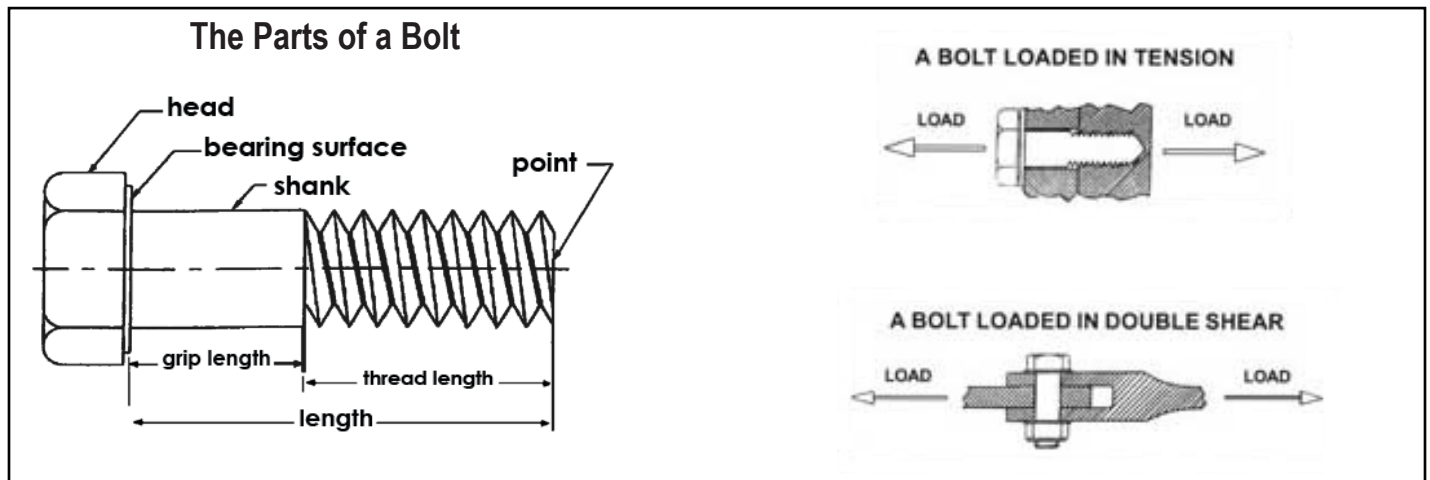


Bolts

General Information & Formulas

The key dimension on aerospace bolts is the grip length. The grip is the unthreaded portion of the bolt underneath the head (see illustration below).

- 1) Within a given diameter (i.e. 1/4, 3/8, 1/2, etc.) of any AN/MS/NAS series, all bolts will have the same thread length, no matter how long the bolt.
- 2) The thread lengths for each series bolt are on the specification prints and in chart form on p. 29 for all sizes from #10–32 through 3/4–16.
- 3) In the commonly specified MS and NAS series bolts, the dash number is the grip in 1/16" (0.0625") increments, e.g. -18 = $18 \times 0.0625" = 1.125" = 18/16"$.
- 4) Thus, to determine the overall length of a bolt, simply add the thread length (for that series and diameter) to the grip length you desire, e.g. NAS 1306–24: grip is 1.50" + threads: 0.578" = 2.078" overall length.
- 5) In AN series bolts, you must have a chart or bolt gauge to determine lengths, grips or part numbers.
THE DASH NUMBERS **DO NOT** INDICATE GRIPS NOR OVERALL LENGTHS.



Bolt Load Capacity Calculations

Load calculations for bolts are always defined by the area of a circle (πr^2 : $\pi = 3.1416$; $r =$ radius of circle or 1/2 the diameter)

The minimum load capacity is calculated at the area it will bear upon times (x) minimum bolt strength rating.

Shear Loads:

Calculate at minimum dimension for full (grip) diameter.

Example NAS1304: $r = .1243$; Area = $\pi r^2 = .049$ square inches.

.049 square inches x 95,000 psi (shear rating) = 4655 lb @ full diameter; single shear

Tensile Loads:

Calculate at maximum pitch diameter: see chart on page 72

Example NAS1304: $r = .1134$; Area = $\pi r^2 = .0404$ square inches.

.0404 square inches x 160,000 psi (tensile rating) = 6464 lb

AN3 – AN20 SERIES: AIRFRAME BOLTS

The most commonly available aircraft-spec bolts: these hex head, fine threaded fasteners have a minimum tensile strength of 125,000 psi and a minimum shear strength of 75,000 psi. Length of thread is consistent within each diameter, and grips (unthreaded shank) are available in 1/8" increments beginning at 1/16". Vastly superior to "Grade 8" tension bolts for almost all shear-type, race car applications.

NAS 1103/6203 AND NAS 1303/6603 SERIES: CLOSE TOLERANCE BOLTS

These fine-threaded, dimpled-head hex bolts have a minimum tensile strength of 160,000 psi and a minimum shear strength of 95,000 psi. Thread length is consistent within each diameter (1103/6203 series have a shorter thread), and grips are available in 1/16" increments beginning at 1/16". Used in applications where a premium-quality, high strength bolt is necessary.

NAS 624/MS 21250 SERIES: 12 POINT EXTERNAL WRENCHING BOLTS

These fine-threaded, twelve-point head bolts have a minimum tensile strength of 180,000 psi and a minimum shear strength of 108,000 psi. Thread length is consistent within each diameter and standard grips are in 1/8" increments beginning at 1/8". These bolts also have a large radius between the bolt head and shank for additional strength. This requires the use of the MS 20002C series beveled washer under the head. A "Superbolt" for the most demanding applications. Please note that odd number grips, i.e. -15, -23, etc., are not standard and may not always be available. Please inquire for specifics.

MS 20004 SERIES: INTERNAL WRENCHING BOLTS

Used where construction necessitates the use of an internal wrenching (Allen hex socket) bolt, they are fine-threaded with a minimum tensile strength of 160,000 psi and a minimum shear strength of 96,000 psi. Standard grips are in 1/8" increments beginning at 1/8". Like the NAS 624 series, they require the use of the MS 20002C beveled washer under the head. Another alternative for critical or limited access applications. PLEASE NOTE THAT HEAD BASE DIAMETERS AND HEAD HEIGHTS ON TWELVE-POINT HEAD AND INTERNAL WRENCHING BOLTS ARE IDENTICAL. Note also that like 12 point bolts, odd number grips are not standard and may not always be available. Please inquire for specifics.

NAS 6303 SERIES: HIGH TEMPERATURE ALLOY HEX BOLTS

Identical in external configuration to the NAS 6203 series bolts listed above. Made from A286 stainless steel alloy, rated for 1200°F operation. Minimum tensile strength is 160,000 psi; minimum shear strength is 95,000 psi. The brake hat bolt of choice for all serious race cars.

NAS1102 SERIES: TORQSETS

These are fully threaded (UNF) 100° flat head screws with a torq-set drive recess; 160,000 psi tensile strength. Used where high strength, a large head area, and a positive drive are required (wings, undertrays, etc.). We also stock the drive tools and mating Tinnerman washers (p. 44).

OTHER MS AND NAS BOLTS

The bolts described above represent over 80% of current race car chassis usage. However, there are many other configurations and materials available under MS and NAS part numbers: contact us with your requirements and we can make a recommendation and provide technical details. **See p. 31 for information on custom configurations.**

*NOTE: Tensile strengths on AN3-AN20 bolts are equal to SAE grade 5.
Tensile strengths on all other series are at least equal to SAE grade 8.*