GUARDRAIL FASTENERS

Bolts Nuts & Washers used in guardrail applications are sold under Construction and Materials specification 606. Within 606 are the references to the materials specifications 710.06. This material specification is a reference to AASHTO M180. The vast majority of fasteners will need to meet AASHTO M180.

Material Spec AASHTO M180

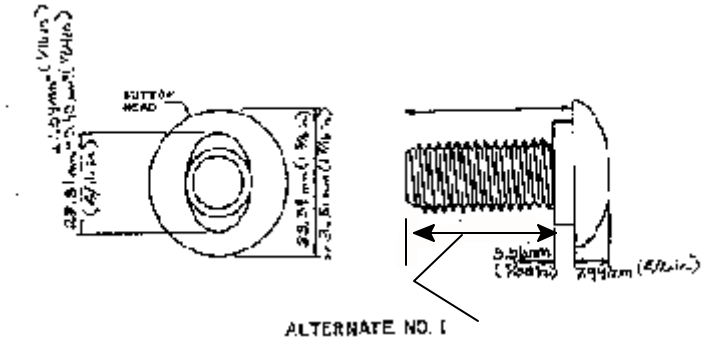
While the guardrail will meet Type II Class A, the specifications for the bolts and nuts are called out in specific sections of the M180 specification. The major difference for bolts, nuts and even washers is the majority of the requirements are not in M180 but listed in other ASTM specifications referenced by the AASHTO specification

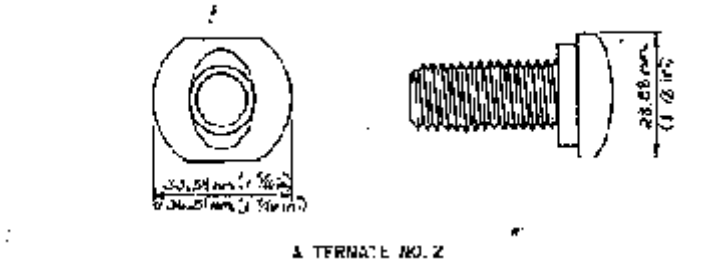
Sections of AASHTO have been repeated below as example.

"Unless otherwise specified, bolts and nuts for Types I, II, and III beams shall conform to or exceed the requirements of ASTM A 307 and shall be coated in accordance with M180, section 9.4"

"All connections or splices shall be formed with oval shoulder button headed bolts to minimize projections on the road side of the guardrail Splice and post bolts and nuts shall conform to one of the configurations shown in Figure 3 or Figure 4. Either of the alternate configurations may be furnished."

(Figure 3 and 4 refer to AASHTO. The figures have been reproduced below to give you an understanding what they describe)





The values for “L” and “T” depend on the length of the bolt. Below is the current table for

“L” length of bolt = DISTANCE FROM UNDER THE HEAD TO THE END OF THE BOLT

“T” minimum thread length of the bolt = LENGTH OF THREADS ON THE BOLT SHANK

Bolt Length “L”	1 1/4	1 3/8	2	8	10	18	24
Thread Length “T”	1	1 1/8	1 3/4	4	4	4	4

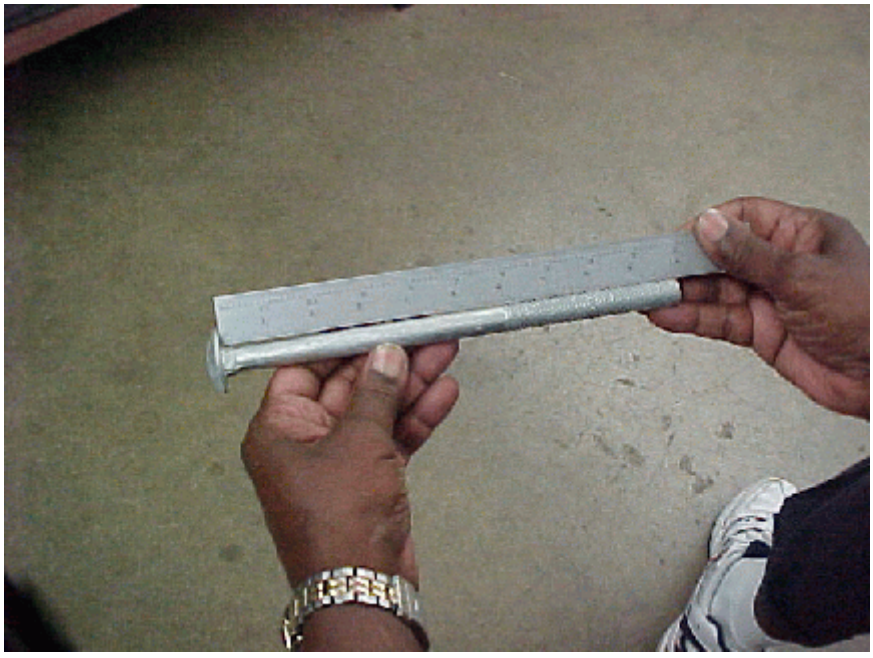
While the table covers most of the standard sizes there may be specials from time to time.

DIMENSIONAL CHECKS

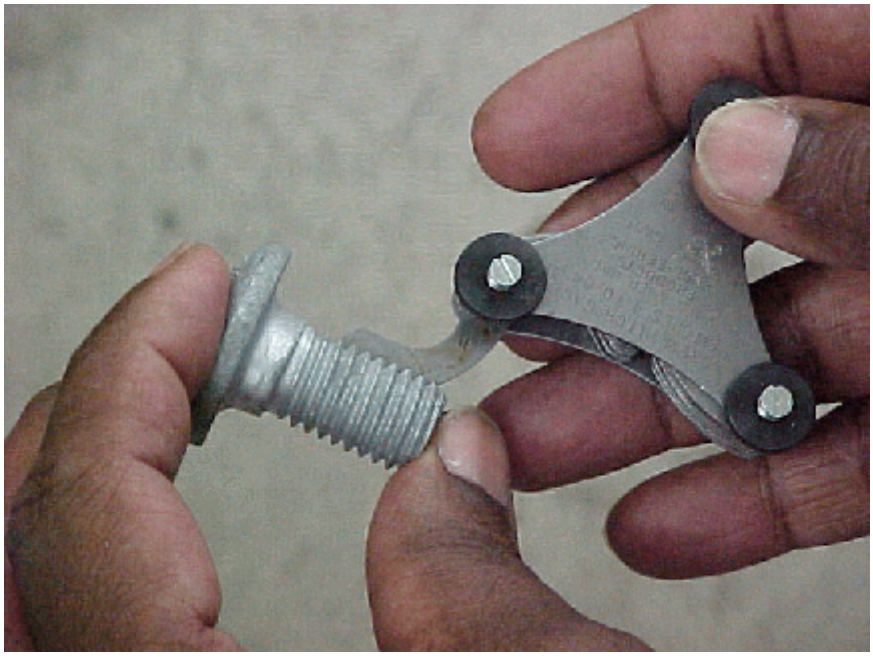
Bolt, nuts and washers should have a random check performed to see they meet the dimensional requirements of the specifications. This typically means checking

Length
Thread Length
Diameter
Bolt threads

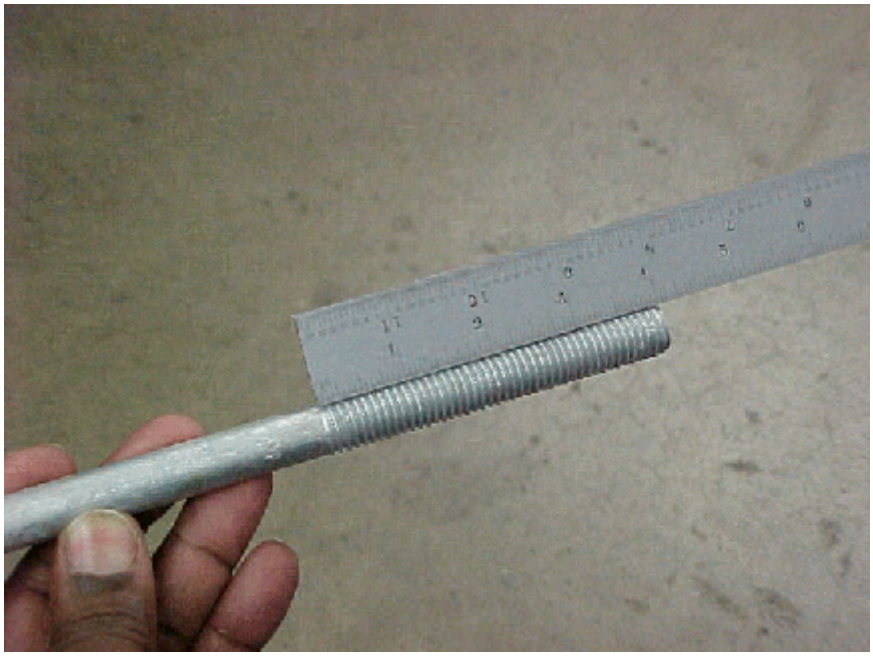
Bolt length and required minimum thread length can be measured with a ruler. Diameter can also be checked with a ruler



Bolt Threads should be spot checked to make sure the 11 threads per inch required for a 5/8" diameter guardrail bolt is what you received.



Thread Length



Bolts (and Nuts) also have chemical requirements to be checked.Unlike guardrail beams that have no chemistry requirements, bolts and nuts do.

Chemical Composition

Chemical requirements for guardrail bolts (and most bolts other than high strength bolts) are listed in ASTM A307. Grade A and B bolts and studs shall have a heat analysis conforming to the requirements specified in the table below and based on the steel producer's heat analysis.

Table 1

	Heat Analysis	Product Analysis
Carbon, Max	0.29	0.33
Manganese, Max	0.90	0.93
Phosphorus, Max	0.04	0.041
Sulfur, Max		
Grade A	0.15	[A]
Grade B	0.05	0.051

bolts and studs are customarily furnished from stock, in which case individual heats of steel cannot be identified.

chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A 751.

Hardness & Proof Load Bolts A307

Hardness and proof load are measurement of the mechanical properties of the Bolts.

TABLE 2 Hardness Requirements for Bolts and Studs

Grade	Length, in.	Hardness[A]			
		Brinell		Rockwell B	
		min	max	min	max
A	Less than 3 × dia[B]	121	241	69	100
	3 × dia and longer	...	241	...	100
B	Less than 3 × dia[B]	121	212	69	95
	3 × dia and longer	...	212	...	95
C	All	No hardness required			

[A] As measured anywhere on the surface or through the cross section.

[B] Also bolts with drilled or undersize heads. These sizes and bolts with modified heads shall meet the minimum and maximum hardness as hardness is the only requirement.

Generally bolts are tested for strength by proofloading. The table below (out of ASTM A307) shows the required proofloads for many A307 bolts.

TABLE 3 Tensile Requirements for Full-Size Bolts and Studs

Bolt Size, in.	Threads per inch	Stress Area,[A] in.^{2}	Tensile Strength, lbf[B]		
			Grade A, min[C]	Grade B	
				min[D]	max[D]
¼	20	0.0318	1 900	1 900	3 180
9/16	18	0.0524	3 100	3 100	5 240
⅜	16	0.0775	4 650	4 650	7 750
7/16	14	0.1063	6 350	6 350	10 630
½	13	0.1419	8 500	8 500	14 190
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
⅝	11	0.226	13 550	13 550	22 600
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
¾	9	0.462	27 700	27 700	46 200
1	8	0.606	36 350	36 350	60 600
1⅛	7	0.763	45 800	45 800	76 300
1¼	7	0.969	58 150	58 150	96 900
1⅜	6	1.155	69 300	69 300	115 500
1½	6	1.405	84 300	84 300	140 500
1¾	5	1.90	114 000	114 000	190 000
2	4½	2.50	150 000	150 000	250 000
2¼	4½	3.25	195 000	195 000	325 000
2½	4	4.00	240 000	240 000	400 000
2¾	4	4.93	295 800	295 800	493 000
3	4	5.97	358 200	358 200	597 000
3¼	4	7.10	426 000	426 000	710 000
3½	4	8.33	499 800	499 800	833 000
3¾	4	9.66	579 600	579 600	966 000
4	4	11.08	664 800	664 800	1 108 000

[A] Area calculated from the equation:

$$A_s = 0.7854\,[D - (0.9743/n)]^2$$

where:

A_s = stress area,
D = nominal diameter of bolt, and
n = threads per inch.

[B] 1 lbf = 4.448 N.
[C] Based on 60 ksi (414 MPa).
[D] Based on 60–100 ksi (414–690 MPa).

The proofload table above shows many different size bolts. The boxed area for a 5/8" diameter by 11 threads per inch bolt, the typical guardrail bolt. All A307 bolts are based on a minimum tensile strength of 60,000 psi. The formula at the bottom of the above table allows you to calculate the proofload if you know the diameter, the number of threads per inch and the minimum allowable ultimate tensile stress. (60,000 psi)

As a general rule: Minimum Allowable Stress X Cross section **Area of bolt = Proofload**

Bolt Markings

Grades A and B Bolts and Studs:

> Bolt heads and one end of studs shall be marked with a unique identifier by the manufacturer to identify the manufacturer or private label distributor, as appropriate. Additional marking required by the manufacturer for his own use shall be at the option of the manufacturer.
>
> In addition to the requirements of 13.1, all bolt heads, one end of studs 3/8 in. and larger, and whenever feasible studs less than 3/8 in. shall be marked with a grade marking as follows.

Grade	Marking
A	307A
B	307B

Product Marking

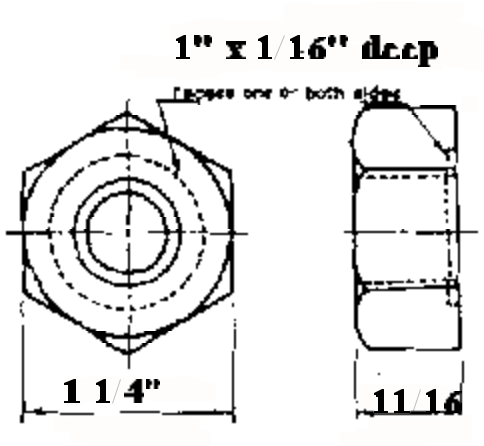
All markings shall be located on the tip of the bolt head or stud end and shall be raised or depressed at the option of the manufacturer.

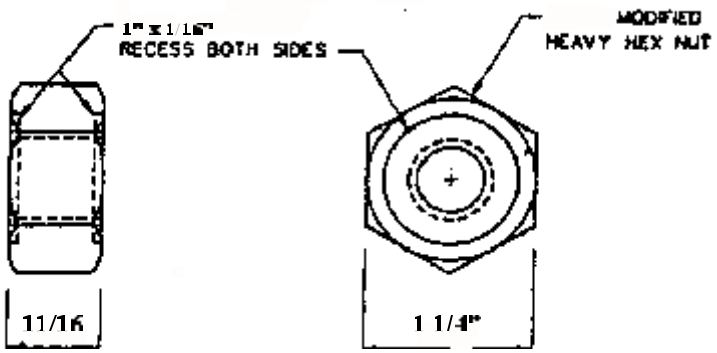
What haven't we covered? Galvanized coating requirements. We will cover this later into this fastener section.

Nuts

Guardrail nuts (and most nuts) conform to the requirements of ASTM A563. This specification covers various types of nuts but guardrail nuts only need to meet the lowest grade of nut in this specification.

Dimensional requirements for nuts. Guardrail nuts are Heavy Hex nuts but are unique in they have offsets on one or both faces





Other size nuts should meet the Dimensional requirements of the table below:

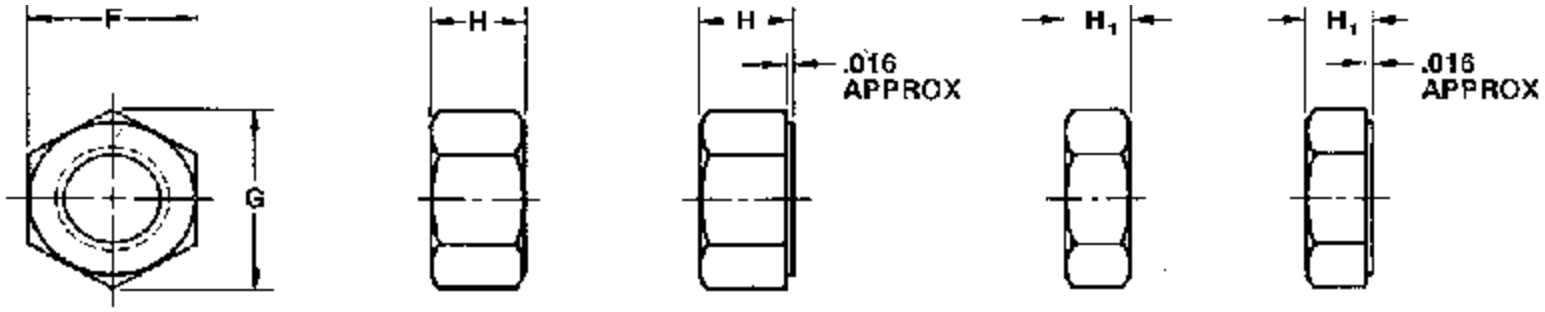


Table 9 Dimensions of Heavy Hex Nuts and Heavy Hex Jam Nuts

Nominal Size or Basic Major Dia of Thread		F			G		H			H_1			Runout of Bearing Face, FIM		
		Width Across Flats			Width Across Corners		Thickness Heavy Hex Nuts			Thickness Heavy Hex Jam Nuts			Heavy Hex Nuts		Heavy Hex Jam Nuts
													Specified Proof Load		
													Up to 150,000 psi	150,000 psi and Greater	All Strength Levels
		Basic	Max	Min	Max	Min	Basic	Max	Min	Basic	Max	Min	Max		
1/4	0.2500	1/2	0.500	0.488	0.577	0.553	15/64	0.250	0.218	11/64	0.188	0.156	0.017	0.011	0.017
5/16	0.3125	9/16	0.562	0.546	0.650	0.622	19/64	0.314	0.280	13/64	0.220	0.186	0.020	0.012	0.020
3/8	0.3750	11/16	0.688	0.669	0.794	0.763	23/64	0.377	0.341	15/64	0.252	0.216	0.021	0.014	0.021
7/16	0.4375	3/4	0.750	0.728	0.866	0.830	27/64	0.441	0.403	17/64	0.285	0.247	0.022	0.015	0.022
1/2	0.5000	7/8	0.875	0.850	1.010	0.969	31/64	0.504	0.464	19/64	0.317	0.277	0.023	0.016	0.023
9/16	0.5625	15/16	0.938	0.909	1.083	1.037	35/64	0.568	0.526	21/64	0.349	0.307	0.024	0.017	0.024
5/8	0.6250	1 1/16	1.062	1.031	1.227	1.175	39/64	0.631	0.587	23/64	0.381	0.337	0.025	0.018	0.025
3/4	0.7500	1 1/4	1.250	1.212	1.443	1.382	47/64	0.758	0.710	27/64	0.446	0.398	0.027	0.020	0.027
7/8	0.8750	1 7/16	1.438	1.394	1.660	1.589	55/64	0.886	0.833	31/64	0.510	0.458	0.029	0.022	0.029
1	1.0000	1 5/8	1.625	1.575	1.876	1.796	63/64	1.012	0.956	35/64	0.575	0.519	0.031	0.024	0.031
1 1/8	1.1250	1 13/16	1.812	1.756	2.093	2.002	1 7/64	1.139	1.079	39/64	0.639	0.579	0.033	0.027	0.033
1 1/4	1.2500	2	2.000	1.938	2.309	2.209	1 7/32	1.251	1.187	23/32	0.751	0.687	0.035	0.030	0.035
1 3/8	1.3750	2 3/16	2.188	2.119	2.526	2.416	1 11/32	1.378	1.310	25/32	0.815	0.747	0.038	0.033	0.038
1 1/2	1.5000	2 3/8	2.375	2.300	2.742	2.622	1 15/32	1.505	1.433	27/32	0.880	0.808	0.041	0.036	0.041
1 5/8	1.6250	2 9/16	2.562	2.481	2.959	2.828	1 19/32	1.632	1.556	29/32	0.944	0.868	0.044	0.038	0.044
1 3/4	1.7500	2 3/4	2.750	2.662	3.175	3.035	1 23/32	1.759	1.679	31/32	1.009	0.929	0.048	0.041	0.046

Chemical Requirements Nuts A563

Chemical Composition: There are various grades of nuts. Generally the O, A, B, C, D is all that you need

Grades O, A, B, C, D, and DH shall conform to the chemical composition specified in Table below.

5a Chemical Requirements for Grades O,A,B,C,D, and DH Nuts:

		Composition %			
Grade of Nut	Analysis	Carbon	Manganese max	Phosphorus max	Sulfur max
O, A, B, C.	heat	0.55 max	...	0.12	0.15[A]
	product	0.58 max	...	0.13[B]	...
D[C]	heat	0.55 max	0.30	0.04	0.05
	product	0.58 max	0.27	0.048	0.058
DH[C]	heat	0.20-0.55	0.60	0.04	0.05
	product	0.18-0.58	0.57	0.048	0.058

A For Grades O,A, and B a sulfur content of 0.23% max is acceptable with purchaser approval.
B Acid bessemer steel only.
C For Grades D. and DH a sulfur content of 0.05-0.15% is acceptable provided the manganese is 1.35%mm

There are other chemical requirements for other nuts. Those are also listed in ASTM A563. The above is an example of the information and would generally cover the guardrail and other nuts used normally with ASTM A307 bolts.

Hardness & Proof Load for Nuts A563

Just like bolts nuts have Hardness and Proofload requirements.

The table on the next page has both the Hardness and minimum required stress for proofload. Nuts do not have a proofload table but the required proofload is established exactly the same way. The minimum ultimate stress is multiplied by the area of the bolt. The nut has to withstand the same load or better.

A second table similar to the hardness and ultimate stress table gives the areas for calculating proofload.

TABLE 3 Mechanical Requirements
Nuts with UNC, 8 UN, 6 UN and Coarser Pitch Threads

Grade of Nut	Nominal Nut Size, in.	Style of Nut	Proof Load Stress, ksi[A]		Hardness			
			Non-Zinc-Coated Nuts[B]	Zinc-Coated Nuts[B]	Brinell		Rockwell	
					min	max	min	max
O	¼ to 1½	square	69	62	109	302	B55	C32
A	¼ to 1½	square	90	68	116	302	B68	C32
O	¼ to 1½	hex	69	62	109	302	B55	C32
A	¼ to 1½	hex	90	68	116	302	B68	C32
B	¼ to 1	hex	120	90	121	302	B69	C32
B	1⅛ to 1½	hex	105	79	121	302	B69	C32
D[C]	¼ to 1½	hex	135	135	159	352	B84	C36
DH[C]	¼ to 1½	hex	150	150	248	352	C24	C36
DH3	¼ to 1	hex	150	150	248	352	C24	C36
A	¼ to 4	heavy hex	100	75	116	302	B68	C32
B	¼ to 1	heavy hex	133	100	121	302	B69	C32
B	1⅛ to 1½	heavy hex	116	87	121	302	B69	C32
C[C]	¼ to 4	heavy hex	144	144	143	352	B78	C36
C3	¼ to 4	heavy hex	144	144	143	352	B78	C36
D[C]	¼ to 4	heavy hex	180	150	159	352	B84	C36
DH[C]	¼ to 4	heavy hex	175	150	248	352	C24	C36
DH3	¼ to 4	heavy hex	175	150	248	352	C24	C36
A	¾ to 1½	hex thick	100	75	116	302	B68	C32
B	¼ to 1	hex thick	133	100	121	302	B69	C32
B	1⅛ to 1½	hex thick	116	87	121	302	B69	C32
D[C]	¾ to 1½	hex thick	150	150	159	352	B84	C36
DH[C]	¾ to 1½	hex thick	175	175	248	352	C24	C36

TABLE 4 Tensile Stress Areas

Nominal Size—Threads per Inch	UNC Tensile Stress Area, A_s, In.^{2}	Nominal Size—Threads per Inch	UNF Tensile Stress Area, A_s, In.^{2}	Nominal Size—Threads per Inch	8 UN Tensile Stress Area, A_s, In.^{2}
¼–20	0.0318	¼–28	0.0364	—	—
5/16–18	0.0524	5/16–24	0.0580	—	—
⅜–16	0.0775	⅜–24	0.0878	—	—
7/16–14	0.1063	7/16–20	0.1187	—	—
½–13	0.1419	½–20	0.1599	—	—
9/16–12	0.182	9/16–18	0.203	—	—
⅝–11	0.226	9/16–18	0.256	—	—
11/16–10	0.334	11/16–16	0.373	—	—
¾–9	0.462	¾–14	0.509	—	—
1–8	0.606	1–12	0.663	1–8	0.606
1⅛–7	0.763	1⅛–12	0.856	1⅛–8	0.790
1¼–7	0.969	1¼–12	1.073	1¼–8	1.000
1⅜–6	1.155	1⅜–12	1.315	1⅜–8	1.233
1½–6	1.405	1½–12	1.581	1½–8	1.492
1⅝–6	1.90	—	—	1⅝–8	2.08
2–4½	2.50	—	—	2–8	2.77
2¼–4½	3.25	—	—	2¼–8	3.56
2½–4	4.00	—	—	2½–8	4.44
2¾–4	4.93	—	—	2¾–8	5.43
3–4	5.97	—	—	3–8	6.51
3¼–4	7.10	—	—	3¼–8	7.69
3½–4	8.33	—	—	3½–8	8.98
3¾–4	9.66	—	—	3¾–8	10.34
4–4	11.08	—	—	4–8	11.81

[A] The stress area is calculated as follows:

$$A_s = 0.7854\left[D - \frac{0.9743}{n}\right]^2$$

where:

A_s = stress area, in.^{2},
D = nominal size, in., and
n = threads per inch.

Nut markings

Nuts made to the requirements of Grades O, A, and B are not required to be marked unless individual marking is specified in the inquiry and order. When individual marking is required, the mark shall be the grade letter symbol on one face of the nut.

Heavy hex nuts made to the requirements of Grade C (Note 4) shall be marked on one face with three circumferential marks 120^O Apart.

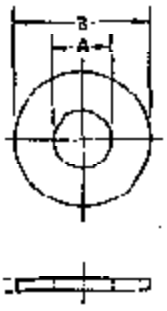
Nuts made to the requirements of Grade D shall be marked with the grade symbol, D (Note 4) on one face.

Marks may be raised or depressed at the option of the manufacturer. However, if marking are located on the bearing surface, they shall be depressed.

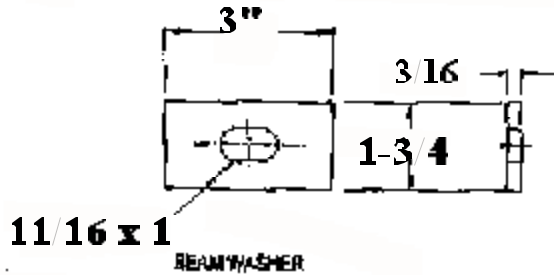
Grade and manufacturer's or private label distributor's identification shall be separate and distinct. The two identifications shall preferably be in different locations and, when on the same level, shall be separated by at least two spaces.

Washers

Discussed earlier washers used for guardrail bolts are rectangular. Other washers generally are round and have dimensions matching the table below.



Nominal Washer Size			A Inside Diameter			E Outside diameter			C Thickness		
			Basic	Tolerance Plus	Tolerance Minus	Basic	Tolerance Plus	Tolerance Minus	Basic	Max	Min
—	—		0.078	0.000	0.005	0.188	0.000	0.005	0.020	0.025	0.016
—	—		0.094	0.000	0.005	0.250	0.000	0.005	0.020	0.025	0.016
—	—		0.125	0.008	0.005	0.312	0.000	0.005	0.022	0.040	0.025
No. 6	0.138		0.156	0.008	0.005	0.375	0.015	0.005	0.049	0.065	0.036
8	0.164		0.188	0.008	0.005	0.438	0.015	0.005	0.049	0.065	0.036
10	0.190		0.219	0.008	0.005	0.500	0.015	0.005	0.049	0.065	0.036
3/16	0.203		0.250	0.015	0.005	0.562	0.015	0.005	0.049	0.065	0.036
12	0.216		0.250	0.015	0.005	0.562	0.015	0.005	0.065	0.080	0.051
1/4	0.250	N	0.281	0.015	0.005	0.625	0.015	0.005	0.065	0.080	0.051
1/4	0.250	W	0.312	0.015	0.005	0.734	0.015	0.007	0.065	0.080	0.051
5/16	0.312	N	0.344	0.015	0.005	0.688	0.015	0.007	0.065	0.080	0.051
5/16	0.312	W	0.375	0.015	0.005	0.875	0.020	0.007	0.083	0.104	0.064
3/8	0.375	N	0.406	0.015	0.005	0.812	0.015	0.007	0.065	0.080	0.051
3/8	0.375	W	0.438	0.015	0.005	1.000	0.000	0.007	0.083	0.104	0.064
7/16	0.438	N	0.469	0.015	0.005	0.922	0.015	0.007	0.065	0.080	0.051
7/16	0.438	W	0.500	0.015	0.005	1.250	0.000	0.007	0.083	0.104	0.064
1/2	0.500	N	0.531	0.015	0.005	1.062	0.030	0.007	0.095	0.127	0.074
1/2	0.500	W	0.562	0.015	0.005	1.375	0.030	0.007	0.109	0.134	0.086
9/16	0.562	N	0.594	0.015	0.005	1.156	0.030	0.007	0.095	0.127	0.074
9/16	0.562	W	0.625	0.015	0.005	1.469	0.030	0.007	0.109	0.134	0.086
5/8	0.625	N	0.656	0.030	0.007	1.312	0.030	0.007	0.095	0.127	0.074
5/8	0.625	W	0.688	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.109
3/4	0.750	N	0.812	0.030	0.007	1.469	0.030	0.007	0.134	0.160	0.109
3/4	0.750	W	0.812	0.030	0.007	2.000	0.030	0.009	0.148	0.177	0.122
7/8	0.875	N	0.938	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.109
7/8	0.875	W	0.938	0.030	0.007	2.250	0.030	0.007	0.134	0.160	0.109
1	1.000	N	1.062	0.030	0.007	2.000	0.060	0.007	0.134	0.160	0.109
1	1.000	W	1.062	0.030	0.007	2.500	0.060	0.007	0.165	0.195	0.138
1 1/8	1.125	N	1.250	0.030	0.007	2.250	0.030	0.007	0.134	0.160	0.109
1 1/8	1.125	W	1.250	0.030	0.007	2.750	0.030	0.007	0.165	0.195	0.138
1 1/4	1.250	N	1.375	0.030	0.007	2.500	0.030	0.007	0.165	0.195	0.138
1 1/4	1.250	W	1.375	0.060	0.007	3.000	0.030	0.007	0.165	0.195	0.138
1 3/8	1.375	N	1.500	0.030	0.007	2.750	0.030	0.007	0.165	0.195	0.138
1 3/8	1.375	W	1.500	0.045	0.010	3.250	0.045	0.010	0.165	0.215	0.153
1 1/2	1.500	N	1.625	0.030	0.007	3.000	0.030	0.007	0.165	0.195	0.138
1 1/2	1.500	W	1.625	0.045	0.010	3.500	0.045	0.010	0.165	0.215	0.153
1 5/8	1.625		1.750	0.045	0.010	3.250	0.045	0.010	0.165	0.215	0.153
1 3/4	1.750		1.876	0.045	0.010	4.000	0.045	0.010	0.165	0.215	0.153
1 7/8	1.875		2.000	0.045	0.010	4.250	0.045	0.010	0.165	0.215	0.153
2	2.000		2.125	0.045	0.010	4.500	0.045	0.010	0.165	0.215	0.153
2 1/4	2.250		2.375	0.045	0.010	4.750	0.045	0.010	0.220	0.340	0.193
2 1/2	2.500		2.625	0.045	0.010	5.000	0.045	0.010	0.238	0.280	0.210
2 3/4	2.750		2.875	0.060	0.010	5.250	0.060	0.010	0.259	0.310	0.220
3	3.000		3.125	0.060	0.010	5.500	0.060	0.010	0.284	0.327	0.235
See Notes 1, 2, 3, 5											



Fastener Coating

Bolts and Nuts:

Bolts and nuts shall be hot-dip zinc coated in accordance with the requirements of M 232, Class C or mechanically zinc coated in accordance with M 298, Class 50, Type 1.

Washers:

Washers shall be hot-dip zinc coated in accordance with the requirements of M232.

AASHTO M232 is equal to ASTM A153. AASHTO M298 is equal to ASTM B695

Weight of Zinc Coating for Various Classes of material

TABLE 1 Mass of Zinc Coating for Various Classes of Material

NOTE 1—Length of the piece, stated in Classes B-1, B-2, and B-3, refers to the overall dimension and not to the developed length.

NOTE 2—Based upon mathematical calculation, 1 oz/ft² of zinc surface corresponds to an average coating thickness of 2.1 mil. Based upon mathematical calculations, 1 g/m² of zinc surface corresponds to an average coating thickness of 0.141 μm; seven times the coating thickness in micrometers is approximately equal to the coating in g/m². References to "coating thickness" or "coating thickness grade," throughout this standard are interchangeable with "mass" in Table 1, in accordance with the above calculation.

Class of Material[A]	Minimum Mass of Zinc Coating, g/m² (oz/ft²) of Surface[B]	
	Average of Specimens Tested[C]	Any Individual Specimen
Class A—Coatings—Malleable Iron, Steel	610 (2.00)	550 (1.80)
Class B—Rolled, pressed, and forged articles (except those which would be included under Classes C and D):		
B-1—4.75 mm (3/16 in.) and over in thickness and over 380 mm (15 in.) in length	610 (2.00)	550 (1.80)
B-2—under 4.75 mm (3/16 in.) in thickness and over 380 mm (15 in.) in length	458 (1.50)	381 (1.25)
B-3—any thickness and 380 mm (15 in.) and under in length	397 (1.30)	336 (1.10)
Class C—Fasteners over 9.5 mm (3/8 in.) in diameter and similar articles. Washers 4.75 mm and 6.35 mm (3/16 in. and 1/4 in.) in thickness	381 (1.25)	305 (1.00)
Class D—Fasteners 9.5 mm (3/8 in.) and under in diameter, rivets, rails, and similar articles. Washers under 4.75 mm (3/16 in.) in thickness	305 (1.00)	259 (0.85)

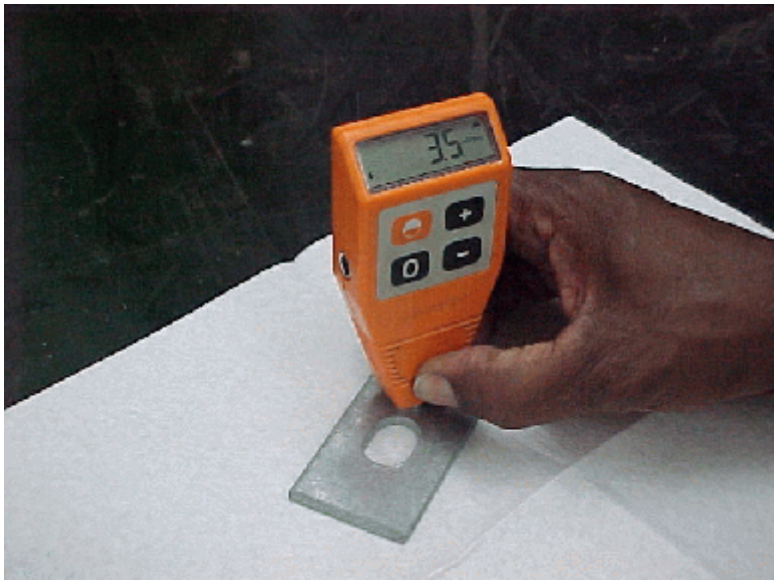
[A] In the case of long pieces such as support rods and similar articles over 1.5 m (5 ft) in length, the mass of coating shall be determined at each end and the middle of the article. In no case shall individual measurements be below the minimum shown in the "Any Individual Specimen" column.

[B] The number of specimens to be tested per lot shall be as specified in Section 5.

Coating Thickness Grade

The table below converts grade (ASTM B695) into mils or oz/sq ft.

Coating Grade	mils	oz/ft^2	um	g/m^2
35	1.4	0.8	35	245
45	1.8	1.0	45	320
50	2.0	1.2	50	355
55	2.2	1.3	55	390
60	2.4	1.4	60	425
65	2.6	1.5	65	460
75	3.0	1.7	75	530
80	3.1	1.9	80	565
85	3.3	2.0	85	600
100	3.9	2.3	100	705



Take (5) Readings with a magnetic thickness gauge; average these readings; and divide by 1.7 mils. Take (3) samples of (5) readings for average.


4.0
F
+
0
-


3.3
+
0
-

Typical galvanizing check example for a NUT.

1 spot requires 5 readings and an average

3 spots and an average are also required

Bolt

Spot	Reading 1	Reading 2	Reading 3	Reading 4	Reading 5	Average (mils)	Average Oz/sq ft
#1	2.4	3.1	4.5	3.8	4.0	3.6	2.1
#2	2.6	2.3	3.2	2.7	3.5	2.9	1.7
#3	3.0	3.4	3.0	2.9	3.0	3.1	1.8
Final Average							1.9

The specification requires 1.25 Oz/sq ft minimum

Certification Acceptance

1. **Bolts:** Require

   Chemistry

   Hardness

   Proof Load

   Coating Check

Example 1

First warning on the possible acceptability of any specification is a certificate of compliance probably means no test data. For this example it isn't totally true. They have chemical data. But:

   No Hardness

   No proof load

   No galvanizing statement or check

Assuming you have checked the dimensions and markings this material doesn't meet until you get a private laboratory to test the for the above data. **REMEMBER YOU SHOULD HAVE ORDERED MATERIALS TO THE AASHTO OR ASTM SPECIFICATION. THEREFORE FOR ANY MANUFACTURER TO STATE IT MEETS THAT SPECIFICATION THERE SHOULD BE TEST DATA TO SUPPORT THAT STATEMENT.**

Example 2 is a good example of certified test data except for galvanizing. If the galvanizing is done by the certified supplier and recorded (along with a spot check of dimensions) the material would be okay.

   Chemistry Okay

   Hardness Okay

   Proof Load Okay

   galvanized check - perform in house record test values

   Spot check dimensions

Example No. 1

CERTIFICATE OF COMPLIANCE

CUSTOMER NAME:

CUSTOMER P.O. :

INVOICE #: **DATE SHIPPED:**

LOT #:

SPECIFICATION: ASTM A307, GRADE A MILD CARBON STEEL BOLTS

COATING: ASTM A153; CLASS C HOT DIP GALVANIZATION

CHEMICAL COMPOSITION

MILL/SUPPLIER	GRADE	HEAT #	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
RARITAN RIVER	1010	F128739	.12	.52	.008	.009	.12				
		F128430	.10	.54	.012	.027	.09				
		F129987	.11	.48	.012	.017	.15				
NORTHWESTERN	1010	81404	.09	.54	.012	.024	.14				
		72459	.10	.38	.010	.013	.11				
JADE STERLING	1010	1W0714	.12	.44	.010	.026	.18				

QUANTITY AND DESCRIPTION:

23400 PCS 5/8" X 18" GUARD RAIL BOLT.

WE HEREBY CERTIFY THE ABOVE BOLTS HAVE BEEN MANUFACTURED BY ROCKFORD BOLT AND STEEL. THE MATERIAL USED WAS MELTED AND MANUFACTURED IN THE U.S.A.. WE FURTHER CERTIFY THAT THIS DATA IS A TRUE REPRESENTATION OF INFORMATION PROVIDED BY THE MATERIALS SUPPLIER, AND THAT OUR PROCEDURES FOR THE CONTROL OF PRODUCT QUALITY ASSURE THAT ALL ITEMS FURNISHED ON THIS ORDER MEET OR EXCEED ALL APPLICABLE TESTS, PROCESS, AND INSPECTION REQUIREMENTS PER ABOVE SPECIFICATION.

TEST METHODS: FA/266
ASTM F606 Sec. 3.4.1- 3.4.3

NVLAP

ACCREDITED BY THE NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM FOR THE SPECIFIC SCOPE OF ACCREDITATION UNDER LAB CODE 200255-0.

Example No 2

TEST CERTIFICATE

Date of Expiration:

DATE:

DESCRIPTION: 5/8"-11 X 10" Guard Rail Bolts
ASTM A307-97(Grade A)

HEAD MARKING: 307A V.
MANUFACTURING DATE:
LOT SIZE:

CUSTOMER:

SHOP ORDER NO.	SIZE	HEAT NO.	C	Mn	P	S	ULTIMATE LOAD LBS.	HARDNESS RHB.
[illegible]	5/8	21924	.09	.46	.009	.007	17,000	77-81
		Bhero Steel	Si	Cu	Ni	Cr	16,900	80-82
		p.o.#13720	.14	.08	.04	.02	16,690	82-81
			Mo	Al	N	Ti	[illegible]	[illegible]
			.007	NIL	.007			
			Cb	B	Sn	V		
					.006	NIL		

*HEAT ANALYSIS

Produced in plant from steel melted and rolled in the U.S.A.
This report contains data which are not covered by the NVLAP Accreditation.(* Not Accredited)
This report shall not be reproduced except in full without approval of the laboratory.
This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.
The results of this report relate only to the items tested.
This report contains data which were produced by a Subcontractor Laboratory Accredited / Not Accredited for the test methods performed.

I CERTIFY THAT THE ABOVE RESULTS ARE A TRUE AND CORRECT COPY OF THE RECORDS PREPARED AND MAINTAINED BY
IN COMPLIANCE WITH THE REQUIREMENTS OF THE SPECIFICATION CITED ABOVE.

Nut Certifications Require

Chemistry

Hardness

Proof Load

Coating

Example 3
If you see a word certificate of COMPLIANCE you are probably in trouble. This is an example.

3.1 Chemistry=Okay

3.2 Hardness=None

3.3 Proof Load=None

3.4 Galvanized Coating - lists a specification but no minimum coating thickness Need to Test

Example 4

4.1 Chemistry=Okay

4.2 Hardness=Okay

4.3 Proof Load=16,950/.226=75,000 psi > 68,000 (the specification requirement)

4.4 Coating=Okay
Spec Acceptable

Example 3

CERTIFICATE OF COMPLIANCE

CUSTOMER NAME:

CUSTOMER P.O. :

INVOICE #: **DATE SHIPPED:**

LOT #:

SPECIFICATION: AASHTO M180 SPECIFICATION FOR HIGHWAY GUARDRAIL

COATING: ASTM A153, CLASS C HOT DIP GALVANIZATION

CHEMICAL COMPOSITION

GRADE	HEAT NO.	C	Mn	P	S	Si
1016	M1346	.17	.65	.008	.010	.19
	B07904	.20	.87	.013	.005	.22

QUANTITY AND DESCRIPTION:

23400 PCS 5/8" GUARD RAIL NUT.

WE HEREBY CERTIFY THE ABOVE PARTS HAVE BEEN MANUFACTURED IN THE U.S.A. WITH DOMESTIC STEEL. WE FURTHER CERTIFY THAT THIS DATA IS A TRUE REPRESENTATION OF INFORMATION PROVIDED BY THE MATERIALS SUPPLIER, AND THAT OUR PROCEDURES FOR THE CONTROL OF PRODUCT QUALITY ASSURE THAT ALL ITEMS FURNISHED ON THIS ORDER MEET OR EXCEED ALL APPLICABLE TESTS, PROCESS, AND INSPECTION REQUIREMENTS PER ABOVE SPECIFICATION.

Example 4 Page 1

MATERIAL CERTIFICATION

Customer: STOCK	Date:
	Invoice #:
	Lot Number:
Part Number: 33403	Quantity:
Description: 5/8 GR NUT	Date Shipped:
Specifications: ASTM A563/A153	Heat #

MATERIAL CHEMISTRY

C	Mn	P	S	Si	Ni	Cr	Mo	V	Al
.15	.46	.01	.15	.05					.058

PLATING AND/OR PROTECTIVE COATING

Hot Dip Galvanized (oz. per sq. ft.)		1.25 Avg.

****THIS PRODUCT WAS MANUFACTURED IN THE UNITED STATES OF AMERICA****

* THE MATERIAL USED IN THIS PRODUCT WAS MELTED AND MANUFACTURED IN THE U.S.A.

WE HEREBY CERTIFY THAT TO THE BEST OF OUR KNOWLEDGE
ALL INFORMATION CONTAINED HEREIN IS CORRECT.

STATE OF_____, COUNTY OF_____

SWORN AND SUBSCRIBED BEFORE ME

THIS _____ DAY OF _____, XX

_____

NOTARY PUBLIC

Example 4 Page 2

LABORATORY TEST CERTIFICATE

Lab. No. :

Received Date :

Heat Code :
P.O. or Work Order No. :
Other Information : SKIPPER'S NO.

Test Specification : F606-ASTM METHODS
Material Type : A 307 GR. A
Material Size : 5/8 GR NUT
Weld Specification :
Completion Date :

OTHER TESTS

Test Type : HARDNESS ROCKWELL B Quantity : 5
Notes/Results/Miscellaneous Information :
A 88-89-90-88
B 87-86-85-87
C 88-86-87-86
D 88-89-87-87
E 86-86-87-86

Test Type : NUT PROOF LOAD Quantity : 1
Notes/Results/Miscellaneous Information :
SAMPLE HAD A PROOF LOAD OF 15,950#'S.

We certify that these tests were prepared and tested in accordance with the referenced specifications.

LAB MANAGER :

Washers

Need Coating

No coating listed on below certification - need to test coating for Spec.

Example 5

March 8, 200[illegible]

Re: Domestic Washers

Dear

manufactures all of our USS, SAE, and F436 Low and High Carbon Washers at our plant. All washers are domestic and conform to Public Fastener Law 101-392.

Any other questions concerning our washers should be addressed to our Quality Control Department.

Thank you for your orders.

Sincerely,

OTHER FASTENER COMPONENTS

Often there are other fasteners, standard A307 bolts, nuts etc. required to meeting standard drawing requirements

ODOT standard end treatments require proof loads. Typically ODOT has both cable type and 1 inch rod types.

Refer to the standard drawing for requirements but generally it is 40,000 proof load.

The other items requiring checking are

Dimensional

Galvanizing

As example the above brace rod would need to meet the 40,000 lb proof load. This could be done by testing or by using the certified test data for ultimate strength; calculating the threaded area and multiplying one times the other to come up with a proof load. The nuts should meet ASTM A563 (standard nuts) and the plate washer should meet dimensional.

All should have galvanized coating thickness checks. If sent out to a galvanizer they should be able to give you their quality control readings as documentation.

The below certification is for the 40,000 proof load cable required in a standard drawings

Date: _____

CERTIFICATION OF COMPLIANCE

This is to certify that the diameter, strand construction, minimum breaking strength, and wire coating weights for RP122260 3/4" 6x19W RRL M30 CL-A SC produced on XC10925 are in accordance to the Standard Specification for Zinc Coated Steel Wire Rope and Fittings for Highway Guard Rail AASHTO Designation; M30-84 and Federal Specification for Wire Rope and Strand RR-W-410D.

I certify that the supplied material is domestic as defined by the Federal Transportation and Assistance Act of 1982 and modified in 1983. All manufacturing processes occurred in the United States.

ACTUAL TEST DATA

Measured Rope Diameter: .772

Strand Construction: 19 Warrington 1-6-(6+6)

Breaking Strength: 57,152 pounds Req'd. 42,800 pounds

Zinc Coating Weights:

Wire Dia.	Min. Oz./Ft.^{2}	Actual Oz./Ft.^{2}
.0395"	N/A	.36
.046"	0.40	.46
.054"	0.40	.48
.061"	0.40	.46

Metallurgy
Assistant

COUNTY OF _____)
)ss.
STATE OF _____)

Before me, the undersigned notary public in and for _____ County and State, appeared _____ personally known to me to be the person who executed the foregoing release and, being first duly sworn, acknowledged the execution of the same to be his free act and deed.

MY COMMISSION EXP. FEB. 23,'00

Notary Public

My commission expires:

This certification also includes the galvanizing coating thickness on the individual wires. What is missing is the galvanizing check on the threaded ends.

PROOF OF DOMESTIC ORIGIN.

THIS HAS BEEN COVERED IN PREVIOUS PARTS OF THIS TRAINING BUT THE STATE LAW AND FEDERAL LAW REQUIRE SOMEONE TO DOCUMENT PROOF OF DOMESTIC ORIGIN.

AT TIMES IT IS AS MUCH OF A PAIN TO US AS IT IS TO YOU BUT

ONE, IT HELPS PARTIALLY PROTECT YOUR JOB

and

TWO, IF YOUR SUPPLIER IS GIVING YOU A LOT OF HEAT ABOUT IT IS IT POSSIBLE THAT THE PROBLEM IS IT IS FOREIGN STEEL.

MAKE SURE YOU HAVE IT COVERED.