

Part 3 Identification Marking

Leaflet 3-1 Identification Marking Processes for Aircraft Parts

1 Introduction

- 1.1 The purpose of this Leaflet is to provide general guidance and advice on processes for marking aircraft parts for the purpose of identification. The information given is not applicable to individual items of equipment such as radio equipment and instruments and does not override any instructions given on drawings. Guidance on the determination and position of identification marking of metallic materials is given in Leaflet 3-2 and Appendix.
- 1.2 Schedule 1 of the Air Navigation Order prescribes that all registered aircraft must have a metal name plate fixed near the main entrance of the aircraft, upon which is stamped or engraved the nationality and registration marks and the registered owner's name and address. This metal plate must be fireproof so that there will be means of identification in the event of the aircraft being destroyed by fire. The CAA recommends the use of a stainless steel plate.
- 1.3 To obviate the need for the revision of this Leaflet when new issues of specifications referred to are published, the prefix or suffix indicating the issue number of the specification has been omitted.

2 Identification Markings

- 2.1 Identification markings consist basically of the drawing number, drawing issue number and the inspection acceptance stamp. With some parts further information is necessary, e.g. a batch number, a process symbol or reference number, a non-destructive examination symbol, an assembly drawing number, a serial number and a date. Organisations manufacturing parts should, therefore, have 'inhouse' procedures defining the form and method of part numbering and identification of details, parts and components, so as to ensure that suitable methods, related to the nature, material and form of the part, are consistently applied.
- 2.2 The procedures should recognise that the application of the inspection stamp alongside the part and issue number (being an identification that the part complies with the full requirements of the drawing) has to be permanently legible.
- 2.3 There may also be a need to mark other information on components progressively during manufacture, so as to indicate satisfactory completion of processes or tests. These markings, however, may not need to be legible on the item in the fully finished condition.
- 2.4 Company procedures should define the form of marking for inspection clearance of part-finished items in such a way as to ensure that such parts are not confused with finished parts.
- 2.5 Where the marking process indents the surface of the part, parts for non-destructive examination (such as radiography) should be marked prior to examination. Unless a

marking medium which will not damage the coating is used, parts should also be marked prior to the application of a protective treatment, e.g. anodising.

3 Marking Medium

3.1 The medium selected for marking a part must be based on such factors as the purpose of the part, material from which it is made and critical features such as fatigue and notch sensitivity. Marking should not be made on highly stressed areas, near edges or on sensitive surfaces which may be needed to seal or conjoin. Processes available include etching, engraving, embossing, grit blasting, stamping, transfers, adhesive labels, marking inks and the attachment of metal plates, clips or tags. The following sub-paragraphs give information on the application of the various processes.

3.2 Acid Etching

3.2.1 Acid etching is widely used for marking hardened or delicate steel parts. The etching fluid can be applied to the surface of the part either by a glass pen fitted with a rubber suction cap or by a rubber stamp. Alternatively, the surface of the part may be coated in a suitable substance, e.g. beeswax and the required markings cut into this, followed by the application of etching fluid.

3.2.2 Before etching operations are commenced, the surface of the metal should be thoroughly cleaned. Immediately after marking is completed, the part should be thoroughly washed, dried and protected from corrosion. Pens and stamps used for applying the etching fluid should not be used for any other purpose.

NOTE: During the etching process care should be taken to avoid contact of the etching fluid with hands or clothing.

3.2.3 A fluid often specified for etching steels, other than corrosion-resisting or nitrided steels, is of the following composition:

Selenious Acid	20 g
Copper Sulphate (Crystals)	10 g
Concentrated Nitric Acid	15 ml
Water	80 ml

NOTE: When the fluid is applied to polished surfaces, a black deposit of iron-copper selenite will result.

3.2.4 A fluid often specified for etching corrosion-resisting and nitrided steels is of the following composition:

Selenious Acid	20 g
Copper Sulphate (Crystals)	10 g
Nitric Acid	25 ml
Hydrochloric Acid	60 ml
Water	10 ml

- a) The grey surface film of nitrided steels should be removed in the area to be etched. With corrosion-resisting steels, the fumes from the fluid tend to stain the surface of the parts; therefore, only the area to be marked should be free from storage grease or other protective compound.
- b) The method of application of the fluid and the general precautions to be taken are similar to those given in paragraph 3.2.2. In addition, special care must be taken not to inhale the etching fluid fumes.

3.3 **Electro-Chemical Etching**

- 3.3.1 This method of marking is generally restricted to corrosion-resisting steels, aluminium and its alloys, titanium and its alloys and copper based alloys. This process utilises an electrolytic principle by which marks can be produced on metal surfaces by using an electrolyte in conjunction with a low-voltage, low-amperage current. The process is simple and easy to apply and in general has no significant effect on the strength of metal parts. The colour and depth of marking is directly related to the voltage and amperage, to the direction and duration of current flow and the electrolytic etching fluid used.
- 3.3.2 Equipment and materials should be checked at regular intervals by etching a test piece and measuring the depth of etched area. This depth should not normally exceed 0.025 mm (0.001 in). In addition, different types of metals require different etching fluids and the instructions given on the relevant drawing or process specifications should be closely followed. This method of marking cannot be used on non-conductive surfaces.
- 3.3.3 The equipment required for the electro-chemical process consists of an electrical power-unit with a means of output adjustment (which usually embodies an automatic timing control), stencils and electrical contact devices. The marks to be etched can be produced either on paper stencils by typing, by stylus or metal stamp, or on plastics stencils by an electronic process. Paper stencils have an approximate life of 200 impressions, whereas plastics stencils have an approximate life of 2,000 impressions. Electrical contact devices may take the form of a bench pad, marking control head, roller and various types of pen. Basically all contact devices provide a means of connecting the part to be marked to the power-unit via the stencil and a felt or cotton-wool pad impregnated with electrolytic etching fluid. The circuit is completed by the attachment of a ground pin which may be embodied in the electrical contact device, but which, in any case, must make a good electrical contact and be attached adjacent to the area which is to be marked.
- 3.3.4 Before etching is commenced the surface of the part should be thoroughly cleaned. The stencils should be in good condition and should be discarded if they are distorted or ruptured, or the mark becomes obliterated. Pad holders should be used with the same electrolytic etching fluid throughout their life and the pad should always be kept moist with electrolyte and renewed when discoloured. All electrical plugs, sockets and ground pins should be checked to ensure good electrical contact. After etching, the part must be neutralised by the application of a suitable agent and thoroughly washed and dried.
- 3.4 **Electrical Etching.** Etching by the use of an electrical pencil, employing either the constant contact or intermittent principle of operation, causes the material to be severely overheated locally and should not be used for the marking of aircraft parts.
- 3.5 **Vibro-Etch Engraving.** This is a vibro-percussive engraving process, also known as 'Vibro-Peen' or 'Vibro-Percussion'. Generally, an electrically or pneumatically operated hand tool with a vibrating stylus is used. Marking by this process avoids the local overheating caused by electrical etching and if lightly applied has little effect on the

fatigue life of the part. Nevertheless, careful supervision is necessary to control the depth of marking and to have strict control of tip radius. Its use in a highly stressed area is not recommended. Inspectors' personal identification letters and numbers should be encircled with a vibro-etched ring to distinguish them from part numbers, issue numbers or date codes.

3.6 **Machine Engraving.** In this process the identification marks are produced by a mechanically guided rotating cutter or grinder normally controlled via a pantograph. The mark dimensions are limited by the size of the cutter and the size of the pantograph used. This process is sometimes used for stressed parts of high-grade steels or high-grade aluminium alloys. The depth of the marks is normally kept to the minimum compatible with clarity. The cutter or grinder used must be rounded, so that sharp corners or cuts are not produced on the part. This method is also used for engraving information or instructions on placards and name plates.

3.7 **Embossing**

3.7.1 In this process, which is suitable for castings, forgings and mouldings, the identification markings are inherent in the mould or die and are produced as part of the manufacturing process. The marks may either be raised or depressed but should not be located on an area of the part which is subject to subsequent machining.

3.7.2 The embossing process is also suitable for application to polytetrafluoroethylene (PTFE) and plastics materials after manufacture of parts. In this case the identification marks are produced by application of controlled heat and pressure via the medium of a die so as to transfer pigment from specially prepared coloured foils onto the prepared area of the part. Colours should be selected to contrast with the background colour of the part.

3.8 **Grit Blasting.** In this process, marks are produced by applying a controlled jet of abrasive material, in conjunction with rubber or plastics stencils, to specific areas. This process may be employed with advantage in certain circumstances, e.g. marking transparent plastics and hard anodised surfaces. The type and grade of abrasive material, air pressure and period of application is normally specified on the drawing. The process is not suitable where contamination by the abrasive material can occur, e.g. parts containing ball, needle or roller bearings and hollow parts. The depth of marking produced by this process is slight and is, therefore, not suitable for parts to which a protective finish will subsequently be applied. This process is not normally permissible for magnesium alloy materials.

3.9 **Stamping**

3.9.1 In this process, steel stamps are used for marking and these can be applied either by mechanical means or by hand in accordance with the drawing instructions. There are various types of machine available for marking parts with steel stamps and it is quite usual for a machine to be specified for this operation, as it can be pre-set to control the depth of the impression.

3.9.2 The indentations resulting from this form of marking can, unless carefully controlled, have a serious effect on the strength of parts and may lead to a considerable reduction of resistance to fatigue. Normally steel stamps are not used on aluminium alloy sheet thinner than 20 s.w.g. or on high strength aluminium alloy parts, or parts made from steel with an ultimate tensile strength in excess of 850 MN/m^2 (55 tonf/in^2).

3.9.3 When steel stamps are used, they should not be larger than is necessary for clarity and a type size of 1.58 mm (0.0625 in) or 2.38 mm (0.09375 in) is usually found to be satisfactory. The symbol should not embody sharp points and should be shaped to produce a depression of 'U' rather than 'V' form. The depth of the impression

produced should be kept to the minimum particularly when applied to parts fabricated from sheet material, the impression should not result in embossment of the reverse surface. Worn stamps should not be used, since the additional hammering necessary to obtain an impression may affect the characteristics of the material. During any stamping operation, the part should be adequately supported by a backing block which has a smooth surface.

- 3.10 **Transfers.** In this process, marks are produced by the application of a prepared wet transfer, bearing the required markings, on the surface of the part to be marked. When dry, the transfer backing is removed leaving a film of the marking which is finally coated with a protective varnish. It is essential that the area of the part to be marked is thoroughly cleaned before the application of the transfer. Transfer markings do not physically alter the surface of the part and are suitable for application after completion of protective treatment. In general, this method can only be regarded as semi-permanent and only recommended for the identification of assemblies.
- 3.11 **Adhesive Labels.** In this process, marks are produced by the application of a label consisting of a foil (backed with adhesive) on which the marks are impressed prior to its being attached to the part. Such labels are often used for the identification of highly stressed components and since the adhesive is unaffected by temperature and most fluids, they provide a permanent identification without any indentation of the part. Where difficulty is experienced in the adhesion of such labels or where metal labels without adhesive backing are used, the application of a suitable flexible adhesive is specified. The possibility of dissimilar metals in juxtaposition setting up corrosion should be borne in mind and in particular, aluminium or zinc labels should not be used on parts manufactured from nickel base alloys, unless they have been cadmium plated.
- 3.12 **Marking Inks.** Marking by means of a suitable ink applied by rubber stamps or stencil is often specified for marking timber, plastics, fabrics, or metal parts which can only be marked after the completion of a protective treatment. It is common practice, particularly with metal parts, to have the area to be marked first painted with a white primer onto which the marks are applied; the area then being protected with an environmentally suitable clear varnish. To avoid deterioration of some materials, as a result of chemical reaction from the ink, it is important that only the ink specified is used (for an example see paragraph 5.9).
- 3.13 **Metal Clips, Plates or Tags.** In general, marking of parts by the attachment of clips, plates or tags is used where the size, shape, finish or material of the part precludes the application of markings to the surface. Further information on metal clips, etc., and other special applications is given in paragraph 5.

4 Position of Markings

- 4.1 The position of the markings and the process to be employed, is usually indicated on the drawing. The location selected for application of markings should always be remote from bearing surfaces, edges, holes, bends, changes of section, narrow or highly stressed areas and surfaces which have been hardened for a specific purpose. Certain manufacturers standardise the marking medium to be used on various materials and issue this information to the workshops as an internal specification, usually by adding a code number on the drawing. Any mark signifying inspection approval should be applied adjacent to the identification markings.
- 4.2 All markings should, if possible, be grouped together and positioned where they will not be obliterated or concealed by subsequent machining or assembly.

- 4.3 When sheet metal parts are heat-treated prior to manipulation, it is usual, where steel stamping is permitted, to apply a cipher to the parts so that the particular heat treatment batch can be identified subsequently. The position of the cipher should be carefully selected before heat treatment and manipulation. If after manipulation the cipher appeared on a bend this would usually lead to rejection of the part.
- 4.4 There are several reasons why the marking of some parts is unpractical, amongst these being size, hardness and fragility. Typical examples are hardened steel springs, bolts of less than 6.35 mm (0.25 in) diameter, nuts of less than 9.52 mm (0.375 in) diameter, split pins and taper pins. In such instances, it is permissible to pack the parts in a suitable container, which should be sealed with the identification and inspection approval applied.
- 4.5 When individual parts are fabricated into assemblies, the appropriate assembly drawing number and drawing issue number should be applied, together with the inspection approval mark, in the manner and position indicated on the drawing.
- 4.6 Information on the application of serial numbers is given in paragraph 6.

5 Special Applications

- 5.1 Because of factors such as shape, material characteristics, etc., it is not always possible to mark all parts in the normal way. The following paragraphs give guidance on the marking of such items.
- 5.2 **Bolts.** Part numbers and inspection stamps should be marked on the flat portion of the head; marking of the shank is not permissible. With cold-headed bolts, the inspection stamp may be omitted, provided the bolts bear the maker's identification symbol and are packed in sealed containers bearing evidence of inspection approval.
- 5.3 **Cable Assemblies**
- 5.3.1 It is recommended that swaged-end cable assemblies should be marked on the swaged shank of the end fittings by a rolling process, but if the necessary equipment is not available, the markings should be applied by a vibro-etching process.
- 5.3.2 If identification tags are fitted on swaged-end cables, they would have to comply with a specification such as British Standard SP51-52 and should be fitted as shown in Figure 1 or, when fitted to cable ends without locking wire holes, in accordance with the approved cable assembly drawings. Tags not covered by a specification, or tags fitted in a manner other than as given above, are unacceptable.

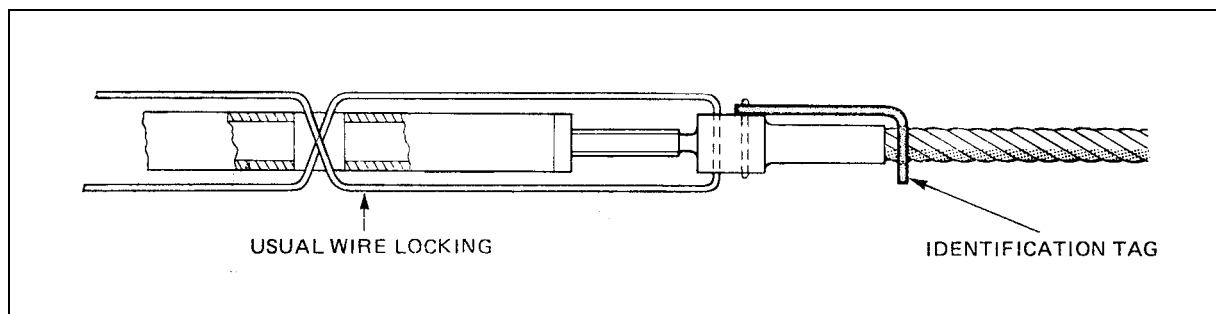


Figure 1 Cable Assembly Identification

- 5.3.3 Identification tags should be attached to spliced cables as shown in Figure 2. Where cast or pulley type thimbles are used, the identification marks can be applied direct to these items.

NOTE: If after the installation of a cable in an aircraft there appears to be any likelihood of the tag subsequently coming loose or causing jamming, it should be removed and the particulars on the tag should be entered in the aircraft log book or maintenance record.

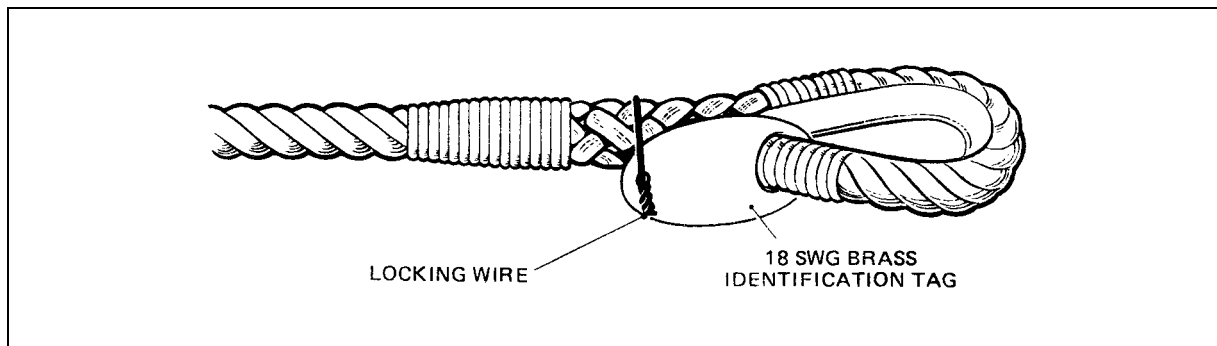


Figure 2 Method of Attaching Identification Tag to Spliced Cable

5.4 Castings

5.4.1 Castings should be marked, batched or tallied as soon as possible after removal from the mould, in a manner which will enable them to be correlated with the relevant mechanical tests and analytical records. The position of the marks should be in accordance with the relevant drawings, but if the position is not indicated on the drawing, thin sections liable to damage should be avoided and if possible, the markings should be placed where they will not be removed by subsequent manufacturing processes.

5.4.2 In many instances raised panels are produced as part of a casting especially for the application of identification marks; in which case the casting should not be marked in any other position.

5.4.3 Small castings from the same batch and for which the size is inconsistent with the display of part marking with adequate clarity may be packed in bags or bundles. The appropriate markings should however be stamped on a metal label securely attached to each bag or bundle.

5.5 **Nuts.** Where identification marks are necessary, i.e. on nuts of 9.52 mm (0.375 in) diameter or more, they should always be applied to the hexagonal sides of the nuts and in no circumstances to the mating surfaces, since this could result in the scoring of underlying metal when the nut is assembled.

5.6 Pipes

5.6.1 Pipes manufactured of material which may be soft soldered are usually marked by means of a brass plate bearing the appropriate data. The inspection stamp should be impressed on the plate just before it is assembled, but in instances where this procedure is unpractical, the stamp may be impressed in a blob of solder beside the plate. It is essential to ensure a complete soldered bond between the plate and the pipe, since flux residue may cause corrosion.

5.6.2 Where soldering is unpractical, pipes may be marked by electro-chemical etching, see paragraph 3.3, or by a rubber stamp using a non-corrosive dye, or by a specially made flexible slip-on sleeve. In some instances an adhesive label is used, but wrap-round or tie-on metal identification tags should not be used.

NOTE: Cases have occurred where metal identification tags have worn a pipe to paper thinness and in the course of time, have produced a pin hole leak under the tag.

5.6.3 Information on the identification marking of aircraft pipe systems is given in British Standard M23.

5.7 **Plastics**

5.7.1 The method of marking plastics parts depends on the thickness, shape and material of the part to be marked. With the majority of plastics produced by a moulding process, the identification markings are included in the moulding, but in the following paragraphs consideration is given to the marking of plastics produced by other processes.

5.7.2 **Glass-fibre Reinforced Plastics Laminates**

- a) On equipment subject to stress, vibro-etching should not be used because it can break strands and create stress raisers. In such cases the component should be marked with either white paint and indian ink, or a rubber stamp on a white painted surface.
- b) In instances where the weave pattern of the reinforcing cloth stands slightly proud of the surface, a rubber stamp and marking ink may be used. Before applying the mark it is essential that the release agent should be removed from the surface of the sheet in the area where it is to be marked. White spirit will remove most release agents, which differ according to the type of material, but it will not remove all traces of silicone. For most purposes, it is recommended that the area to be marked should be lightly rubbed with fine abrasive cloth.
- c) For non-stressed parts and if the laminate has a smooth surface, the use of a vibro-etching process is suitable. An ink or dye can be wiped over the etched surface so that the letters show more clearly.

5.7.3 **Thermo-plastics.** Thermo-plastics, such as cellulose derivatives and vinyl resins, are materials which can be made pliable by heat and which retain their original properties when cooled, it being possible to repeat the process any number of times without appreciable change in properties. All thermo-plastics, with the exception of certain forms of celluloid and vinyl acetates, can be marked satisfactorily with heated dies, but this method may not be suitable for tubular sections. However, the die temperatures vary with different materials and the recommended temperature should be ascertained from the manufacturer.

5.7.4 **Thermo-setting Plastics.** Thermo-setting plastics are materials in which a chemical reaction takes place while they are being moulded under heat and pressure. The chemical and physical properties of the material are entirely changed and it is subsequently resistant to further applications of heat. The heated die process is not suitable for materials in this group and for the majority of applications the vibro-etching method can be used, but where this may cause damage to the material, white paint and marking ink may be preferable.

5.7.5 **Transparent Plastics.** The marking of parts manufactured of transparent plastics materials should be avoided where possible. If the material is bonded permanently to a metal frame it is preferable to apply the marking to the metal portion. However, if it is necessary to apply identification markings to transparent plastics, these should be applied to the inner face of the panel by means of mild sandblasting and stencil. When it is necessary to mark a part temporarily, a label should be affixed by means of masking tape but labels should not be stuck directly to the material. When parts are annealed by the process prescribed in specification DTD 925, this should be indicated by marking the part in the manner described above, with the legend 'DTD 925', followed by the date.

5.8 Propellers

5.8.1 In the case of wooden propellers, it is usual to apply steel identification stamps on the rounded portion of the boss, so positioned that the markings will not be obscured by the engine hub or the spinner. Inspection stamps are usually applied to indicate approval of the various stages of inspection, i.e. timber and cementing, inspection in the white and final inspection.

5.8.2 In the case of metal propellers, identification marks may be applied by using a suitable acid etching process. It is essential however, that careful control of this process be exercised to avoid weakening the metal or setting up stress raisers as a result of etching to an excessive depth.

5.9 **Radiators and Oil Coolers.** With the exception of components manufactured of light alloy, the identification marking should be stamped on a brass plate soft soldered to the casing adjacent to the inlet neck. Inspection approval is usually indicated by the application of a metal stamp in a blob of solder adjacent to the plate.

5.10 Rescue Equipment

5.10.1 Rescue equipment such as dinghies and life jackets should be marked with the manufacturer's identification symbol, the date of manufacture, the serial number and an inspection stamp. The marking medium used should have no deleterious effect on the fabrics to which they are applied. An ink containing phenol should not be used on nylon and an ink containing copper should not be used on rubber fabric as it would cause considerable damage after ageing and exposure to the air.

5.10.2 A record should be maintained by the manufacturer by which the serial number of each component can be correlated with the roll numbers of the fabric from which it was made and also with the batch number of such items as valves, CO₂ cylinders and webbing.

5.10.3 When rescue equipment components are repaired, inspection approval should be signified by the application of an inspection stamp and the date of that repair along with the part number for that component, on a record label attached to the component. Where overhauls or inspections are completed in accordance with the time/life requirements of an approved Maintenance Schedule, it is recommended that the date when the next inspection or overhaul is due is also entered on the record label.

5.11 **Tanks.** Tanks manufactured of light alloy material not provided with a metal data plate should be marked by coloured paint or ink on a white paint background. A rubber inspection stamp should be used and when the markings are complete, they should be protected by a coat of clear varnish.

5.12 **Timber.** All timber parts should be marked with a rubber stamp and ink and should be date stamped to enable the age of the part to be subsequently ascertained.

5.13 Tubes and Tubular Structures

5.13.1 Difficulty is sometimes experienced with marking steel tubes. A steel or brass plate applied in a manner similar to that described in paragraph 5.9 is sometimes used, but it should be noted that soldering H.T. steel tubes can adversely affect the fatigue resistance. In some instances a rubber stamping procedure is used. This consists of applying a rubber stamp, using a suitable ink, to a white paint background and then protecting the markings with a specified clear varnish. Adhesive labels are also often used.

- 5.13.2 In instances where the diameter of the tube is sufficiently large and at least one end is open, the markings may be applied around the circumference of the tube near one end, while the tube is supported internally by means of a suitable mandrel.
- 5.13.3 If the structure is to be painted, the identification markings should be temporarily masked until painting is complete.

6 Serial Numbers

- 6.1 Company procedures should be raised to cover the allocation and control of serial numbers, so that traceability to assembly, test and overhaul records can be achieved. Additionally, it provides a reliable reference for general recording purposes.
- 6.2 Where possible, serial numbers should be prefixed by a combination of letters which enables the manufacturer to be identified. In the majority of instances they should be identical to those used on the firm's inspection stamps. Where components are being produced by a sub-contractor, the serial numbers may be allotted either by the main contractor or the sub-contractor, but in no circumstances should the same combination of symbols and serial numbers be used by the main and sub-contractors for identical components.
- 6.3 Where possible, the serial number of the item, together with the drawing number and issue number of the drawing and the date of inspection, should be stamped on a plate similar to that illustrated in Figure 3. The plate should be manufactured of a material compatible with the component and should be attached to the component using a jointing compound to prevent corrosion. Where a plate cannot be used, the data should be painted on the component and protected with a coat of clear varnish.

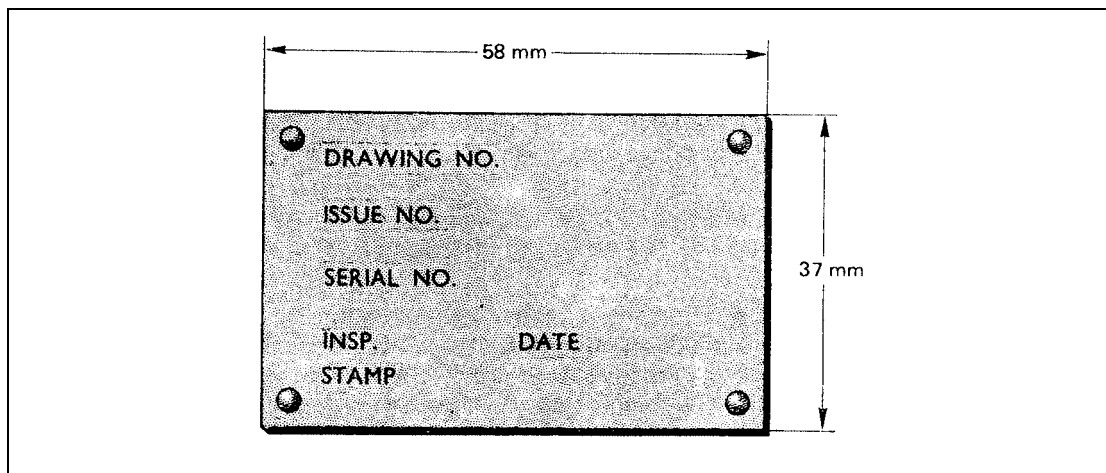


Figure 3 Identification Plate

- 6.4 Wherever possible, the serial number should be so positioned that it can be seen when the component is installed in the aircraft or on the engine; on certain components, the provision of a window, or a rip-off patch, may be necessary to achieve this.
- 6.5 The markings on the plate should be legible and not obliterated by paint, etc. During overhaul the plate should be checked for security since, should the plate be lost, difficulty may be experienced in proving the identity of the component and hence its state of serviceability. The identification plates of condemned components should be destroyed.

- 6.6 The serial numbers of fabric covered components are often reproduced externally on the fabric by stencils. Such markings are not necessarily permanent due to the periodical renewal of fabric and dope. Care is necessary to ensure that the markings correspond at all times with those displayed on the permanent plate.
- 6.7 Additional serial numbers must not be added to components by repair or overhaul organisations. When an area of a component bearing a serial number is renewed, or where extensive repairs are carried out, a copy of the original identification plate should be fitted, on which the letter 'R' should be placed after the serial number as a stroke number. The inspection stamp signifying approval of the repair and the date on which the repair was inspected should also be added.

7 Modifications

A record of modifications incorporated in a component should be listed on a modification record plate, so that the modification state of the component can be subsequently identified. Where possible, the plate should be positioned adjacent to the identification plate and should show the serial number and date of manufacture of the component with the modification numbers tabulated below. Where a plate cannot be used, the data should be painted on the component and protected with clear varnish.

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Leaflet 3-2 Identification Markings on Metallic Materials

1 Introduction

- 1.1 This Leaflet provides guidance and advice on the determination of type and positioning of markings on metallic materials, for the purpose of identification during manufacture. This Leaflet should be read in conjunction with Leaflet 3-1 which gives information on the processes for identification marking of aircraft parts.
- 1.2 Chapter A1-4 of British Civil Airworthiness Requirements specifies that materials used in parts affected by airworthiness requirements shall comply with one of the following specifications:
- British Standard Aerospace Series Specifications.
 - DTD Specifications.
 - Specifications approved by the CAA.
 - Specifications prepared for a material in accordance with BCAR, Chapter D4-1 for large aeroplanes¹, by an Organisation approved for design where the material is to be used in a part designed within the terms of the design approval.
- 1.3 British Standards Aerospace Series and DTD specifications, make provision for the identification of materials by requiring the mark of the inspector and such other markings as may be necessary to ensure full identification. Manufacturers' Specifications (as in paragraph 1.2 d)) normally refer to the inspectional clauses of the relevant BS or DTD Specifications and consequently similar provision for identification is made.
- 1.4 To obviate the need for the revision of this Leaflet when new issues of specifications referred to are published, the prefix or suffix indicating the issue number of the specification has been omitted.

2 Method of Marking

- 2.1 Materials should be identified as early as possible in their manufacture.
- 2.2 The markings most appropriate for materials such as sheet, bar and castings are:
- Metallic stamp markings;
 - Markings produced by the die or mould used in shaping the material; and
 - Marking by rubber stamp, hand roller or printing machine.

Whichever method of marking is employed, damage to the material must be avoided and particular care should be taken when marking stressed parts of materials.

- 2.3 The markings most appropriate for parts and semi-finished materials are:
- Acid etching;
 - Electro-chemical methods;
 - Vibratory percussion;
 - Grit blasting; and

1. Chapters K4-1 for light aeroplanes, G4-1 for rotorcraft, C2-2 for engines.

- e) Deposition of iron-copper selenite.
- 2.4 Incised markings are not recommended for:
- a) Stressed parts where the impressions may act as stress raisers and originate cracks;
 - b) Materials and parts of thin section;
 - c) Materials or parts of such hardness, surface condition or shape that it is impracticable to apply a well defined marking;
 - d) Material ordered to exact sizes where no provision is made for the subsequent removal of the portion containing the incised markings.
- NOTE:** Electro-engraving of parts is prohibited and metallic stamp and vibratory percussion methods must not be used at highly stressed locations. If it is necessary to mark a part in a stressed region, etching or electro-chemical methods should be employed.
- 2.5 When metallic stamp marking is used, (as preferred for stock or random sizes of material) the marks have to be confined to a minimum area in a suitable position.
- 2.6 When marking with ink, enamel or paint is permitted, the marking medium has to meet the following criteria:
- a) It has to be permanent, except for 'non-immersion' markings used with some aluminium-based materials, where the marking is designed to disappear during solution treatment.
 - b) It has to have no corrosive or adverse effect on the material and be compatible with any material or substance with which it may subsequently be in contact.
- NOTE:** For stainless steels, the marking medium has to be free from organic compounds to obviate the possibility of carbon 'pick-up'.
- c) It has to remain legible when any protective process is applied to the material.
- 2.7 Where material is ordered to sizes which do not permit the identification markings being removed during production of a part, the purchaser may state expressly in his order that the material is to be used in the size as delivered and must not bear any incised markings. In such circumstances the material may be identified by:
- a) The pieces of material being bundled or parcelled and the marks required being stamped on a metal label securely attached to each bundle or parcel;
 - b) marking with paint, enamel or ink (see paragraph 2.6); or
 - c) one of the etching or electro-chemical methods.

3 Identification of Metallic Materials to Approved Specifications

- 3.1 The Procedure Specifications in the British Standards Aerospace Series, i.e. HC100, HR100, L100, L500, S100, S500, T100 and TA100, contain identification marking clauses which are applicable to all BS Aerospace Series and DTD Specifications for iron, nickel, copper and refractory base alloy castings, wrought heat resisting alloys, wrought aluminium and aluminium alloys, aluminium base and magnesium base ingots and castings, wrought magnesium alloys, wrought steels and wrought titanium and titanium alloys. New issues of approved specifications will include references to the identification clauses of the relevant specification.
- 3.2 The identification marking of metallic materials other than those covered in paragraph 3.1 is governed by the individual Approved Specification.

- 3.3 The identification markings should consist of the specification reference, the inspection stamp (except as indicated in paragraph 4) and such other markings as are necessary to enable the following details to be established:
- a) Manufacturer;
 - b) Cast number (where cast or cast/heat treatment batching is required by the Specification);
 - c) Batch number;
 - d) Test report number.
- 3.4 The identification mark of the inspector and the manufacturer's trade or identification mark may be combined in one symbol. Correlation between the relevant approved certificate and test report may conveniently be secured by marking the material with the test report number.
- 3.5 Additional markings such as those agreed by the supplier and purchaser and stated on the order or drawing may also be applied.

4 Identification of Material Forms

- 4.1 The identification markings which are generally applicable to various forms of material, ingots, castings, bars, sheets, etc., are given in this paragraph.
- 4.2 **Ingots.** Each ingot should be stamped with the marks indicated in paragraph 3.3, except that the inspection stamp may be omitted if the manufacturer's name or trade mark is cast on each ingot and the relevant inspection records are signed by the inspector accepting the ingots.
- 4.3 **Castings, Forgings and Stampings**
- 4.3.1 Each casting, forging and stamping which is large enough to be individually marked should bear the marks described in paragraph 3.3 and such other markings as may be stated on the order.
- 4.3.2 Marks, such as the part number and the manufacturer's name, may be incorporated in the die or mould used in shaping the part. Marks not so applied should be added by means of stamps unless some other method of marking is specified. All stamp markings must be placed where they have the least detrimental effect on the part; such position usually being indicated on the drawing.
- 4.3.3 Where forgings, stampings and precision castings approximate closely to the finished parts, the method of identification should follow the requirements for the marking of the finished parts, as shown on the drawing. Wherever practicable, compressor and turbine blade forgings should be individually identified, and this is of particular importance where the blade forgings are of similar shape and size and made from closely associated alloys, e.g. the alloys of the Nimonic series. Segregation and identification of stock, 'uses' and forgings for blades throughout the various production and heat treatment stages is necessary.
- 4.4 **Billets and Bars.** Each billet and bar, the diameter or width across flats of which is greater than 19 mm (0.75 in), should be stamped at one end with the markings detailed in paragraph 3.3.
- 4.5 **Sheets and Strips.** Each sheet and each coil or strip wider than 19 mm (0.75 in) should be stamped with the markings detailed in paragraph 3.3.

- 4.6 **Sections.** Each extruded and rolled section, the major sectional dimension of which exceeds 19 mm (0.75 in), should be stamped at one extreme end with the markings detailed in paragraph 3.3.
- 4.7 **Wire.** Each coil or bundle of wire should bear a metal label stamped with the markings detailed in paragraph 3.3 and such additional markings as may be required by the relevant specification (which may also require colour identification).
- 4.8 **Tubes.** Each tube, the diameter of which exceeds 25 mm (1 in), or in the case of light alloy and steel tubes exceeds 19 mm (0.75 in), should be stamped at one end with the markings detailed in paragraph 3.3 and with any additional markings required by the relevant specification.
- 4.9 **Items not Requiring Individual Identification.** As an alternative to individual identification, and provided that the material is from the same cast or batch:
- Ingots, small castings, forgings, stampings and bars, the diameter or width across flats of which does not exceed 6.5 mm (0.25 in);
 - Sheet and flat strips, the width of which does not exceed 19 mm (0.75 in);
 - Sections, the major sectional dimensions of which do not exceed 19 mm (0.75 in);
 - Tubes, the diameter of which does not exceed 25 mm (1 in), or in the case of light alloy and steel tubes does not exceed 19 mm (0.75 in);
- should be either wired together or packed in parcels, as appropriate. A metal label, stamped with the markings detailed in paragraph 3.3, should also be attached to each bundle or parcel.

5 Aluminium-based Materials

- 5.1 The identification marking requirements for aluminium-based materials are prescribed in British Standards L100 and L101, and castings, extruded bars, sections and sections rolled from strip, wire and tubes should, unless otherwise specified, be so identified.
- 5.2 **Ingots.** Ingots which have a sufficiently clean and smooth face to enable full legibility to be secured, may, at the discretion of the appropriately authorised person, be rubber stamped with the specification reference, preferably at each end of the ingot. The letters and figures should be not less than 13 mm (0.5 in) high and the ink used should comply with paragraph 2.6.
- 5.3 **Sheet and Strip in Coil Form**
- 5.3.1 In addition to the identification markings detailed in paragraph 3.3, sheet and strip may be required to be 'all-over' marked by the specification. Where strip is identified by ink markings, marking the material with the Specification reference may be omitted. 'All-over' marking should be carried out in accordance with the relevant clauses of BS L100 and as detailed in paragraphs 5.3.2 to 5.3.5, unless otherwise agreed between the manufacturer and the purchaser and stated on the order.
- 5.3.2 Each sheet and each strip in coil form, the width of which is 152 mm (6 in) or greater, should be marked in green ink with the Specification reference and the manufacturer's symbol in figures and letters 13 mm (0.5 in) high. The lines of markings should be at a pitch of 100 mm (4 in). The markings should be arranged in accordance with a) or b).
- The specification reference and the manufacturer's symbol should appear alternately and should be repeated at intervals of approximately 100 mm (4 in)

along each line of marking; the marks being so disposed that the Specification reference in one line is above the manufacturer's symbol in the line immediately below it.

- b) The specification reference and manufacturer's symbol should appear on alternate lines, the marks in each line being repeated with a gap of approximately 25 mm (1 in) between them.

5.3.3 Each sheet and each strip in coil form, the width of which does not exceed 152 mm (6 in) (but not less than 50 mm (2 in) wide), should be marked as in 5.3.2 a) or b) at intervals of 100 mm (4 in) approximately along the centre line.

5.3.4 At the option of the manufacturer, each sheet and strip in coil form, the width of which does not exceed 50 mm (2 in) wide, can be 'all-over' marked, individually identified as detailed in paragraph 3.3, or, if from the same batch, bundled together with the required marks stamped on a metal label attached to each bundle.

5.3.5 Sheet and strip in coil form of material 26 s.w.g. and thinner, in the heat treatment condition stipulated by the specification and wide enough to be 'all-over' marked, may be hand marked in green ink along two lines only.

5.4 **Plate and Extrusions**

5.4.1 Plate, not included in the current issue of BS L100, should, unless otherwise specified, be marked in accordance with the relevant DTD Specification.

5.4.2 For plate fabrication and machining it is advantageous to know both the direction of rolling (not readily apparent with pieces cut to size) and the results of non-destructive testing. The user may require appropriate indications to be marked on each plate; such additional markings should be agreed between the purchaser and manufacturer and stated on the drawing or order.

5.4.3 Extrusions and plate which have been stretched in accordance with the specification or other conditions should be marked with the letters CS in a circle. Bars and sections should be marked at one end and plate should be marked alongside the specification reference. The marks should be made either by rubber stamp (blue or black ink) or by metal stamps, at the discretion of the material manufacturer.

NOTE: See also paragraph 5.6 when the contents of that paragraph are applicable.

5.5 **Forgings.** Forgings should, unless otherwise specified, be finally marked as required by BS L100. Where individual markings are required, L100 specifies that the drawing for the forgings should state the position at which the identification marks are to be applied; this is particularly important for forgings in high strength alloys.

NOTE: The method of applying the identification markings should be confirmed where it is not indicated on the drawing.

5.6 **Annealed, Not Aged, and as-Rolled Material**

5.6.1 Material released in other than the heat treatment condition stipulated by the specification should be marked in red by means of a transfer, paint or ink markings with the appropriate term to denote its condition and Approved Certificates covering such material should be clearly annotated "annealed", "not aged", etc., as appropriate.

5.6.2 For sheet and strip in coil form, the red markings in letters 13 mm (0.5 in) high should be repeated at intervals of approximately 101 mm (4 in) in lines midway between the lines of markings detailed in paragraph 5.3.3 and 5.3.4.

- 5.6.3 For extruded bars, sections and tubing, the red marking should be applied near one end of each length but, where lengths greater than 5 m (15 ft) are supplied, the markings should be applied at each end of each length.
- 5.6.4 For plate, the red marking should be placed near the specification reference or, where 'all-over' marking is required by the order, repeated at intervals midway between the lines of 'all-over' marking.
- 5.6.5 Material which is to be bundled and labelled should bear the appropriate wording stamped on the attached label.
- 5.6.6 The following terms are to be used, as appropriate:
- a) **As Rolled**. To denote 'as-rolled' material.
 - b) **Annealed**. To denote material in the softened condition.
 - c) **Not Aged**. To denote material solution treated but which requires precipitation treatment.
- 5.6.7 The method of applying the red markings is left to the discretion of the manufacturer but the medium used should comply with paragraph 2.6.

6 Magnesium-Based Materials

Cast products should, unless otherwise specified, be identified in accordance with the requirements of BS L101. Wrought products should be identified as required to BS L500, the contents of paragraph 3.3 being taken into consideration. In general, the guidance given in previous paragraphs is applicable and the markings should be applied before chromate treatment.

7 Titanium-Based Materials

Titanium-based materials should be finally marked in accordance with BS TA100 and order requirements, the contents of paragraph 3.3 being taken into consideration. It is preferable not to use metallic stamping unless otherwise indicated on the order; billets, bars, sheet, etc., may be identified by rubber stamp markings. Where the cross-section is insufficient to enable full legibility to be secured, bars, rods, etc., from the same cast or batch and of the same nominal size may be wired together and the marks required may be stamped on a metal label attached to each bundle.

8 Ferrous Materials

Steel ingots and wrought products should, unless otherwise specified, be identified in accordance with the relevant procedure specifications, i.e. BS S100, S500 and T100; the identification marking requirements for steel castings are given in the relevant specifications.

NOTE: Leaded steels should be identified with a distinguishing mark 'L', 'LED' or 'LEADED' and the associated Approved Certificate should be appropriately endorsed.

9 Identification of Metallic Materials to other than Approved Specifications

Parts for general supplies (i.e. uncontrolled items as specified in Section A, Chapter A4–8 of British Civil Airworthiness Requirements) may be made from materials for which identification marking requirements are not specified. In such cases the appropriate person employed by the materials manufacturer should be guided by the terms of the order, but it is preferable that some form of marking be carried out by the manufacturer to correlate the material with its accompanying release documentation. It is essential, however, that the material is rendered identifiable after delivery to prevent any possible confusion with other material held by the purchaser.

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Leaflet 3-3 Bolts and Screws of British Manufacture

1 Introduction

- 1.1 The purpose of this Leaflet is to provide guidance on the identification of bolts and screws complying with British Standards 'A' Series of Aircraft Materials and Components and the Society of British Aerospace Companies 'AS' Series of specifications. The Leaflet does not include information on the Aircraft General Standards (AGS) Series since these have been entirely superseded by other standards. Information on the manufacture and testing of bolts and screws will be found in British Standards A100 and A101, entitled "General Requirements for Bolts and Nuts of Tensile Strength not exceeding 180 000 lbf/in² (125 hbar)", and "General Requirements for Titanium Bolts", respectively.
- 1.2 The identification of bolts and screws located on aircraft may not always be an easy task since not all are marked to show the standard to which they conform. This Leaflet sets out to show the features from which positive identification may be made, but it should be understood that items exist, which although identical in appearance, may not be interchangeable. It is also important to understand the direction of stress in a particular bolt since a 'shear' bolt must not be used to replace a 'tension' bolt. If any doubt exists as to the identity of a particular item the appropriate Parts Catalogue should be consulted; replacement of an incorrect part may lead to failure in service.
- 1.3 It will be found that a number of Specifications are either obsolete or obsolescent, in some instances due to the standardisation of a countersunk head of 100° included angle. The replacements are indicated in the tables.
- 1.4 Information on the identification of nuts of British manufacture are provided in Leaflet 3-4.
- 1.5 A list of the abbreviations used in this Leaflet is in paragraph 5.

2 British Standards

- 2.1 This paragraph is concerned with the identification of bolts and screws complying with the British Standards 'Aircraft' (A) series. For ease of reference the paragraph has been divided into two sections, paragraph 2.2 dealing with bolts and screws having either British Association (BA) or British Standard Fine (BSF) threads, and paragraph 2.3 dealing with bolts and screws having Unified threads.

2.2 Bolts and Screws with BA or BSF Threads

- 2.2.1 In this series, BSF threads are used on bolts of ¼ inch diameter and larger; smaller bolts and all screws have BA threads, except that grub screws are also supplied in ¼ inch BSF. BA sizes larger than 2 BA are not specified. Table 1 gives a list of the relevant Standards, superseding Standards and identification data appropriate to the series, and Figure 1 illustrates the types of head used. To find the Standard number of a given item proceed as follows:

Identify the head from Figure 1, for example '(1)'. Reference to Table 1 shows that '(1)' refers to an A61 bolt. If the illustration applies to more than one specification, further information contained in the table, such as the type of finish, should enable the identification to be completed.

Table 1 BA and BSF Bolts and Screws

Standard No.	Description	Material	Finish	Head (fig.1)	Remarks	Thread	Normal Size Range
A17	Hex.hd.bolt	Al Al	anodic	e or f	obsolescent	BA/BSF	6 BA to 1 in BSF
A25	Hex.hd.bolt	HTS	cad	a,b,c or d	replaces A15Y	BA/BSF	6 BA to 1 in BSF
A26	Hex.hd.bolt	CRS	nat	a	replaces A15Z	BA/BSF	6 BA to 1 in BSF
A28	Hex.hd.bolt	Al Al	anodic	g or h	obsolescent	BA/BSF	6 BA to 1 in BSF
A30	Hex.hd.c/t bolt	HTS	cad	i or j	cad h & t	BA/BSF	6 BA to 1 in BSF
A31	Cheese hd. screw	LTS	cad	o	replaces AGS 247	BA	12 BA to 2BA
A32	Round hd.screw	LTS	cad	n	replaces AGS 245	BA	10 BA to 2BA
A33	90° csk. hd. screw	LTS	cad	q	replaces AGS 249	BA	12 BA to 2BA
A34	Raised csk.hd. screw	LTS	cad	p		BA	10 BA to 2BA
A35	Cheese hd. screw	CRS	nat	o	replaces AGS 896	BA	12 BA to 2BA
A36	Round hd.screw	CRS	nat	n	replaces AGS 967	BA	10 BA to 2BA
A37	90° csk. hd. screw	CRS	nat	q	replaces AGS 968	BA	12 BA to 2BA
A38	Raised csk.hd. screw	CRS	nat	p		BA	10 BA to 2BA
A39	Cheese hd. screw	Al Al	anodic	o		BA	12 BA to 2BA
A40	Round hd.screw	Al Al	anodic	n	replaces AGS 564	BA	10 BA to 2BA
A41	90° csk. hd. screw	Al Al	anodic	q		BA	12 BA to 2BA
A42	Raised csk.hd. screw	Al Al	anodic	p		BA	10 BA to 2BA
A43	Cheese hd. screw	Brass	tinned	o	replaces AGS 246	BA	12 BA to 2BA
A44	Round hd.screw	Brass	tinned	n	replaces AGS 244	BA	10 BA to 2BA
A45	90° csk. hd. screw	Brass	tinned	q	replaces AGS 248	BA	12 BA to 2BA
A46	Raised csk.hd. screw	Brass	tinned	p		BA	10 BA to 2BA
A55	Grub screw	FCS	cad	none		BA/BSF	6 BA to 1/4 BSF
A56	Grub screw	CRS	nat	none		BA/BSF	6 BA to 1/4 BSF
A57	Hex. hd. shear bolt	HTS	cad	k	cad h & t only	BSF	1/4 to 3/4 in BSF
A59	Hex.hd.c/t bolt	HTS	cad	i		BA/BSF	6 BA to 1 in BSF
A60	Hex. hd. shear bolt	HTS	cad	k		BSF	1/4 to 3/4 in BSF
A61	Hex.hd. bolt	Al Al	anodic	l or m	replaces A28	BA/BSF	6 BA to 1 in BSF

2.2.2 In some instances, e.g. A31 to A56 in Table 1, identification can only be effected from the finish applied (mechanical testing apart), or by the labelling on packages.

2.2.3 **Code Systems for Bolts.** The code system used for the identification of the bolts listed in Table 1 consists of the standard number followed by the part number of the particular bolt. The part number consists of a number indicating the nominal length of the plain portion of the shank in tenths of an inch, followed by a letter indicating the nominal diameter (Table 2). Example: The complete part reference number for an A57 bolt of 3.1 inches in length and 3/8 inch in diameter is; A57 31J.

Table 2 Diameter Code Letters

Code	Size	Code	Size
A	6BA	P	9/16 in BSF
B	4BA	Q	5/8 in BSF
C	2BA	S	3/4 in BSF
E	1/4 in BSF	U	7/8 in BSF
G	5/16 in BSF	W	1 in BSF
J	3/8 in BSF	X	12 BA
L	7/16 in BSF	Y	10 BA
N	1/2 in BSF	Z	8 BA

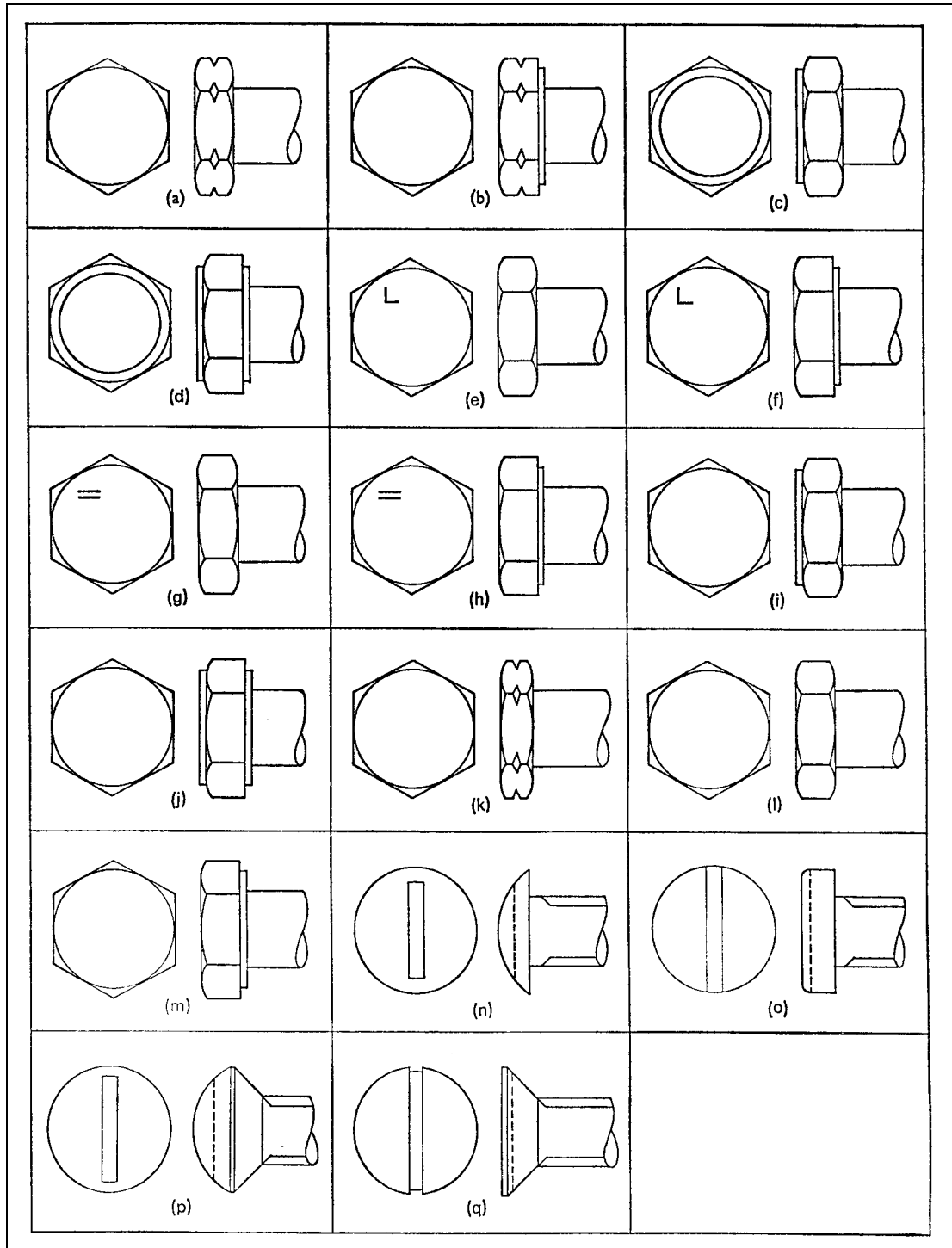


Figure 1 Identification of British Standards BA/BSF Bolts and Screws

- a) All bolts to British Standards A25, A26, A30, A57, A59, A60 and A61 of $\frac{1}{4}$ inch nominal diameter and over are marked with the appropriate British Standard on the upper face of the head. Additionally, bolts of $\frac{7}{16}$ inch nominal size and larger have the appropriate part number applied to the upper face of the head. Parcels of bolts have the number of the relevant British Standard and the appropriate part number clearly stated on the labels.
- b) The positions at which the plain length is measured on hexagon bolts and the overall lengths on various types of screws are indicated in Figure 2. It should be

noted that with BA and BSF bolts, the plain portion of the shank includes the thread 'run-out'. A 'washer face' (e.g. Figure 1 (b)) on the undersurface of a bolt head is not included in the plain length of the shank.

2.2.4 **Code System for Screws (A31 to A46).** The code system used for the identification of the screws listed in Table 1 consists of the British Standard number followed by the part number of the particular screw. The part number consists of a number indicating the nominal length of the screw (in thirty-seconds of an inch) when measured as described below (see also Figure 2) preceded by a letter indicating the nominal diameter (Table 2). Example: The complete part referencing number for a 2 BA A41 countersunk head aluminium alloy screw $\frac{1}{2}$ inch long, is A41 C16.

- Cheese and Round Heads.** The nominal length is the distance measured from the underside of the head to the extreme end of the shank, including any chamfer or radius.
- Countersunk Heads.** The nominal length is the distance measured from the upper surface of the head to the extreme end of the shank, including any chamfer or radius.
- Raised Countersunk Heads.** The nominal length is the distance measured from the upper surface of the head (excluding the raised portion) to the extreme end of the shank, including any chamfer or radius.

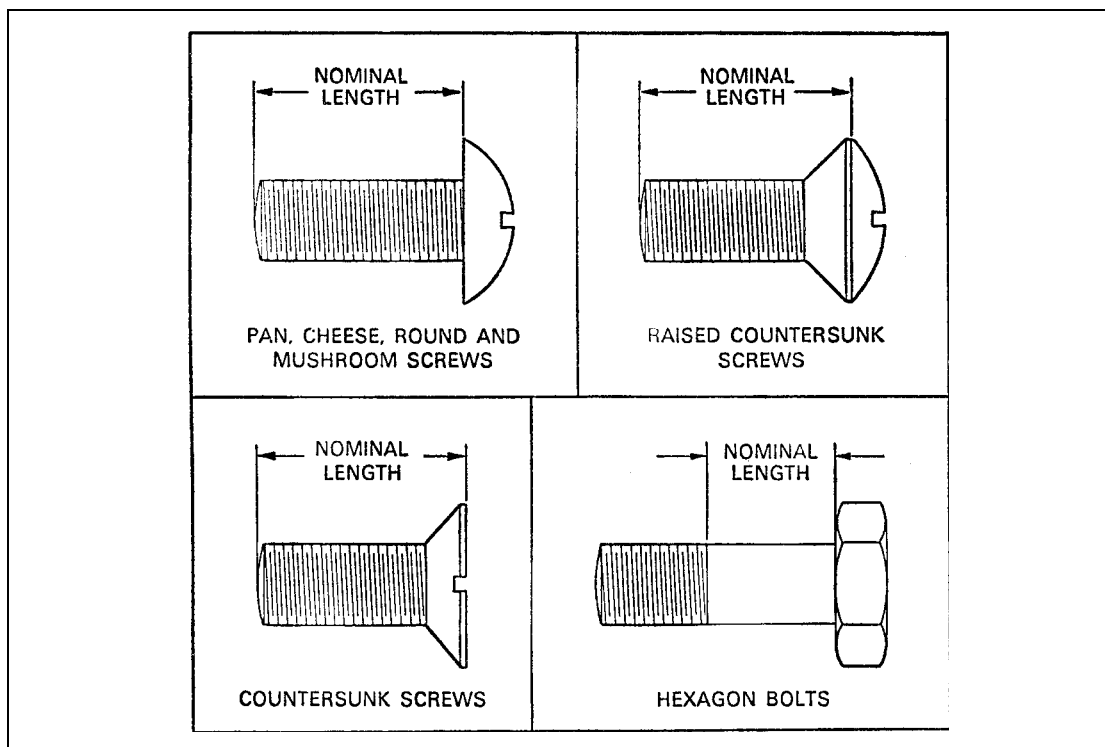


Figure 2 Length of BA/BSF Bolts and all Screws

2.2.5 **Code System for Grub Screws Complying with A55–A56.** The code system used for these screws consists of the British Standard number followed by the part number of the particular screw. The part number consists of a number indicating the overall length of the screw in sixteenths of an inch, preceded by a letter indicating the nominal diameter. Example: The complete part referencing number for a $\frac{1}{4}$ inch diameter A55 screw, $\frac{1}{2}$ inch long, would be A55 E8.

2.3 **Bolts and Screws Having Unified Threads**

- 2.3.1 Table 3 gives a list of current and obsolescent bolts and screws in the Unified range. Figure 3 illustrates the type of head used in this range and also shows the general 'Unified' symbols, including (h) the cylindrical extension (dog point) sometimes used on parts not having hexagon shaped heads. It will be noticed that there are several shapes of hexagon head; these are alternative methods of manufacture and do not necessarily provide a means of identification, although A108 and A111 bolts, which have close tolerance shanks, have a cylindrical extension on top of the head and shear bolts always have thin heads. Bolts and screws of similar shape may be further identified by the material; aluminium alloy is dyed green, high tensile steel is cadmium plated and corrosion resistant steel or brass are normally uncoated. When the British Standard number is not marked on the bolt head, identification should be made as follows.
- 2.3.2 Identify the head from Figure 3, for example (g). Reference to Table 3 shows that the bolt could be an A113, A114 or A170. Complete identification is possible in this example from the type of finish; in other instances it may be derived from further information, such as diameter or thread length, contained in Table 3

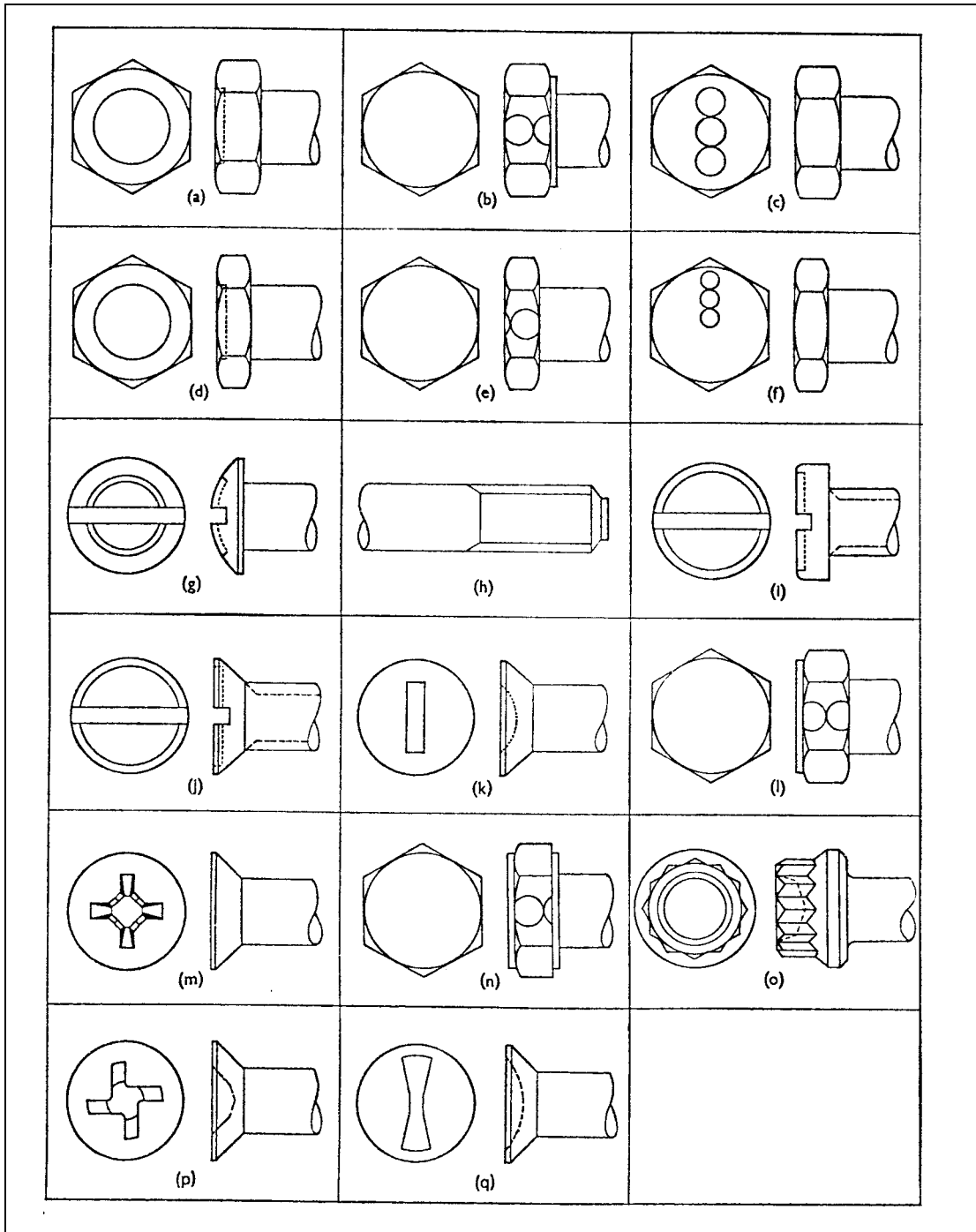


Figure 3 Identification of British Standards Unified Bolts and Screws

2.3.3 **Code System for Unified Bolts and Screws.** The code system used for the identification of the bolts and screws listed in Table 3 consists of the Standard number followed by the part number of the particular bolt. The diameter code shown in Table 4 is used on all parts but the measurement of length varies with different Standards as follows:-

- a) All bolts from A102 to A212 inclusive, nominal length in tenths of an inch followed by the diameter, e.g. an A102, 10—32 UNF bolt with plain length of one inch = A102—10D.

NOTE: Hexagon and mushroom head bolts are also supplied in lengths of 0.05 inch in some specifications, e.g. an A170— $\frac{1}{2}$ D bolt has a plain length of 0.05 inch.

b) All screws from A204 to A221 inclusive, diameter followed by length in thirty seconds of an inch, e.g. a 4—40 UNC A217 screw 1 inch long = A217—A32.

c) All bolts from A226 to A232 inclusive, diameter followed by nominal length in sixteenths of an inch, e.g. a $\frac{1}{4}$ inch UNJF A229 bolt with plain length of one inch = A229—E16.

NOTE: The position at which the nominal length of bolts is measured is shown in Figure 4; screws are measured as shown in Figure 2. It should be noted that the plain portion of the shank, on bolts with Unified threads, does not include the thread run-out.

Table 3 Unified Bolts and Screws

BS No.	Description	Material	Finish	Identification (fig.3)	Remarks	Thread and Class	Normal Size Range
A102	Hex.hd.bolt	HTS	cad	a,b or c		Unified, 2A	4-40 to 1 in
A104	Hex.hd.bolt	CRS	nat	a,b or c		Unified, 2A	4-40 to 1 in
A108	Hex.hd.bolt	HTS	cad	l or n	} cad hd. and thread only	Unified, 2A	10-32 to $\frac{1}{2}$ in
A109	Hex.hd. shear bolt	HTS	cad	d,e or f		Unified, 2A	$\frac{1}{4}$ to $\frac{3}{4}$ in
A111	Hex.hd.c/t bolt	HTS	cad	l or n		Unified, 2A	10-32 to $\frac{1}{2}$ in
A112	Hex.hd. shear bolt	HTS	cad	d,e or f		Unified, 2A	$\frac{1}{4}$ to $\frac{3}{4}$ in
A113	Mush. hd. bolt	HTS	cad	g, h		Unified, 2A	6-32 to $\frac{5}{16}$ in
A114	Mush. hd. bolt	CRS	nat	g, h		Unified, 2A	6-32 to $\frac{5}{16}$ in
A116	Pan. Hd. bolt	HTS	cad	i, h		Unified, 2A	4-40 to $\frac{5}{16}$ in
A117	Pan. hd. bolt	CRS	nat	i, h		Unified, 2A	4-40 to $\frac{5}{16}$ in
A119	90° csk. hd. bolt	HTS	cad	j	obsolescent	Unified, 2A	$\frac{1}{4}$ to $\frac{1}{2}$ in
A120	90° csk. hd. bolt	CRS	nat	j	obsolescent	Unified, 2A	$\frac{1}{4}$ to $\frac{1}{2}$ in
A169	Hex.hd.bolt	Al Al	green	b or c	replaces A106	Unified, 2A	6-32 to $\frac{5}{8}$ in
A170	Mush. hd. bolt	Al Al	green	g	replaces A115	Unified, 2A	6-32 to $\frac{5}{16}$ in
A171	Pan. hd. bolt	Al Al	green	i	replaces A118	Unified, 2A	4-40 to $\frac{5}{16}$ in
A172	90° csk. hd. bolt	Al Al	green	j, h	obsolescent	Unified, 2A	$\frac{1}{4}$ to $\frac{1}{2}$ in
A173	100° csk. hd. bolt	HTS	cad	k			8-32 to $\frac{1}{2}$ in
A174	100° csk. hd. bolt	CRS	nat	k		Unified, 2A	8-32 to $\frac{1}{2}$ in
A175	100° csk. hd. bolt	Al Al	green	k	replaces A172	Unified, 2A	8-32 to $\frac{1}{2}$ in
A204	100° csk. hd. screw	LTS	cad	j, h		Unified, 2A	0-80 to 10-32
A206	100° csk. hd. screw	CRS	nat	j, h		Unified, 2A	4-40 to 10-32
A208	100° csk. hd. screw	Al Al	green	j, h		Unified, 2A	4-40 to 10-32
A211	100° csk. hd. bolt	HTS	cad	m		Unified, 2A	8-32 to $\frac{1}{2}$ in
A212	Hex.hd.c/t bolt	HTS	cad	b or c	special quality	Unified, 3A	10-32 to $\frac{1}{2}$ in
A217	Pan. hd. screw	LTS	cad	i, h	replaces A205	Unified, 2A	0-80 to 10-32
A218	Pan. hd. screw	CRS	nat	i, h	replaces A207	Unified, 2A	4-40 to 10-32
A219	Pan. hd. screw	Al Al	green	i, h	replaces A209	Unified, 2A	4-40 to 10-32
A220	100° csk. hd. screw	Brass	tinned	j, h		Unified, 2A	0-80 to 10-32
A221	Pan. hd. screw	Brass	tinned	i, h		Unified, 2A	0-80 to 10-32
A226	Hex.hd.bolt	HTS	cad	a,b or c	short thread	Unified, 3A	4-40 to 10-32
A227	Pan. hd. bolt	HTS	cad	i, h	short thread	Unified, 3A	4-40 to 10-32
A228	Double hex. hd. c/t bolt	HTS	cad	o		UNJF, 3A	$\frac{1}{4}$ to 1 in
A229	Hex. hd. c/t bolt	HTS	cad	a,b or c		UNJF, 3A	10-32 to $\frac{1}{2}$ in
A230	Csk. hd. c/t bolt	HTS	cad	q		UNJF, 3A	10-32 to $\frac{1}{2}$ in
A232	Csk. hd. c/t bolt	HTS	cad	p		UNJF, 3A	10-32 to $\frac{1}{2}$ in

2.3.4 **Extent of Marking.** The markings actually applied to a bolt depend on the particular specification and whether marking is practical. Adding the code 'A217—Z32' to the

head of a 2—64 UNF pan head screw (head diameter 0.155 to 0.167 in), for example, would be very difficult, and having raised characters on a countersunk head bolt would, in certain circumstances, defeat the object of using that shape of head.

- a) **'Unified' Marking.** Most bolts, and screws 4—40 UNC and larger, are marked with a symbol to show that they have 'Unified' threads. The markings consist of contiguous circles (hexagon headed bolts only), a recessed head or shank dog point, and are illustrated in Figure 3.

NOTE: At some future date, to be agreed, the 'Unified' marking of screws will be discontinued and identification of these items will be solely from the label on the package.

- b) **Code Markings.** Most hexagon head bolts 10—32 UNF and larger are marked with the full code, i.e. Standard plus size code, but pan and mushroom head bolts may only be marked with the bolt length and countersunk head bolts are not usually marked at all. The code is not applied to screws, or bolts smaller than 10—32 UNF.

Table 4 Diameter Code Letters

Code	Size	Code	Size
Y	0-80 UNF	J	$\frac{3}{8}$ in UNF (UNJF)
Z	2-64 UNF	L	$\frac{7}{16}$ in UNF (UNJF)
A	4-40 UNC	N	$\frac{1}{2}$ in UNF (UNJF)
B	6-32 UNC	P	$\frac{9}{16}$ in UNF (UNJF)
C	8-32 UNC	Q	$\frac{5}{8}$ in UNF (UNJF)
D	10-32 UNF (UNJF)	S	$\frac{3}{4}$ in UNF (UNJF)
E	$\frac{1}{4}$ in UNF (UNJF)	U	$\frac{7}{8}$ in UNF (UNJF)
G	$\frac{5}{16}$ in UNF (UNJF)	W	1 in UNF (UNJF)

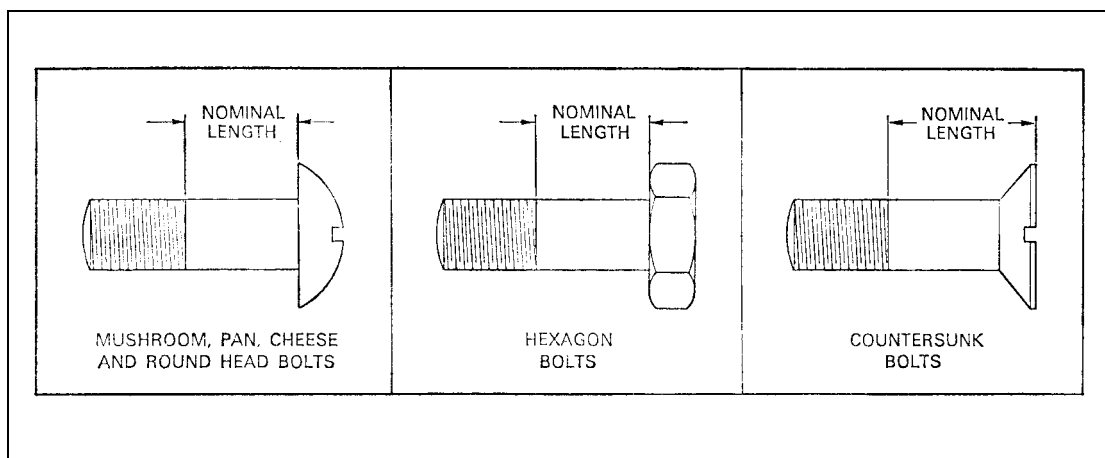


Figure 4 Length of BS Unified Bolts

3 'AS' Bolts and Screws

- 3.1 This paragraph is concerned with the identification of bolts and screws complying with the Society of British Aerospace Companies 'AS' series of specifications. The specifications provide a range of bolts and screws in sizes and head shapes not found

in British Standards specifications. Bolts manufactured from special materials (e.g. heat resistant steel) and having Unified threads are also included.

3.2 Table 5 shows the AS specifications for bolts and screws with BA/BSF threads, together with complete identification details.

Table 5 'AS' Numbers of BA/BSF Bolts and Screws







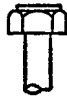
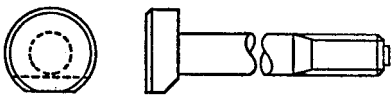

Head	Round 	Mush-room 	Raised Counter-sunk (90°) 	Counter-sunk (90°) 	Raised Counter-sunk (120°) 	Counter-sunk (120°) 	hexagon 	Material	Finish
Bolts with screwdriver slot or hexagonal head	1247+	1249+	1245+	1243+				Al Al	Anodic
	4565	4566	4564	4563				Al Al	Blue
	1246	1248	1244+	1242			4569++	HTS	Cad.
	2922	2923	2921	2920				SS	Nat.
Bolts with Phillips recess							2504++	HTS	Cad h & t
	3078*+	3079*+						HTS	Cad.
Screws with Phillips recess	4597**	4598**	3295**	3294**	3296**	3297**		HTS	
	2991	2992	2994	2993	2995	2996		Mild Steel	Cad.
* 1 dot on head ** 2 dots on head								+ obsolescent ++ 2 BA only	

Table 6 'AS' Numbers of Round Head Bolts with Flat (Unified)


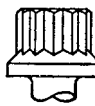
 Small head				 Large head			
10-32 UNF	1/4 UNF	5/16 UNF	3/8 UNF	10-32 UNF	1/4 UNF	5/16 UNF	3/8 UNF
6760 to 6804	6895 to 6939	7033 to 7077	7171 to 7215	6850 to 6894	6985 to 7032	7123 to 7170	7264 to 7308

3.3 Table 6 shows the AS specifications for 'round head' bolts with a locking flat and Unified threads. These bolts are manufactured from high tensile steel and are cadmium plated.

3.4 **Double Hexagon Head Bolts**

3.4.1 Table 7 shows the AS specifications for double hexagon head bolts manufactured from heat resistant steel and having UNS or UNJF threads. Requirements for protective treatment vary between specifications, some bolts being silver plated while others have a natural finish.

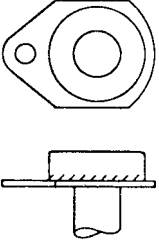
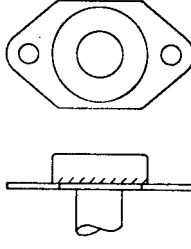
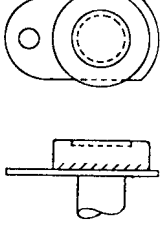
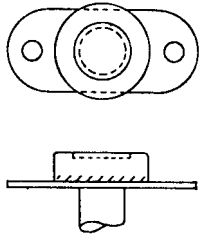
Table 7 'AS' Specifications

Thread	Type	Material	Head Shape	
				
UNS Threads (10-32 to 3/8-24 UNS-3A)	Plain	DTD 5066	13000 - 13399	17000 - 17399
		DTD 5026	13400 - 13799	17400 - 17799
		DTD 5077	13800 - 14199	17800 - 18199
	Externally Relieved Body	DTD 5066	14500 - 14899	18200 - 18599
		DTD 5026	14900 - 15299	18600 - 18999
		DTD 5077	15300 - 15699	19000 - 19399
	Close Tolerance Shank	DTD 5066	19400 - 19799	
		DTD 5026	19800 - 20199	
		DTD 5077	20200 - 20599	
UNJF Threads	Plain (8-36 to 3/8-24 UNJF)	DTD 5066	20800 - 21299	
		DTD 5026	21300 - 21799	
		DTD 5077	21800 - 22299	
	Close Tolerance Shank (10-32 to 3/8-24 UNJF)	DTD 5066	22400 - 22799	
		DTD 5026	22900 - 23299	
		DTD 5077	23400 - 23799	

NOTE: The UNS bolts listed in the table have reduced diameter threads for use in high temperature applications and should be fitted with nuts complying with specifications AS20620 to AS20639.

- 3.4.2 For purposes of standardisation a further series of heat resistant bolts with UNJF threads is being introduced to replace those with UNS threads. Details of the AS numbers allocated to these bolts are not, as yet, available, but the method of identification will be the same as described for the bolts in Table 7.
- 3.5 Table 8 shows the AS specifications for anchor bolts manufactured from weldable steel.
- 3.6 AS1 and AS2 are specifications for titanium bolts having Unified threads, with hexagon and 100° countersunk heads respectively. Both specifications are obsolescent but the bolts may be recognised by the material finish and the marking 'AS1' or 'AS2' on the head, as appropriate.

Table 8 'AS' Numbers of Anchor Bolts

BA/BSF		Unified	
			
4752	4753	6735	6736
Weldable bolt is AS 4754		Weldable bolt is AS 6737	

3.7 **Identification Marking.** AS1, AS2 and all the bolts listed in Table 7 are marked with the AS specification to which they conform. Other AS bolts are unmarked except for the 'Unified' symbol which is applied to anchor bolts (recessed head) and the round head bolts shown in Table 6 (shank dog point).

3.8 Code System

3.8.1 Although a large number of AS bolts and screws are not marked in any way, codes are necessary for ordering and storage purposes.

3.8.2 The code system used for the identification of the bolts and screws listed in Tables 5 and 8, and for AS1 and AS2 bolts, is the same as that used for British Standards bolts, i.e. AS number followed by a number indicating length in tenths of an inch and a letter indicating diameter (Tables 2 or 4 as appropriate). The length is measured in the same way as for British Standard parts.

NOTE: AS2504 and 4569 bolts are only manufactured in 2 BA; the diameter code is therefore not required.

3.8.3 Reference to Table 6 shows that a batch of AS numbers is allocated to each diameter of bolt in this series. A separate number within each batch is reserved for a particular length of bolt so that a code system is unnecessary; any particular AS number in this series applies only to a bolt of specified length and diameter. The plain length is graduated in steps of 0.05 inch from 0.05 inch to 0.9 inch, and steps of 0.1 inch thereafter up to 3.4 inch. A 10–32 UNF bolt 1.2 inch long and having a small head will therefore be AS6780.

3.8.4 The bolts shown in Table 7 also have a batch of AS numbers allocated to each diameter but in this case the range of available lengths varies between specifications. The length of the bolt is taken as the whole length of the shank, including the thread in sixteenths of an inch up to 2 inches long, and eighths thereafter, each particular size having a unique reference number. It should be noted that this series of bolts has a threaded length greater than that normally found on aircraft fasteners. A minimum length of plain portion is also maintained, so that the thread length in the shorter bolts is reduced below the normal for the particular diameter.

4 Future Trends

4.1 Because of the importance of reducing weight in the manufacture of an aircraft, designers are constantly seeking means of using higher strength or lighter alloys for structural purposes. This trend applies particularly to fasteners and it is apparent that

the use of smaller diameter bolts and miniature anchor nuts will become more widespread. It will be accompanied by the use of threads of UNJF form.

- 4.2 In the field of light alloys, specifications for titanium bolts are being prepared and will probably be drawn up in accordance with existing American practice, within the framework of British Standard A101, entitled 'General Requirements for Titanium Bolts'.
- 4.3 Because of the vast experience gained, particularly in America, in the use of both standard and miniature components, it has been internationally agreed to use Unified inch threads on fasteners. However, with the introduction of metric dimensions in other fields, it is probable that a metric thread series will eventually be accepted.
- 4.4 As far as identification features are concerned it appears likely that the system used for recent specifications will continue; bolts in the AS series will be marked with a number which will be unique for a particular diameter and length, and bolts in the BS series will use the code at present applied to bolts with UNJF threads.

NOTE: There is no symbol used to differentiate between threads of standard unified or UNJ form.

5 Abbreviations

The following is an alphabetical list of abbreviations used in this Leaflet:

AGS	Aircraft General Standards
AS	Aircraft Standards
Al Al	Aluminium alloy
BA	British Association
blue	dyed blue over anodic film
BSF	British Standard Fine
cad.	cadmium plated all over
cad.h & t	cadmium plated head and thread only
csk.	countersunk
c/t	close tolerance
CRS	corrosion resisting steel
FCS	free-cutting steel
green	dyed green over anodic film
hd.	head
hex.	hexagon
HTS	high tensile steel
LTS	low tensile steel
mush.	mushroom
nat.	natural finish
SS	stainless steel
UNC	Unified coarse thread
UNF	Unified fine thread
UNS	Unified special thread
UNJF	Unified fatigue-resistant fine thread

Leaflet 3-5 Standard Fasteners of American Manufacture

1 Introduction

This Leaflet provides guidance on the identification and coding of bolts, nuts, screws and washers which are manufactured to American National Standards and are used for general aircraft assembly. Many other types of American fasteners are used on aircraft, particularly in the field of light-weight, self-locking nuts and bolts, and these are approved for use by the relevant manufacturer or Airworthiness Authority; these fasteners will not necessarily be marked or identified in accordance with the national standards, but will comply with information published by the particular manufacturer.

2 Specifications

- 2.1 Standard aircraft fasteners in America are manufactured in accordance with Government, Military and Civil Specifications. The following series of specifications cover the materials, processes, and component drawings for all standard fasteners:

Federal Specifications

Society of Automotive Engineers Specifications (SAE)

Aeronautical Materials Division of SAE Specifications (AMS)

Air Force/Navy Specifications (AN)

Military Standards (MIL and MS)

National Aerospace Standards (NAS)

- 2.2 These specifications provide for a range of fasteners with Unified threads in the UNC, UNF and UNJF series. However, whereas for British aircraft, fasteners are manufactured in a selected range of Unified threads, American fasteners are, in some instances, supplied with both UNC and UNF threads. Extreme care is necessary when matching up nuts with screws or bolts in these series. If not properly identified, then thread gauges must be used to check the thread. Visual comparison of small threads is not recommended.
- 2.3 The various standards are dealt with separately in this Leaflet, and it should be noted that the AN series has to a large extent been replaced by MS and NAS components.

3 AN Fasteners

- 3.1 These specifications are in two series. The early series has numbers from 3 to 9000, with the fasteners occupying a range from 3 to 1000; these fasteners are of comparatively low strength, and are manufactured in steel or aluminium alloy. The steel parts are generally manufactured from low-alloy steel and if non-corrosion-resistant, are cadmium plated, whilst the aluminium parts are anodised. The later series parts have six figure numbers commencing with 100 000, are of more recent design and are generally manufactured from higher-strength materials.

3.2 Early Series AN Bolts

- 3.2.1 Table 1 gives a list of the early series AN Bolts, and Figure 1 shows the types of heads and the identification marking used to indicate the material from which the parts are made.

Table 1 Early Series AN Bolts

AN Number	Type	Material	Process	Nominal Range of Thread Sizes	Thread
3-20	Bolt, hexagon head	Steel	Cad.plated	No. 10 to 1 ¼ in	UNF
		CRS ¹	Nil		
		Al. alloy	Anodised		
21-36	Bolt, clevis	Steel	Cad.plated	No.6 to 1 in	UNF
42-49	Bolt, eye	Steel	Cad.plated	No.10 to 9/16 in	UNF
73-81	Bolt, hexagon, drilled head	Steel	Cad.plated	No.10 to ¾ in	UNF or UNC
173-186	Bolt, close-tolerance	Steel	Cad.plated thread and head	No. 10 to 1 in	UNF
		CRS ¹	Nil		
		Al. alloy	Anodised		

1. CRS = Corrosion-resistant steel.

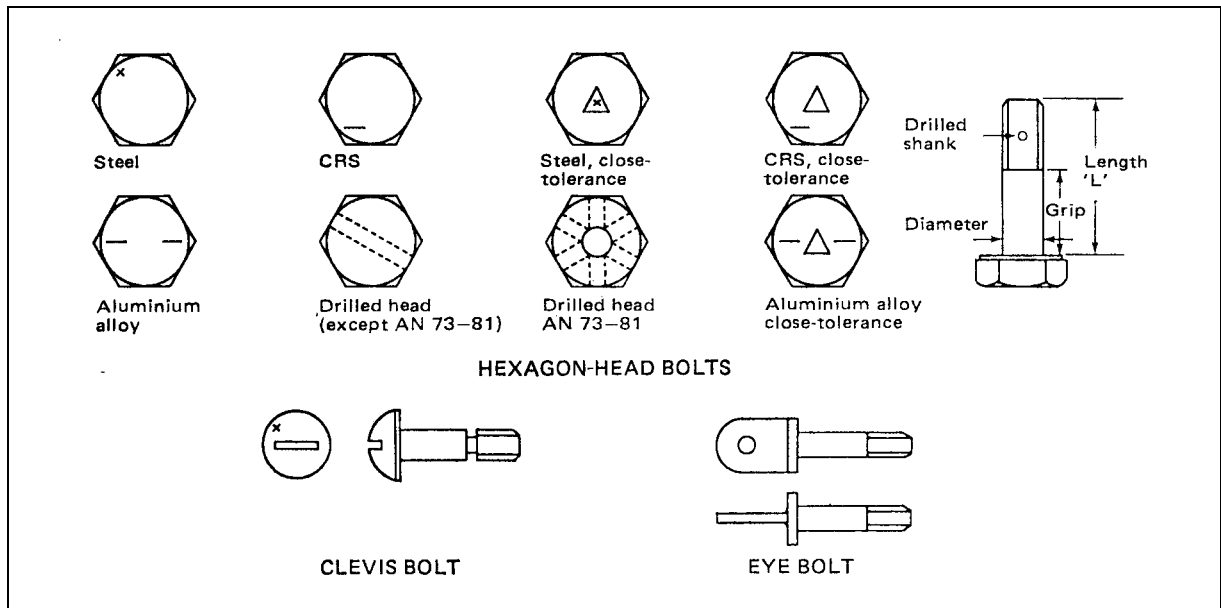


Figure 1 Early Series AN Bolts

3.2.2 All of the bolts listed in Table 1 may be identified as to type by reference to the head marking or position of the locking wire holes. Diameter may be identified by experience, or by measurement and reference to the specification. Other dimensions such as grip length, head size and thread length, must be obtained from the specification.

3.2.3 **Coding.** For identification purposes the AN number is used to indicate the type of bolt and its diameter, and a code is used to indicate the material, length and thread (where these vary) and the position of the locking wire or cotter pin (split pin) hole.

- a) **Diameter.** The last figure or last two figures of AN number indicate the diameter of the thread. 1 = No. 6, 2 = No. 8, 3 = No. 10, and 4 = $\frac{1}{4}$ in, and subsequent numbers indicate the diameter in $\frac{1}{16}$ in increments; above $\frac{5}{8}$ in the available sizes are in $\frac{1}{8}$ steps, but are still coded in sixteenths. Thus an AN 4 is a hexagon head bolt with $\frac{1}{4}$ in thread, an AN 14 is a hexagon head bolt with a $\frac{7}{8}$ in ($\frac{14}{16}$) thread and an AN 182 is a close-tolerance bolt with a $\frac{3}{4}$ in ($\frac{12}{16}$) thread (the numbering in this case starting at 173). An exception to this is the eye bolt, where different diameter pin holes affect the coding; AN 42 is No.10, AN 43 is $\frac{1}{4}$ in, AN 44 is $\frac{5}{16}$ in with a $\frac{1}{4}$ in diameter pin hole, and AN 45 is $\frac{5}{16}$ in with a $\frac{5}{16}$ in diameter pin hole.
- b) **Length.** The length of a bolt as quoted in the specifications, is the overall length from under the head to the end of the shank (L in Figure 1), but the length is generally regarded as from under the head to the first full thread (excluding the chamfer) and is quoted in $\frac{1}{8}$ in increments as a 'dash' number. The last figure of the dash number represents eighths of an inch, and the first figure of the dash number represents inches. Thus an AN 4–12 is a $\frac{1}{4}$ in hexagon-head bolt $1\frac{1}{4}$ in (i.e. $1\frac{2}{8}$) long, and an AN 12–24 is a 3 in hexagon-head bolt $2\frac{1}{2}$ in long. The total lengths quoted in the specifications for these bolts, is actually $1\frac{9}{32}$ in and $2\frac{21}{32}$ in, respectively. Clevis bolts (AN 21 to 36) do not follow this coding, but the length is indicated in $\frac{1}{16}$ in increments by the dash number; thus an AN 29–9 is $\frac{9}{16}$ in long.
- c) **Position of Drilled Hole.** Bolts are normally supplied with a hole drilled in the threaded part of the shank, but different arrangements may be obtained by use of the following code:
- Drilled shank = normal coding, e.g. AN 24–15.
 - Undrilled shank = A added after dash number, e.g. AN 24–15A.
 - Drilled head only = H added before dash number (replacing the dash sign) and A added after dash number, e.g. AN 6H10A.
 - Drilled head and shank = H added before dash number, e.g. AN 6H10.
- d) **Material.** The standard coding applies to a non-corrosion-resistant, cadmium-plated steel bolt. Where the bolt is supplied in other materials, letters are placed after the AN number as follows:
- C = corrosion-resistant steel (CRS)
 - DD = aluminium alloy, e.g. AN 6DD10.
- e) **Thread.** Where the bolt is supplied with either UNF or UNC threads, a UNC thread is indicated by placing an 'A' in place of the dash, e.g. AN 74A6.

Table 2 Early Series AN Machine Screws

AN Number	Type	Material	Process	Head Marking ¹	Nominal Range of Thread Sizes	Thread	
500	Screw, fillister head	Steel	Cad.plated		No.2 to $\frac{3}{8}$ in	UNC	
		CRS	Nil				
		Brass	Nil				
501	Screw, fillister head	Steel	Cad.plated		No.0 to $\frac{3}{8}$ in	UNF	
		CRS	Nil				
		Brass	Nil				
502	Screw, fillister head (drilled)	Steel	Cad.plated	XX	No.10 to $\frac{5}{16}$ in	UNF	
503	Screw, fillister head (drilled)	Steel	Cad.plated	XX	No.6 to $\frac{5}{16}$ in	UNC	
505	Screw, flat 82°	Steel	Cad.plated	--	No.2 to $\frac{3}{8}$ in	UNC	
		CRS	Nil				
		Brass	Nil				
		Al. alloy	Anodised				
507	Screw, flat 100°	Steel	Cad.plated	--	No.6 to $\frac{1}{4}$ in	UNC and UNF	
		CRS	Nil				
		Brass	Black oxide				
		Brass	Nil				
		Al. alloy	Anodised				
509	Screw, flat 100° Structural	Steel	Cad.plated	XX	No.8 to $\frac{5}{16}$ in	UNF	
		Al. alloy	Anodised				
		Bronze	Cad.plated				= =
		Bronze	Nil				= =
510	Screw, flat 82°	Steel	Cad.plated		No.5 to $\frac{1}{4}$ in	UNF	
		CRS	Nil				--
		Brass	Nil				
		Al. alloy	Anodised				
515	Screw, round head	Steel	Cad.plated		No.5 to $\frac{3}{8}$ in	UNC	
		CRS	Nil				--
		Brass	Nil				
		Al. alloy	Anodised				
520	Screw, round head	Steel	Cad.plated		No.5 to $\frac{1}{4}$ in	UNF	
		CRS	Nil				--
		Brass	Nil				
		Al. alloy	Anodised				
525	Screw, washer head	Steel	Cad.plated		No.8 to $\frac{1}{4}$ in	No.8 UNC & UNF No.10 UNF $\frac{1}{4}$ in UNF	
526	Screw, truss head	Steel	Cad.plated		No.6 to $\frac{1}{4}$ in	UNF and UNC	
		CRS	Nil				--
		Al. alloy	Anodised				

1. Only one Symbol may be found on some screw heads

3.3 Early Series AN Machine Screws

3.3.1 Screws differ from bolts in being made from a lower strength material, having a looser fit (class 2A thread instead of class 3A) and having a slotted or a cruciform-recessed head, for rotation by a suitably-shaped screwdriver. The thread is usually continued up to the head, but the shank of 'structural' screws (i.e. AN 509 and 525) has a plain portion and may be used in locations where shear loading is present. Some screw heads are marked to indicate the material from which they are made, and these markings are listed in Table 2. The markings, head shape and material will enable identification of a particular screw to be made. Table 2 lists the AN machine screws, and Figure 2 illustrates the various head shapes. It should be noted that some of these screws are obsolescent, and may not be available in the full range of sizes.

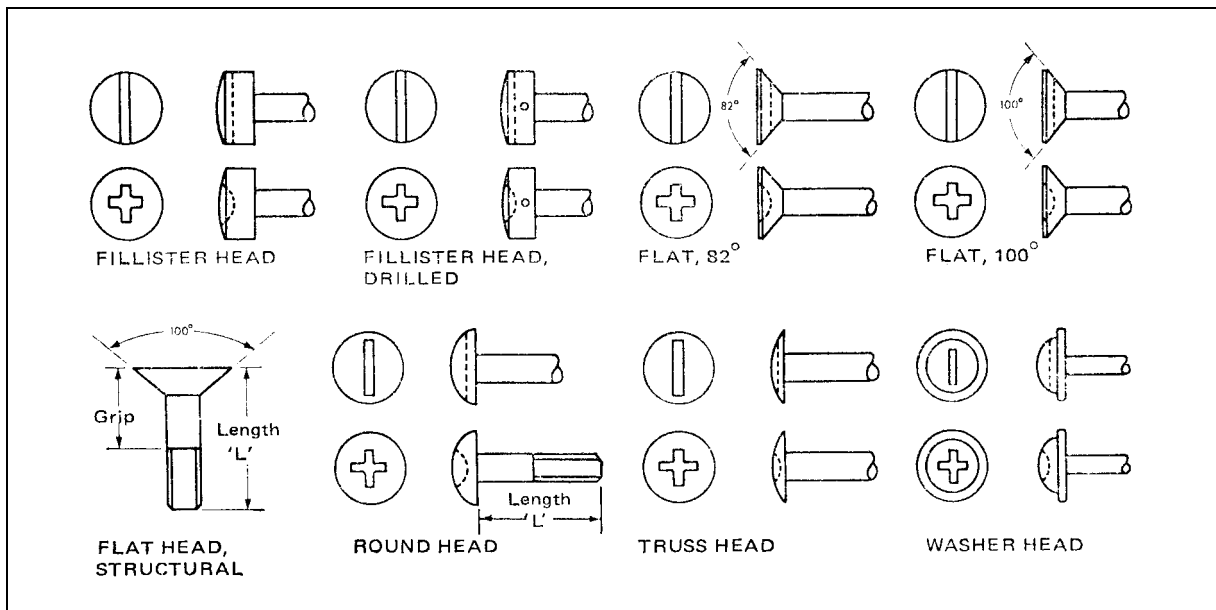


Figure 2 Early Series AN Screws

3.3.2 **Coding.** Screws are coded by the AN number, to indicate the type (e.g. round head), with letters to indicate material (and in some cases the shape of the screwdriver recess), and two dash numbers indicating diameter and length. In addition, some are coded to indicate whether the head is drilled or not.

- a) **Diameter.** The coding for the diameter depends on whether the screw is available with only fine or coarse threads, or with either type of thread. Diameter is indicated by the first dash number.
- i) Screws available with only one type of thread are coded by the thread number or diameter in sixteenths of an inch. For example, No. 4 (UNC or UNF) = -4, No. 10 (UNC or UNF) = -10, $\frac{1}{4}$ in (UNC or UNF) = -416, $\frac{5}{16}$ in (UNC or UNF) = -516, etc.
 - ii) Screws available with both coarse and fine threads (AN 507, AN 525 and AN 526) are coded by the thread number or diameter in sixteenths of an inch, followed by the number of threads per inch. For example, No. 6-32 (UNC) = -632, No. 8-36 (UNF) = -836, $\frac{1}{4}$ -20 (UNC) = -420, $\frac{1}{4}$ -28 (UNF) = -428, etc.
 - iii) AN 525 screws are available in only one coarse thread size (No. 8) and this is coded -832. The remaining sizes are coded in accordance with i).

- b) **Length.** The second dash number indicates the length (L in Figure 2) of a screw in sixteenths of an inch. AN 509 screws are an exception to this rule, the actual length of the screw being $1/32$ in longer than the size indicated by the code.
- c) **Material.** Material is indicated by a letter (or letters) placed after the AN number as follows:

Steel = no letter

CRS = C

Brass (unplated), AN 507 = UB, and other screws = B

Brass (black oxide), AN 507 = B

Aluminium alloy, AN 507, 509 and 526 = DD, and other screws = D

Bronze (cad.plated), AN 509 = P

Bronze (unplated), AN 509 = Z

- d) **Head Recess.** Where a screwdriver slot is required the basic code only is used. Where a cruciform recess is required, 'R' is added instead of the second dash.
- e) **Drilled Head.** AN 500 and 501 screws are provided with plain or drilled heads. The letter A before the first dash number indicates a screw with a drilled head.

f) Examples of Coding

- i) An AN 500A6-32 is a fillister head screw with a locking wire hole. It is made of cadmium-plated steel, has a No. 6 (UNC) thread, has a slotted head and is 2 in long.
- ii) An AN 507C832R8 is a 100° flat head screw in corrosion-resistant steel. It has a No. 8-32 (UNC) thread, has a cruciform recessed head and is $1/2$ in long.
- iii) An AN 509DD416-20 is a 100° flat head, structural screw in aluminium alloy. It has a $1/4$ in (UNF) thread, has a slotted head and is $1\ 9/32$ in long.

3.4 Early Series AN Nuts

- 3.4.1 These nuts are made in a variety of different materials, and should normally be used with early series AN bolts and AN screws. Some nuts are designed specifically for use in engines and should not be used in airframe locations; they are thicker than standard airframe nuts. Early series AN nuts are not marked for identification purposes, but can be recognised from their shape and surface finish. Table 3 gives a list of these nuts, and Figure 3 illustrates the various types. As with the AN screws, some nuts may be obsolescent, and not available in the full range of sizes.

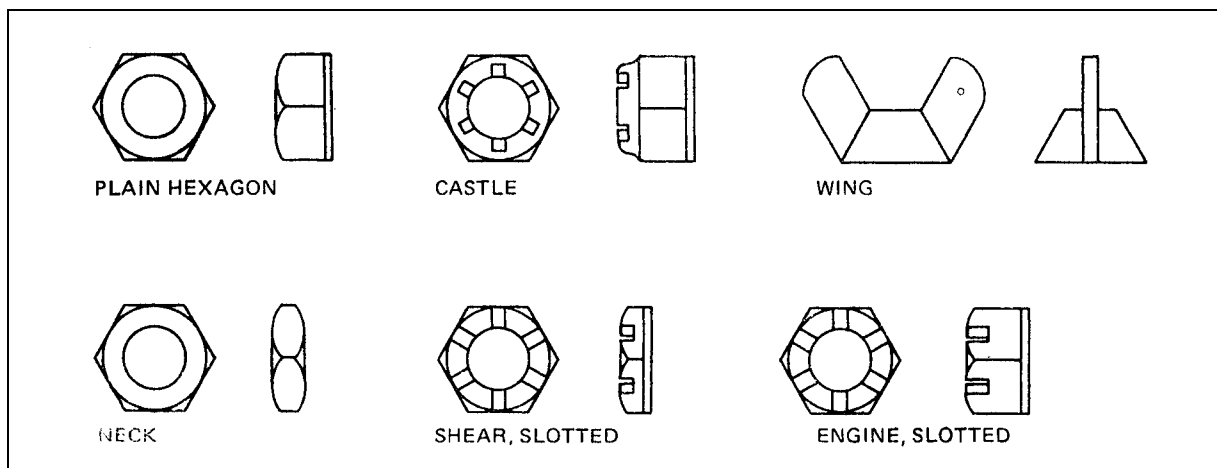


Figure 3 Early Series AN Nuts

3.4.2 **Coding.** The nuts listed in Table 3 are coded according to the type and size of thread, indicated by a dash number placed after the AN number. Those nuts which are intended for use with AN bolts have the same code as the bolts, i.e. a number indicating thread diameter in sixteenths of an inch, and No.6, No.8 and No.10 threads being -1, -2 and -3 respectively. Those nuts intended for use with machine screws (AN 340 and 345) are coded according to the code for screws. The code represents the thread number (-0 to -10) or the diameter in sixteenths of an inch (-416, -516, etc.) as detailed in paragraph 3.2.3 a) i). Wing nuts (AN 350) are coded by the thread designation (-640, -832, etc.) or thread diameter in the fraction sizes (-4 = ¼ in, -5 = 5/16 in, etc.). Material is indicated by a letter placed in the code instead of the dash; C = corrosion-resistant steel, DD = aluminium alloy, machine-screw nuts, D = other aluminium alloy nuts, B = brass, and the absence of a letter indicates a non-corrosion-resistant steel nut. With AN 315 and 316 nuts, 'L' or 'R' is added after the code to indicate left- or right-hand threads. Examples of this coding are: AN 350B4 is a brass wing nut to fit a ¼ in bolt, and AN 316-6L is a steel check nut to fit a 3/8 in bolt with a left-hand thread.





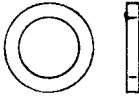
Table 3 Early Series AN Nuts

AN Number	Type	Material	Process	Nominal Range of Thread Sizes	Thread
310	Nut, castle	Steel	Cad.plated	No.10 to ¼ in	UNF
		CRS	Nil		
		Al. alloy	Anodised		
315	Nut, Plain	Steel	Cad.plated	No.6 to 1¼ in (also left-hand thread)	UNF
		CRS	Nil		
		Al. alloy	Anodised		
316	Nut, check	Steel	Cad.plated	¼ to 1 in (also left-hand thread)	UNF
320	Nut, castle, shear	Steel	Cad.plated	No.6 to 1¼ in	UNF
		CRS	Nil		
		Al. alloy	Anodised		
340	Nut, machine screw, hexagon	Steel	Cad.plated	No.2 to ¼ in	UNC
		CRS	Nil	No.2 to ¼ in	
		Brass	Nil	No.2 to No.6	
		Al. alloy	Anodised	No.6 to 3/8 in	
345	Nut, machine screw, hexagon	Steel	Cad.plated	No.0 to ¼ in	UNF
		CRS	Nil	No.0 to ¼ in	
		Brass	Nil	No.0 to No.10	
		Al. alloy	Anodised	No.10 to ¼ in	
350	Nut, wing	Steel	Cad. plated	No.6 to ½ in	UNF
		Brass	Nil		
355	Nut, engine, slotted	Steel	Cad. plated	No.10 to ¾ in	UNF
360	Nut, engine, plain	Steel	Cad. plated	No.10 to ¾ in	UNF

3.5 Early Series AN Washers

3.5.1 AN Standards include three types of washers, and, although these have been replaced in later aircraft designs by MS washers, they may still be found on some older types of aircraft and are included for reference. These washers are listed and illustrated in Table 4.

Table 4 Early Series AN Washers

AN Number	Type	Shape	Material	Process	Material Code
935	Washer, lock, spring		Steel Bronze CRS	} Cadmium plated Nil	Nil B C
936	Washer, Shakeproof	A  B  C 	Steel	Cadmium plated	Nil
			Bronze	Tinned	B
960	Washer, Plain		Steel	Cadmium plated	Nil
			CRS	Nil	C
			Brss	Nil	B
			Al. alloy	Nil	D
			Al. alloy	Anodised	PD

3.5.2 **Coding.** Washers are identified by the AN number, a dash number to indicate size, and letters to indicate material and finish.

- Size.** The size of a washer is related to the size of bolt it is designed to fit, and the dash number is in accordance with the code outlined in paragraph 3.3.2 a) i).
- Material.** Material is indicated in the code by adding the letters shown in Table 4.
- Thickness.** AN 935 and 960 washers may be available in light or regular thickness, the light washer being indicated by an 'L' at the end of the code. Actual thicknesses should be obtained from the AN Standard.

d) **Examples**

- AN 936A416B is a style A regular shakeproof washer designed to fit a ¼ in bolt and is made of bronze.
- AN 960 C-616L is a light plain washer in corrosion-resistant steel, for a 3/8 in bolt.





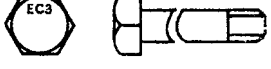



3.6 Late Series AN Fasteners

3.6.1 These fasteners are all marked to show the material from which they are made. When ordering a particular fastener, the part number should be taken from the tables in the appropriate specification, since the size cannot be determined from a standard coding. Tables 5, 6 and 7 list the various bolts, screws and nuts which are currently

available in this series of specifications, and give the range of numbers allocated to each type.

- 3.6.2 Late series AN bolts are listed in Table 5 and are available in sizes 10–32, ¼–28, 5/16–24, 3/8–24, 7/16–20, ½–20, 9/16–18, 5/8–18 and ¾–16.

Table 5 Late Series AN Bolts

AN Number	Type	Material	Identification
101001-101900	Bolt, hexagon head	Alloy steel (AMS 6322) cadmium plated	
101901-102800	Bolt, hexagon head, drilled shank		
102801-103700	Bolt, hexagon head, drilled head (1 hole)		
103701-104600	Bolt, hexagon head, drilled head (6 holes)		
104601-105500	Bolt, hexagon head	Corrosion-resistant steel (AMS 7472)	
105501-106400	Bolt, hexagon head, drilled shank		
106401-107300	Bolt, hexagon head, drilled head (1 hole)		
107301-108200	Bolt, hexagon head, drilled head (6 holes)		

- 3.6.3 Late series AN screws are listed in Table 6, and are available in the sizes shown.

- 3.6.4 Late series AN nuts are listed in Table 7 and are available in the sizes shown.

- 3.6.5 A plain washer is also available in the late series AN specifications. This is a plain steel washer of cadmium plated steel (AMS 6350), made to fit bolts in sizes No.10 to 1 in, and given a number in the range 122576 to 122600. The washers are rubber stamped with the mark 'E 23'.

4 MS Fasteners

- 4.1 A wide variety of fasteners are available in the MS range. All of these fasteners are marked to show the material from which they are made or the MS specification to which they conform; in addition, most fasteners are marked with the manufacturer's identification. Bolts and screws are marked on their heads, and nuts are marked either on the flat (hexagon nuts) or on the top face (other types). To assist in identification, Figure 4 illustrates the various types of bolt and screw heads in this series, and these are referred to in the appropriate Tables. Nuts are similar to those illustrated in Table 7.

Table 6 Late Series AN Screws



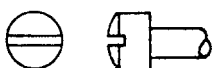

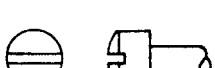
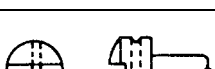





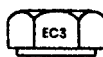



AN Number	Type	Material	Sizes	Identification
116901-116912	Screw, oval fillister	Carbon steel (AMS 5061) cadmium plated	4-40	
116913-116924	Screw, oval fillister, drilled		4-40	
116925-116960	Screw, oval fillister		6-32	
116961-117000	Screw, oval fillister, drilled		6-32	
117001-117040	Screw, oval fillister		8-32	
117041-117080	Screw, oval fillister, drilled		8-32	
115401-115600	Screw, flat fillister	Alloy steel (AMS 6322) cadmium plated	UNF No.10 to 3/8 in	
115601-115800	Screw, flat fillister, drilled shank			
115801-116150	Screw, flat fillister, drilled head		No.10 UNF 1/4 to 3/8 in UNF 1/4 to 3/8 in UNC	

Table 7 Late Series AN Nuts

AN Number	Type	Material	Sizes	Identification
121501-121525	Nut, hexagon, plain	Alloy steel (AMS 6322) cadmium plated	No.10 to 1 in UNF	
121551-121575	Nut, hexagon, castle			
121526-121550	Nut, hexagon, plain	Corrosion-resistant steel (AMS 7472)		
121576-121600	Nut, hexagon, castle			
150401-150425	Nut, hexagon, check	Alloy steel (AMS 6320) cadmium plated	No.10 to 3/4 in UNF	
150426-150450	Nut, hexagon, shear, slotted			

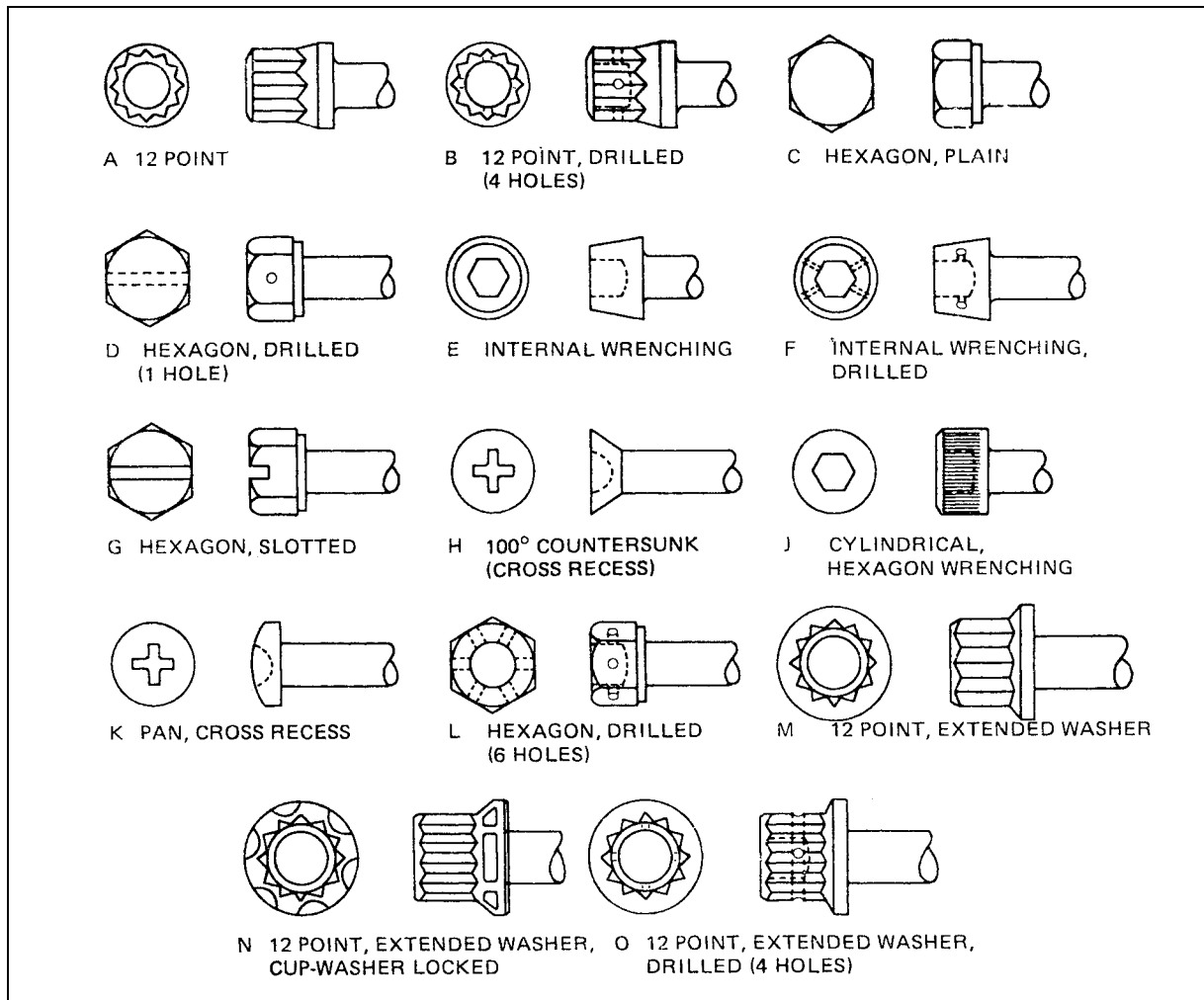


Figure 4 MS Bolts and Screws

4.2 MS Bolts

4.2.1 Table 8 lists a wide range of bolts and screws in the MS series. It should be noted however, that the term 'bolt' is applied to the whole range of sizes in which a particular item is supplied. In the specifications, an item with a No. 8 or smaller thread is generally termed a 'screw', regardless of the fact that it is identical in shape and material to a larger item, which is termed a 'bolt'. However, in some cases the term 'bolt' is also applied to an item with a No. 8 thread.

4.2.2 **Coding.** For most of the items listed in Table 8, the MS number relates to an item of a particular diameter, and a table provided in the specification details the range of lengths available in that size. Length is indicated by a dash number, but the length indicated by a particular dash number varies with the diameter, so that the complete part number of a particular item can only be determined by reference to the specifications.

Table 8 Early Series AN Machine Screws

MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material ¹	Plating
9033-9038	Bolt, 12 point, heat resistant	A	EH 19	UNF	No.10 - ½ in	AMS 5735	Nil
9060-9066	Bolt, 12 point, drilled, extended washer head	O	EH 19	UNF	No.10 - ½ in	AMS 5735	Nil
9088-9094	Bolt, 12 point, drilled head	B	E 11	UNF	No.10 - ⁹ / ₁₆ in	AMS 6322	Cad.
9110-9113	Bolt, 12 point, extended washer head	M	MS No.	UNF	No.10 - ³ / ₈ in	AMS 5731	Nil
9146-9152	Bolt, 12 point	A	E 11	UNF	No.10 - ⁹ / ₁₆ in	AMS 6322	Cad.
9157-9163	Bolt, 12 point	A	E 11	UNF	No.10 - ⁹ / ₁₆ in	AMS 6322	Black oxide
9169-9175	Bolt, 12 point, drilled head	B	E 11	UNF	No.10 - ⁹ / ₁₆ in	AMS 6322	Black oxide
9177 and 9178	Screw, 12 point, extended washer head	N	EH 19	UNF	No.6 & No.8	AMS 5735	Nil
9183 and 9184	Screw, 12 point, drilled head	B	E 11	UNF	No.6 & No.8	AMS 6322	Cad.
9185 and 9186	Screw, 12 point	A	E 11	UNF	No.6 & No.8	AMS 6322	Cad.
9189 and 9190	Screw, 12 point	A	E 11	UNF	No.6 & No.8	AMS 6322	Black oxide
9191 and 9192	Screw, 12 point, drilled head	B	E 11	UNF	No.6 & No.8	AMS 6322	Black oxide
9206-9214	Bolt, 12 point, extended washer head	M	MS No.	UNJF	No.6 - ⁹ / ₁₆ in	AMS 6304	Diffused nickel cadmium
9215-9222	Bolt, 12 point, extended washer drilled head	O	MS No.	UNJF	No.6 - ½ in	AMS 6304	Diffused nickel cadmium
9224	Bolt, 12 point, heat resistant	A	EH 19	UNF	⁹ / ₁₆ in	AMS 5735	Nil
9281-9291	Bolt, hexagon head	C	MS No.	UNF	No.4 - ³ / ₄ in	AMS 6322	Black oxide
9292-9302	Bolt, hexagon head, drilled	D	MS No.	UNF	No.4 - ³ / ₄ in	AMS 6322	Black oxide
9438-9448	Bolt, hexagon head, drilled	D	MS No.	UNJF	No.6 - ³ / ₄ in	AMS 6304	Diffused nickel cadmium

Table 8 Early Series AN Machine Screws

MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material ¹	Plating
9449-9459	Bolt, hexagon head	C	MS No.	UNJF	No.6 - $\frac{3}{4}$ in	AMS 6304	Diffused nickel cadmium
9487-9497	Bolt, hexagon head	C	MS No.	UNJF	No.8 - $\frac{3}{4}$ in	AMS 5731	Nil
9498-9508	Bolt, hexagon head, drilled	D	MS No.	UNJF	No.6 - $\frac{3}{4}$ in	AMS 5731	Nil
9516-9526	Screw, hexagon head	C	MS No.	UNJF	No.4 - $\frac{3}{4}$ in	AMS 6322	Cad.
9527-9537	Screw, hexagon head, drilled	D	MS No.	UNJF	No.4 - $\frac{3}{4}$ in	AMS 6322	Cad.
9554-9562	Bolt, 12 point, extended washer head, PD shank	M	MS No.	UNJF	No.6 - $\frac{9}{16}$ in	AMS 5731	Nil
9563-9571	Bolt, 12 point, ext. washer, drilled head, PD shank	O	MS No.	UNJF	No.6 - $\frac{9}{16}$ in	AMS 5731	Nil
9572-9580	Bolt, 12 point, extended washer head	M	MS No.	UNJF	No.6 - $\frac{9}{16}$ in	AMS 5731	Silver plated
9583-9591	Bolt, hexagon head, drilled	L	MS No.	UNJF	No.10 - $\frac{3}{4}$ in	AMS 5731	Nil
9676-9679	Bolt, 12 point, extended washer head, cupwasher locked	N	MS No.	UNJF	No.10 - $\frac{5}{8}$ in	AMS 5731	Nil
9680-9683	Bolt, 12 point, extended washer head, cupwasher locked	N	MS No.	UNJF	No.10 - $\frac{3}{8}$ in	AMS 6322	Cad.
9694-9702	Bolt, 12 point, extended washer head	M	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	AMS 5708	Nil
9712-9720	Bolt, 12 point, extended washer, drilled	O	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	AMS 5708	Silver plated
9730-9738	Bolt, 12 point, extended washer, PD shank	M	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	AMS 5643	Nil
9739-9747	Bolt, 12 point, extended washer, drilled, PD shank	O	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	AMS 5643	Nil
9748-9756	Bolt, 12 point, extended washer head, PD shank	M	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	Titanium	Nil

Table 8 Early Series AN Machine Screws

MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material ¹	Plating
9757-9765	Bolt, 12 point, extended washer drilled head, PD shank	O	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	Titanium	Nil
9883-9891	Bolt, 12 point, extended washer head	M	MS No.	UNJF	No.4 - $\frac{9}{16}$ in	AMS 5616	Nil
20004-20024	Bolt, internal wrenching	E or F	MS No.	UNF	$\frac{1}{4}$ to 1 $\frac{1}{2}$ in	Alloy steel	Cad.
20033-20046	Bolt, hexagon head, 1200°F	C	1200	UNF	No.10 - 1 in	Corrosion-and heat-resisting steel	Nil
20073 & 20074	Bolt, hexagon head, drilled	D	X	-73 =UNF -74 =UNC	No.10 - $\frac{3}{4}$ in	Alloy steel	Cad.
21095	Bolt, self-locking, 250°F, hexagon head	C	-	UNF	No.10 - 1 $\frac{1}{4}$ in	CRS	Nil
21096	Bolt, self-locking, 250°F, pan head + recess	K	Nil	4,6,8=UNC, larger = UNF	No.4 - $\frac{1}{2}$ in	Alloy steel	Cad.
21097	Bolt, self-locking, 250°F, pan head + recess	K	Nil	4,6,8=UNC, larger = UNF	No.4 - $\frac{1}{2}$ in	CRS	Nil
21250	Bolt, 12 point, 180 000 lbf/in ² , drilled or plain	A or B	MS No.	UNF	$\frac{1}{4}$ - 1 $\frac{1}{2}$ in	Alloy steel	Cad.
21277-21285	Bolt, 12 point, extended washer head	M	MS No.	MIL-S-8879	No.4 - $\frac{9}{16}$ in	AMS 5735	Nil
21286-21294	Bolt, 12 point, extended washer, drilled	O	MS No.	MIL-S-8879	No.4 - $\frac{9}{16}$ in	AMS 5735	Nil

1. AMS 6304 and AMS 6322 are low alloy steels.

All other AMS specifications in the Table are corrosion and heat-resisting alloys.

Table 9 MS Screws








MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material	Plating
9122 and 9123	Screw, hex. head, slotted	G	E 11	UNF	No.10 and ¼ in	AMS 6322	Cadmium
21262	Screw, cyl. head, 160 KSI int. wren. 250°F	J		4,6,8=UNC Larger = UNF	No.4 - 5/8 in	Alloy steel	Cadmium
21295	Screw, cyl. head, 160 KSI int. wren. 250°F	J		4,6,8=UNC Larger = UNF	No.4 - 5/8 in	CRS	Nil
24693	Screw, flat 100°, + recess	H	—	UNC 2A UNF 2A	No.6 - 3/8 in	CRS	Nil
24694	Screw, flat 100°, + recess	H	—	UNC 3A UNF 3A	No.6 - 9/16 in	CRS	Nil
27039	Screw, pan head, + recess, structural	K		8=UNC Larger = UNF	No.8 - ½ in	Bronze Alloy steel CRS	Nil Cadmium Nil
35297	Screw, cap, hex. head	C		UNC 2A	¼ in	Carbon steel	Cad. or zinc
35299	Screw, cap, hex. head	C		UNC 2A	¼- 1¼ in	Carbon steel	Phosphate
35307	Screw, cap, hex. head	C		UNC 2A	¼- 1¼ in	CRS	Nil
35308	Screw, cap, hex. head	C		UNF 2A	¼- 1¼ in	CRS	Nil

Table 9 MS Screws














MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material	Plating
51095	Screw, cap, hex. head, drilled	D		UNC 2A	¼ - 1 in	Carbon steel	Cadmium
51096	Screw, cap, hex. head, drilled	D		UNF 2A	¼ - 1 in	Carbon steel	Cadmium
51099	Screw, cap, hex. head, drilled	D		UNC 2A	¼ - 1 in	CRS	Nil
51100	Screw, cap, hex. head, drilled	D		UNF 2A	¼ - 1 in	CRS	Nil
51105	Screw, cap, hex. head, drilled	D		UNC 2A	¼ - 1 in	Carbon steel	Cadmium
51106	Screw, cap, hex. head, drilled	D		UNF 2A	¼ - 1 in	Carbon steel	Cadmium
51107	Screw, cap, hex. head, drilled shank	C		UNC 2A	¼ - 1 in	Alloy steel	Phosphate
51108	Screw, cap, hex. head, drilled shank	C		UNF 2A	¼ - 1 in	Alloy steel	Phosphate
51109	Screw, cap, hex. head, drilled shank	C		UNC 2A	¼ - 1 in	CRS	Nil
51110	Screw, cap, hex. head, drilled shank	C		UNF 2A	¼ - 1 in	CRS	Nil

Table 9 MS Screws

MS Number	Type	Head Shape (Fig.4)	Head Marking	Thread	Thread Size Range	Material	Plating
90726	Screw, cap, hex. head	C		UNF 2A	1/4 - 1 1/2 in	Carbon steel	Cadmium
90727	Screw, cap, hex. head	C		UNF 2A	1/4 - 1 1/2 in	Alloy steel	Cadmium
90728	Screw, cap, hex. head	C		UNC 2A	1/4 - 1 1/2 in	Alloy steel	Cadmium

4.2.3 With bolts in the ranges MS 20004 to 20024 and MS 20033 to 20046, the thread size is indicated by the part number as outlined in paragraph 3.2.3(a), and the length is indicated by a dash number, which represents grip length in sixteenths of an inch.

4.2.4 With bolts in the MS 21250 series, the dash number indicates both diameter and length. The first two figures indicate diameter in sixteenths of an inch, and the last two figures indicate grip length in sixteenths of an inch.

4.2.5 With the MS 20004 to 20024, and MS 21250, bolts, an H in place of the dash indicates a drilled-head bolt.

4.3 MS Screws

4.3.1 Table 9 lists a variety of the screws covered by MS specifications, and shows the features by which these screws may be partially identified.

4.3.2 Because the individual specifications vary, the screws listed in Table 9 should be fully identified by reference to the particular specification.

4.4 MS Nuts

4.4.1 The non-self-locking nuts to MS specifications are listed in Table 10. These nuts are similar in appearance to those shown in Table 7, but all are marked with the appropriate MS part number for identification purposes.

Table 10 MS Non-self-locking Nuts

MS Number	Type	Thread	Size Range	Material	Plating
9356	Nut, plain, hexagon	No.4,6 and 8 nuts have UNC thread	No.4 - 1 in	AMS 5735	Nil
9357	Nut, plain, hexagon		No.4 - 1 in		Silver
9358	Nut, castle	Larger size nuts have UNF thread	No.10 - 1 in		Nil
9359	Nut, castle		No.10 - 1 in		Silver
9360	Nut, plain, hexagon, drilled		No.10 - 1 in		Silver
9361	Nut, plain, hexagon, check		No.10 - 1 in		Nil
9362	Nut, plain, hexagon, check		No.10 - 1 in		Silver
9363	Nut, hexagon, slotted, shear		No.10 - 1 in		Nil
9364	Nut, hexagon, slotted, shear	No.10 - 1 in	Silver		

4.4.2 **Coding.** Nuts are coded by the MS number plus a dash number indicating thread size –04 is No. 4, –06 is No. 6, –08 is No. 8, –09 is No. 10, –10 is ¼ in, –11 is 5/16 in, –12 is 3/8 in, –13 is 7/16 in, –14 is ½ in, –15 is 9/16 in, –16 is 5/8 in, –17 is ¾ in, –18 is 7/8 in, and –19 is 1 in.

4.5 **MS Washers.** Two ranges of washers are covered in the MS series. MS 35338 is a cadmium-plated, steel, spring washer, and replaces the AN 935 regular spring washer. MS 35333 and 35335 are lock washers in cadmium-plated steel and bronze, which replace the AN 936 style A and style B shakeproof washers, respectively. All of these washers are ordered by the MS number, followed by a dash number indicating the size of bolt the washer is designed to fit. The dash number applicable to a particular washer should be obtained from the tables provided in the specification.

5 NAS Fasteners

5.1 NAS Specifications provide a wide range of fasteners, with a variety of head shapes and wrenching recesses (Figure 5). The range of bolts and screws includes both self-locking and non-locking versions, and many varieties are also available with oversize shanks for repair work. A few washers and nuts are also included in the NAS specifications, but these items are generally supplied under manufacturers' specifications and are not included in this Leaflet.

5.2 All NAS bolts and screws are marked for identification purposes, but the extent of the marking depends on the size of the head and on the requirements of the particular specification. Many components are marked in accordance with NAS 1347, which provides for four types of identification. Type I is the material code and is the same as that shown in Figure 1 for AN bolts; Type II is the basic part number, i.e. the NAS number; Type III is the basic part number and a material code letter; Type IV is the complete part number, including basic part number, material code, figures for diameter and length, and a letter for type of finish. These markings are shown in Table 11, and explained in paragraphs 5.3 and 5.4. It should be noted, however, that in the smaller sizes a shortened version of the code may be permitted by the specification. On fasteners with a Tri-Wing recess the marking also includes a figure, inside a circle,

which indicates the size of the recess in accordance with NAS 4000. Oversize bolts are also marked with an 'X' or 'Y'.

NOTE: Provision is also made for including the manufacturer's identification mark on the head.

5.3 Coding

5.3.1 The bolts and screws listed in Table 11 are coded according to their type, diameter, length, type of plating and material. Where a component is made in more than one material, an alloy steel part is given the basic part number; similarly, where applicable, the basic part number implies that the part is not drilled for locking purposes.

5.3.2 **Diameter.** Most bolts and screws are coded according to thread size in a similar way to AN and MS parts; however, there are some exceptions.

a) NAS 1261 to 1265 and NAS 1266 to 1270 are available in sizes $\frac{9}{16}$ -18, $\frac{5}{8}$ -18, $\frac{3}{4}$ -16, $\frac{7}{8}$ -14, and 1-12; they are coded in numerical order and indicated by an 'A' in Table 11.

b) For bolts and screws which are given a range of numbers (except as detailed in d)), the last figure or two figures indicates the size as follows:

NAS xxx0 = 4-40, xxx1 = 6-32, xxx2 = 8-32, xxx3 = 10-32, xxx4 = $\frac{1}{4}$ -28, xxx5 = $\frac{5}{16}$ -24, xxx6 = $\frac{3}{8}$ -24, xxx7 = $\frac{7}{16}$ -20, xxx8 = $\frac{1}{2}$ -20, xxx9 = $\frac{9}{16}$ -18, xx10 = $\frac{5}{8}$ -18, xx12 = $\frac{3}{4}$ -16, xx14 = $\frac{7}{8}$ -14, xx16 = 1-12, xx18 = $1\frac{1}{8}$ -12, and xx20 = $1\frac{1}{4}$ -12.

The threads are usually UNC, UNF, UNJC or UNJF, but some bolts and screws are also available with American National threads, and these are coded separately. Those parts which comply with the Unified standard are indicated by a 'B' in Table 11.

c) For bolts and screws which are given a single NAS number, the diameter is given by the first dash number as follows:

NAS xxxx-02 = 2-56, xxxx-04 = 4-40, xxxx-06 = 6-32, xxxx-08 = 8-32, xxxx-3 = 10-32, xxxx-4 = $\frac{1}{4}$ -28, and so on, in steps of $\frac{1}{16}$ in, following the sizes given in b). Parts following this code are marked 'C' in Table 11.

d) NAS 1271 to 1280 are available in sizes from $\frac{1}{4}$ to 1 in, and are coded in numerical order.

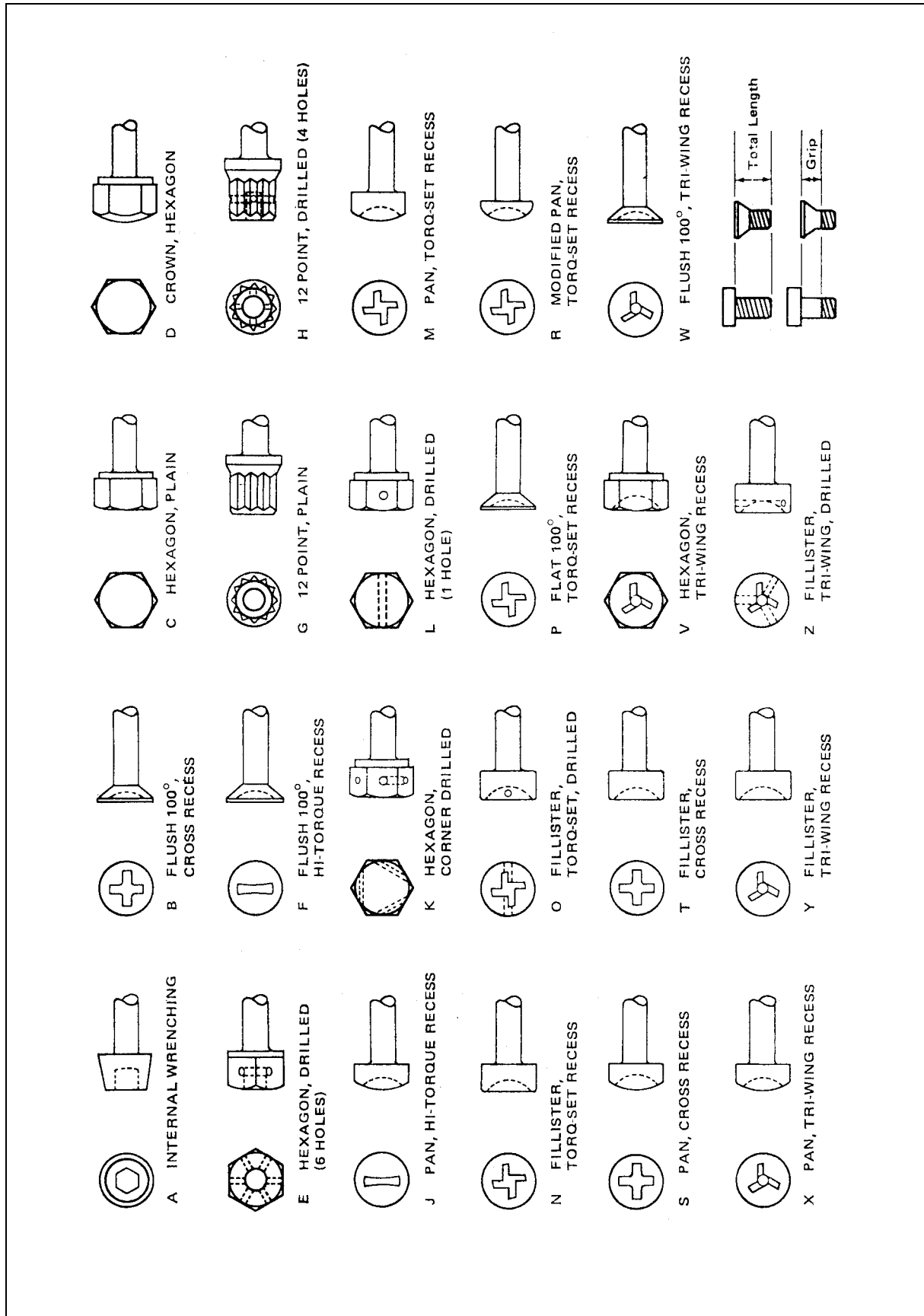


Figure 5 NAS Bolts and Screws

5.3.3 **Length.** The length is indicated by the second dash number for parts with the 'C' diameter code, or the first dash number for all other parts. The length dash number indicates the total length of a part with a full thread or the grip length of a part with a shorter thread (see Figure 5), in sixteenths of an inch; exceptions are NAS 563 to 572, for which the length dash number represents thirty-seconds of an inch, and NAS 428, for which the dash number represents eighths of an inch as detailed in paragraph 3.2.3 b) for AN parts.

5.3.4 **Plating.** Alloy-steel bolts and screws are normally cadmium plated in accordance with QQ-P-416 Type II Class 3. If a different plating is used, or if CRS or titanium parts are plated, the following code may be used:

W = QQ-P-416 Type I Class 3 plating.

B = Blackened Type II plating.

H = CRS with Type II plating.

P = CRS or titanium with Type II plating.

U = Unplated.

A = Aluminium coating to NAS 4006.

5.3.5 **Type of Locking.** Unless otherwise noted in Table 11, the type of locking is indicated as follows:

D = Drilled shank.

H = Drilled head.

L = Nylon strip locking element.

N = Nylon button or pellet locking element.

LK = KEL-F strip locking element.

NK = KEL-F pellet locking element.

K = KEL-F locking element, type optional.

NOTE: The lack of a letter for a self-locking bolt indicates that the type of locking element is unimportant.

5.3.6 **Type of Recess.** Where a choice of wrenching recesses is available, the following code is used to indicate the type required:

T = Torq-Set.

H = Hi-Torque.

P or R = Phillips (cruciform).

NOTE: The type of recess indicated by the lack of a code letter is shown in Table 11.

5.3.7 **Type of Material.** The NAS fasteners listed in Table 11 are manufactured from alloy steel, corrosion-resistant steel (CRS), corrosion-and-heat-resistant (C and HR) steel, and titanium alloy. Except in the case of titanium alloy, which is sometimes indicated by a 'V' (see Table 11), the type of material is not specified unless the fastener is made in more than one material. The basic code applies to alloy steel, and the following code indicates other materials:

CR = corrosion-resistant steel, 125 000 lbf/in².

C = corrosion-resistant steel, 140 000 lbf/in².

E = corrosion-resistant steel, 160 000 lbf/in².

V = titanium alloy.

Table 11 NAS Bolts and Screws



NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
144-158	Bolt, internal wrenching	A	No.1 - 1 ¼ in	Alloy steel	B	A = drilled shank DH = drilled head Nil = undrilled			NAS No.
333-340	Bolt, flush 100°, close-tolerance	B	No.10 - 5/8 in	Alloy steel	B	A = undrilled shank P = Phillips recess Nil = hex.socket C = cad.plated shank	-	See Specification for Length Code	NAS No. + 
428	Bolt, crown hex.head	D	No.10 - 3/8 in	Alloy steel	C	H = drilled head K = slotted shank	-	-	NAS 1347 Type IV
464	Bolt, shear, close-tolerance	C	No.10 - 1 in	Alloy steel	C	P = cad.shank	A = undrilled shank		NAS No. + 
501	Bolt, hex.head, non-magnetic	C	No.10 - 1 ¼ in	CRS	C	A = undrilled shank H = drilled head	-	-	NAS No. + -
560	Screw, 100°, non-magnetic, structural	B	No.8 - 9/16 in	CRS	C	C = low strength H = high temp. X = high strength	K = Phillips recess P = cad.plated	-	NAS No. + C,H, or X
563-572	Bolt, full threaded, fully identified	E	No.10 - 3/4 in	Alloy steel	B	-	-	-	NAS No. + dash no.
583-590	Bolt, 100°, close-tolerance, 160,000 lbf/in ² , Hi-Torque	F	No.10 - 5/8 in	Alloy steel	B	-	-	-	NAS 1347 Type IV

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
624-644	Bolt, 12 point 180,000 lbf/in ²	G or H	¼ - 1½ in	Alloy steel	B	H = drilled head	–	–	NAS No.
653-658	Bolt, hex. head, short thread, close-tolerance	C	No.10 - ½ in	Titanium	B	V = titanium	–	D = drilled shank	NAS No. + dash no. + material
663-668	Bolt, 100°, close-tolerance, long thread	F	No.10 - ½ in	Titanium	B	V = titanium	–	HT = Hi-Torque	NAS 1347 Type IV
673-678	Bolt, hex. head, close-tolerance	C or K	No.10 - ½ in	Titanium	B	V = titanium	–	D = drilled shank H = drilled head	NAS No. + dash no. + material
1003-1020	Bolt, hex. head, non-magnetic, heat-resistant	C or L	No.10 - ¼ in	CRS	B	–	–	A = undrilled H = drilled head Nil = drilled shank	NAS No. + dash no.
1083-1088	Bolt, 100°, close-tolerance, short thread	F	No.10 - ½ in	Titanium	B	V = 6AL-4V alloy T = 4AL-4M _N alloy		Nil = Phillips HT = Hi-Torque	NAS 1347 Type IV
1100	Screw, pan head, full thread, Torq-Set	M	No.0 - ¾ in	Alloy steel Titanium CRS	C	C = CRS 140,000 psi E = CRS 160,000 psi V = titanium	–	B = black plating P = type II plating W = type I plating	NAS No. + dash no. + material
1101	Screw, flat fillister, full thread, Torq-Set	N or O	No.0 - ¾ in	As 1100	C	As 1100	H = drilled head	As 1100	NAS No. + dash no. + material
1102	Screw, 100°, full thread, Torq-set	P	No.2 - ¾ in	As 1100	C	As 1100	–	As 1100	NAS No. + dash no. + material

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1103-1120	Bolt, shear, hex. head, modified short thread	C	No.10 - 1 ¼ in	Alloy steel	C	As 1100	–	As 1100 D = drilled	NAS No. + dash no. + material
1121-1128	Screw, flat fillister, close-tolerance, short thread	N or O	No.6 - ½ in	As 1100	B	As 1100	–	H = drilled head P and W as 1100	NAS No. + dash no. + material
1131-1138	Screw, pan head, close-tolerance, short thread	M	No.6 - ½ in	As 1100	B	C = CRS V and T as 1083	–	P and W as 1100	NAS No. + dash no. + material
1141-1148	Screw, pan head (mod), close-tolerance, short thread	R	No.6 - ½ in	As 1100	B	As 1100	–	P and W as 1100	NAS No. + dash no. + material
1151-1158	Screw, 100°, close-tolerance, short thread	P	No.6 - ½ in	As 1100	B	As 1131	–	D = drilled shank P and W as 1100	NAS No. + dash no. + material
1161-1168	Screw, 100°, shear, self-locking	P	No.6 - ½ in	Alloy steel CRS	B	E as 1100	–	P and W as 1100 + locking code	NAS No. + dash no. + material + circle of dots
1171-1178	Screw, pan, shear, self-locking	M	No.6 - ½ in	Alloy steel CRS	B	E as 1100	–	P and W as 1100 + locking code	NAS No. + dash no. + material + circle of dots

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1181-1188	Screw, flat fillister, shear, self-locking	N	No.6 - ½ in	Alloy steel CRS	B	C and E as 1100	–	P and W as 1100 + locking code	NAS No. + dash no. + material + circle of dots
1189	Screw, 100°, full thread, self-locking, 250°F	B or P	No.2 - ¾ in	Alloy steel CRS	C	C as 1100	P = Phillips recess T = Torq-Set recess	W as 1100 + locking code	NAS No. + dash no. + circle of dots
1190	Screw, pan head, full thread, self-locking	M or S	No.2 - ¾ in	Alloy steel CRS	C	C and E as 1100	P = Phillips recess T = Torq-Set recess	H = type II plating W = type I plating + locking code	NAS No. + dash no. + circle of dots
1191	Screw, flat fillister, full thread, self-locking, 250°F	N or T	No.2 - ¾ in	Alloy steel CRS	C	C and E as 1100	P = Phillips recess T = Torq-Set recess	H and W as 1190 + locking code	NAS No. + dash no. + circle of dots
1202-1210	Bolt, 100°, close-tolerance, 160,000 lbf/in ² , short thread	B	No.8 - ⅝ in	Alloy steel	B		–	D = drilled shank W as 1190	NAS 1347 Type IV
1216	Bolt, pan head, full thread, Hi-Torque	J	No.4 - ¾ in	Alloy steel CRS	C	–	CR = CRS 125,000 lbf/in ² C = CRS 140,000 lbf/in ²	B = black plating P = type II plating	NAS 1347 Type IV

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1217	Bolt, pan head, short thread, Hi-Torque	J	No.8 - $\frac{3}{8}$ in	Alloy steel CRS	C	–	C and CR as 1216	B and P as 1216	NAS 1347 Type IV
1218	Bolt, pan head, long thread, Hi-Torque	J	No.4 - $\frac{3}{8}$ in	Alloy steel CRS	C	–	C and CR as 1216	B and P as 1216	NAS 1347 Type IV
1219	Bolt, 100°, full thread, Hi-Torque	F	No.4 - $\frac{3}{8}$ in	Alloy steel CRS	C	–	C and CR as 1216	B and P as 1216	NAS 1347 Type IV
1220	Bolt, 100°, short thread, Hi-Torque	F	No.8 - $\frac{3}{8}$ in	Alloy steel CRS	C	–	C and CR as 1216	B and P as 1216	NAS 1347 Type IV
1221	Bolt, 100°, long thread, Hi-Torque	F	No.4 - $\frac{3}{8}$ in	Alloy steel CRS	C	–	C and CR as 1216	B and P as 1216	NAS 1347 Type IV
1223-1235	Bolt, hex. head, close-tolerance, self-locking	C	No.10 - 1 $\frac{1}{4}$ in	Alloy steel CRS	B	C = CRS	–	W as 1190 + locking code	NAS 1347 Type IV + circle of dots
1243-1250	Bolt, 100°, close-tolerance, short thread, Hi-Torque, 0.0156 in oversize, 160,000 lbf/in ² (a)	F	No.10 - $\frac{5}{8}$ in	Alloy steel CRS	B	–	–	–	NAS 1347 Type IV
1253-1260	Bolt, 100°, close-tolerance, short thread, Hi-Torque, 0.0312 in oversize, 160,000 lbf/in ² (a)	F	No.10 - $\frac{5}{8}$ in	Alloy steel	B	–	–	–	NAS 1347 Type IV

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1261-1265	Bolt, hex. head, close-tolerance, short thread	C	$\frac{9}{16}$ - 1 in	Titanium	A	–	–	D = drilled shank	NAS 1347 Type IV
1266-1270	Bolt, hex. head, close-tolerance	C	$\frac{9}{16}$ - 1 in	Titanium	A	–	–	D = drilled shank	NAS 1347 Type IV
1271-1280	Bolt, 12 point	G or H	$\frac{1}{4}$ - 1 in	Titanium	D	H = drilled head	–		NAS 1347 Type IV
1303-1320	Bolt, hex. head, close-tolerance, 160,000 lbf/in ²	C or K	No.10 - 1 $\frac{1}{4}$ in	Alloy steel	B	–	–	D = drilled shank H = drilled head W = type I plating	NAS No. + dash no
1503-1510	Bolt, 100°, close-tolerance, short thread, Hi-Torque, 160,000 lbf/in ²	F	No.10 - $\frac{5}{8}$ in	Alloy steel	B	–	–	W = type I plating	NAS No. + dash no
1578	Bolt, pan head, shear, 1200°F	J or M	No.10 - $\frac{1}{2}$ in	C and HR steel (U-212)	C	–	T = Torq-Set recess H = Hi-Torque recess	–	NAS 1347 Type II
1579	Bolt, pan head, Full thread, 1200°F	J or M	No.10 - $\frac{3}{8}$ in	C and HR steel (U-212)	C	–	T and H as 1578	–	NAS 1347 Type II
1580	Bolt, tension, 100°, 1200°F	F or P	No.10 - $\frac{5}{8}$ in	C and HR steel (U-212)	C	–	T and H as 1578	–	NAS 1347 Type II

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1581	Bolt, shear, 100° reduced, 1200°F	F or P	No.10 - ⁵ / ₈ in	C and HR steel (U-212)	C	–	T and H as 1578	–	NAS 1347 Type II
1582	Bolt, 100°, Full thread, 1200°F	F or P	No.10 - ³ / ₈ in	C and HR steel (U-212)	C	–	T and H as 1578	–	NAS 1347 Type II
1586	Bolt, tension, 12 point, 1200°F, external wrenching	G or H	¹ / ₄ - 1 ¹ / ₄ in	C and HR steel (U-212)	C	–	H = drilled head	–	NAS 1347 Type II
1588	Bolt, shear, hex. head, 1200°F	C	No.10 - 1 in	C and HR steel (U-212)	C	–	–	–	NAS 1347 Type II
1603-1610	Bolt, 100°, close-tolerance, 0.0312 in oversize, 160,000 lbf/in ² (b)	F or P	No.10 - ⁵ / ₈ in	Alloy steel	B	–	–	R = Phillips recess Nil = Hi-Torque	NAS 1347 Type IV
1620-1628	Screw, 100°, short thread, Torq-Set recess	P	No.4 - ¹ / ₂ in	Alloy steel CRS Titanium	B	C,E and V as 1100	–	D = drilled shank P = type II plating	NAS 1347 Type IV
1630-1634	Screw, pan head, short thread, Torq-Set	M	No.4 - ¹ / ₄ in	Alloy steel CRS Titanium	B	C,E and V as 1100	–	D = drilled shank P = type II plating	NAS 1347 Type IV

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
1703-1710	Bolt, 100°, close-tolerance, 0.0156 in oversize, 160,000 lbf/in ² (b)	B or F	No.10 - 5/8 in	Alloy steel	B	–	–	R = Phillips recess Nil = Hi-Torque	NAS 1347 Type IV
2803-2810	Bolt, 100°, close-tolerance, 180,000 lbf/in ² Torq-Set	P	No.10 - 5/8 in	Alloy steel	B	–	–	–	NAS No. + dash no.
2903-2920	Bolt, shear, hex. head, 0.0156 in oversize (b)	C or K	No.10 - 1 1/4 in	Alloy steel	B	E = short thread	–	D = drilled shank H = drilled head W = type I plating	NAS No. + dash no.
3003-3020	Bolt, shear, hex. head, long or short thread, 0.0312 in oversize (b)	C or K	No.10 - 1 1/4 in	Alloy steel	B	E = short thread	–	D = drilled shank H = drilled head W = type I plating	NAS No. + dash no.
4104-4116	Bolt, 100°, close-tolerance, long thread, Tri-wing recess, self-locking and non-locking	W	1/4 - 1 in	Alloy steel	B	B = black plating D,L or P see (g)	–	X = 0.0156 in oversize Y = 0.0312 in oversize	NAS No. + dash no. (e) (f) (g)
4204-4216	Bolt, 100°, close-tolerance, long thread, Tri-wing recess, self-locking and non-locking	W	1/4 - 1 in	CRS (c)	B	U = unplated D,L or P see (g)	–	X and Y as 4104	NAS No. + dash no. (e) (f) (g)
4304-4316	Bolt, 100°, long thread, Tri-wing recess, self-locking and non-locking	W	1/4 - 1 in	Titanium (d)	B	U = unplated D,L or P see (g)	–	X and Y as 4104	NAS No. + dash no. (e) (f) (g)

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
4400-4416	Bolt, 100°, short thread, Tri-wing recess, self-locking and non-locking	W	No.4 - 1 in	Alloy steel	B	B = black plating D,L or P see (g)	–	X and Y as 4104	NAS No. + dash no. (e) (f) (g)
4500-4516	Bolt, 100°, close-tolerance, short thread, Tri-wing recess, self-locking or non-locking	W	No.4 - 1 in	CRS (c)	B	U = unplated D,L or P see (g)	–	X and Y as 4104	NAS No. + dash no. + C for CRS (e) (f) (g)
4600-4616	Bolt, 100°, close-tolerance, short thread, Tri-wing recess, self-locking and non-locking	W	No.4 - 1 in	Titanium (d)	B	U = unplated D,L or P see (g)	–	X and Y as 4104	NAS No. + dash no. + V for titanium (e) (f) (g)
4703-4716	Bolt, 100°, close-tolerance, short thread, reduced head, non-locking, Tri-wing recess	W	No.10 - 1 in	Alloy steel	B	D = drilled shank Nil = undrilled	–	X and Y as 4104	NAS No. + dash no. (e) (f)
4803-4816	Bolt, 100°, close-tolerance, short thread, reduced head, non-locking, Tri-wing recess	W	No.10 - 1 in	CRS (c)	B	D = drilled shank U = unplated	–	X and Y as 4104	NAS No. + dash no. + C for CRS (e) (f)

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
4903-4916	Bolt, 100°, close-tolerance, short thread, reduced head, non-locking, Tri-wing recess	W	No.10 - 1 in	Titanium (d)	B	D = drilled shank U = unplated	–	X and Y as 4104	NAS No. + dash no. + V for titanium (e) (f)
5000-5006	Bolt, pan head, close-tolerance, short thread, Tri-wing recess, self-locking and non-locking	X	No.4 - ³ / ₈ in	Alloy steel	B	B = black plating L or P see (g)	–	X and Y as 4104	NAS No. + dash no. (e) (f) (g)
5100-5106	Bolt, pan head, close-tolerance, short thread, Tri-wing recess, self-locking and non-locking	X	No.4 - ³ / ₈ in	CRS (c)	B	U = unplated L or P see (g)	–	X and Y as 4104	NAS No. + dash no. + C for CRS (e) (f) (g)
5200-5206	Bolt, pan head, close-tolerance, short thread, Tri-wing recess, self-locking and non-locking	X	No.4 - ³ / ₈ in	Titanium (d)	B	U = unplated L or P see (g)	–	X and Y as 4104	NAS No. + dash no. + V for titanium (e) (f) (g)
5300-5360	Screw, flat fillister head, full thread, Tri-wing recess, self-locking and non-locking	Y or Z	No.4 - ³ / ₈ in	Alloy steel	B	H = drilled head B = black plating L or P see (g)	–	–	NAS No. + dash no. (f) (g)

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
5400-5406	Screw, flat fillister head, full thread, Tri-wing recess, self-locking and non-locking	Y or Z	No.4 - ³ / ₈ in	CRS (c)	B	H = drilled head U = unplated L or P see (g)	–	–	NAS No. + dash no. + C for CRS (f) (g)
5500-5506	Screw, flat fillister head, full thread, Tri-wing recess, self-locking and non-locking	Y or Z	No.4 - ³ / ₈ in	Titanium (d)	B	H = drilled head U = unplated L or P see (g)	–	–	NAS No. + dash no. + V for titanium (f) (g)
5600-5606	Screw, 100°, full thread, Tri-wing recess, self-locking and non-locking	W	No.4 - ³ / ₈ in	Alloy steel	B	B = black plating L or P see (g)	–	–	NAS No. + dash no. (f) (g)
5700-5706	Screw, 100°, full thread, Tri-wing recess, self-locking and non-locking	W	No.4 - ³ / ₈ in	CRS (c)	B	B = black plating U = unplated L or P see (g)	–	–	NAS No. + dash no. + C for CRS (f) (g)
5800-5806	Screw, 100°, full thread, Tri-wing recess, self-locking and non-locking	W	No.4 - ³ / ₈ in	Titanium (d)	B	U = unplated L or P see (g)	–	–	NAS No. + dash no. + V for titanium (f) (g)

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
6000-6003	Screw, hex.head, full thread, Tri-wing recess	V	No.4 to No.10	CRS (c)	B	U = unplated	–	–	NAS No. + dash no + C for CRS (f)
6100-6103	Screw, hex.head, full thread, Tri-wing recess	V	No.4 to No.10	Titanium (d)	B	U = unplated	–	–	NAS No. + dash no. + V for titanium
6203-6220	Bolt, hex.head, short thread, close-tolerance, self-locking and non-locking	C or K	No.10 - 1¼ in	Alloy steel	B	D,L or P see (g)	–	X or Y as 4104 D = drilled shank H = drilled head	NAS No. + dash no. (e) (g)
6303-6320	Bolt, hex. head, short thread, close-tolerance, self-locking or non-locking	C or K	No.10 - 1¼ in	CRS (c)	B	U = unplated L or P see (g)	–	X or Y as 4104 D = drilled shank H = drilled head	NAS No. + dash no. (e) (g)
6403-6420	Bolt, hex.head, short thread, close tolerance, self-locking or non-locking	C or K	No.10 - 1¼ in	Titanium (d)	B	U = unplated L or P see (g)	–	X or Y as 4104 D = drilled shank H = drilled head	NAS No. + dash no. (e) (g)
6604-6620	Bolt, hex.head, long thread, close-tolerance, self-locking and non-locking	C or K	¼ - 1¼ in	Alloy steel	B	D = drilled shank H = drilled head L or P see (g)	–	X or Y as 4104	NAS No. + dash no. (e) (g)

Table 11 NAS Bolts and Screws

NAS No.	Type	Head (Fig.5)	Size Range	Material	Coding				Head Marking
					Dia.	Replacing Dash or First Dash	Replacing Second Dash	At End	
6704-6720	Bolt, hex.head, long thread, close-tolerance, self-locking and non-locking	C or K	¼ - 1 ¼ in	CRS (c)	B	D = drilled shank H = drilled head U = unplated L or P see (g)	–	X or Y as 4104	NAS No. + dash no. (e) (g)
6804-6820	Bolt, hex.head, long thread, close-tolerance, self-locking and non-locking	C or K	¼ - 1 ¼ in	Titanium (d)	B	D = drilled shank H = drilled head U = unplated L or P see (g)	–	X or Y as 4104	NAS No. + dash no. (e) (g)

NOTE:

- a) For repair work only, replacing NAS 1503 to 1510.
- b) For repair work only.
- c) Cadmium plated CRS bolts have green dye or paint on the end of the shank.
- d) Cadmium plated titanium bolts have red dye or paint on the end of the shank.
- e) Oversize bolts are marked with 'X' or 'Y' (see code).
- f) Heads are also marked with an encircled number, to indicate the size of the Tri-wing recess, in accordance with NAS 4000.
- g) Method of locking, included in code and marked on head, is as follows:
D = drilled shank. L = locking element is optional. P = patch type locking element.

5.4 **Examples of Coding**

- a) NAS 564-15 is a full-threaded bolt in cadmium-plated alloy steel, with $\frac{1}{4}$ -28 thread, and length of $\frac{15}{32}$ in.
- b) NAS 1146E12P is a screw with a modified pan head, close-tolerance shank and Torq-Set recess, made from CRS (160 000 lbf/in²), with Type II plating. It has a $\frac{3}{8}$ -24 thread and a $\frac{3}{4}$ in grip length.
- c) NAS 1189-3T8L is a self-locking screw with a 100° countersunk head and full thread. It has a 10-32 thread, is $\frac{1}{2}$ in long, and is in alloy steel with Type II plating. It has a strip-type nylon locking element and a Torq-Set recess.
- d) NAS 6804D10X is a hexagon head, close-tolerance bolt in titanium alloy, with a long thread. It has a $\frac{1}{4}$ -28 thread and $\frac{5}{8}$ in grip length, and a drilled shank which is 0.0156 in oversize.