



DRAFT TANZANIA STANDARD

Steel components for road guardrail – Specification

DRAFT TANZANIA STANDARD (DTZS) FOR STAKEHOLDER'S COMMENTS

TANZANIA BUREAU OF STANDARDS

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Tanzania Bureau of Standards
P O Box 9524
Dar es Salaam
Tel: +255 (22) 2450206/2450949/2450298
Fax: +255 22 2450298
E-mail: info@tbs.go.tz

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0 Foreword

This Tanzania Standard was prepared by the Metals and Structures Technical Committee (MEDC 02), under the supervision of the Mechanical Engineering Standards Divisional Committee (MEDC).

In preparation of this Tanzania Standard assistance was derived from AASHTO M 180-23, *Standard specification for steel components for highway guardrail*, published by the American Association of State Highway and Transportation Officials.

1 Scope

This standard covers steel components used in road guardrail, including corrugated steel sheet prepared for use as guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates; fasteners including standard and high-strength bolt, nuts, and washers; steel guardrail posts; anchorage wire rope and swage fittings.

This standard covers materials, coating, handling and storage requirements for zinc coated, zinc-alloy coated, uncoated, and atmospheric corrosion resistant components used in road guardrail.

The road guardrail specified in this standard applies for both highway roads and non-highway roads.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below:

- TZS 168/ ISO 68-1, *ISO general purpose screw threads — Basic and design profiles — Part 1: Metric screw threads*
- TZS 172/ ISO 4014, *Fasteners — Hexagon head bolts — Product grades A and B*
- TZS 173/ ISO 4016, *Fasteners — Hexagon head bolts — Product grade C*
- TZS 174/ ISO 4032, *Fasteners — Hexagon regular nuts (style 1)*
- TZS 175/ ISO 4033, *Fasteners — Hexagon high nuts (style 2)*
- TZS 1060/ ISO 9364, *Steel sheet, 55 % aluminium-zinc alloy-coated by the continuous hot-dip process, of commercial, drawing and structural qualities*
- TZS 1061/ ISO 4998, *Steel sheet, zinc-coated and zinc-iron alloy-coated by the continuous hot-dip process, of structural quality*
- TZS 2568-1/ ISO 630-1, *Structural steels — Part 1: General technical delivery conditions for hot-rolled products*
- TZS 2568-2/ ISO 630-2, *Structural steels — Part 2: Technical delivery conditions for structural steels for general purposes*
- TZS 2568-3/ ISO 630-3, *Structural steels — Part 3: Technical delivery conditions for fine-grain structural steels*
- TZS 2568-4/ ISO 630-4, *Structural steels — Part 4: Technical delivery conditions for high yield strength quenched and tempered structural steel plates and wide flats*
- TZS 2568-5/ ISO 630-5, *Structural steels — Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance*
- TZS 2811/ ISO 4995, *Hot-rolled steel sheet of structural quality*
- TZS 2813/ ISO 4996, *Hot-rolled steel sheet of high yield stress structural quality*
- TZS 2892/ ISO 2408, *Steel wire ropes — Requirements*
- TZS 2893/ ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*
- TZS 3082/ ISO 10684, *Fasteners — Hot dip galvanized coatings*

TZS 3189/ ISO 1460, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*
 TZS 3332/ EAS 196, *High-Strength Low-Alloy (HSLA) Steel for hot rolled sheet and cold rolled sheet — Specification*
 TZS 3735/ ISO 4997, *Cold-reduced carbon steel sheet of structural quality*
 TZS 3838/ ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*
 TZS 3840-1/ ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*
 TZS 4355/ ISO 5952, *Steel sheet, hot-rolled, of structural quality with improved atmospheric corrosion resistance*
 ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*
 ISO 898-2, *Fasteners — Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes*
 ISO 898-3, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 3: Flat washers with specified property classes*
 ISO 2063-1, *Thermal spraying — Zinc, aluminium and their alloys — Part 1: Design considerations and quality requirements for corrosion protection systems*
 ISO 2063-2, *Thermal spraying — Zinc, aluminium and their alloys — Part 2: Execution of corrosion protection systems*
 ISO 2232, *Round non-alloy steel wires for general purpose wire ropes, large diameter wire ropes and mine hoisting wire ropes — Specifications*
 ISO 3108, *Steel wire ropes — Test method — Determination of measured breaking force*
 ISO 3506-1, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs with specified grades and property classes*
 ISO 3506-2, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 2: Nuts with specified grades and property classes*
 ISO 3506-7, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 7: Flat washers with specified grades and property classes*
 ISO 4035, *Fasteners — Hexagon thin nuts (style 0)*
 ISO 8353, *Steel sheet, zinc-aluminium-magnesium alloy-coated by the continuous hot-dip process, of commercial, drawing and structural qualities*
 ISO 8673, *Fasteners — Hexagon regular nuts (style 1), with fine pitch thread*
 ISO 8674, *Fasteners — Hexagon high nuts (style 2), with fine pitch thread*
 ISO 8675, *Fasteners — Hexagon thin nuts (style 0), with fine pitch thread*
 ISO 7089, *Plain washers — Normal series — Product grade A*
 ISO 7090, *Plain washers, chamfered — Normal series — Product grade A*
 ISO 7091, *Plain washers — Normal series — Product grade C*
 ISO 7092, *Plain washers — Small series — Product grade A*
 ISO 7093-1, *Plain washers — Large series — Part 1: Product grade A*
 ISO 7093-2, *Plain washers — Large series — Part 2: Product grade C*
 ISO 7989-1, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 1: General principles*
 ISO 7989-2, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc-alloy coating*
 ISO 14921, *Thermal spraying — Procedures for the application of thermally sprayed coatings for engineering components*
 ISO 15201, *Zinc and zinc alloys — Castings — Specifications*

3 Terms and definitions

3.1 guardrail

a type of traffic barrier specifically designed to protect vehicles and vulnerable users from direct impacts with hazardous objects on the sides of the road and beyond the barrier, and to prevent vehicles leaving the safe travel path.

3.2 road guardrail

a railing guarding usually against danger especially: a barrier placed along the edge of a road at dangerous points.

4 Classification

Six types and two classes of guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates are provided as follows:

4.1 Types

Type I

Zinc-coated, 550 g/m² total both sides coating weight (mass) minimum single-spot.

Type II

Zinc-coated, 1100 g/m² total both sides coating weight (mass) minimum single-spot.

Type III

Paint-coated.

Type IV

Atmospheric corrosion resistant steel (weathering steel).

Type V

Zinc-aluminum-magnesium alloy coated, 245 g/m² total both sides coating weight (mass) minimum single-spot.

Type VI

Zinc-aluminum-magnesium alloy coated, 305 g/m² total both sides coating weight (mass) minimum single-spot.

4.2 Classes

4.2.1 Class A

Base metal nominal thickness of 2.67 mm, 12 gauge.

4.2.2 Class B

Base metal nominal thickness of 3.43 mm, 10 gauge.

4.3 Tolerances

4.3.1. Tolerances for Types I, II, V, and VI coatings shall conform to the values in Table 1.

4.3.2. Thickness tolerance for Classes A and B base metal shall conform to Table 2.

5 Ordering information

5.1. Orders for guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates shall include the following information, as required, to adequately describe the desired steel sheet component:

- i. Quantity (length or number of pieces),
- ii. Class,
- iii. Type,
- iv. Effective length of section for guardrail beams or backup plates,
- v. Shape (W-, thrie, symmetrical, asymmetrical),
- vi. Component (beam, transition beam, end section, buffer section, terminal connector, backup plate),
- vii. Radius and direction of curvature (convex or concave) for curved guardrail beams, if applicable, and
- viii. Special requirement, if any.

5.2 Orders for fasteners shall include the following information, as required, to adequately describe the desired fastener:

- i. Quantity (number of pieces),
- ii. Coating requirement to match guardrail type (zinc coated, atmospheric corrosion resistant, zinc alloy coated),
- iii. Grade of fastener,
- iv. Size of fastener,

- v. Fastener type (splice bolt [alternative 1 or 2], splice nut, post bolt [alternative 1 or 2], post nut, high strength anchor bolt, or washer),
- vi. Overall bolt length and threaded length of bolt, and
- vii. Special requirements, if any.

5.3 Orders for steel guardrail posts shall include the following information as required to adequately describe the steel guardrail post:

- i. Quantity (number of pieces),
- ii. Coating requirement,
- iii. Material grade,
- iv. Shape and size of post cross-section,
- v. Special requirements, if any.

5.4 Orders for anchor wire rope and swage fittings (typically used as part of a trailing end anchor) shall follow the requirements of relevant standard for metallic-coated steel wire rope and fittings for road guardrail.

6 Sampling and acceptance criteria

6.1 Sampling

The following sampling procedure shall be applied in determining whether a lot complies with the relevant requirements of the specification. The sample so taken shall be deemed to represent the lot.

From the lot draw at random the number of units given in column 2 of table 8 relative to the appropriate lot size given in column 1.

Table 8: Sampling

Lot size, units	Sample size, units
10 – 50	3
51 – 90	5
91 – 150	8
151 – 280	13
281 – 500	20

6.2 Acceptance criteria

The lot shall be deemed acceptable if after inspection and testing of the sample taken in accordance with 6.1 no defective unit is found.

7 Materials

7.1 Base metal for steel sheet

The guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates shall consist of sheet and shall meet the mechanical properties specified in clause 9. The chemical composition of the base metal for Type IV shall be according to T2S 4355/ ISO 5952 or T2S 2568-5/ISO 630-5.

7.1.1 All steel sheet components including guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates shall be the same type (i.e., coating) as the guardrail beam to which it is attached.

7.1.2 End section or buffer section

The material for end sections and buffer sections shall be of the same or greater metal thickness (i.e., Class) as the guardrail beam to which it is attached.

7.2 Zinc

The zinc used for the coating of Types I and II shall be according to ISO 15201 and shall be at least equal to 98.65% of zinc composition.

7.3 Zinc-aluminum-magnesium alloy

The zinc-aluminum-magnesium alloy for Types V and VI shall be according to ISO 8353 and shall contain 5–13 percent aluminum, 2–4 percent magnesium, and up to 1 percent total additional alloying elements (except iron), and the balance shall be zinc.

7.4 Fasteners

7.4.1 Standard strength bolts

7.4.1.1 Unless otherwise specified, standard strength bolts used with Types I, II, III, V, and VI steel sheet components or steel guardrail posts shall conform to or exceed the requirements of ISO 898-1 property class 8.8 and shall be coated in accordance with clause 10.2.2.

7.4.1.2 Standard strength bolts used with Type IV sheet steel components or steel guardrail posts shall be of an approved atmospheric corrosion-resistant material and conform to or exceed the requirements of ISO 898-1 property class 8.8.

7.4.1.3 Thread profiles shall conform to TZS 168/ ISO 68-1.

7.4.1.4 All beam-to-post connections or beam-to-beam splices shall be formed with oval shoulder, button-headed bolts to minimize projections on the traffic side of the guardrail. Standard strength bolts used in splice and post connections shall conform to one of the configurations shown in Figure 1. Either of the alternate configurations may be furnished.

7.4.2 High-strength bolts

7.4.2.1 Components shall conform to or exceed the requirements of ISO 898-1 property class 10.9 or 12.9 and shall be coated in accordance with clause 10.2.3.

7.4.2.2 High-strength bolts used with Type IV steel sheet components shall be of an approved atmospheric corrosion resistant material and conform to or exceed the requirements of ISO 3506-1 or ISO 898-1 property class 10.9 or 12.9.

7.4.3 Nuts

7.4.3.1 Unless otherwise specified, nuts used with Types I, II, III, V, and VI steel sheet components or steel guardrail posts shall conform to or exceed the requirements of ISO 898-2 property class 8.8, 10.9 or 12.9, TZS 174/ ISO 4032, TZS 175/ ISO 4033 or ISO 4035 and shall be coated in accordance with clause 10.2.4.

7.4.3.2 Nuts used with Type IV sheet steel components or steel guardrail posts shall be of an approved atmospheric corrosion resistant material and conform to or exceed the requirements of ISO 3506-2, TZS 174/ ISO 4032, TZS 175/ ISO 4033 or ISO 4035.

7.4.3.3 Nuts used in splice and post connections shall conform to the configuration shown in Figure 1. The nut may have recesses on one or both sides.

7.4.4 Washers

7.4.4.1. Plain round washers, when specified under a nut, shall be manufactured according to the requirements of ISO 898-3, ISO 7089, ISO 7090, ISO 7091, ISO 7092, ISO 7093-1, or ISO 7093-2. Washers shall be galvanized in accordance with clause 10.2.5 unless atmospheric corrosion resistant steel washers are used.

7.4.4.2. Hardened washers used with high-strength fasteners shall be manufactured according to the requirements of ISO 898-3, ISO 7089, ISO 7090, ISO 7091, ISO 7092, ISO 7093-1, or ISO 7093-2 and coated in accordance with clause 10.2.5 unless atmospheric corrosion resistant steel washers are used. When atmospheric corrosion resistant steel washers are used, they shall be manufactured according to the requirements of ISO 3506-7, ISO 898-3, ISO 7089, ISO 7090, ISO 7091, ISO 7092, ISO 7093-1, or ISO 7093-2.

7.4.4.3. Washers, when specified under the head of button-head shouldered bolts, shall be rectangular with a slotted hole, as shown in Figure 2. Washers are not to be used under the bolt-head for strong-post guardrails unless specified by the designer.

7.4.4.4. Washers, when specified under the head of hex-head bolts, such as used in some weak-post systems, shall be square with a round hole, as shown in Figure 2.

7.4.4.5. Rectangular or square washers used with Types I, II, III, V, and VI steel sheet components or steel guardrail posts shall be manufactured from T2S 1061/ISO 4998 or equivalent steel and galvanized in accordance with clause 10.2.6. Unless otherwise specified, washers used with Type IV sheet steel components shall be manufactured from T2S 4355/ISO 5952 or other approved atmospheric corrosion resistant steel.

7.5. Steel guardrail posts:

7.5.1. Steel guardrail posts shall meet the mechanical properties specified in clause 9 and coating requirements specified in clause 10. Acceptable materials and grades include but are not limited to the following standards:

- i. T2S 2568-1/ISO 630-1,
- ii. T2S 2568-2/ISO 630-2,
- iii. T2S 2568-3/ISO 630-3
- iv. T2S 2568-4/ISO 630-4.
- v. T2S 3332/EAS 196
- vi. T2S 1060/ISO 9364
- vii. T2S 1061/ISO 4998
- viii. T2S 2811/ISO 4995
- ix. T2S 2813/ISO 4996, or
- x. T2S 3735/ISO 4997

7.5.2. Where atmospheric corrosion resistant steel is required, the steel guardrail posts shall meet the mechanical properties specified in clause 9. Acceptable materials and grades include but are not limited to the following standards:

- i. T2S 2568-5/ISO 630-5
- ii. T2S 4355/ISO 5952

7.6. Anchorage wire rope and swage fittings:

7.6.1. The anchor wire rope shall be 19 mm diameter, Metallic-Coated Wire Rope, Type II (a) 6x19 wire-strand core or Type II independent wire rope core (IWRC), right regular lay wire rope.

7.6.2. The anchor wire rope swage fittings shall be machined from hot-rolled carbon steel conforming to ISO 2232. The material shall be suitably annealed for cold swaging.

7.6.3. A lock pin hole shall be drilled through the head of the anchor wire rope swage fitting and a 6 mm plated spring-steel pin shall be installed into the hole to retain the stud in the proper position.

7.6.4. Materials used for anchorage wire rope and swage fittings (typically used as part of a trailing end anchor) shall follow the requirements of ISO 2232 or other equivalent standard.

8 Manufacture

8.1. Guardrail beams, transition beams, end sections, buffer sections, and terminal connectors shall be shaped and punched in conformance with the requirements shown in Figures 2 and 3. Transition beams shall be fabricated in accordance with Figure 4 and shall provide a smooth and uniform transition between guardrail beams. Two common methods for shaping sheet steel components are roll forming and press forming; these two processes result in different levels of springback which must be accounted for in the forming process to ensure proper bolt hole alignment, nesting and lapping of sheet steel components. Sheet steel components shall be ready for assembly when delivered.

8.2. Only drilling or cutting necessary for special connections and for sampling will be permitted in the field. Guardrail beams to be erected on a radius of 46 m or less shall be shop-curved to the appropriate curvature of the installation. Shop-curved guardrail beam shall be provided in 1.5 m increments of curvature with a minimum radius of curvature of 1.5 m. Due to the nature of long lengths of guardrail beam there is flexibility to match the curvature required upon installation in the field.

9 Mechanical properties

9.1 The mechanical properties of the base metal for steel sheet components shall conform to the following requirements:

9.1.1 Guardrail beams, transition beams, and terminal connectors:

- i. Yield point, minimum, 345 MPa;
- ii. Tensile strength, minimum 483 MPa; and
- iii. Elongation, in 50 mm minimum, 16 percent.

9.1.2 End sections, buffer sections, and backup plates:

- i. Yield point, minimum, 227 MPa; and
- ii. Tensile strength, minimum 310 MPa.

9.1.3 Test specimens for mechanical properties testing shall be prepared and tested as specified in TZS 3840-1/ISO 6892-1.

9.2. The mechanical properties of the guardrail fasteners shall conform to the following requirements:

9.2.1 Standard strength bolts:

Shall conform to the mechanical property requirements specified in the appropriate referenced standards identified in the clause of 7.4.1 of this specification.

9.2.2 High-strength bolts:

Shall conform to the mechanical property requirements specified in the appropriate referenced standards identified in the Subsections of 7.4.2 of this specification.

9.2.3 Nuts:

Shall conform to the proof load requirements specified in the appropriate referenced standards identified in the Subsections of 7.4.3 of this specification.

9.2.4 Washers:

Shall conform to the mechanical property requirements specified in the appropriate referenced standards identified in the Subsections of 7.4.4 of this specification.

9.3 Steel guardrail posts

The mechanical properties of the steel guardrail posts shall conform to the appropriate referenced standards identified in Subsections of 7.5 of this specification and the following requirements, unless otherwise specified by the engineer:

- i. Yield point, minimum, 250 MPa;
- ii. Tensile strength, 400 – 550 MPa; and
- iii. Elongation, in 50 mm minimum, 21 percent.

9.4. The mechanical properties of anchor wire rope and swage fittings shall conform to the following requirements:

9.4.1. Anchorage wire rope:

The anchor wire rope steel shall be improved steel with a minimum breaking strength of 190 kN. The breaking strength shall be tested according to ISO 3108.

9.4.2. Anchorage wire rope swage fittings:

The anchor wire rope swage fitting, stud, and nut shall develop the full breaking strength of the wire rope.

10 Coating requirements

10.1. Steel sheet components:

Table 1: Coating weight and coating thickness requirements

Type	Coating weight (Total both sides) ^a		Minimum single-spot single side coating thickness ^b
	Minimum single-spot g/m ²	Minimum triple-spot g/m ²	
I	550	610	38.5 ^b
II	1100	1220	77.0 ^b
V	245	275	20.4 ^c
VI	305	350	25.4 ^c

^a The spot shall be a randomly selected location on the finished sheet steel component. The weight is deemed to be the combined coating weight on both sides of the sheet steel component at that spot.

^b Values in these columns correspond to the thickness value converted from the minimum single-spot column divided by 2 which results in a single sided thickness value.

^c Galvanized coating thickness conversion: 7.14 g/m² = 1.00 µm.

^d Zinc-aluminum-magnesium alloy coating thickness conversion: 6.01 g/m² = 1.00 µm.

10.1.1.1 Type I and II steel sheet components

The sheet steel components may be galvanized before or after fabrication. Steel sheet components galvanized before fabrication shall be coated in accordance with TZS 1061/ ISO 4998. Sheet steel components galvanized after fabrication shall conform to the requirements of TZS 2893/ISO 1461. The mass of coating shall conform to the requirements prescribed in Table 1 for the types specified. The mass of coating is the total amount of galvanizing on both sides of a steel sheet component, expressed as grams per square meter of the steel sheet component.

10.1.1.2 The zinc coating shall be of prime finish, that is, free from defects such as blisters, flux, and uncoated spots. Uncoated edges resulting from transverse shearing or punching of holes will not be considered objectionable.

10.1.1.3 The coating shall be smooth, free of beading or sharp projections along the edges, and shall adhere tenaciously to the surface of the metal. The adherence of the zinc coating to the surface of the base metal shall be determined by cutting or prying with a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating by paring or whittling, and it shall not be possible to peel any portion of the coating so as to expose the base metal.

10.1.1.4 Precautions shall be taken during the shipping and storage processes to limit the opportunity for wet storage stain (i.e., white rust) to form before the protective layer is formed on the galvanized surface. Sheet steel components shall be arranged to encourage airflow and limit standing water on the galvanized surface, along with water repellent or barrier coatings to eliminate the formation of wet storage stain. If areas affected by wet storage stain become darker or show signs of red rust the area shall be cleaned, the remaining coating thickness checked, and if required touch-up galvanizing shall be performed as prescribed in clause 10.5.

10.1.1.5 The test specimen size and method of tests for determining the mass of coating shall be according to TZS 3189/ISO 1460. Steel sheet components may be tested on the basis of magnetic gauge determinations made in accordance to TZS 3838/ISO 2178 and conforming to the values in Table 1.

10.1.2 Type III steel sheet components

Sheet steel components that are to be painted shall be cleaned and painted with one coat of rust-inhibitive primer. The primer shall have a tough and durable surface and shall be thoroughly dry before the steel sheet components are handled or packed for shipment.

10.1.3. Type IV steel sheet components

Sheet steel components made of atmospheric corrosion resistant steel shall not be painted or galvanized. They shall be so handled and stored so that the traffic face of these sheet steel components, used in a continuous run of guardrail, shall not show a distinctive color differential.

Note 1:

When Type IV sheet steel components are in direct contact with each other or with other atmospheric corrosion resistant steel components they can potentially fuse together as a result of the weathering process, making repair or replacement difficult.

10.1.4. Type V and VI steel sheet components

The steel sheet components shall be zinc alloy-coated before fabrication and shall be coated in accordance to ISO 8353.

10.1.4.1. The mass of coating shall conform to the requirements prescribed in Table 1 for the types specified. The mass of coating is the total amount of coating on both sides of a sheet steel component, expressed as grams per square meter of the steel sheet component.

10.1.4.2. The zinc alloy coating shall be of prime finish, that is, free from defects such as peeling, lamination, and uncoated spots. Uncoated, bare edges resulting from transverse shearing, longitudinal slitting, and punching of holes are permissible and expected for Type V and VI steel sheet components.

10.1.4.3. The coating shall be smooth, free of beading or sharp projections along the edges, and shall adhere tenaciously to the surface of the metal. The adherence of the zinc-aluminum-magnesium alloy coating to the surface of the base metal shall be determined by cutting or prying with a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating by pairing or whittling, and it shall not be possible to peel any portion of the coating so as to expose the base metal.

10.1.4.4. The test specimen size and method of tests for determining the mass of coating shall be as prescribed in TZS 3189/ISO 1460. Steel sheet components may also be tested on the basis of magnetic gauge determinations made in accordance to TZS 3838/ISO 2178 and conforming to the values in Table 1.

10.2. Fasteners

10.2.1. All components of mating fasteners (bolts, nuts and washers) shall be coated by the same zinc coating process, and the supplier's option is limited to one process per item with no mixed processes in a lot.

10.2.2. Standard strength bolts

The bolts shall be hot-dip zinc coated in accordance with the requirements of TZS 3082/ISO 10684 or mechanically zinc-coated in accordance with ISO 2063-1, ISO 2063-2 and ISO 14921.

10.2.3. High-strength bolts

The bolts shall be hot dip zinc coated in accordance with the requirements of TZS 3082/ISO 10684 or mechanically zinc coated in accordance with ISO 2063-1, ISO 2063-2 and ISO 14921.

10.2.4. Nuts

The nuts shall be hot-dip zinc coated in accordance with the requirements of TZS 3082/ISO 10684 or mechanically zinc coated in accordance with ISO 2063-1, ISO 2063-2 and ISO 14921.

10.2.5. Plain round and hardened washers

The washers shall be hot-dip zinc-coated in accordance with the requirements of TZS 3082/ISO 10684 or mechanically zinc coated in accordance with ISO 2063-1, ISO 2063-2 and ISO 14921.

10.2.6. Rectangular and square washers

The washers may be galvanized before or after fabrication. Rectangular and square washers galvanized after fabrication shall conform to the requirements of TZS 2893/ISO 1461.

10.3. Steel guardrail posts:

10.3.1. After the steel guardrail post has been cut-to-length and all holes have been drilled or punched, the steel guardrail post shall be zinc-coated (hot-dip galvanized) in accordance with TZS 2893/ISO 1461, unless atmospheric corrosion resistant steel is used. When atmospheric corrosion resistant steel is used, the portion of the steel guardrail post to be embedded in soil shall be zinc-coated (hot-dip galvanized) in accordance with TZS 2893/ISO 1461.

10.3.2. Precautions shall be taken during the shipping and storage processes to limit the opportunity for wet storage stain (i.e., white rust) to form before the protective layer is formed on the galvanized surface. Steel

guardrail posts shall be arranged to encourage airflow and limit standing water on the galvanized surface, along with water repellent or barrier coatings to eliminate the formation of wet storage stain. If areas affected by wet storage stain become darker or show signs of red rust the area shall be cleaned, the remaining coating thickness checked, and if required touch-up galvanizing shall be performed as prescribed in clause 10.5.

10.4. Anchorage wire rope and swage fittings:

10.4.1. Anchor wire rope

The mass of coating shall conform to the minimum requirements of 152 g/m² according to ISO 7989-1 and ISO 7989-2.

10.4.2. Anchor wire rope swage fittings

Wire rope swage fittings used in anchorages shall be zinc-coated according to ISO 7989-1 and ISO 7989-2 before swaging.

10.5 Galvanizing repair:

10.5.1 Where the galvanizing on the surface of steel sheet components, steel guardrail posts, or anchorage wire rope and swage fittings has been damaged or disturbed during field modifications beyond the limits in TZS 2893/ISO 1461, the coating shall be repaired by re-galvanizing, or the surface repaired by painting with two coats of zinc dust/zinc oxide paint conforming to TZS 2893/ISO 1461.

10.5.2 Field drilled holes typically do not require galvanizing repair.

11 Dimensions

11.1. Steel sheet component thickness

10.1.1. The minimum thickness for the finished sheet steel components shall conform to the requirements in Table 2.

Table 2: Finished steel sheet component thickness

Type	Class A	Class B
	Minimum Finished Thickness, mm	Minimum Finished Thickness, mm
	No Tolerance Under, No Limit for Over Thickness	
I	2.62	3.38
II	2.69	3.45
III	2.54	3.30
IV	2.54	3.30
V	2.58	3.34
VI	2.59	3.35
Note: See clause 4.3 for coating and base metal thicknesses and tolerances.		

11.1.2. For fabricated steel sheet components, thickness measurements will be made on tangent portions of the cross section.

11.2. Guardrail beam width

11.2.1. Guardrail beam shall be formed from steel sheet having nominal widths of 310 mm or 483 mm for W-beams and 503 mm or 749 mm for thrie beams. Tolerance for the nominal width on guardrail beams shall be ± 3.2 mm. Symmetrical and asymmetrical transition beams shall be formed from sheets of nominal widths to ensure connection to the W-beam on one end and thrie beam on the other end.

Note

The requirements of clause 11.2.1 are intended to define the minimum permissible width for guardrail and transition beams. Calculation of exact width dimensions from Figures 2 and 3 shows that the finished product may slightly exceed these widths. However, the dimensions of Figures 2 and 3 can be met within allowable tolerance by using the nominal widths. Use of steel sheet slightly greater than the nominal widths is permissible provided the tolerances in Figures 2 and 3 are met.

11.3. Effective length of sections

Effective length of section for guardrail beams should be a minimum of 3.8 m or 7.6 m; and backup plates side should be 152.4 mm or 304.8 mm. Other special effective length of sections may be produced and supplied according to agreement between manufacturer and consumer.

12 Marking

12.1. Steel sheet components

12.1.1. Each steel sheet component shall be identified by the following for traceability:

- i. Name of manufacturer or registered trademark,
- ii. Identification symbols or code for heat number,
- iii. Reference standard,
- iv. Country of origin
- v. Class and type, and
- vi. Radius of guardrail beam, if applicable.

12.1.2. When the radius of a curved guardrail beam requires shop-bending, an additional four-character field shall be marked to indicate the direction of curvature of the guardrail beam and the radius. The first character shall be "1" for convex or "2" concave. The next three characters shall indicate the radius, measured in meters (e.g., a 30m radius concave guardrail beam would be marked "2030"). When required, radius markings shall be placed between 457 - 610 mm of each end of the guardrail beam; radius markings are intended to be separate from the traceability markings.

12.1.3. Markings shall not be placed at such a location that they will be obscured after erection or in a manner that they will be clearly visible to traffic, as shown in Figure 5. Markings placed on the traffic face of the steel sheet component shall be placed in the valley of a corrugation and shall be die-imprinted with letters and numerals having a maximum height of 32 mm and a minimum height of 19 mm, and shall be clearly legible after galvanization of the steel sheet component.

12.1.4. Markings shall resist obliteration during storage, transportation, and erection.

12.1.5. Markings for end sections, buffer sections, terminal connectors, and backup plates may be on durable tags securely attached to each section or bundle.

12.2 Fasteners

12.2.1 Standard strength bolts

Marking for standard strength bolts shall be in accordance with TZS 172/ ISO 4014, TZS 173/ ISO 4016 or equivalent.

12.2.2 High-strength bolts

Marking for high-strength bolts shall be in accordance with TZS 172/ ISO 4014, TZS 173/ ISO 4016 or equivalent.

12.2.3 Nuts

Marking for nuts shall be in accordance with TZS 174/ ISO 4032, TZS 175/ ISO 4033, ISO 4035, ISO 8673, ISO 8674, ISO 8675 or equivalent.

12.2.4 Washers

Marking for washers shall be in accordance with the applicable standard from clause 7.4.4 of this specification.

12.3. Steel guardrail posts

12.3.1. Each steel guardrail post shall be identified by the following:

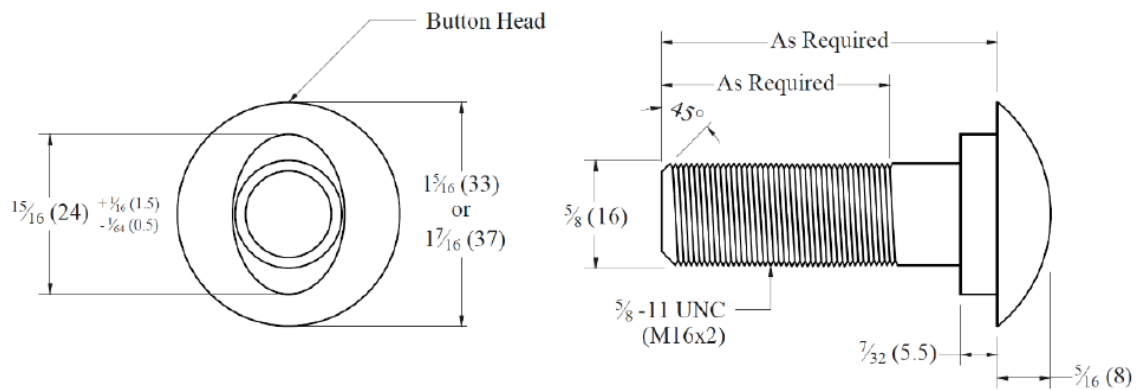
- i. Name of manufacturer or registered trademark,
- ii. Class and type,
- iii. Country of origin,
- iv. Reference standard
- v. Identification symbols or code for heat number.

12.3.2. Markings shall be placed within the top 610 mm of the steel guardrail post. Horizontal and vertically oriented markings are both acceptable and may be located in the web or flange(s) of the steel guardrail post as seen in Figure 5. If markings are not obscured by the blockout when erected, then only one set of markings is required. Flange markings located where a blockout would obscure it shall be marked on both flanges. Stencil height shall be a minimum of 6 mm and shall be permanent and clearly legible after galvanizing of the steel guardrail post.

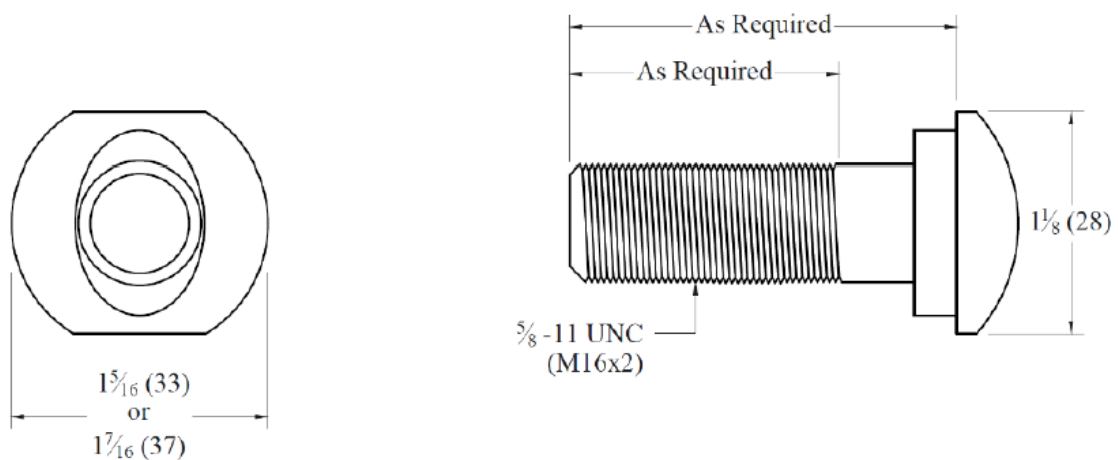
12.4. Anchorage wire rope and swage fittings

12.4.1. Marking of anchor wire rope and swage fittings shall be in conformance with TZS 2892/ ISO 2408.

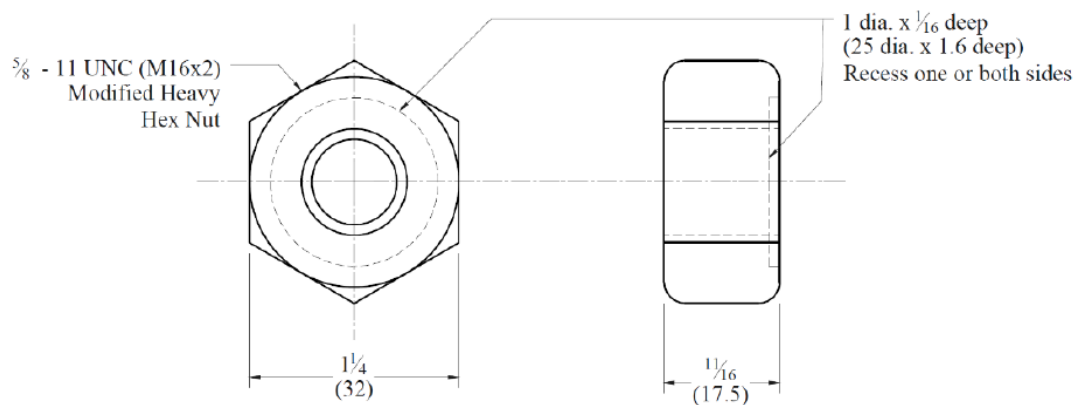
12.4.2. The marking may be on durable tags securely attached to each bundle.



Alternate No. 1
(US Customary and Metric alternative)



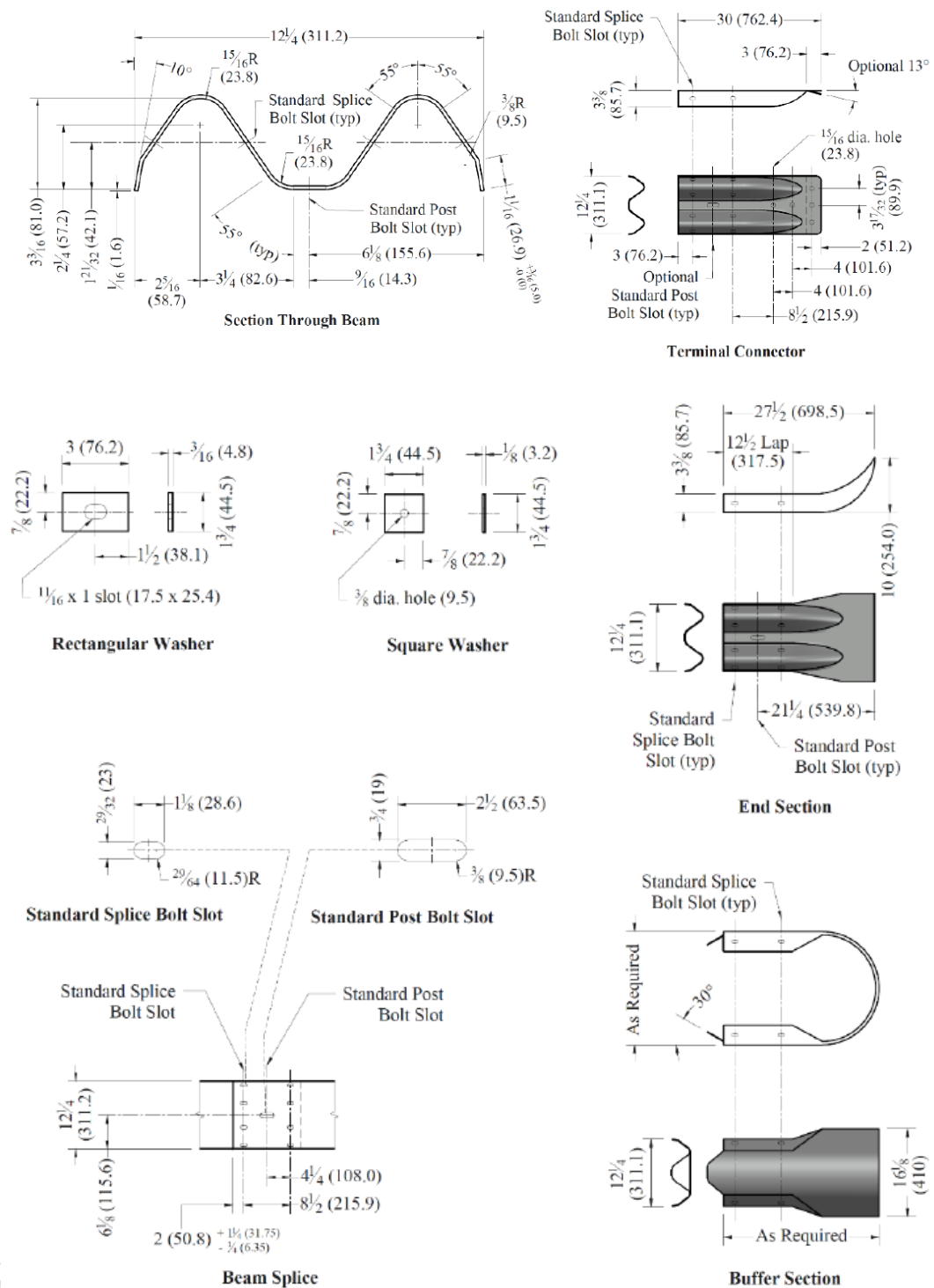
Optional Alternate No. 2



Notes:

1. All dimensions shown on Alternate Bolt No. 1 also apply to Alternate Bolt No. 2. All dimensions are subject to manufacturer's tolerances except where allowable tolerances are shown.
2. Metric values shown are the equivalent metric bolt dimensions.
3. Oval shoulder shall have smooth radii and shall maintain an essentially full vertical height of the apex of the oval.

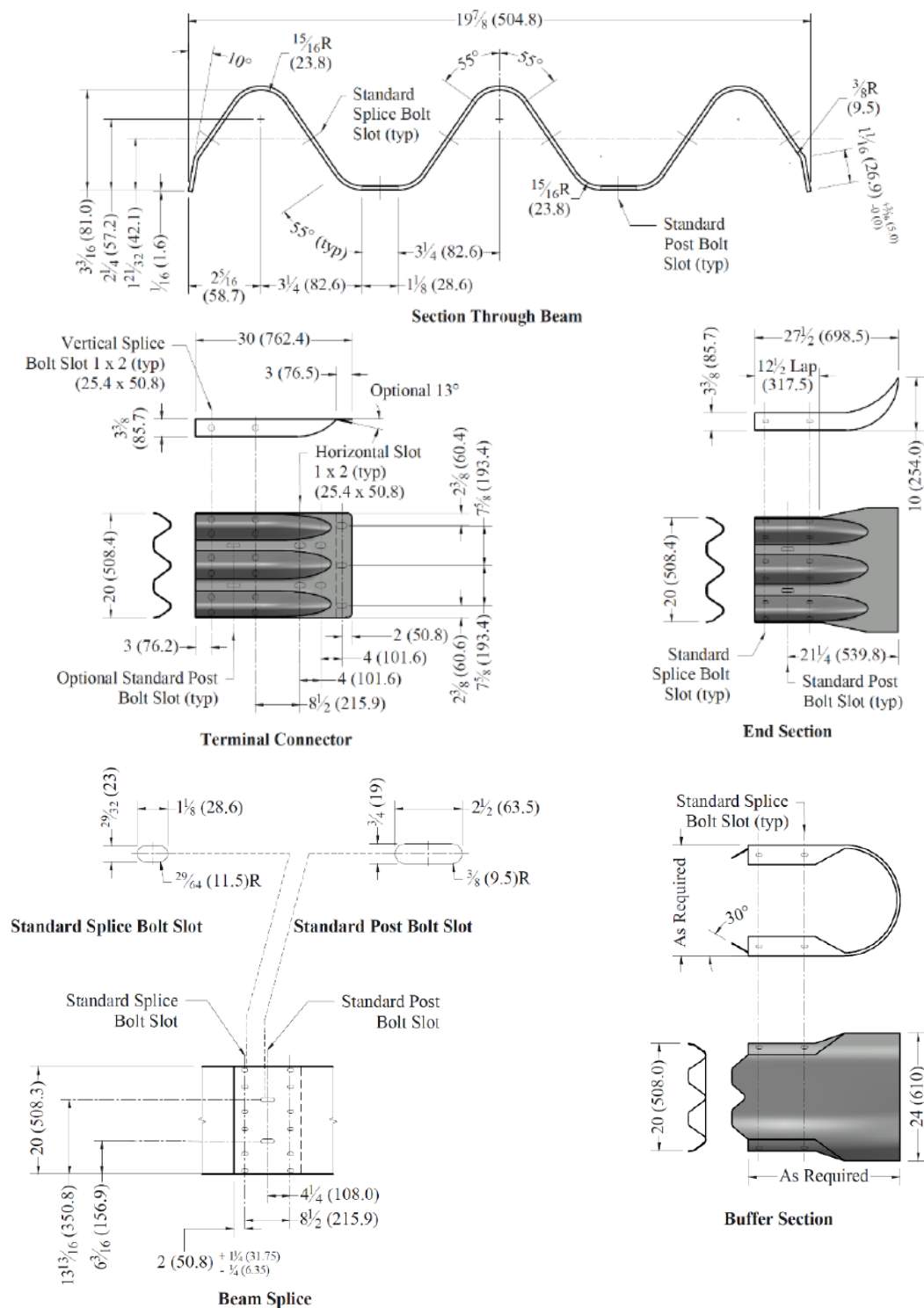
Figure 1: Standard Strength Post or Splice Bolt and Nut



Notes:

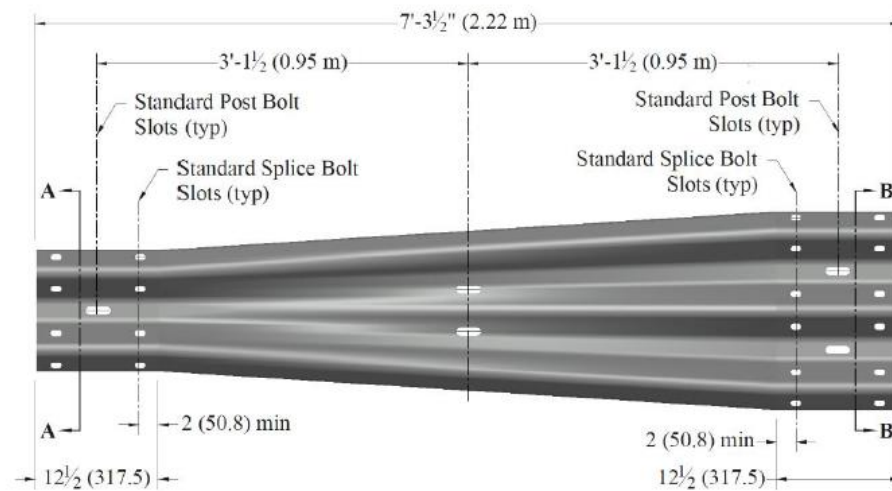
1. All dimensions are subject to manufacturer's tolerances except where allowable tolerances are shown.
2. All dimensions shown in inches unless otherwise noted. (All parenthetical values are in millimeters unless otherwise noted.)
3. Square washers are used in some weak-post guardrail designs; however, washers are not to be used under the bolt head in the main spans of strong-post guardrail, unless specified by the designer.
4. The terminal connector shown has the typical standard splice bolt slots. Other splice slot orientations and dimensions for terminal connectors may be specified by the engineer.

Figure 2: W-Beam

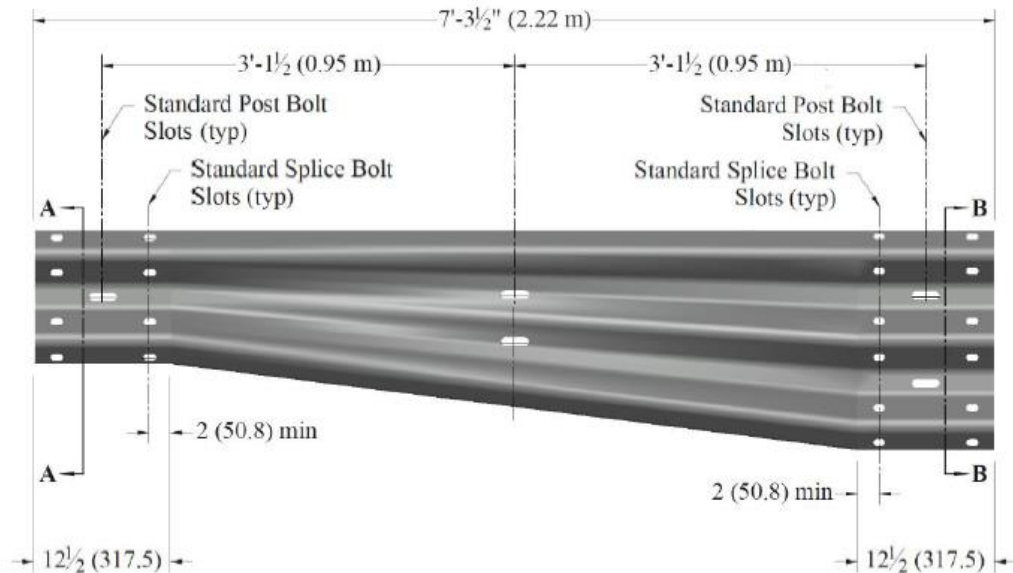
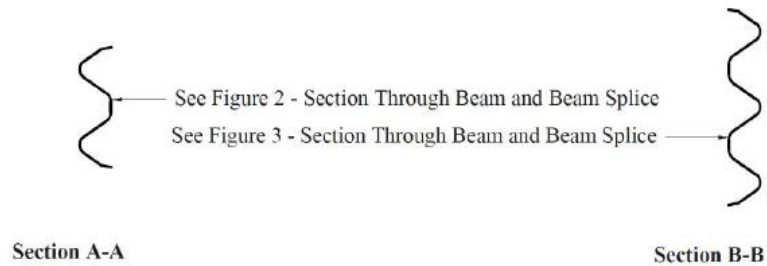
**Notes:**

1. All dimensions are subject to manufacturer's tolerances except where allowable tolerances are shown.
2. All dimensions shown in inches unless otherwise noted. (All parenthetical values are in millimeters unless otherwise noted.)
3. The terminal connector shown has vertical splice slots. Other splice slot orientations and dimensions for terminal connectors may be specified by the engineer.

Figure 3: Thrie Beam



Symmetrical Transition Beam



Asymmetrical Transition Beam

Note:

All dimensions shown in inches unless otherwise noted. (All parenthetical values are in millimeters unless otherwise noted.)

Figure 4: Symmetrical and Asymmetrical Transition Beams

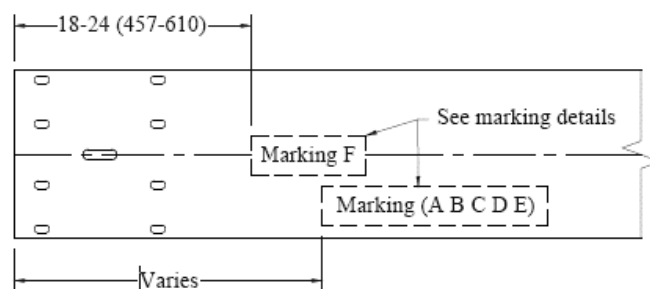


Figure 5 (a): Recommended location for markings on sheet steel components (W-beam)

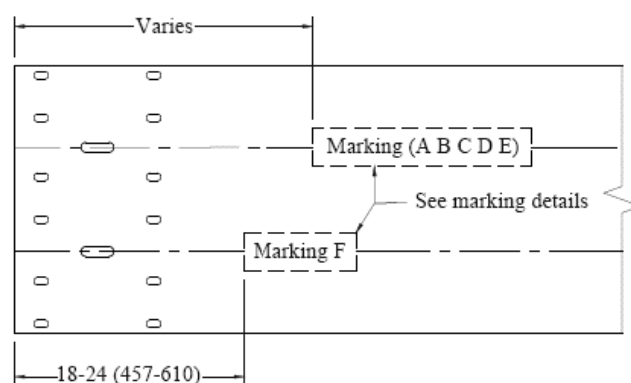
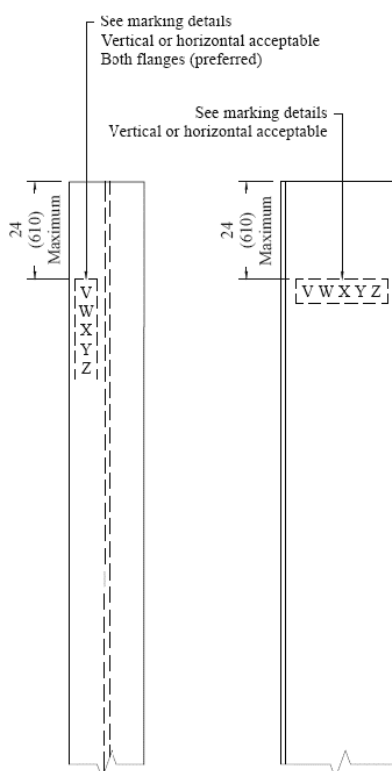


Figure 5 (b): Recommended location for markings on sheet steel components (Thrie beam)



Note: All dimensions are shown in inches unless otherwise noted. (All parenthetical values are in millimeters unless otherwise noted.)

Figure 5 (c): Recommended location for markings on steel guardrail post

Steel sheet component marking details

- A) Name of manufacturer or registered trademark
- B) Identification symbols or code for heat number
- C) Reference standard
- D) Country of origin
- E) Class and type
- F) Radius of guardrail beam (if applicable)

Steel guardrail post marking details

- V) Name of manufacturer or registered trademark
- W) Class and type
- X) Country of origin
- Y) Reference standard
- Z) Identification symbols or code for heat number

Bibliography

[1] AASHTO M 180-23, Standard specification for steel components for highway guardrail

DRAFT TANZANIA STANDARD (DTZS) FOR STAKEHOLDER'S COMMENTS

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