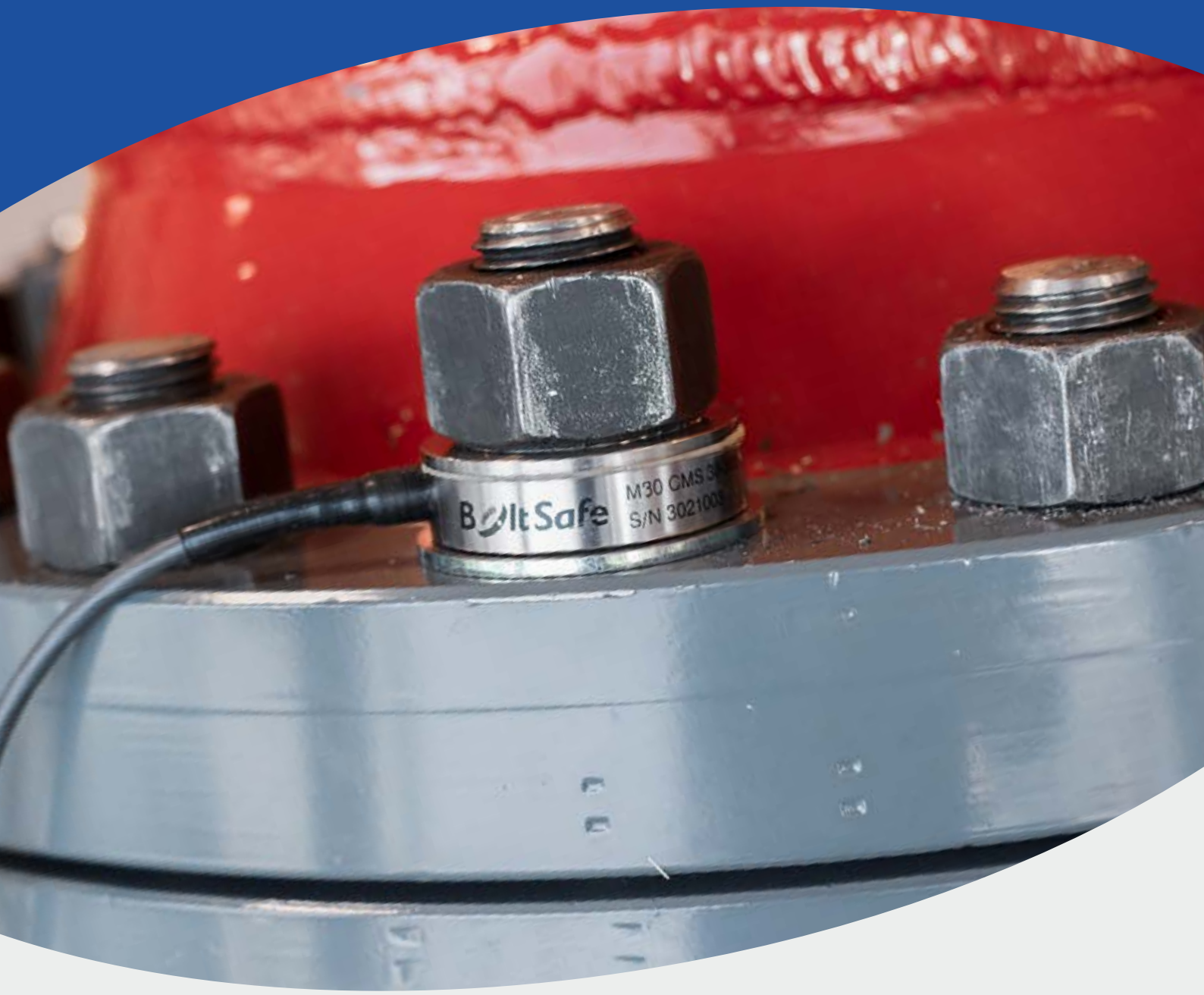
BoltSafe

Load Measuring Systems



Product sheet | CMS Bolt Load Sensor

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How does the CMS bolt load sensor work?

The BoltSafe bolt load cell is a specially designed load cell (load sensor) that monitors the (residual) bolt load in bolted joints. CMS stands for Continuous Monitoring System, which allows for continuous monitoring of the bolt load from one connection point. Several load sensors can be interconnected within a network.

Using a BoltSafe load cell eliminates any uncertainties about the bolt load. This results in enhanced safety, dependable joints and better control over the structure. Besides those safety benefits, the costs during installation and throughout the joint's service life are reduced.

How is the CMS bolt load cell used?

The load cell is shaped and used as a regular washer and is available in sizes M20 to M72 and 7/8" to 2-3/4". Sensors for bolt sizes smaller than M20 and 3/4" are available upon request. The BoltSafe bolt load cell is installed 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 results in minor deformations 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 moment.

Because of the rugged design of the load cells, 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). We do not recommend using the washers in conditions where the temperature is above 80 or below -40 degrees Celsius. Each sensor utilizes an ASIC (Application Specific Integrated Circuit), which performs all signal conditioning and digital communication. Because of this, each BoltSafe load sensor has a unique serial number for individual identification and traceability. The digital monitoring system not only measures the residual bolt load, but can also monitor the sensor temperature.

The calibration of the sensor is done once by BoltSafe. After that, the sensor is plug-and-play and there is no need to recalibrate when different readout methods are used. There is also no need for recalibrating the load cell during its service life, provided that it is used according to its 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 make sure that the temporary construction does not collapse.

Benefits of a continuous monitoring bolt load sensor

With continuous monitoring, it is a lot easier to determine the bolt load while the load cell is mounted, at any time. In addition to checking the bolt load at any given time, it is also possible to view historical data. This helps to determine when and where a problem with the bolt load might have occurred. The CMS sensor is usually slightly smaller than the PMS sensor. Another benefit of the CMS load cell is that it can be linked with other CMS load cells in a network, where data from all sensors can be monitored at once. The live data from the bolt load cells can be checked remotely with different readout methods.

Readout methods that are compatible with the CMS sensor

The CMS load cell data can be read by various readout systems. The first option is our handheld reader, the SM-200. The second method is Network with PDI (CM-1000 box with PDI). The next method is Network with PDI-NT (CM-1000 box with PDI-NT). Another method is the RS-232 and Analog Converter. The last possible readout method is our newest innovation, the IoT-node.

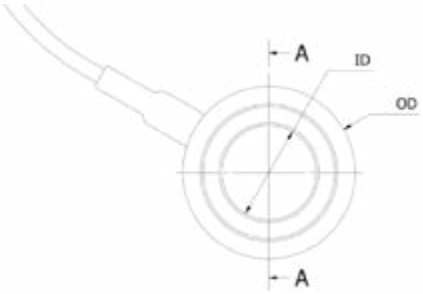
Technical data

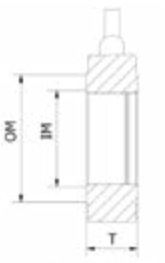
Sizes	To fit bolt sizes from M20 to M72 (7/8” to 2 3/4”)
Cable lengths	Standard: 1 meter (3.3 feet) (5 or 10 m optional)
Full Scale Load (FS)	From 166 kN to 2500 kN (37318 lbf to 562022 lbf) depending on sensor size
Maximum Load at ambient temperature	FS range x 1.3 (without affecting the validity of the calibration)
Temperature range	-40°C to 80°C (-40°F to 176°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°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
Connection	M12 connector male 5 pole
Intrinsic Safe Code	II 2 G, EEx ib IIC T4 (upon special request)

We also produce CMS 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
M20	20,4	0.80	37,0	1.46	14	0.55	73	2.58	166	37318	22,0	0.87	27,7	1.09
M22	22,4	0.88	40,0	1.57	14	0.55	85	3.00	208	46760	24,2	0.95	31,4	1.24
M24	24,4	0.96	44,0	1.73	14	0.55	104	3.67	239	53729	26,4	1.04	33,3	1.31
M27	27,4	1.08	50,0	1.97	14	0.55	137	4.83	315	70815	29,7	1.17	38,0	1.50
M30	30,6	1.20	56,0	2.20	17	0.67	214	7.55	385	86551	33,0	1.30	42,8	1.69
M33	33,6	1.32	58,0	2.28	17	0.67	218	7.69	480	107908	36,3	1.43	46,6	1.83
M36	36,6	1.44	66,0	2.60	17	0.67	295	10.41	560	125893	39,6	1.56	51,1	2.01
M39	39,6	1.56	68,0	2.68	17	0.67	300	10.58	670	150622	42,9	1.69	55,9	2.20
M42	42,6	1.68	75,0	2.95	20	0.79	445	15.70	772	173553	46,2	1.82	60,0	2.36
M45	45,6	1.80	80,0	3.15	20	0.79	506	17.85	905	203452	49,5	1.95	64,7	2.55
M48	48,6	1.91	86,0	3.39	20	0.79	591	20.85	1018	228856	52,8	2.08	69,5	2.74
M52	52,6	2.07	92,0	3.62	20	0.79	669	23.60	1221	274492	57,2	2.25	74,2	2.92
M56	56,6	2.23	100,0	3.94	20	0.79	798	28.15	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
M64HV	68,4	2.69	120,0	4.72	23	0.91	1310	46.21	2100	472099	73,5	2.89	93,0	3.66
M72	72,8	2.87	124,0	4.88	23	0.91	1360	47.97	2250	505820	79,2	3.12	104,0	4.09
M72(HV)	72,8	2.87	124,0	4.88	23	0.91	1370	48.32	2500	562022	78,4	3.09	110,0	4.33





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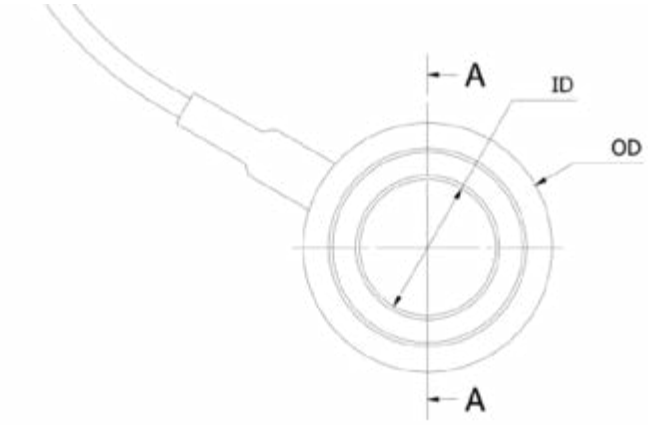
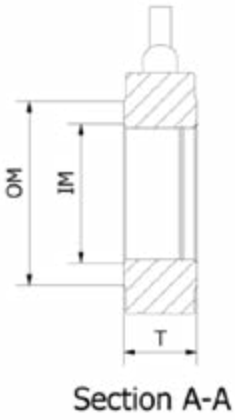
Dimensions of the bolt load sensor (imperial)

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
7/8”	22,6	0.89	47,0	1.85	14	0.55	133	4.69	214	48109	25,8	1.02	32,9	1.30
1”	25,8	1.02	52,0	2.05	14	0.55	160	5.64	280	62947	29,0	1.14	37,1	1.46
1-1/8"	29,0	1.14	57,1	2.25	14	0.55	191	6.74	354	79582	32,2	1.27	41,4	1.63
1-1/4”	32,3	1.27	63,0	2.48	17	0.67	286	10.09	437	98242	35,5	1.40	45,7	1.80
1-3/8”	35,5	1.40	69,0	2.72	17	0.67	343	12.10	529	118924	38,7	1.52	50,0	1.97
1-1/2”	38,7	1.52	78,0	3.07	20	0.79	391	13.79	629	141405	41,9	1.65	54,3	2.14
1-5/8”	41,9	1.65	80,0	3.15	20	0.79	543	19.15	739	166134	45,4	1.79	58,6	2.31
1-3/4"	45,1	1.78	85,0	3.35	20	0.79	608	21.45	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





Section A-A

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