

Hot Dipped Galvanized Structural Bolts and Nuts Require Special Thread Gage Sizes

by Larry Borowski



Many structural bolts and nuts are ordered with heavy coatings on them to increase their resistance to corrosion. The applicable American Society for Testing and Materials (ASTM) standards provide special thread allowances to accommodate the heavy coatings. These heavy coatings can be a major source of assembly problems if the special thread size allowances are not understood and used by bolt and nut suppliers.

ASTM publishes the requirements for inch and metric structural bolts and nuts used in the United States. The structural bolt standards are ASTM A307, A325, A325M, A490, and A490M. The structural nut specifications are ASTM A563 and A563M. The specification numbers ending in “M” cover metric bolts and nuts and those without the “M” cover inch bolts and nuts.

Within these standards, the thread class specified for the uncoated inch bolts is 2A, and for Metric bolts, it is 6g. The thread classes specified for nuts to be used with the uncoated bolts are 2B for inch nuts and 6H for Metric nuts. Thread sizes are of all coarse thread series.

Thread sizes for galvanized ASTM A307 & A325 bolts and A563 nuts

Thread	Bolt		Nut			ASTM Allowance
	Max. Pitch Diam. Go	Maximum Major Diam.	Min. Pitch Diam., Go	Max. Pitch Diam., NoGo	Minimum Minor Diam.	
1/4-20	0.2324	0.2649	0.2335	0.2384	0.2120	0.016
5/16-18	0.2922	0.3283	0.2934	0.2987	0.2690	0.017
3/8-16	0.3501	0.3907	0.3514	0.3571	0.3240	0.017
7/16-14	0.4059	0.4541	0.4091	0.4152	0.3780	0.018
1/2-13	0.4665	0.5165	0.4680	0.4745	0.4350	0.018
9/16-12	0.5268	0.5809	0.5284	0.5352	0.4920	0.020
5/8-11	0.5844	0.6434	0.5860	0.5932	0.5470	0.020
3/4-10	0.7032	0.7682	0.7050	0.7127	0.6620	0.020
7/8-9	0.8229	0.8951	0.8248	0.8330	0.7770	0.022
1.0-8	0.9408	1.0220	0.9428	0.9516	0.8890	0.024
1 1/8-7	1.0540	1.1468	1.0562	1.0656	0.9940	0.024
1 1/4-7	1.1790	1.2718	1.1812	1.1908	1.1190	0.024
1 3/8-6	1.2913	1.3996	1.2937	1.3041	1.2220	0.027
1 1/2-6	1.4163	1.5246	1.4187	1.4292	1.3470	0.027
1 3/4-5	1.6674	1.7973	1.6701	1.6817	1.5840	0.050
2.0-4.5	1.9028	2.0471	1.9057	1.9181	1.8090	0.050

When ASTM A307, A325, and A325M bolts are ordered coated the most commonly specified coatings are hot dipped galvanized per ASTM A153 or mechanical zinc per ASTM B695. When bolts are ordered coated, it is a good practice to order the ATM A563 or ASTM A563M nuts that go with those bolts with the same type of finish. ASTM standards A490 and A490M do not allow any coating to be applied to these bolts as a precaution against Hydrogen Embrittlement.

Galvanizing and mechanical zinc coating deposits alter the sizes of the thread characteristics such as Pitch Diameter, major diameter, and minor diameter by several thousandths of an inch. To prevent possible thread interference between the bolt and nut at time of assembly, the ASTM standards provide a clearance allowance for both in order to accommodate the size changes resulting from the thicker coating.

These coating allowances are provided in a table of each standard, but only ASTM A563 provides the exact thread size limits when the allowances are added. In all other standards the supplier or user must calculate these special thread sizes if they wish to order thread gages to inspect their coated bolts and nuts. To make thread gage ordering easier and more consistent for those wanting to inspect coated structural bolts and nuts, the following two charts are provided.

Thread sizes for galvanized ASTM A325M bolts and A563M nuts

Thread	Bolt		Nut			ASTM Allowance
	Max. Pitch Diam. Go	Maximum Major Diam.	Min. Pitch Diam., Go	Max. Pitch Diam., NoGo	Minimum Minor Diam.	
M5 X .8	4.612	5.132	4.636	4.761	4.290	0.156
M6 X 1.0	5.524	6.174	5.550	5.700	5.117	0.200
M8 X 1.25	7.415	8.226	7.443	7.603	6.902	0.255
M10 X 1.5	9.304	10.279	9.336	9.516	8.686	0.310
M12 X 1.75	11.194	12.331	11.228	11.428	10.471	0.365
M14 X 2.0	13.083	14.383	13.121	13.333	12.255	0.420
M16 X 2.0	15.083	16.383	15.121	15.333	14.255	0.420
M20 X 2.5	18.864	20.487	18.906	19.130	17.824	0.530
M22 X 2.5	20.864	22.487	20.906	21.130	19.824	0.530
M24 X 3.0	22.643	24.592	22.691	22.956	21.392	0.640
M27 X 3.0	25.643	27.592	25.691	25.956	24.392	0.640
M30 X 3.5	28.424	30.697	28.477	28.757	26.961	0.750
M36 X 4.0	34.202	36.801	34.262	34.562	32.530	0.860
M42 X 4.5	39.984	42.905	40.047	40.362	38.099	0.970
M48 X 5.0	45.761	49.010	45.832	46.167	43.667	1.080
M56 X 5.5	53.543	57.115	53.618	53.973	51.236	1.190
M64 X 6.0	61.323	65.219	61.403	61.778	58.805	1.300

Coated nuts must be tapped after coating to achieve the special nut thread sizes indicated above. To be acceptable, coated nut threads must be within both these maximum and minimum size limits. For coated structural bolt threads to be acceptable, they must not exceed the maximum allowable sizes shown above. Thread inspection is to be performed using thread gages made to the sizes in these charts.

When using thread gages to inspect for thread acceptability it is permissible to apply a light machine oil to the thread gages or product to prevent galling and excessive gage wear.

For the product threads to be acceptable the Go thread ring gage must assemble on the bolts, and the nuts must assemble on the threaded Go work plug gage using only hand effort. Because the bolt threads are either 2A or 6g before plating, only the Go ring is necessary to accept parts after plating. For nuts, because they are over tapped after plating, both Go and NoGo must be used to inspect the product threads. In addition, the author cautions users of these standards to verify the maximum minor on the nut threads as there is potential to lose effective material and reduce the proof load capacity. ■