°F to 158°F)
Storage Temperature	-20°C to 70°C (-4°F to 158°F)
Minimum Load	10% FS
Total accuracy at ambient temperature (rms)	<1% FS (machined parallel surfaces in bolt-nut assembly)
Linearity	<1.5% FS
Hysteresis	<0.9% FS
Creep	<0.1% FS
Repeatability	<0.5% FS
Typical Temperature effects	< ± 0.08% FS/°C
Sealing	IP66
Material	Stainless Steel 17-4 PH, Condition H1025
Sensor Output	Serial digital signal
Power Supply	Powered through electronic interface
Electrical Connection	None-inductive / optical connection (no cable)
Intrinsic Safe Code	II 2 G, EEx ib IIC T4 (upon special request)

We also produce PMS bolt load sensors that are able to withstand and measure 15% higher loads, the dimensions of these sensors stay the same (see next page for dimensions). Contact us for more information about these sensors through info@boltsafe.com or by phone +31(0)24 6790797.



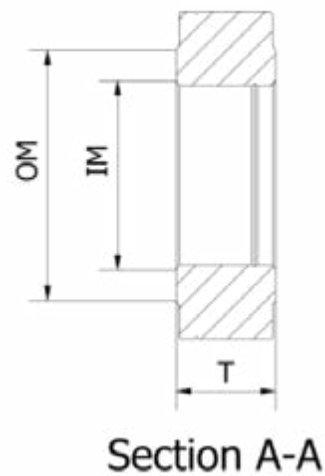
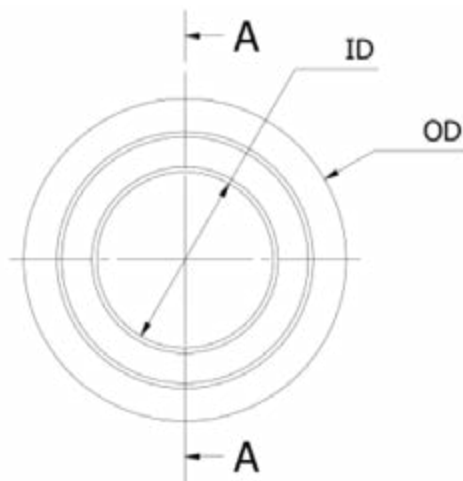
Dimensions of the bolt load sensor (metric)

Bolt Size	Clearance Hole ID		Outside Diameter OD		Overall Thickness T		Steel Weight		Max. Load		Measuring surface IM		Measuring surface OM	
	mm	inch	mm	inch	mm	inch	gr	oz	kN	lbf	mm	inch	mm	inch
M30	30,6	1.20	64,3	2.53	20	0.79	372	13.12	385	86551	33,0	1.30	42,8	1.69
M33	33,6	1.32	68,4	2.69	20	0.79	413	14.57	480	107908	36,3	1.43	46,6	1.83
M36	36,6	1.44	72,8	2.87	20	0.79	462	16.30	560	125893	39,6	1.56	51,1	2.01
M39	39,6	1.56	78,0	3.07	20	0.79	528	18.62	670	150622	42,9	1.69	55,9	2.20
M42	42,6	1.68	83,0	3.27	20	0.79	593	20.92	772	173553	46,2	1.82	60,0	2.36
M45	45,6	1.80	87,6	3.45	20	0.79	655	23.10	905	203452	49,5	1.95	64,7	2.55
M48	48,6	1.91	92,0	3.62	20	0.79	716	25.26	1018	228856	52,8	2.08	69,5	2.74
M52	52,6	2.07	97,2	3.83	20	0.79	784	27.65	1221	274492	57,2	2.25	74,2	2.92
M56	56,6	2.23	102,0	4.02	20	0.79	845	29.81	1408	316531	61,6	2.43	78,7	3.10
M60	60,8	2.39	108,0	4.25	23	0.91	1083	38.20	1647	370260	66,0	2.60	83,4	3.28
M64	64,8	2.55	114,0	4.49	23	0.91	1196	42.19	1794	403307	70,4	2.77	88,2	3.47



Dimensions of the bolt load sensor (imperial)

Bolt Size	Clearance Hole ID		Outside Diameter OD		Overall Thickness T		Steel Weight		Max. Load		Measuring surface IM		Measuring surface OM	
	mm	inch	mm	inch	mm	inch	gr	oz	kN	lbf	mm	inch	mm	inch
1-1/4"	32,3	1.27	67,0	2.64	20	0.79	401	14.14	437	98242	35,5	1.40	45,7	1.80
1-3/8"	35,5	1.40	73,0	2.87	20	0.79	474	16.72	529	118924	38,7	1.52	50,0	1.97
1-1/2"	38,7	1.52	78,0	3.07	20	0.79	535	18.87	629	141405	41,9	1.65	54,3	2.14
1-5/8"	41,9	1.65	84,0	3.31	20	0.79	619	21.83	739	166134	45,4	1.79	58,6	2.31
1-3/4"	45,1	1.78	86,0	3.39	20	0.79	628	22.15	857	192661	48,9	1.93	63,6	2.50
1-7/8"	48,2	1.90	91,0	3.58	20	0.79	698	24.62	983	220987	52,4	2.06	67,9	2.67
2"	51,4	2.02	98,0	3.86	20	0.79	816	28.78	1119	251561	55,9	2.20	72,2	2.84
2-1/4"	57,8	2.28	108,8	4.28	23	0.91	1156	40.78	1416	318329	62,9	2.48	81,8	3.22
2-1/2"	64,3	2.53	116,6	4.59	23	0.91	1289	45.47	1748	392966	69,9	2.75	90,6	3.57
2-3/4"	70,8	2.79	124,0	4.88	23	0.91	1372	48.40	2000	449618	76,4	3.01	99,0	3.90





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