

Technical Data [ข้อมูลทางเทคนิค] [อ้างอิงจาก ASTM A490 - 14a]

ASTM A490 : Heavy Hex Structural Bolts

1. Materials [วัสดุ]

Type 1: Medium carbon alloy steel

Type 3: Weathering steel

*** Recommended Nuts and Washers

Bolt Type and Finish	Nuts Class and Finish Specification	Washer Finish
1, plain	A563 : DH, DH3, plain	F436 : plain
1, zinc-coated ^d	A563 : DH [zinc-coated] ^d	F436 : zinc-coated ^d
3, Weathering Steel	A563 : DH3, Weathering Steel	F436 : Weathering Steel

^d Zinc-coated = coated in accordance with Specification F1136(Gr.3) or F2833(Gr.1)

Table1 : Chemical Requirements for Bolts

Element	Type : 1				Element	Type : 3	
	Alloy Steel		Alloy Boron Steel			Alloy Boron Steel	
	Heat Analysis, %	Product Analysis, %	Heat Analysis, %	Product Analysis, %		Heat Analysis, %	Product Analysis, %
Carbon					Carbon		
For sizes through 1 ³ / ₈ "	0.30 - 0.48	0.28 - 0.50	0.30 - 0.48	0.28 - 0.50	Sizes ³ / ₄ " and smaller	0.20 - 0.53	0.19 - 0.55
For sizes 1 ¹ / ₂ "	0.35 - 0.53	0.33 - 0.55	0.35 - 0.53	0.35 - 0.55	Sizes larger ³ / ₄ "	0.30 - 0.53	0.28 - 0.55
Manganese	0.60min	0.57min	0.60min	0.57min	Manganese	0.40min	0.37min
Phosphorus	0.040max	0.045max	0.040max	0.045max	Phosphorus	0.035max	0.040max
Sulfur	0.040max	0.045max	0.040max	0.045max	Sulfur	0.040max	0.045max
Boron	...	...	0.0005 - 0.003	0.0005 - 0.003	Copper	0.20 - 0.60	0.17 - 0.63
					Chromium	0.45min	0.42min
					Nickel	0.20min	0.17min
					Molybdenum	0.15min	0.14min

2. Mechanical Properties [สมบัติทางกล]

2.1 Hardness [ค่าความแข็ง]

Table2 : Hardness Requirements for Bolts

Bolt Size [in]	Bolt Length [in]	Brinell		Rockwell C	
		Min	Max	Min	Max
1/2" to 1", Inclusive	Less than 2D	311	352	33	38
	2D and longer	...	352	...	38
1" to 1 1/2", Inclusive	Less than 3D	311	352	33	38
	3D and longer	...	352	...	38

2.2 Tensile Load and Proof Load [ค่าแรงดึงและแรงดึงพิสูจน์]

Table3 : Tensile Load and Proof Load Requirements for Bolts Tested Full-Size

Bolt Size [in.]	Stress Area [in ²]	Tensile Load, min [lbf]		Proof Load, Length Measurement Method [lbf]	Alternative Proof Load, Yield Strength Method [lbf]
		min	max		
1/2 - 13 UNC	0.142	21,300	24,600	17,050	18,500
5/8 - 11 UNC	0.226	33,900	39,100	27,100	29,400
3/4 - 10 UNC	0.334	50,100	57,800	40,100	43,400
7/8 - 9 UNC	0.462	69,300	79,950	55,450	60,100
1 - 8 UNC	0.606	90,900	104,850	72,700	78,800
1 1/8 - 7 UNC	0.763	114,450	132,000	91,550	99,200
1 1/4 - 7 UNC	0.969	145,350	167,650	116,300	126,000
1 3/8 - 6 UNC	1.155	173,250	199,850	138,600	150,200
1 1/2 - 6 UNC	1.405	210,750	243,100	168,600	182,600

2.3 Tensile Strength [ค่าความแข็งแรงทางแรงดึง]

Table4 : Tensile Strength Requirements for Specimens Machined From Bolts

Bolt Size [in]	Tensile Strength, min [psi]		Yield Strength, min [psi]	Elongation in 2 in, min [%]	Reduction of Area, min [%]
	min	max			
1/2 to 1 1/2, Inclusive	150,000	173,000	130,000	14	40

3. Dimension [รูปร่างและขนาด Bolt A490] (อ้างอิงจาก ANSI B18.2.6)

3.1 Body Length, L [ความยาวของ Bolts]

The bolt length shall be the distance measured parallel to the axis of the product from the bearing surface of the head to the extreme end of the bolt including point. Bolts are normally furnished in 1/4 in. length increments.

[ความยาวของ Bolts จะวัดระยะเริ่มจากส่วนหัวด้านในจนถึงปลายสุด โดยระยะจะเพิ่มความยาวครั้งละ 1/4 นิ้ว]

3.2 Basic Dimensions [ขนาดทั่วไปของ Bolts A490]

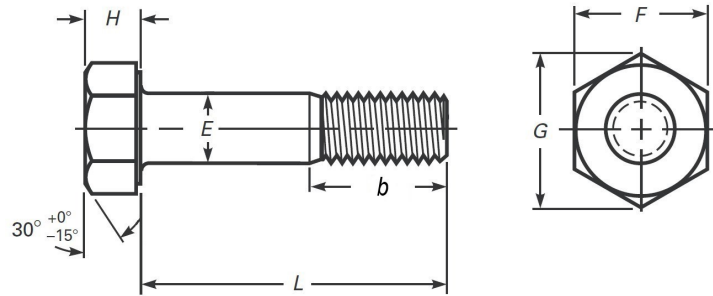


Table5 : Dimensions of Heavy Hex Structural Bolts

Bolt Size [in]	Body Diameter E, [in]		Width Across Flats F, [in]		Width Across Corners G, [in]		Head Height H, [in]		Thread Length, b	
	Max	Min	Max	Min	Max	Min	Max	Min	Bolt Length ≤ 6 in [mm]	Bolt Length > 6 in [mm]
1/2	0.515	0.482	0.875	0.850	1.010	0.969	0.323	0.302	1.00 25.40	1.19 30.23
5/8	0.642	0.605	1.062	1.031	1.227	1.175	0.403	0.378	1.25 31.75	1.47 37.34
3/4	0.768	0.729	1.250	1.212	1.443	1.383	0.483	0.455	1.38 35.05	1.63 41.40
7/8	0.895	0.852	1.438	1.394	1.660	1.589	0.563	0.531	1.50 38.10	1.78 45.21
1	1.022	0.976	1.625	1.575	1.876	1.796	0.627	0.591	1.75 44.45	2.06 52.32
1 1/8	1.149	1.098	1.812	1.756	2.093	2.002	0.718	0.658	2.00 50.80	2.34 59.44
1 1/4	1.277	1.223	2.000	1.938	2.309	2.209	0.813	0.749	2.00 50.80	2.38 60.45
1 3/8	1.404	1.345	2.188	2.119	2.526	2.416	0.878	0.810	2.25 57.15	2.69 68.33
1 1/2	1.531	1.470	2.375	2.300	2.742	2.622	0.974	0.902	2.25 57.15	2.69 68.33

3.3 Length Tolerances [ค่าความคลาดเคลื่อนของความยาว]

Bolt length tolerances shall be as tabulated below. [ค่าความคลาดเคลื่อนของความยาว Bolts กำหนดตามตารางด้านล่าง]

Table7 : Tolerance Requirements for Bolts Length

Bolt Length [in]	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Length ≤ 6 in.	-0.12	-0.12	-0.19	-0.19	-0.19	-0.25	-0.25	-0.25	-0.25
Length > 6 in.	-0.19	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25

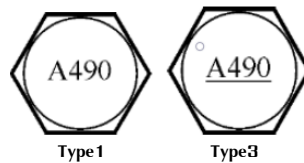
4. Surface and Marking [ผิวและสัญลักษณ์บน Bolts A490]

4.1 Finish/Coatings

- 1. Plain / Black
- 2. Hot-Dip Galvanized [ASTM A153/153M]

4.2 Product Marking

- 1. Type 1 bolts shall be marked "A490"
- 2. Type 3 bolts shall be marked "A490" [with the A490 underlined]



5. Weight [น้ำหนัก Bolts A490]

Table8 : Weight (Kg. / 100 pcs.) of Heavy Hex Structural Bolts

Body Lengths [in]	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
½	5.81	6.40	7.03	7.62	8.26	8.85	9.48	10.07	10.70	11.29	11.88	12.52	13.11	13.74
5/8	9.84	10.66	11.61	12.56	13.52	14.47	15.42	16.33	17.28	18.23	19.19	20.14	21.09	22.04
¾	15.38	16.56	17.69	19.05	20.41	21.82	23.18	24.54	25.90	27.26	28.67	30.03	31.39	32.75
7/8	-	24.04	25.67	27.26	29.12	30.98	32.84	34.75	36.60	38.46	40.32	42.18	44.45	46.27
1	-	-	35.74	37.83	39.92	42.64	44.91	47.17	49.90	52.16	54.43	57.15	59.42	62.14
1 1/8	-	-	-	-	-	-	58.06	60.78	63.96	67.13	70.31	73.48	76.20	79.38
1 ¼	-	-	-	-	-	-	75.75	79.38	83.01	87.09	90.72	94.80	98.43	102.06
1 ½	-	-	-	-	-	-	118.84	123.83	129.73	135.17	141.07	146.51	151.95	157.85

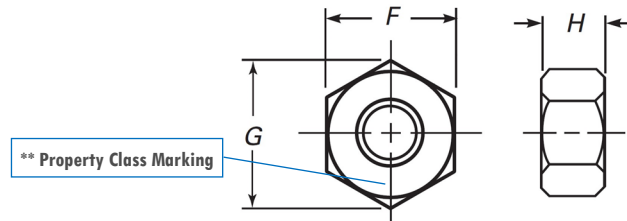
Table8 : Weight (Kg. / 100 pcs.) of Heavy Hex Structural Bolts [Continued]

Body Lengths [in]	5	5¼	5½	5¾	6	6½	7	7½	8	8½	9	9½	10
½	14.33	-	14.56	-	16.78	17.87	19.10	20.32	21.55	-	-	-	-
5/8	23.00	23.95	24.90	25.85	26.81	28.53	30.44	32.34	34.25	36.15	-	-	-
¾	34.11	35.52	36.88	38.24	39.60	42.14	44.91	47.63	52.16	53.07	55.79	58.51	61.23
7/8	48.08	49.90	51.71	53.52	55.34	58.97	62.60	66.22	70.31	73.94	77.56	81.19	85.28
1	64.41	66.68	69.40	71.67	73.94	78.47	83.46	88.45	93.44	97.98	102.97	109.54	112.94
1 1/8	82.55	85.73	88.90	-	94.80	100.70	106.59	112.94	119.29	125.19	131.54	137.44	143.79
1 ¼	106.14	-	113.85	-	121.11	128.37	136.08	143.79	151.05	158.76	166.47	174.18	185.43
1 ½	163.29	169.19	174.63	180.08	185.97	197.31	208.20	219.54	230.88	242.22	253.56	256.28	267.17

ASTM A563 : Heavy Hex Nuts Use With Structural Bolts[A325M]. [อ้างอิงจาก ASTM A563 - 15]

1. Dimension and Weight of Metric Heavy Hex Nuts for Use With Structural Bolts

[รูปร่างและขนาด Nuts A563 + น้ำหนัก] [อ้างอิงจาก ANSI B18.2.6]



*** Recommended ***
Finish/Coatings : Self Color/Black, HDG

Table 11 : Dimension and Weight of Metric Heavy Hex Nuts for Use With Structural Bolts

Nuts Size [in]	Width Across Flats F, [in]		Width Across Corners G, [in]		Head Height H, [in]		Weight [Kg./100pcs.]
	Max	Min	Max	Min	Max	Min	
1/2	0.875	0.850	1.010	0.969	0.504	0.464	3.21
5/8	1.062	1.031	1.227	1.175	0.631	0.587	5.09
3/4	1.250	1.212	1.443	1.382	0.758	0.710	8.82
7/8	1.438	1.394	1.660	1.589	0.885	0.833	12.95
1	1.625	1.575	1.876	1.796	1.012	0.956	18.45
1.1/8	1.812	1.756	2.093	2.002	1.139	1.079	25.42
1.1/4	2.000	1.938	2.309	2.209	1.251	1.187	33.09
1.3/8	2.188	2.119	2.526	2.416	1.378	1.310	43.18
1.1/2	2.375	2.300	2.742	2.622	1.505	1.433	55.10

2. Materials [วัสดุ]

Table 9 : Chemical Requirements for Nuts

Element	DH		DH3	
	Heat Analysis	Product Analysis	Heat Analysis	Product Analysis
Carbon	0.20 - 0.55	0.18 - 0.58	0.20 - 0.53	0.19 - 0.55
Manganese	0.60min	0.57min	0.40min	0.37min
Phosphorus	0.040max	0.048max	0.046max	0.052max
Sulfur	0.050max	0.058max	0.050max	0.055max
Silicon	...	...	...	...
Copper	...	...	0.20min	0.17min
Nickel	...	...	0.20min	0.17min
Chromium	...	...	0.45min	0.42min
Vanadium	...	...	...	...
Molybdenum	...	...	0.15min	0.14min
Titanium	...	...	...	...

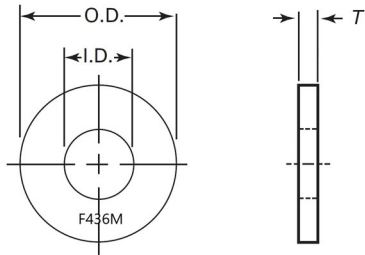
2. Mechanical Properties [สมบัติทางกล]

Table10 : Mechanical Properties Requirements for Heavy Hex Nuts

Size [in]	DH		DH3	
	Proof Load Stress, [ksi]	Hardness, [Rockwell]	Proof Load Stress, [ksi]	Hardness, [Rockwell]
	[Plain, HDG]		[Plain, HDG]	
¼ to 4	175, 150	C24 - C38	175, 150	C24 - C38

ASTM F436 : Metric Hardened Steel Washers. [อ้างอิงจาก ASTM F436 - 11]

Table12 : Dimension and Weight of Washers for Use With Structural Bolts



Size [in]	I.D., [in]		O.D., [in]		T, [in]		[Kg./1,000pcs.]
	Min	Max	Min	Max	Min	Max	
1/2	0.531	0.563	1.031	1.095	0.097	0.177	10.11
5/8	0.688	0.720	1.281	1.345	0.122	0.177	19.00
3/4	0.813	0.845	1.437	1.501	0.122	0.177	22.61
7/8	0.938	0.970	1.718	1.782	0.136	0.177	34.75
1	1.063	1.085	1.937	2.063	0.136	0.177	42.50
1.1/8	1.188	1.251	2.187	2.313	0.136	0.177	55.59
1.1/4	1.375	1.438	2.437	2.563	0.136	0.177	69.35
1.3/8	1.500	1.563	2.687	2.813	0.136	0.177	76.70
1.1/2	1.625	1.688	2.937	3.063	0.136	0.177	101.80

Table13 : Chemical Requirements for Washers

Element	Composition, %	
	Heat Analysis	Product Analysis
Phosphorus	0.040max	0.050max
Sulfur	0.050max	0.006max

**Hardness for Plain Washers = 38 to 45 HRC. **Hardness for HDG Washers = 26 to 45 HRC.