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## ASTM A453 Grade 660 Class D Specification

**ASTM A453 Grade 660 Class D** specification provides a yield strength viz. 95 ksi 655 MPa respectively for use in high temperature service for bolting components such as Stud bolts, screws, nuts, hex bolts & various other fasteners for pressure vessel and valve flanges. [A453 Grade 660 Class D](#) is equivalent to Class A or Class B provided the respective heat treatment cycles are matched while manufacturing in single age hardened condition A453 Grade 660 Cl D Studs and nuts are capable of meeting impact test requirements of 70 joules minimum at - 196 Degrees Centigrade. [ASTM A453 Grade 660 Class D](#) is produced in various other forms like wire rods, round bars, shafts, castings, forgings, threaded bars, threaded rods, wires, tubings, sheets, plates, welding rods, hex bars, Rivets & Springs. *ASTM A453 Grade 660 Cl. D* is high yield Bolting material and hence stress rupture test is not required. [A453 Gr. 660 Class D](#) Bolting has to be certified under nace with the maximum hardness not over 35HRC. Class D Fasteners are certified under API 20F Specification under qualification requirements of BSL-2 & BSL-3. [ASTM A453 Grade 660 Class D](#) UNS S66286 Bolting Duly certified under NORSOK M630 Edition 2020 in accordance with MDS S39 Revision 1. with impact testing @ -101 Degrees C is manufactured at TorqBolt.

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## ASTM A453 Grade 660 Class D Properties

### Chemical Composition

Grade	ASTM A453 Grade 660 Class D	
UNS Number	S66286	
Elements	Content, %	Product Analysis Variation, Over or Under, %
Carbon (C)	0.08 max	0.01 over
Manganese (Mn)	2.00 max	0.04
Phosphorus (P)	0.040 max	0.005 over
Sulfur (S)	0.030 max	0.005 over
Silicon (Si)	1.00 max	0.05
Nickel (Ni)	24.0-27.0	0.2
Chromium (Cr)	13.5-16.0	0.2
Molybdenum (Mo)	1.00-1.50	0.05
Titanium (Ti)	1.90-2.35	0.05
Aluminum (Al)	0.35 max	0.05 over
Vanadium (V)	0.10-0.50	0.03
Boron (B)	0.001-0.010	0.0004 under to 0.001 over

### Mechanical Properties

Grade	ASTM A453/A453M Grade 660		
Class	D (≤2 1 / 2 in. [63.5 mm])		D (>2 1 / 2 in. [63.5 mm])
Tensile Strength,min	ksi	130	120
	MPa	895	825

(\* 100% Hardness Mandatory)

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Yield Strength(0.2 % Offset), min	ksi	105	95
	MPa	725	655
Elongation in 4× Diam, min, %		15	15
Reduction of Area, min, %		18	18
Brinell Hardness Number		248-321	248-321
Approximate Rockwell Hardness,B and C	min	24 HRC	24 HRC
	max	35 HRC	35 HRC
Hardness as per API 20F BSL2 & BSL3*		35 HRC	35 HRC

(\* 100% Hardness Mandatory)

## Heat Treatment

ASTM A453/A453M Grade 660D solution treated and age hardened bolting as stated in API 20F should not be used on pressure containing and high load bearing connectors in the following situations :

- wet/dry offshore and coastal applications in the presence of salt air;
- where it is routine to clean/wash equipment with untreated/raw seawater.
- NOTE 1 - Environmentally assisted cracking, such as stress corrosion cracking (SCC), may result from the presence or accumulation of Chlorides from deposited salt on highly stressed austenitic stainless steel bolting, such as Grade 660D .*
- NOTE 2 - API 6ACRA addresses alternative, higher-strength CRA materials suitable for sour exposure .*

## Annealing & Ageing Cycles

Grade Symbol	Class	Solution Treatment	Hardening Treatment
ASTM A453/A453M Grade 660	D	1650 ± 25 °F [900 ± 14 °C], hold 2 h min, and liquid quench or 1800 ± 25 °F [980 ± 14 °C], hold 1 h min, and liquid quench	1325 ± 25 °F [720 ± 14 °C], hold 16 h, air cool If necessary to achieve properties, second age: 1200 ± 25 °F [650 ± 14 °C] hold 16 h, air cool

(A) Times refer to the minimum time material is required to be at temperature.

## Continuous Heat Treatment Charge Sizes

Diameter, in. [mm]	Weight, lb [kg]
To 1 <sup>3</sup> / <sub>4</sub> [44]	3000 [1400]
Over 1 <sup>3</sup> / <sub>4</sub> [44] to 2 <sup>1</sup> / <sub>2</sub> [63]	6000 [2700]
Over 2 <sup>1</sup> / <sub>2</sub> [63]	12000 [5400]

## Lot / Batch Sizes

Diameter, in. [mm]	Maximum Lot Size, lb [kg]
1 <sup>1</sup> / <sub>2</sub> [38] and under	200 [90]
Over 1 <sup>1</sup> / <sub>2</sub> [38] to 1 <sup>3</sup> / <sub>4</sub> [44], incl	300 [140]
Over 1 <sup>3</sup> / <sub>4</sub> [44] to 2 <sup>1</sup> / <sub>2</sub> [63], incl	600 [270]
Over 2 <sup>1</sup> / <sub>2</sub> [63]	20 pieces

## Marking Requirements

Grade	Marking
ASTM A453 Grade 660 Class D	TB 660D M1/M2/R1/R2 NR
ASTM A453 Grade 660 Class D BSL2	TB NR 660D API 20F2 Heat No.
ASTM A453 Grade 660 Class D BSL3	TB NR 660D API 20F3 Heat No.

## Bolting Threading Types

Specification	Grade	UNS No.	CLASS	Type			
ASTM A453/A453M	Grade 660	S66286	Class D	M1	M2	R1	R2

## ASTM A453 Grade 660 Class D Product Range

Based on the application & Usage



**BARS / RODS**



**FORGINGS**



**HEAVY HEX NUTS**



**BOLTS**



**HEX BOLTS**



**SOCKET HEAD CAP SCREWS**



**PUSH BOLTS / RODS**



**HEX CAP SCREWS**



**SET SCREWS / GRUB SCREWS**



**WASHERS**



**COUNTERSUNK SCREWS**



**U BOLT**



**ALL THREAD STUDS**



**STUD BOLTS**

## ASTM A453 Grade 660 Class D Related Keywords

- A453 660 cl d
- A453 660 class d
- A453 660 d
- A453 gr 660 class d
- A453 gr 660 d
- A453 grade 660 class d
- ASTM A453 660 class d
- ASTM A453 660d
- ASTM A453 gr 660 cl d
- ASTM A453 gr 660 class d
- ASTM A453 gr 660 d
- ASTM A453 grade 660 class d
- ASTM A453 grade 660 d
- ASTM A453/A453m grade 660d
- A453 660d
- A453 gr 660 bolts
- A453 gr 660d bolts
- A453 grade 660 bolts
- ASTM A453 gr.660 cl.d
- ASTM A453 grade 660 bolts
- SA 453 660 d
- SA 453 gr 660 d
- SA 453 gr 660 class d
- SA 453 grade 660 class d
- SA 453-660 d
- SA 453-660 type d

### Specifications

ASTM A453  
 ASTM A638  
 EN 10269  
 EN 10083-3  
 ISO 3506-5  
 DIN 267

### Surface Treatments

Xylan 1070 / 1014 / 1400 / 1424  
 Xylar 2 / 101  
 SermaGard 1105 / 1280  
 Dacromet 320 / 500  
 TakeCoat 1000 Ceramic  
 Magnigard  
 MolyKote

### Certifications

ISO 9001 - 2015 Certified  
 PED 2014/68/EC  
 API 6A ; API 20E; API 20F  
 NACE MR0175/ISO 15156-2  
 NORSOK M-650  
 DFAR  
 MERKBLATT AD 2000 W2/W7/W10

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