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. 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.

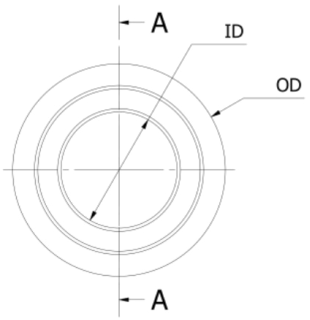
Technical data

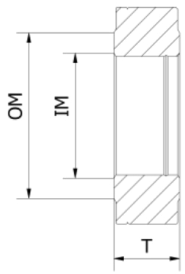
Sizes	To fit bolt size from M30 to M64 (1 3/4' to 2 1/2')
Full Scale Load (FS)	From 385 kN to 1794 kN dependent on Sensor size.
Maximum Load at ambient temperature	FS range x 1.3 (without affecting the validity of the calibration)
Temperature range	-20°C to 70°C
Storage Temperature	-20°C to 70°C
Minimum Load	10% FS
Total accuracy at ambient temperature (rms)	< 5 % 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
Classification	10.9 (upon special request: 12.9)
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 (M)

Size	Clearance Hole ID	Outside Diameter OD	Overall Thickness A	Steel Weight	Clamping Load Class 10.9	Steps	Measuring surface IM	Measuring surface OM
M30	30,6 mm	64,3 mm	20 mm	372 gr	385 kN	5 kN	33,0 mm	42,8 mm
M33	33,6 mm	68,4 mm	20 mm	413 gr	480 kN	5 kN	36,3 mm	46,6 mm
M36	36,6 mm	72,8 mm	20 mm	462 gr	560 kN	5 kN	39,6 mm	51,1 mm
M39	39,6 mm	78 mm	20 mm	528 gr	670 kN	5 kN	42,9 mm	55,9 mm
M42	42,6 mm	83 mm	20 mm	593 gr	772 kN	5 kN	46,2 mm	60,0 mm
M45	45,6 mm	87,6 mm	20 mm	655 gr	905 kN	10 kN	49,5 mm	64,7 mm
M48	48,6 mm	92 mm	20 mm	716 gr	1.018 kN	10 kN	52,8 mm	69,5 mm
M52	52,6 mm	97,2 mm	20 mm	784 gr	1.221 kN	10 kN	57,2 mm	74,2 mm
M56	56,6 mm	102 mm	20 mm	845 gr	1.408 kN	15 kN	61,6 mm	78,7 mm
M60	60,8 mm	108 mm	23 mm	1.083 gr	1.647 kN	20 kN	66,0 mm	83,4 mm
M64	64,8 mm	114 mm	23 mm	1.196 gr	1.794 kN	20 kN	70,4 mm	88,2 mm
M52	52,6 mm	97,2 mm	20 mm	669 gr	1.221 kN	10	57,2 mm	74,2 mm
M56	56,6 mm	102 mm	20 mm	798 gr	1.408 kN	15	61,6 mm	78,7 mm
M60	60,8 mm	108 mm	23 mm	1.083 gr	1.647 kN	20	66 mm	83,4 mm
M64	64,8 mm	114 mm	23 mm	1.196 gr	1.794 kN	20	70,4 mm	88,2 mm
M72	72,8 mm	124 mm	23 mm	1.454 gr	2.500 kN	20	78,4 mm	110 mm

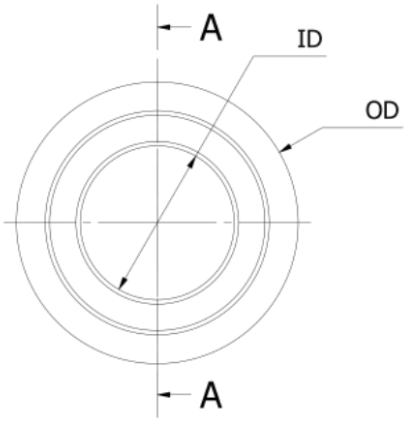


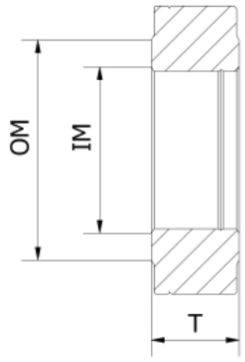


Section A-A

Dimensions of the bolt load sensor (inch)

Size	Clearance Hole ID	Outside Diameter OD	Overall Thickness A	Steel Weight	Clamping Load Class 10.9	Steps	Measuring surface IM	Measuring surface OM
1-1/4"	32,3 mm	67 mm	20 mm	401 gr	437 kN	5 kN	35,5 mm	45,7 mm
1-3/8"	35,5 mm	73 mm	20 mm	474 gr	529 kN	5 kN	38,7 mm	50 mm
1-1/2"	38,7 mm	78 mm	20 mm	535 gr	629 kN	5 kN	41,9 mm	54,3 mm
1-5/8"	41,9 mm	84 mm	20 mm	619 gr	739 kN	5 kN	45,4 mm	58,6 mm
1-3/4"	45,1 mm	86 mm	20 mm	628 gr	857 kN	10 kN	48,9 mm	63,6 mm
1-7/8"	48,2 mm	91 mm	20 mm	698 mm	983 kN	10 kN	52,4 mm	67,9 mm
2"	51,4 mm	98 mm	20 mm	816 mm	1.119 kN	10 kN	55,9 mm	72,2 mm
2-1/4"	57,8 mm	108,8 mm	23 mm	1.156 mm	1.416 kN	15 kN	62,9 mm	81,8 mm
2-1/2"	64,3 mm	116,6 mm	23 mm	1.289 mm	1.748 kN	15 kN	69,9 mm	90,6 mm
2"	51,4 mm	98 mm	20 mm	816 gr	1.119 kN	10	55,9 mm	72,2 mm
2-1/4"	57,8 mm	108,8 mm	23 mm	1.156 gr	1.416 kN	15	62,9 mm	81,8 mm
2-1/2"	64,3 mm	116,6 mm	23 mm	1.289 gr	1.748 kN	15	69,9 mm	90,6 mm
2-3/4"	70,8 mm	124 mm	23 mm	1.372 gr	2.000 kN	20	77 mm	99 mm





Section A-A