# 12 FENCING

## 12.1 GENERAL

### 12.1.1 Scope

1 This part of the specification covers the materials and installation requirements for the following permanent fence types. The definition of each type is given in the relevant section of the specification.

(a) chainlink fencing.

(b) strained wire fencing.

(c) pedestrian guard-rail.

2 Related Sections and Parts:

This Section

Part 1..... General
Part 10..... Vehicle Crash Barriers

Section 5, Concrete

### 12.1.2 References

AASHTO M181 .....Chain link fence

ASTM A193.....Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature

ASTM A240.....Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

ASTM A53.....Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM B108.....Specification for Aluminium-Alloy Permanent Mould Castings

ASTM B221.....Specification for Aluminium-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM D4364.....Practice for Performing Accelerated Outdoor Weathering of Plastics Using Concentrated Natural Sunlight

ASTM DI499.....Standard practice for filtered open-frame carbon-arc exposure of plastic

ASTM G23 .....Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Non-metallic Materials

ASTM G152 .....Standard practice for operating open flame carbon-arc light apparatus for exposure of non-metallic materials

ASTM G153 .....Standard practice for operating endorsed arc light apparatus for exposure of non-metallic materials.

BS 1449: Part 2.....Stainless and heat resistant steel plate sheet and strip

BS 1474 .....Wrought aluminium and aluminium alloys for engineering purposes

BS 1490 .....Aluminium and aluminium ingots for engineering purposes

BS 1722, Part 1.....Chain link fences

BS 1722, Part 2.....Rectangular wire mesh and hexagonal wire netting fences

BS 1722-2 .....Strained wire fences

BS 4.....Structural steel sections

BS 4102 .....Specifications for steel wire and wire products for fences

BS 4320 .....Metal washers for general engineering purpose

BS 4464 .....Spring washers for general engineering and automobile purposes

BS 4652 .....Specifications for zinc rich priming paint

BS 970.....Wrought steels for mechanical and allied engineering purposes

BS 7818……Specification for pedestrian restraint systems in metal

BS 1722…….Fences: Specification for free-standing temporary steel mesh perimeter fencing panels

EN 1011 .....Welding

EN 10210-2 .....Hot finished structural hollow sections of non alloy and fine grain steels

EN 10244-2 .....Steel wire and wire products

ISO 1461 .....Hot dip galvanised coatings on iron and steel articles

ISO 3506 .....Corrosion-resistant stainless steel fasteners

USA Federal Salt Spray Test (Test Standard 141 Method 6061)

**12.1.3 Submittals**

1 For all fencing systems, the Contractor shall submit the following for the Engineer's approval, before an order is placed with the manufacturer:

(a) Name and address of the factories at which the required materials will be manufactured.

(b) Technical submittals accompanied by a completed specification in the English language, catalogues and a tabulation showing the overall dimensions of each type and size of the required materials.

(c) Programme of delivery certified by the manufacturer and supplier.

(d) Detailed drawings.

(e) Material composition certificates.

(f) Technical information for the materials and system.

2 The submittals shall clearly show the standard to which the material complies. All materials shall meet the requirements of the relevant BS. The Engineer may accept materials that comply to a comparable international standard if the contractor demonstrates that the standard is equivalent.

## 12.2 FENCING GENERALLY

1 All permanent fencing, unless otherwise designated shall be erected to present a flowing alignment both in plan and elevation following approximately the level of the finished ground along the line of the fence. The Contractor shall trim or fill the ground along the line of the fence when required. The fencing shall be neatly and effectively joined to existing fences and to other structures and parapets.

2 Where designated, existing fences, gates and stiles, with posts shall be carefully taken down, laid aside, removed or later re-erected. Fences, gates, stiles and posts which are to be re-erected shall be handled carefully to avoid any damage.

## 12.3 CHAIN LINK FENCING

### 12.3.1 General

1 This work consists of the supply and installation of all plastic coated chain link fencing complete with all necessary hardware and appurtenances as designated and in conformity with the lines and grades directed by the Engineer.

2 Chain Link Fences and all materials to be furnished and installed shall conform to all requirements of BS1722: Parts 1 and 2 except as otherwise designated.

### 12.3.2 Materials

1 The base metal for the manufacture of posts and braces shall conform to the requirements of BS1722: Part 1, except that the carbon content of steel posts shall not be more than 0.4 % if welding is required. Posts and braces shall be galvanised in accordance with ISO 1461.

2 Fence posts and braces and gate frames shall be pipe conforming to the requirements of Table 12.1 unless otherwise designated:

Table 12.1
Fence posts and braces and gate frames requirements

| Location | Minimum O.D., mm | Minimum Weight, kg/m |
|---|---|---|
| End, Corner, Pull Posts | 60.3 | 5.43 |
| Line Posts | 48.3 | 4.05 |
| Braces | 42.2 | 3.38 |

3 Posts for each side of gates shall be pipe conforming to the requirements of Table 12.2:

Table 12.2
Post dimensions for chain link fences

| Gate Opening, m | Minimum O.D., mm | Minimum Weight, kg/m |
|---|---|---|
| 1.5 | 60.3 | 5.43 |
| 4.0 | 73.0 | 8.62 |

4 All fence and gate posts (including all end and corner posts) shall be fitted with plastic or vinyl coated aluminium tops designed to fit securely over the posts and crowned to shed water.

5 Changes in line where the angle of deflection is 15° or more shall be considered as corners and corner posts shall be installed.

6 Extension arms, stretcher bars, and other required fittings and hardware shall be steel, malleable iron or wrought iron and shall be hot dipped galvanised. All required fittings and hardware shall be fastened to the posts in the proper manner.

7 Chain link fence fabric shall be galvanised steel fabric conforming to the BS1722: Part 1. The base metal for the fabric shall be medium high carbon hot-dip galvanised steel wire. All chain link fence fabric shall be woven into approximately 50 mm mesh such that in a vertical dimension of 600 mm along the diagonals of the openings there shall be at least 7 meshes.

8 Between posts, chain link fabric shall be fastened to a top and bottom tension cable. The tension cable shall be 10 gauge galvanised steel.

9 Tie wires and post clips shall be at least 9 gauge galvanised steel.

10 Turnbuckles and truss tighteners shall be fabricated of steel, malleable iron, or wrought iron and shall be hot dipped galvanised. The truss tighteners shall have a strap thickness of not less than 6 mm.

11 The class of concrete for post footings shall be as designated.

**12.3.3 Gates**

1 Gate frames shall be constructed of not less than 42.2 mm galvanised pipe weighing 3.38 kg/m and conforming to ASTM A53. Gate frames shall be cross trussed with 9 mm adjustable truss rods. The corners of gate frames shall be fastened together and reinforced with a malleable iron fitting designed for the purpose or by welding. All welds shall be ground smooth.

2 Chain link fence fabric designated for the fence shall be attached to the gate frame by the use of stretcher bars and the tie wires as designated for fence construction, and suitable tension connectors shall be spaced at approximately 300 mm intervals.

3 The gates shall be hung by at least two steel or malleable iron hinges not less than 80 mm in width, so designed as to securely clamp to the gate post and permit the gate to be swung back against the fence. The bottom hinge shall have a socket to take the bail end of the gate frame.

4 Gates shall be provided with a combination steel or malleable iron catch and locking attachment of approved design. Stops to hold gates open and a centre rest with catch shall be provided where required.

5 All gates shall be provided with standard hardware and heavy duty padlocks with four keys each, the type and details of which shall be to the approval of the Engineer.

**12.3.4 Finish to Components**

1 All posts, gate frames, rails and similar materials shall have a coating thickness of 254 to 356 micron of a polyvinyl chloride (PVC) which has been chemically bonded to the metal surface with an appropriately cured primer. Final finish colour shall be as designated.

2 Chain link fence fabric shall have a vinyl coating of minimum wall thickness of 0.559 mm over the galvanised substrate. The vinyl coating shall be continuously extruded (not sprayed or dipped) over the galvanised steel wire by the thermal extrusion process under pressures to 352 kg/cm2 to ensure a dense and impervious covering free of voids, having a smooth and lustrous surface appearance.

3 The wire shall be vinyl-clad before weaving and shall be free and flexible at all joints.

4 Colours shall be stabilised and have a light fastness that shall withstand a minimum WEATHER-O-METER exposure time of 4000 h without any deterioration in accordance with ASTM Dl499 and G23, Type E. Alternatively a sample of fencing may be subject to an exposure time of 2000 h at 85 °C humidity in a humidity oven. The sample shall exhibit no colour loss, cracking, peeling, blistering or other deterioration.

5 The vinyl-clad wire shall withstand an accelerated ageing test of 2000 hours at 62 °C without cracking or peeling.

6 The vinyl covering shall, in addition, resist attack from prolonged exposure to dilute solutions of most common mineral acids, sea water and dilute solutions of most salts and alkali.

7 The pipe resin formulation shall meet the standard ASTM D4364, minimum 5000 h WEATHER-O-METER requirement without cracking, blistering, or loss of adhesion. The protective resin coating shall withstand an impact resistance test (Gardner Test Method) of a minimum of 1850 mm/kg. Certified abrasion resistance shall be in excess of a ten minute blast of 5.6 kg/cm2 at 305 mm at 25 °C with S230 shot at an impingement angle of 90 ° without exposing the steel substratum.

8 It shall not support combustion and shall be self-extinguishing; and shall withstand a salt spray test (Federal Test Standard 141, Method 6061 of greater than 10,000 h with no perceptive deterioration to coating or evidence of metal corrosion for unscored samples. For scored samples after exposure of 1000 h, under-cutting shall not exceed 5 mm. The protective resin coating shall exhibit a chemical resistance after prolonged exposure at 24 °C to fumes.

### 12.3.5 Construction

1 Line posts shall be spaced at not more than 3.0 m intervals, measured from centre to centre of posts, in general, in determining the post spacing, measurement will be made parallel to the slope of the natural ground, and all posts shall be placed in a vertical position, except in unusual locations where the posts shall be set perpendicular to the ground surface if so directed by the Engineer.

2 All posts shall be set in concrete footings conforming to the designated details.

3 End, corner, pull and gate posts shall be braced to the nearest line post with galvanised diagonal or horizontal braces used as compression members and galvanised 9 mm steel truss rods with turnbuckles or truss tighteners used as tension members.

4 Pull posts shall be placed at locations agreed by the Engineer. They shall be placed at 200 m intervals between posts to which the ends of the fabric are clamped or midway between such posts when the distance is greater than 40 m but less than 200 m.

5 Chain link fabric shall be fastened on the side of the posts designated by the Engineer.

6 The fabric shall be stretched and securely fastened to the posts, and between posts the top and bottom edges of the fabric shall be fastened to the tension wires. Tension wires shall be stretched tight, the bottom tension wire shall be installed on a straight grade between posts by excavating at the high points of ground and in no case will filling of depressions be permitted.

7 The fabric shall be fastened to end, corner and gate posts tall with minimum 10 mm diameter steel stretcher bars and not less our than 3 mm by 18 mm stretcher bar bands spaced at maximum or 300 mm intervals. The fabric shall be fastened to line posts ends and tension wires with tie wires or post clips. The fasteners shall be spaced at maximum intervals of 500 mm.

## 12.4 STRAINED WIRE FENCING

### 12.4.1 General

1 Strained wire general and dropper fences shall be as designated and they shall comply with BS 1722-2 with the following amendments.

2 This part of the specification covers the requirements for materials and workmanship for strained wire fences of the general pattern and of the dropper pattern. Droppers are defined as intermediate and vertical stiffeners between some or all of the wires that are used to maintain the spacing of the wires. The droppers are not connected to the ground.

3 Strained wire fences comprise of tensioned horizontal steel wires fixed between vertical straining posts with support angle struts and connected to intermediate posts. Posts shall be constructed of either steel or precast reinforced concrete and anchored in concrete foundations.

4 Wire dropper fencing shall be provided at locations where it is necessary to restrict the access of vehicles, and camels and wandering animals.

5 Strained wire general and dropper fences shall be of one of the types shown in Table 12.3

6 The strained wire fences shall be coded according to the type dependant on the number of line wires, whether droppers are used, material used for the posts, these type references are given in Table 12.3. The first letter indicates that it is either a general pattern or a dropper pattern strained wire fence, the second letter indicates the type of posts that are used, the numbers give an indication of the height of the fence e.g. DC90 indicates a 0.9m high fence with concrete posts and droppers.

7 For the sake of uniformity quoted heights of those to the top wire and exclude any variation in ground clearance to the base, the third letter where present indicates the number of line wires.

Table 12.3
General Characteristics of Strained Fences - Fence Types

| **With Concrete Posts** | | **With Steel Posts** | | **With Wooden Posts** | | **Height of Top Wire & Number of Wires** | | **Spacing between horizontal wires, from the top wires** |
|---|---|---|---|---|---|---|---|---|
| **General Pattern** | **Dropper Pattern** | **General Pattern** | **Dropper Pattern** | **General pattern** | **Dropper Pattern** | | | |
| | | | | | | m | No. | mm |
| | DC 90 | SS90 | DS90 | SW90 | DW90 | 0.90 | 3 | 330,330 |
| SC105A | DC105A | SS105A | DS105A | SW105A | DW105A | 1.05 | 5 | 250,250,230,150 |
| SC105B | SS105B | SS105B | DS105B | SW105B | DW105B | 1.05 | 6 | 250,250,230,150, 100 |
| SC120 | DC120 | SS120 | DS120 | SW120 | DW120 | 1.20 | 6 | 250,250,230,150, 150 |
| SC135A | DC135A | SS135A | DS135A | SW135A | DW135A | 1.35 | 7 | 250,250,230,150, 150,150 |

| With Concrete Posts | | With Steel Posts | | With Wooden Posts | | Height of Top Wire & Number of Wires | | Spacing between horizontal wires, from the top wires |
|---|---|---|---|---|---|---|---|---|
| General Pattern | Dropper Pattern | General Pattern | Dropper Pattern | General pattern | Dropper Pattern | | | |
| SC135B | DC135B | SS135B | DS135B | SW135B | DW135B | 1.35 | 8 | 250,250,230,150, 150,150,100 |
| SC135C | DC135C | SS135C | DS135C | SW135C | DW135C | 1.35 | 9 | 250,225,225,150, 125,125,100,75 |
| | DC180 | | DS180 | | DW180 | 1.80 | 11 | 225,225,200,175, 175,175,150,150, 125,100 |
| | DC210 | | DS210 | | DW210 | 2.10 | 16 | 100,100,100,100, 100 |

### 12.4.2 Materials

1 The sizes stated for components are the minimum requirements and it is permissible to use larger sizes except where this would adversely affect the fit of the components or where replacement parts need to match those already present.

2 Line wire shall comply with BS 4102 and shall be one of the following:

3 Zinc coated low carbon steel with a nominal wire diameter of either 4.5 or 5mm

4 Zinc coated high tensile wire with a nominal wire diameter of 3.15mm

5 Plastic coated high tensile wire having a tensile strength of 1050 N/mm2 with a Zinc coated core of 3.15mm nominal core diameter and a 4 .0mm overall diameter.

6 Stirrup wire shall comply with BS4102 and shall be of zinc coated low carbon steel with grade A plastic coated low carbon steel and should have a nominal wire core diameter of 2.5 mm.

7 Barbed wire shall comply with BS 4102, shall be zinc coated and made from either low carbon steel or high tensile steel wire.

8 The materials, protective treatment, tolerances on size and general construction details of steel posts and struts, for strained wire fences shall comply with the requirements for chain link fences, except that components shall not be plastic coated unless specifically required under the contract documentation.

9 The materials and tolerances on precasting of all concrete components shall comply with the relevant parts of section 5.

10 The minimum concrete grade for posts shall be C25 and the minimum cement content should be 350 kg.

11 The mixing, placing and compaction of the concrete shall be as per Section 5.

12 All inserts and holes cast into precast concrete components with posts shall be adequate for the bolts or appurtenances to be fitted.

13 All holes shall be free from obstructions and accurately positioned.

14 The minimum grade of concrete to be used for posts shall be C25 and the minimum cover to embedded steel in posts shall be 50mm.

15 The dimensions of concrete fence posts and struts shall be as given in Table 12.4.

16 Posts shall be reinforced with 4 steel reinforcing bars of the size given in Table 12.4.

17 Straining posts and struts shall not be tapered.

18 The dimensions and details of the foundations shall be as shown in the contract drawings. Concrete for foundations for the bases of posts and struts shall comply with the requirement of section 5 of the specification and shall be grade C15.

19 Straining posts shall be provided with a firm bearing struts at a point within the top of the length of the string posts, measured above the ground level.

20 Straining posts shall be provided with holes for the attachment of straining fittings.

21 Where line wires are to be passed through them, struts shall be provided with either holes or slots.

22 Intermediate posts shall be tapered to 75mm x 75mm at the top and shall be holed to allow the attachment of line wires.

23 High bolt strain shall consist of bolts of 250mm overall length, not less than 9.5mm diameter with an eye at one end. They should be threaded and fitted with nuts and washers.

24 2 way eye bolt strainers shall be fitted with ring nuts. They shall be hopped and galvanised to ISO 1461. Widening brackets intended for attachment to the post shall be manufactured from mild steel flat not less than 25mm x 3mm and shall be fitted with a widening bolt 12mm minimum diameter with a friction type ferrule or ratchet winder.

25 Hair pin staples shall be of not less than 3mm diameter round wire or sectional wire of the same cross sectional area and shall have a zinc coating complying with 10244-2.

26 Droppers shall be at least 65 mm longer than the distance between the top and bottom wires covered by them and shall be made of steel of the section not less than 0.0066 kg/m or steel wire or galvanised in accordance with ISO 1461.

Table 12.4
Concrete Fence Posts and Struts

| Height | Intermediate Posts | | | Strain Posts | | | Struts | | |
|---|---|---|---|---|---|---|---|---|---|
| | Length | Section | Reinf. Dia. | Length | Section | Reinf. Dia. | Length | Section | Reinf. Dia. |
| m | m | mm x mm | mm | m | mm x mm | mm | m | mm x mm | mm |
| 0.90 | 1.57 | 100 x 100 | | 1.57 | 100 x 100 or 125 x 125 | 5 or 8 | 1.50 | 75 x 75 or 100 x 75 | 6 |
| 1.05 | 1.72 | 100 x 100 | | 1.87 | 100 x 100 or 125 x 125 | 5 or 8 | 1.83 | 75 x 75 or 100 x 75 | 6 |
| 1.20 | 1.87 | 125 x 125 | | 2.02 | 125 x 125 | 8 | 1.98 | 100 x 75 | 6 |
| 1.35a and b | 2.02 | 125 x 125 | | 2.17 | 125 x 125 | 8 | 2.13 | 100 x 75 | 6 |
| 1.35c | 2.17 | 125 x 125 | | 2.32 | 150 x 150 | 10 | 2.13 | 100 x 75 | 6 |
| 1.80 | 2.62 | 125 x 125 | | 2.77 | 200 x 200 | 12 | 2.73 | 100 x 100 | 8 |
| 2.10 | 2.92 | 125 x 125 | | 3.07 | 200 x 200 | 12 | 3.03 | 100 x 100 | 8 |

### 12.4.3 Installation

1 Droppers shall be securely fixed to all the line wires covered by them and be of sufficient strength to maintain the spacing of the line wires and spread the load between them in use.

2 The post shall be adequately braced in both directions after insertion into the wet concrete and support shall be maintained till the concrete is fully hardened.

3 Excavation for foundations for post and struts shall be of the minimum stipulated dimensions at the base of the hole.

4 When erecting fence posts the concrete shall be placed in position before the commencement of the initial set.

5 The entire foundation hole shall be filled with concrete, the use of partly backfilled holes shall not be permitted. Straining posts shall be provided at the ends and corners of changes of direction or acute variations in level and at intervals not exceeding 150m for mild steel line wire or 300m for high tensile line wire in straight lengths of fence.

6 Struts shall be provided at each straining post.

7 Where there is a change in plan direction of the fence two struts shall be provided.

8 Intermediate posts shall be provided at intervals measured centre to centre of posts not exceeding 3.5m.

9 The number of line wires shall be as given in Table 12.3.

10 The top wire shall be secured with approximately 75mm below the top of the posts, each line wire shall be strained tightly and secured to each straining posts by either widening brackets attached to the post with fixing bolts or high bolt strainers passing through a hole in the post and secure with a nut and washer.

11 If barbed wire is specified it shall be attached to the straining posts and intermediate posts by the same method as the line wire.

12 Attachment to intermediate posts with the exception of the high tensile line wire for which stirrups are not permitted each line wire shall be secured to each intermediate posts by one of the following means;

13 A wire stirrup pass through a hole in the posts secured to the

14 a hairpin stapled post through a hole in the post and the ends twice bent over

15 A line wire pass through a hole in the post

16 Small areas of hot dipped galvanised coating damaged by welding cutting or by excessively rough treatment during the transit and erection shall be renovated either by the use of melting point zinc alloy repair rods or powders made specifically for this purpose or by the use of at least 3 coats of good quality zinc paint as per BS 4652. Sufficient material shall be applied to provide a zinc coating at least equal in thickness.

17 Droppers shall be attached after all wires have been strained and secured in position.

18 The interval between dropper and the posts or between adjacent droppers shall not exceed the following:

(a) For full length droppers 2m.

(b) For sectional droppers, bottom wires 2m.

(c) Top wires 2.5m.

19 Where sectional droppers are used the ends of all droppers or adjacent levels of wire shall be fixed to at least one wire common to both levels.

20 When measured within 14 days of erection the settled tension in the line wire between straining posts at 100 m apart shall be at least 1.6 kN

21 The method of approximately measuring the tension shall be as described in appendix F to BS 1722-2.

## 12.5 PEDESTRIAN GUARD-RAIL

### 12.5.1 Aluminium Guard Rails

1 This Sub-section covers the requirements for the supply and installation of aluminium pedestrian guard-rails and accessories.

2 Guard-rails shall be constructed to the designated line and grade and shall not reflect any unevenness in the founding construction. Unless otherwise designated, railing posts shall be vertical. For bridges, railing shall not be placed on a span until centring or falsework has been removed, rendering the span self-supporting.

3 The foundation details for the fence shall be as per the designated details and dimensions.

4 Base Plate details shall conform to the requirements of BS 7818.

### 12.5.2 Galvanised Steel Rails

1 Galvanised steel pedestrian guard rails shall comply with the strength requirements of BS 3049 Clause 'A' and shall be fabricated to the dimensions shown on the drawings from hot rolled steel section and bars to EN 10210-2 and BS 4360, Grade 43C.

2 The following Minimum steel section thickness shall be used:

| | | | |
|---|---|---|---|
| Rails - | Sealed hollow section | : | 2.5 mm |
| | Other sections | : | 4.0 mm |
| Posts - | Sealed hollow sections | : | 3.0 mm |
| | Other sections | : | 5.0 mm |

3 Joints shall be welded by metal arc welding to EN 1011 except where shown otherwise on the drawings.

4 The guard rails and components shall be fabricated such that no burrs or sharp edges occur, that the finished work is free from distortion and cracks and that welded joints are fully bonded, form accurate fit and are finished smooth and flush with adjacent surfaces.

5 The guard rail components shall be fixed to the posts at the lower joints by 12 mm diameter, 80 mm long galvanised steel bolts with one galvanised steel washer through 40 x 40 x 6 mm cleats. End units shall be purpose made to project over the posts with a rounded end.

6 Posts shall be closed at the top with a 6 mm plate having two 12.5 mm, 25 mm long dowels welded thereto. The holding down plate at the bottom of the post shall be a minimum of 20 x 100 x 6 mm thick.

7 All steel posts shall be hot dip galvanized both inside and outside to ISO 1461. "-end of specification addition.

### 12.5.3 Materials and Fabrication

1 Material for cast aluminium guard-rail posts shall conform to the requirements of AASHTO M193 and ASTM B108, alloy S7A - T4 (A444 - T4).

2 Aluminium alloy extruded rail shall conform to the requirements of ASTM B221 alloy, 6061-T6 or 6351-T5 with a minimum yield strength of 2466 kg/cm2, a minimum tensile strength of 2677 kg/cm2 and an elongation of 10 % in 50 mm.

3 Stainless steel hardware for aluminium railings shall be machine bolts or cap screws conforming to ASTM A193, grade B8, Class 2.

4 Stainless steel flat washers and lock washers shall conform to the requirements of ASTM A240, Type 302.

5 Material 12.7 mm thick or less may be cut by shearing, sawing or milling. Material over 12.7 mm thick shall be sawed or milled. Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be filleted by drilling before cutting. Flame cutting will not be permitted. Material may be heated to a temperature not exceeding 240 °C for a period not exceeding 30 minutes to facilitate bending unless cold bending is required to retain the original mechanical properties of the material furnished.

6 Rivet and bolt holes shall be drilled to finished size or stub punched smaller than the nominal diameter of the fastener and reamed to size. The amount by which the diameter of a stub punched hole is smaller than that of the finished hole shall be at least one-quarter the thickness of the piece. The finished diameter of circular holes shall be not more than 7 % greater than the nominal diameter of the fastener. Slotted bolt holes to take care of expansion shall be provided as designated. Anchor-bolt holes may be up to 25 % greater than the nominal bolt diameter with a maximum of 12.7 mm greater than the nominal bolt diameter.

### 12.5.4 Installation

1 The Contractor shall co-ordinate and space the rail posts to miss any items which may be furnished and installed under this Contract. The Contractor shall also co-ordinate and space the rail posts to miss lighting poles and any other existing obstructions.

2 Where aluminium alloys come in contact with other metals, except stainless steel, the contacting surfaces shall be thoroughly coated with an aluminium-impregnated caulking compound, or a synthetic rubber gasket may be placed between the two surfaces. Aluminium alloys shall not be placed between the two surfaces. Aluminium alloys shall not be placed in contact with copper, copper base alloys, lead or nickel.

END OF PART