

**BEWARE**

# DON'T USE MISMATCHED

It is of the utmost importance to **CORRECTLY MATCH ALL FASTENER COMPONENTS USED IN AN ASSEMBLY** if proper holding power and service life is to be obtained.

**Bolts** - Whilst this section applies in general to all bolts we are particularly discussing commercially used fasteners in the following grades Gr 5, Gr 8 & Gr 9 in UNF / UNC threads and Property Class (PC) 8.8 & 10.9 in metric threads. It does not apply to higher grades fasteners such as the conventional socket head range in PC 12.9 and no advice is given or offered for these products other than to consult an engineer for recommendations as to best assembly to be used.

**Nuts** - A common area of neglect is the nut; just as there are high tensile bolts there are also "high tensile nuts" that can be matched to the corresponding grade of fastener. They will have markings that are similar or corresponding to the markings on the bolt head.

Rather than being seen as the lesser member of the bolt and nut assembly, the nuts perform the crucial function of maintaining the clamping force in the joint

If a lower grade of nut is used on a bolt e.g. a grade 5 nut on a grade 8 bolt it is likely that the threads on the nut will fail before sufficient torque can be applied to create the clamping force that is necessary to obtain proper performance of the bolt. A lower grade nut cannot support the loads that are required and expected of a higher grade fastener and therefore the nut fails first. A nut that is softer than the bolt runs the risk of distorting as the bolt is being tightened and this can cause the nut to jam or freeze to the threads of the bolt. Additional tightening of the nut can cause damage to the bolt through tension or twist which can lead to the failure of the bolt during installation

The old adage "a chain is only as strong as its weakest link" certainly applies to fasteners. The nut grade **must** match or exceed the bolt grade in an assembly.

Australian Standards AS1110 states the following:

**C1 RECOMMENDED COMBINATIONS OF NORMAL, SLOTTED AND CASTLE NUTS WITH BOLTS AND SCREWS**

A steel nut in accordance with AS 1112, when assembled with the equivalent property class bolt in accordance with table C1, has been designed to provide an assembly capable of being tightened to achieve a bolt tension equivalent to the bolt proof load without stripping.

**TABLE C1 - RECOMMENDED COMBINATIONS FOR METRIC FASTENERS**

Class of external threaded fastener	4.6	5.8	8.8	9.8	10.9	12.9
Recommended property class of nut*	5	5	8	9	10	12**

\*Property classes in accordance with AS 1112 \*\* Not commercially available

*The property classes represent the minimum grade of nut which should be selected. Nuts of higher property class may be used.*

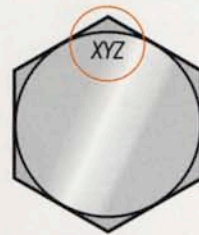
**RECOMMENDED COMBINATIONS FOR SAE/UNIFIED FASTENERS**

Grade of external threaded fastener	5	8	9
Recommended grade of nut	5	8	9

**Standard Bolt Head Markings**

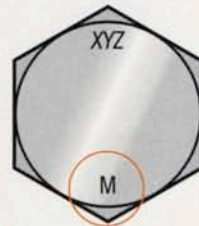
It is important to view the head of the bolt to get an indication of what thread strength each bolt is.

Set out below are the standard head markings used in Australia.



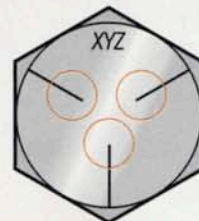
**XYZ = Manufacturer or Suppliers Identification-mandatory head markings**

- Mild Steel Gr 2
- No other markings usually means Whitworth Thread



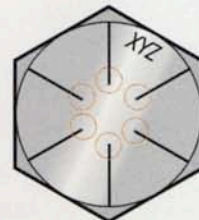
**M = Indicates Metric Series**

- Mild Steel CL 4.6
- Manufacturers or Supplier's Identification



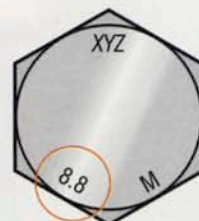
**3 Radial Lines = Indicates Imperial Grade 5**

- Manufacturers or Supplier's Identification
- SAE/Unified Series



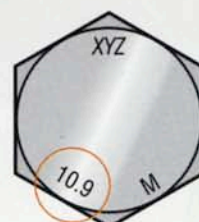
**6 Radial Lines = Indicates Imperial Grade 8**

- Manufacturers or Supplier's Identification
- SAE/Unified Series



**8.8 = Indicates Metric Class 8.8**

- Manufacturers or Supplier's Identification
- Metric Series



**10.9 = Indicates Metric Class 10.9**

- Manufacturers or Supplier's Identification
- Metric Series

# FASTENER COMPONENTS

**Nyloc and Conelock nuts** - (prevailing torque locknuts) it is further recommended that where prevailing torque locking nuts are being used that they be of the same or higher grade than the mating fastener. Conelock nuts are available in high tensile in Gr C (for use with Gr 8 UNF and UNC) and Cl 10 and in nylon locking nuts, (Nyloc Nuts) a full range is available in Gr 8 and Cl 10.

It should be noted that the nylon insert does not increase the strength of the nut or assembly but merely is designed to prevent the nut from rotating off the bolt should tension in the bolt be lost. Another common mistake is confusing the crimp marks on the nut as markings denoting strength or property class. These are crimping impressions only used to retain the nylon insert.

Warburtons strongly recommend that correct matching grades of nylocs be used in an assembly in line with Australian and International standards **and therefore recommend Gr 8 and Cl 10 nyloc nuts only be used with high Gr 8 & CL 10.9 tensile bolts.**

Standard cold forged nyloc nuts are only recommended for use on low tensile mild steel fasteners i.e. BSW or PC 4.6 fasteners.

No fastening system is complete without a flat washer. Washers are used to provide a larger load bearing surface to help reduce the imbedment of either the head of the bolt or the nut into the work surface.

**Washers** - Mild steel washers are commonly used in assemblies however the only problem is that they are very soft. If used in conjunction with a high tensile bolt and matching high tensile nut it will be impossible to achieve, let alone maintain the desired amount of preload upon the connection. The mild steel washer will compress as the bolt is being tightened, which will lead to an increase in the amount of work energy required to stretch the bolt due to compressive friction. If the bolt is subject to vibration or impact the washer can compress even further which may cause the bolt to relax and lose even more of its preload, this can lead to fatigue failure of the bolt. A bolt will lose 30,000 PSI of clamping force for each 0.001 inch of bolt relaxation per loaded inch.

To maintain the integrity of connection **always use a hardened or high tensile washer.** High tensile washers (or commonly termed as a grade 8 washer) are designed to withstand the high loads produced by a high tensile fastener (Gr 5, Gr 8, Cl 8.8 or Cl 10.9) bolt without allowing the washer to compress. These washers are of a comparable Rockwell hardness as the bolt and nut being used and are in the range of Rc 38 to Rc 45.

## Hardness comparison chart (Rockwell C)

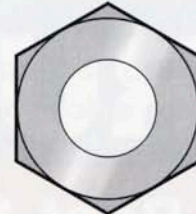
Fastener type	Gr5	Gr8	8.8	10.9	12.9 socket screw	HT washer
Rockwell C Hardness	Rc23-34	Rc33-39	Rc23-34	Rc33-39	Rc38-45	Rc38-45
HT Washer Hardness	RC 38 - RC45					

**Spring Washers & Internal / External Tooth Lock Washers** again like mild steel nyloc nuts, it is strongly recommended that use be confined to mild steel / low tensile assemblies. Where high tensile fasteners are used it is again strongly recommended that flat high tensile washers be used. The main function of these devices are similar to the nylon insert on a Nyloc Nut - they are for preventing the already weakened assembly from further loosening.

Whilst there is a small increase in overall cost the knowledge that the joint is now clamped to desired pre-load through the correct choice of nut, bolt and washer must surely be the governing factor in providing a safe joint assembly.

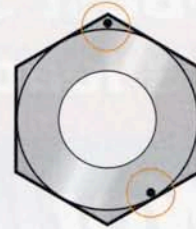
*Thomas Warburton Pty Ltd carry a full range, in all grades and property classes of high tensile bolts, high tensile nuts, conelock nuts, nyloc nuts in mild steel and high tensile and mild steel and high tensile washers.*

## Standard Nut Markings



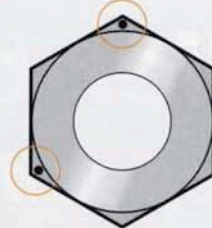
### AS/NZS - 2451

- Hexagon BSW Mild Steel Nuts
- No Markings



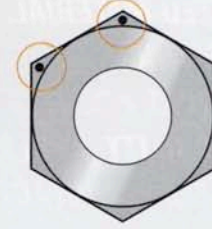
### AS/NZS - 1112

- Hexagon ISO Metric Nuts Prop. Class 5
- (Alternative marking can be 5 on one face of hex flat)



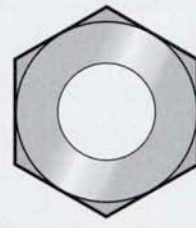
### AS/NZS - 1112

- Hexagon ISO Metric Nuts Prop. Class 8
- Alternative marking can be 5 on one face of hex flat)



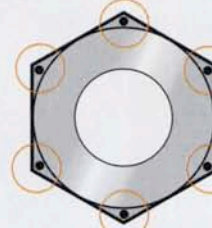
### AS/NZS - 1112

- Hexagon ISO Metric Nuts Prop. Class 10
- Alternative marking can be 5 on one face of hex flat)



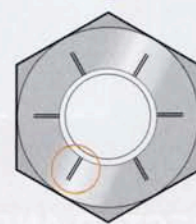
### AS/NZS - 2465

- Hexagon Unified High Tensile UNC/UNF Nuts SAE Grade 5
- No Markings



### AS/NZS - 2465

- Hexagon Unified High Tensile UNC/UNF Nuts SAE Grade 8



### Nyloc Nut

- Marks in side of nut denoting Gr8 or Cl10 notching or may have grade markings on bearing face.

• Crimping marks for nylon