60-SDMS-01

Rev.00

SPECIFICATION OF SECURITY FENCE FOR UNIT SUBSTATION AND RMU

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#	Date	Revision No.	New Specification	Major Description
1	02-2025	Rev.00	60-SDMS-01	SPECIFICATION OF SECURITY FENCE FOR UNIT SUBSTATION AND RMU
			ENGINEERING DEVELOPMENT DEPARTMENT ENGINEERING & PROJECT SECTOR	1. Engr. Randy C. Tiemsim 3-2025 2. Engr. Benrazer T. Dahum 3-2025

1. SCOPE

This SEC Material Standard Specification (SDMS) specifies the minimum technical requirement for design, engineering, manufacturing, inspection, testing and performance of accessories for Security Fence to be used in the locations for Substations and RMU of Saudi Electricity Company (SEC).

2. CROSS REFERENCES

The Material Standard Specification shall be read in conjunction with SEC General Specification No. 01-SDMS-01 (latest revision) for General Requirement for all Equipment/Materials as an integral part of this SDMS.

This SDMS shall also be read in conjunction with SEC purchase order requirements.

3. APPLICABLE CODES AND STANDARDS

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this SDMS. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of SEC Standards shall supersede the provisions of these alternate standards in case of any difference.

TABLE 1: LIST OF APPLICABLE STANDARDS

Standard number	Title
ASTM A6	Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use
ASTM A36M	Standard Specification for Carbon Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
ASTM A121	Standard Specification for Zinc Coating (Galvanized) Steel Barbed Wire
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings of Iron and Steel Products
ASTM A143	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A239	Standard Test Method for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles by the Preece Test (Copper Sulfate Dip)
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
ASTM A354	Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

ASTM A385	Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip)
ASTM A475	Standard Specification for Zinc-Coated Steel Wire Strand
ASTM A510	Standard Specification for General requirements for Wire Rods and Coarse Round Wire, Carbon Steel
ASTM A563M	Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A687	Standard Specification for High-Strength Non-Headed Steel Bolts and Studs
ASTM B6	Specification for Zinc (Slab Zinc)
ASTM B98	Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes
ASTM B139	Standard Specification for Phosphor Bronze Rod, Bar and Shapes
ASTM B140	Standard Specification for Copper-Zinc-Lead (Red Brass or Hardware Bronze) Rod, Bar and Shapes
ASTM B150	Standard Specification for Aluminum Bronze Rod, Bar and Shapes
ASTM B209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B249	Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar and Shapes
ASTM B580	Specification for Anodic Oxide Coatings on Aluminum
ASTM E165	Standard Test Method for Liquid Penetrant Examination
ASTM E376	Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods
ASTM F436M	Standard Specification for Hardened Steel Washers
ASTM F541	Standard Specification for Alloy Steel Eyebolts
ASTM F568	Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
ASTM F606	Standard Test Materials for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers and Rivets
ASTM F3125M	Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120ksi (830MPa) and 150ksi (1040MPa) Minimum Tensile Strength, Metric Dimensions
AISC	Manual of Steel Construction, 14th Edition
ANSI B1.13M	Metric Screw Threads
ANSI B18.2.4.6	Metric Heavy Hex Nuts
ANSI B18.22.1	Plain Washers
ANSI C135.1	Galvanized Steel Bolts and Nuts for Overhead Line Construction
ANSI C119.4	Electric Connectors – Connectors for Use Between Aluminum-to-Aluminum or Aluminum-to-Copper Bare Overhead Conductors
AWS D1.1	Structural Welding Code, Steel
BS 183	General Purpose Galvanized Steel Wire Strand

BS 464	Thimbles for Wire Ropes
BS 3692	ISO Metric Precision Hexagon Bolts, Screws and Nuts
BS 3288	Specification for Insulators and Conductor Fittings for Overhead Power Lines
BS 4102	Steel Wire for Fences
BS 4360	Specification for Weldable Structural Steels
DIN 40500	Copper for Electrical Purposes
EN 13605	Copper and Copper-Alloys – Copper Profiles and Profile Wire for Electrical Purposes
EN 50086	Flexible Non-Metallic Conduit System
EN 50189	Conductors for Overhead Lines – Zinc Coated Steel Wires
IEC 61284	Overhead Lines – Requirements and Tests for Fittings
IEC 61386	Flexible Non-Metallic Conduit System
IEC 62561-1	Lightning Protection System Components (LPSC) – Part 1: Requirements for Connection Components
IEC 62561-2	Lightning Protection System Components (LPSC) – Part 2: Requirements for Conductors and Earth Electrodes
IEEE C135.2	Threaded Galvanized Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction
ISO 630	Standards for Structural Steels
ISO R657	Recommendation for Hot-Rolled Steel Sections
ISO 1459	Metallic Coatings - Protection
ISO 1460	Metallic Coatings - Hot-Dip Galvanized Coatings on Ferrous Materials - Gravimetric Determination of the Mass per Unit Area
ISO 1461	Metallic Coatings - Hot Dip Galvanized Coatings on Fabricated Ferrous Products - Requirements
ISO 3575	Continuous Hot-Dip Zinc-Coated Carbon Steel Sheet of Commercial, Lock-Forming and Drawing Qualities
ISO 4997	Cold-Reduced Steel Sheet of Structural Quality
ISO 4998	Continuous Hot-Dip Zinc-Coated Carbon Steel Sheet of Structural Quality
ISO 7413	Hexagon Nuts for Structural Bolting, Style 1, Hot-Dip Galvanized (Oversize Tapped) - Product Grades A and B - Property Classes 5, 6 and 8
ISO 7417	Hexagon Nuts for Structural Bolting - Style 2, Hot-Dip Galvanized (Oversize Tapped) - Product Grade A - Property Class 9
NEMA CC 3	Standard Connectors for Use Between Aluminum or Aluminum-to-Copper Bare Overhead Conductors
NEMA GR 1	Grounding Rod Electrodes and Grounding Rod Electrode Couplings
SASO/SSA 39	Mechanical Testing of Welded Joints
SASO/SSA 107	Tensile Testing of Steel

SASO/SSA 157	Charpy Method of Impact Test on Metals
SASO/SSA 199	Methods of Tests for Steel Wire Ropes
SASO/SSA 200	Steel Wire Ropes for General Purposes

4. SERVICE CONDITIONS AND SYSTEM PARAMETERS

The Security Fence accessories shall be suitable for operation under the service conditions and system parameters given in the latest revision of SEC General Specification No. 01-SDMS-01.

5. DESIGN AND CONSTRUCTION REQUIREMENTS

5.1. GENERAL

5.1.1. All accessories associated with security Fence for the installation process. are included in this specification. These broadly include but are not limited to the materials listed in Table 2.

5.1.2. The security Fence accessories shall be of manufacturer's standard design and shall meet or exceed the performance requirements of this specification in all respects.

5.1.3. Manufacturer's drawings, as required by 01-SDMS-01, shall show the details of the security Fence accessories, together with all pertinent dimensions. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

5.1.4. All the materials shall be of the highest grade, free from defects and imperfections, of recent manufacture and unused, and of the classification and grades designated, conforming to the requirements of the latest issue of the appropriate specifications cited herein.

5.1.5. Workmanship and general finish shall be of the highest grade and the best modern practice.

5.2. FABRICATED STEEL SHAPES AND PLATES

5.2.1. The name or type of fabricated steel shapes or plates shall be as specified in technical data schedule of this specification.

5.2.2. All fabricated steel shapes and plates shall be strictly in conformity with the dimensions, arrangements, sizes, weights and thickness indicated on the drawings or stipulated in the specifications.

5.2.3. Unless otherwise specified, the steel material shall comply with the applicable requirements of ASTM A36 or equivalent with minimum yield strength of 250N/mm².

5.2.4. All fabricated steel sheets shall be galvanized in accordance with the requirement of 01-SDMS-01 with the minimum average coating thickness of 0.086 mm (equivalent to 610 g/m^2).

5.2.5. Bolts, nuts and washers to be furnished, as component parts of fabricated materials, shall comply with the requirements in Clause 5.3 of this specification. Cotter pins and keys shall comply with the requirements in Clause 5.5 of this specification.

5.2.6. Shearing and cutting shall be performed carefully and all portions of the work shall be finished neatly.

5.2.7. All forming and bending during fabrication shall be done by method that will prevent embrittlement or loss of strength in the material being worked.

5.2.8. Weld material shall be compatible with the material of the fabricated steel as defined by American Welding Society and all welding operations shall be done in accordance with the American Welding Society, AWS D1.1 or equivalent.

5.2.9. Holes shall be cut, drilled, or punched at right angles to the surface and shall not be made or enlarged by burning. Holes shall be clean cut without torn or ragged edges, and burrs resulting from the drilling or reaming operations shall be removed.

5.2.10. All fabricated materials shall conform to the tolerances specified in the AISC Manual and ASTM A6 or equivalent. In particular, the tolerances are as follows:

- +/- 2 mm for center-to-center distance between holes
- +/- 0.5 mm for diameter of pre-drilled holes

5.3. BOLTS, NUTS, WASHERS, AND ANCHOR RODS

5.3.1. The bolts, nuts, washers and anchor rods shall be of manufacturer's standard design and shall meet the basic dimensional and performance requirements of this specification in all respects.

5.3.2. Bolts, nuts and anchor rods shall be made from hot-rolled steel which has been produced by the open hearth, basic oxygen or electric furnace process and which is of a grade and quality suitable to meet the requirements of this specification.

5.3.3. Machine bolts shall be high strength Grade 8.8 and shall comply with the applicable requirements of ASTM F3125M or equivalent.

5.3.4. Nuts shall comply with the applicable requirements of ASTM A563M or equivalent.

5.3.5. Bolts, nuts and washers shall be hot-dipped galvanized in accordance with the requirement of 01-SDMS-01 with minimum average coating thickness of 0.053 mm, equivalent to 381 g/m².

5.3.6. Galvanized bolts, nuts shall be free from burrs, seams, laps and irregular surfaces that affect serviceability.

5.3.7. The top of the bolt head or nut shall be flat and the edges shall be chamfered or rounded. The thread end of the bolts shall be chamfered or rounded.

5.3.8. All machine bolt heads and nuts shall be regular hexagonal and shall be in accordance with ANSI B18.2.4.6M or equivalent.

5.3.9. The thread and threaded hole of nut shall match the thread of the bolt. The external threaded portion of all bolts shall, after galvanizing, be in such condition that nuts tapped will fit the galvanized bolt so that the nut can run the entire length of the thread without the use of tools.

5.3.10. Washers shall be in accordance with ANSI B18.22.1, ASTM F436M or equivalent.

5.3.11. The galvanized ferrous shoulder eyebolts and nuts shall be in accordance with ASTM F541 or equivalent. Shoulder eyebolts shall be forged in one-piece without welds. Welding in manufacturing process of the shoulder eyebolts is not acceptable.

5.3.12. The galvanized ferrous eye-nuts shall be in accordance with ANSI C135.5 or equivalent.

5.3.13. Unless otherwise specified, each machine bolts and shoulder eyebolts shall be furnished with one (1) nut, two (2) flat washers, and one (1) spring washer assembled thereon.

5.3.14. All galvanized steel bolts shall be marked with the property class symbol and with the manufacturer's identification symbol. For machine bolts, markings shall be located on the top of the head and may be raised or recessed. When raised, markings shall project not less than 0.10 mm for 12 mm and smaller bolts, and 0.20 mm for 16 mm and larger bolts above the surface of the head.

5.3.15. The anchor rods and associated nuts shall be in accordance with IEEE C135.2 or equivalent. The anchor rod shall be galvanized steel with drop-forged thimble eye or twin eye at one end with a thread length of 100 mm at the other end.

5.3.16. Each anchor rod shall be furnished with two (2) nuts and two (2) 3mm thick flat washers assembled thereon.

5.3.17. The anchor rod length and diameter shall be stamped below the eye of each anchor rod.

5.4. GROUNDING RODS AND ACCESSORIES

5.4.1. The grounding cables shall be copper materials with (1*25) mm between fence items and (1*70) mm between fence and the substation.

Coils shall be packaged and piled-up as two (2) concentric rings in a strong wooden pallet at a maximum height and weight of 1.0m and 1,000kg respectively, then secured firmly using high tensile low elongation steel straps.

The minimum coating thickness of the following metallic layers shall be as follows:

- Surface Preparation: Sand and Chemical treatment as per ASTM D7803.
- Powder Painting: Polyester Powder Coating as per EN ISO 12944 with Minimum Coating Thickness of 70-80 Microns.

5.5. DANGER, NUMBERING AND PHASING PLATES

5.5.1. The danger, numbering and phasing plates shall be manufactured from flat sheet aluminum per BS 1470.

5.5.2. The danger sign plate for MV equipment shall show a white “skull and crossbones” and “DANGER HIGH VOLTAGE” in Arabic and English marking on red background on 150mm X 150mm X 1.5mm aluminum plate as shown in attached Figure.

5.5.3. The danger sign plate for LV equipment shall be manufactured on 100mm X 100 mm X 1.5mm aluminum plate as shown in attached Figure.

5.5.4. The numbering plates shall consist of a number tag holder and number tags as shown in Fig. No. 51. The number tag holder shall be black painted aluminum size 400mm (maximum) x 50mm x 1mm and shall be provided with flanges to accommodate the 48 mm x 20 mm tags. The number plates shall be yellow painted aluminum size 48 mm x 20 mm with the cut through numbers or letters.

5.5.6. Paint shall be high gloss baked enamel finish. This shall include a transparent lacquer capable of blocking the ultraviolet rays of sun and preventing their discoloring influence.

5.5.7. The plates shall have rounded corners and no sharp or rough edges.

6. INSPECTION AND TESTING

In addition to the requirements specified in 01-SDMS-01, the following shall be fulfilled:

- The supplier shall make adequate routine tests and inspections to determine the conformity of materials furnished under this specification.

6.1. INSPECTION/ROUTINE TEST REQUIREMENTS

6.1.1. Inspection/routine tests shall be in accordance with the applicable standards in this specification.

6.1.2. Visual inspection shall include checks for satisfactory workmanship, materials, freedom from surface defects and for compliance with the purchase order and the general specifications.

6.1.3. SEC designated representative shall have free access at any time while work is being carried on, to all areas of the manufacturer's plant, which concern the work.

6.1.4. Inspection/routine tests may be made on all stages of production and shipping.

6.1.5. SEC or its designated representative reserve the right to conduct acceptance testing at the manufacturer's plant or take random samples after delivery to test the products at SEC approved 3rd party laboratory to verify compliance with this specification.

6.2. TYPE TESTING REQUIREMENTS

All materials covered in this specification shall be type tested at SEC approved laboratory or at manufacturer's test facility witnessed by SEC designated representative, in accordance with the requirement of the latest standards specified in this specification provided the manufacturer's test facility is certified and/or the tests are supervised by representatives of SEC approved laboratories.

Following the completion of all tests, two certified copies of the test reports, including the mill test certificate, approved fabrication drawings, and material standard compliance certificate demonstrating that the materials used conforms in the standards specified in this specification, shall be submitted to SEC for review and approval. The following type tests shall be carried out:

6.2.1. Fabricated steel shapes and plates shall be type tested in accordance with the following standards:

- Steel materials suitable for use in fabrication of steel shapes and plates shall conform in the applicable requirements of ASTM A36.
- Hot-dipped galvanizing tests in accordance with ASTM or ISO or equivalent standards referenced in this specification shall be carried out for all galvanized materials, including the threads of the bolts.
- Design, shape and dimensional verification as per applicable drawings in this specification.

- Fasteners (nuts. bolts, and washers) included as part of the assembly shall be tested as per applicable standards.
- Weldments shall conform in the requirements of AWS D1.1 or equivalent.
- Unless otherwise specified in this specification, tolerances shall conform in the requirements of ASTM A6 or equivalent industry standards.

6.2.2. Bolts, nuts, washers, and anchor rods shall be type tested in accordance with the following standards:

- Machine bolts shall conform in the requirements of ASTM F3125M.
- Hexagonal nuts and machine bolt heads shall conform in the requirements of ANSI B18.2.4.6 or equivalent.
- Washers shall conform in the requirements of ASTM F436M or equivalent.
- Shoulder eyebolts shall conform in the requirements of ASTM F541 or equivalent.
- Eye-nuts shall conform in the requirements of ANSI C135.5 or equivalent.
- Anchor rods shall conform in the requirements of IEEE C135.2 or equivalent.
- Stay/guy wires shall conform in the requirements of EN 50189 or equivalent.

6.2.3. Ground rods and grounding accessories shall be type tested respectively in accordance with IEC 62561-1 and IEC 62561-2.

6.2.4. Flat sheet aluminum suitable for use in danger plates, numbering plates and phasing plates shall be type tested in conformance with ASTM B209M or equivalent.

6.2.5. Non-metallic accessories shall be type tested in accordance with the following standards: Surface Preparation: Sand and Chemical treatment as per ASTM D7803.

6.2.6 Powder Painting: Polyester Powder Coating as per EN ISO 12944 with Minimum Coating Thickness of 70-80 Microns.

7. PACKING AND SHIPMENT

In addition to the packing and shipping requirements specified in 01-SDMS-01, the following shall be fulfilled:

7.1 Items consisting of two or more parts such as bolts with nuts and washers shall be delivered, as far as possible, fully assembled/packed as one set.

7.2 The stay wire shall be furnished in lengths shown in the Data Schedule and packed in wooden or steel reals and lagged externally. Wood lagging or better material shall be secured with steel straps to provide physical protection during transit and customary storage and handling operations.

8. GUARANTEE

8.1 The vendor shall guarantee the materials against all defects arising out of faulty design, sub-standard materials or poor workmanship for a period of five (5) years from date of delivery.

8.2 The vendor shall guarantee that the materials that will be delivered in SEC warehouses are uniform and consistent with the approved samples. SEC reserves the right to blacklist the vendor and/or the manufacturer should they be proven guilty of supplying sub-standard materials and not uniform or consistent with the approved samples.

8.3 If no exceptions to this specification are taken and no list of deviations is submitted, it shall be deemed that, in every respect, all items offered shall conform to this specification. SEC interpretation of this specification shall be accepted.

9. SUBMITTALS

In addition to documentations specified in 01-SDMS-01, the following shall be submitted by the vendor/manufacturer:

9.1 Detailed working/fabrication drawings shall be supplied with the proposals. The drawing shall include but not limited to the following:

- The complete dimensions and location of bolt holes.
- Details of connections, bends, shaping and cuts.
- Details of identification marks or numbers.

9.2 Type tests and routine tests reports for metallic and non-metallic products shall be submitted during evaluation of tender. Submittals required following award of contract:

Samples together with actual CAD drawings, routine test reports, and materials certificate of compliance with applicable standards shall be submitted for inspection/evaluation prior to issuance of approval for mass production. The following attributes shall be checked:

a. Dimensional verification

b. Engraved markings (SEC Item Code, Manufacturer Logo or Initials, Manufacturer Catalogue/Product Number)

c. Uniformity of the product/samples

d. Finishing

e. Manufacturing schedule, progress report and test schedules.

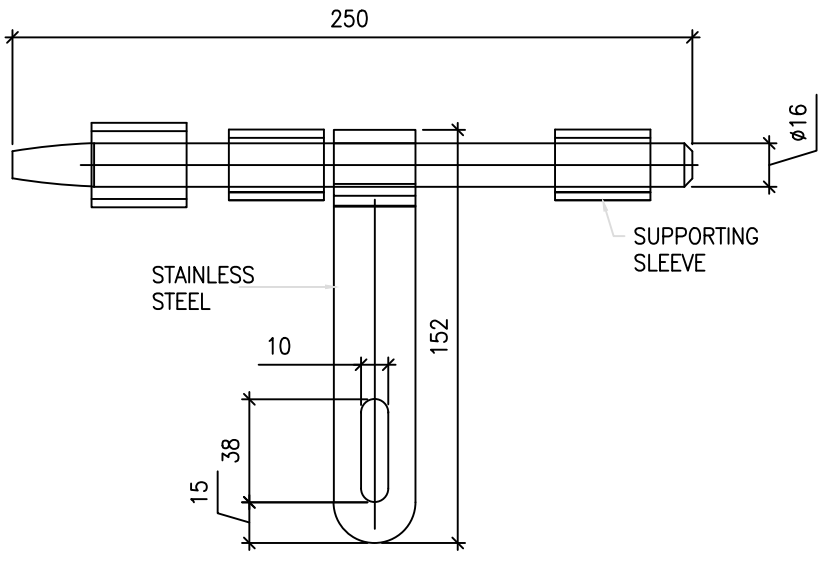
f. Test reports including, but not limited to, the following:

- Certified mill tests report for all material
- Certified welding reports, if applicable
- Test reports on coating thickness, nuts & bolts and reports on dimensional checks
- Report of all material testing, when required, including photos, diagrams, etc.

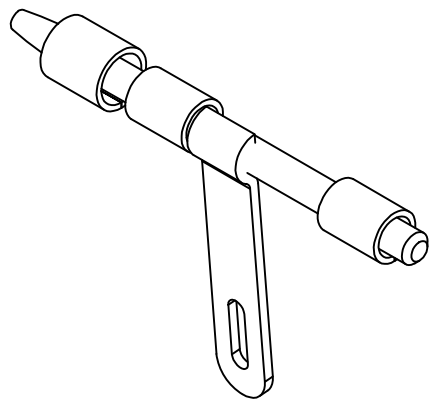
TABLE 2: LIST OF MATERIALS

S/N	MATERIALS DESCRIPTION
1	2.0mm THICK GALVANIZED STEEL SHEET (POWDER COATING RAL 7035)
2	SQUARE TUBE 80X80X5mm THICK
3	RECTANGULAR TUBE 80X40X1.2mm THICK
4	STAINLESS STEEL DOOR HINGES
5	BASE PLATES 250X250X10mm THICK WITH 4-22 DIA. HOLES
6	SQUARE TUBE 40X40X1.5mm THICK
7	120X120X5mm THICK CAP
8	STEEL BAR 70X3mm THICK WELDED TO RIGHT LEAF
9	STAINLESS STEEL DOOR LATCHING SUPPORTING ANGLE FIX WITH RIVET PIN
10	DOOR STOPPER AT TOP HORIZONTAL TUBE 30X6X50mm
11	12 DIA. ROD STAINLESS STEEL (GRADE 304) SLIDING
12	12 DIA. ROD STAINLESS STEEL (GRADE 304) SLIDING
13	DOOR LOCK
14	F.BAR 30X100X5mm THICK FOR DOOR LOCKING WELDED TO DECORATIVE MESH
15	DOOR LOCK LENGTH 40mm
16	STAINLESS STEEL (GRADE 304) SLIDING DOOR LOCK
17	EARTHING BOLT M12X30 LG. W/ HEX, NUT & PLAIN WASHER
18	HEX. BOLT M16X120 LG. W/ HEX. NUT & WASHER
19	DANGER PLATE
20	C35 CONCRETE 500X500X700mm PRECAST CONCRETE
21	1X70mm SQ. EARTHING CABLE
22	1X25mm SQ. EARTHING CABLE
23	RECTANGULAR PLATE 40X100X5mm THICK
24	BEND PLATE 100X200X5mm THICK
25	BOLT M8X100 LG. W/ HEX. NUT & WASHER
26	BOLT M20X200 LG. W/ HEX. NUT & WASHER

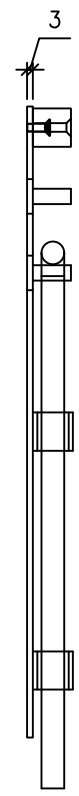
SPECIFICATION OF SECURITY FENCE FOR UNIT SUBSTATION AND RMU



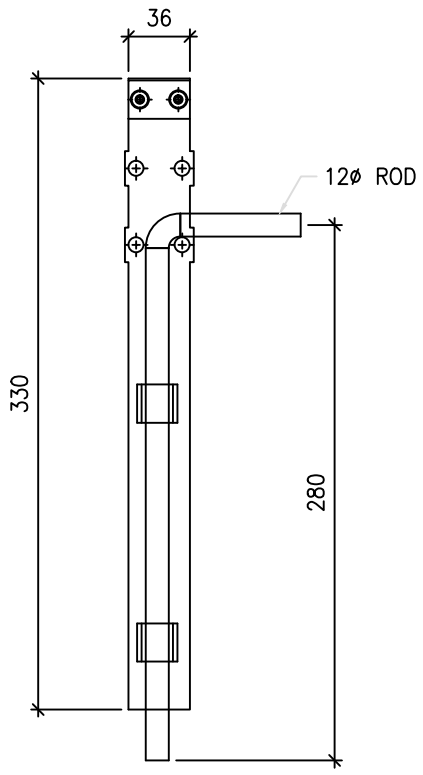
DOOR LOCK DETAIL
FRONT VIEW
ASSEMBLY



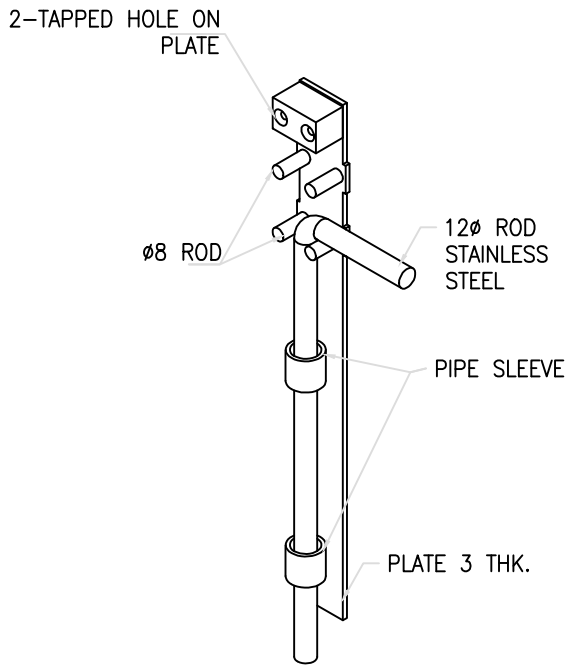
ISOMETRIC VIEW



SIDE VIEW

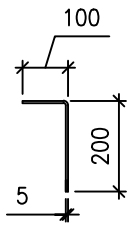


FRONT VIEW

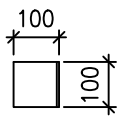


ISOMETRIC VIEW

BOTTOM LATCH ASSEMBLY DETAIL



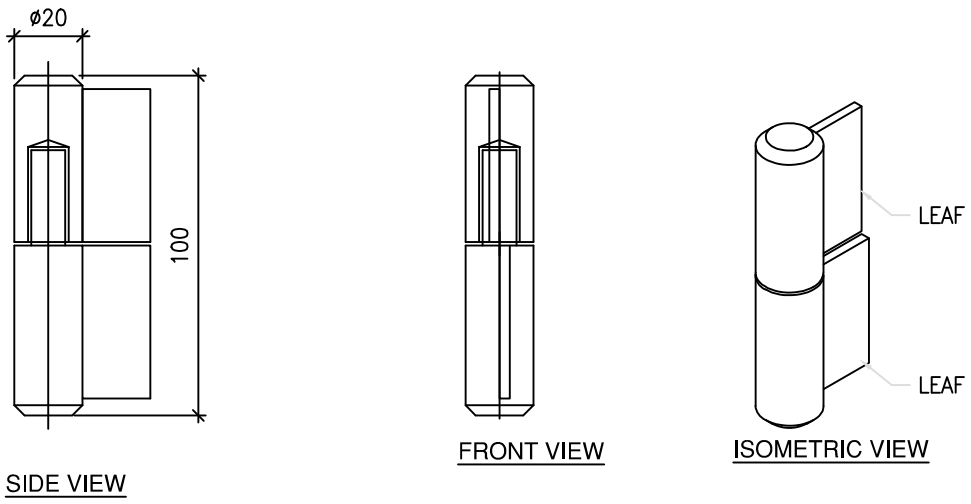
TOP VIEW



FRONT VIEW

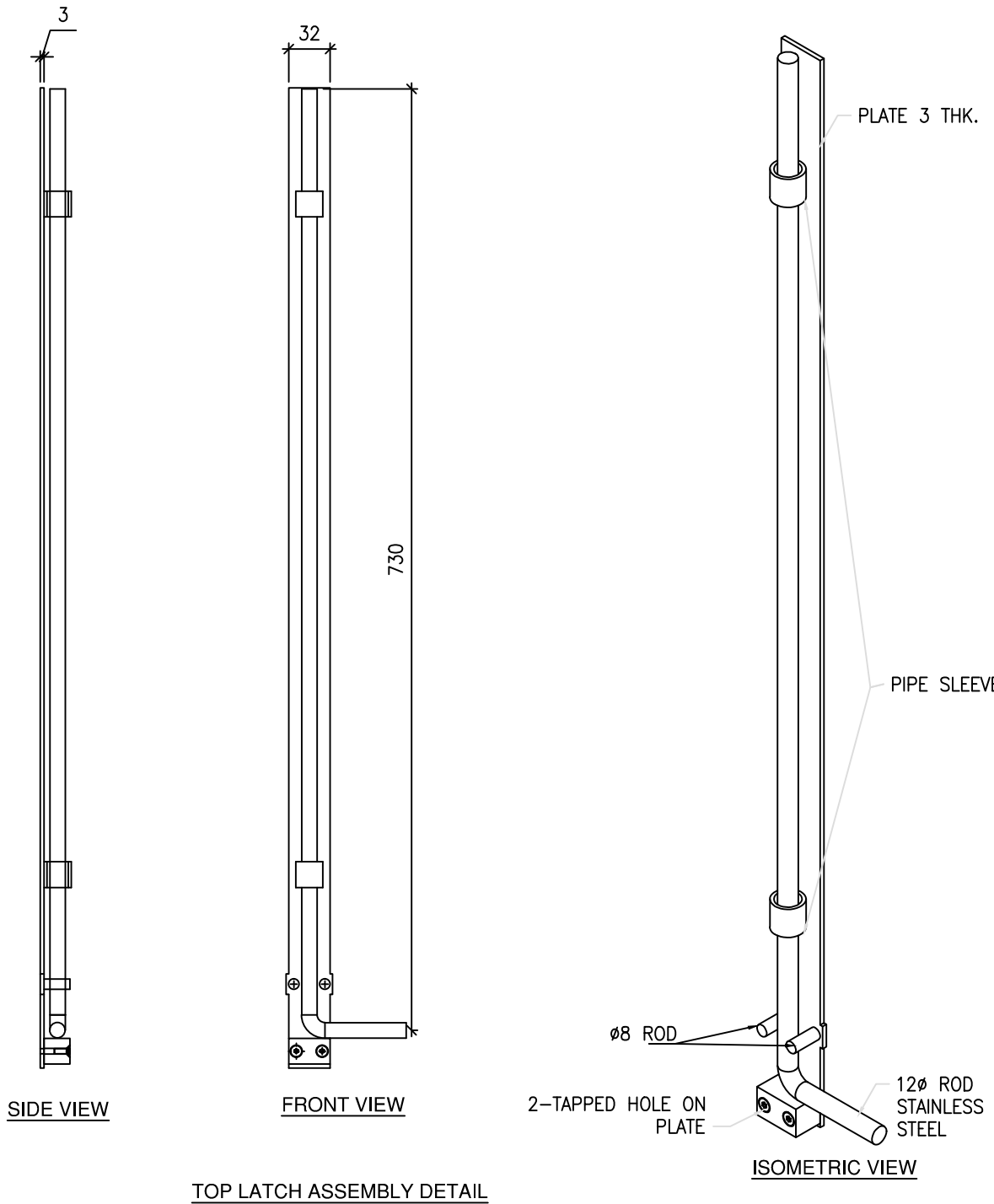
CLAMP DETAIL FOR CONNECTION BETWEEN WALLS AND VERTICAL STEEL COLUMN

Accessories Details of Security Fence



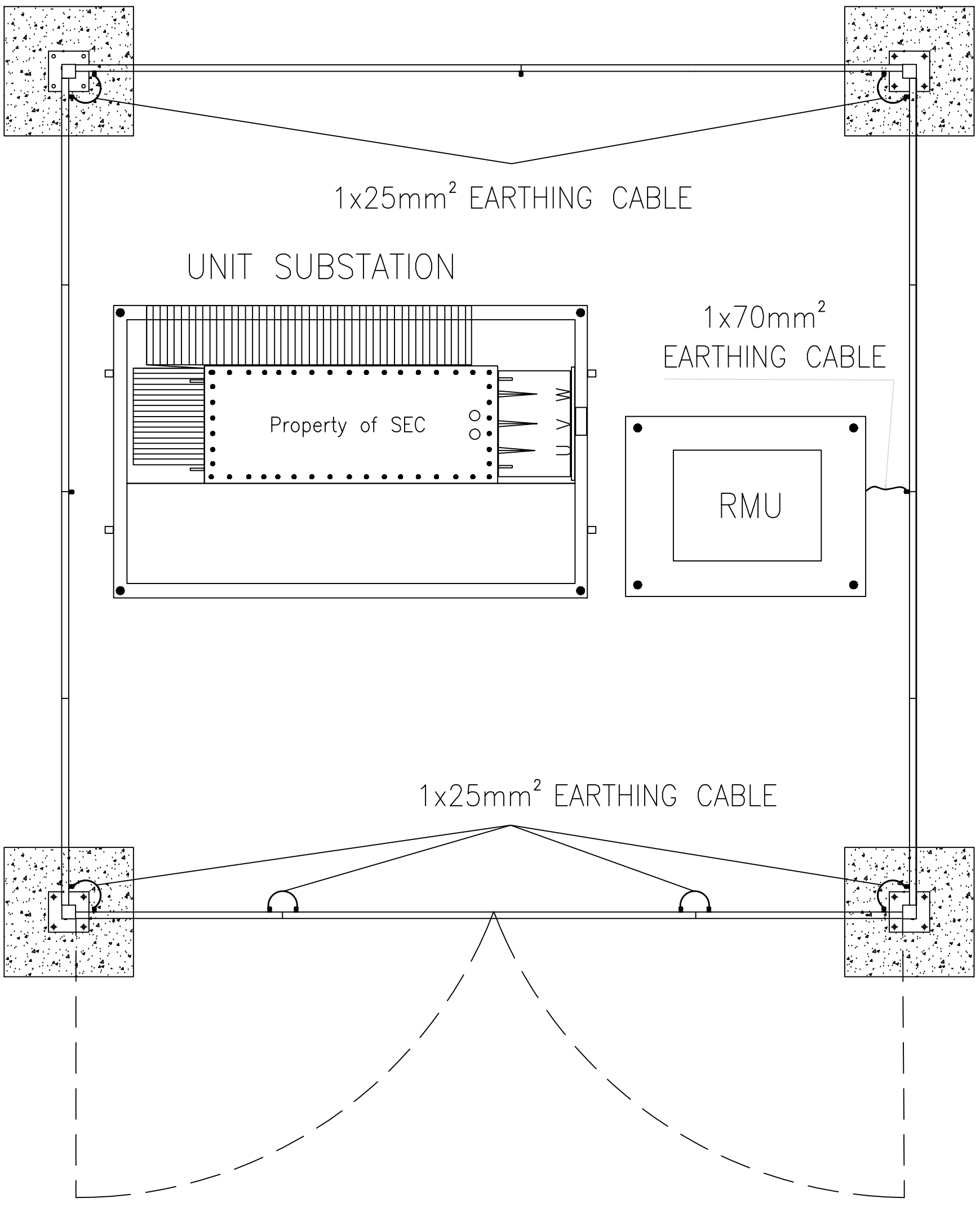
SIDE VIEW | FRONT VIEW | ISOMETRIC VIEW

S.S HINGE DETAIL



SIDE VIEW | FRONT VIEW | ISOMETRIC VIEW

TOP LATCH ASSEMBLY DETAIL



Typical Earthing Details of Security Fence