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SECTION – 2
Part – A (GI LATTICE STRUCTURE)

2.0 GENERAL

This section covers the standard technical specification for GI Structures.

2.1 STEEL MATERIAL

Mild Steel (MS) and High Tensile (HT) Steel materials shall be tested quality and shall conform to IS:2062. Steel material (Both HT and MS) should be procured from Customer approved source.

Steel shall not be pitted and should be free from scales and rust. If the rolled section and plates are bent or distorted, bend or distortion shall normally be removed by the cold treatment. Straightening under hot stage shall be resorted to only under specific permission from BHEL. If any rolling defects viz., laminations, cracks etc. are discovered in the steel during the processing, it is to be rejected.

TOLERANCE:

The dimensional and weight tolerances for rolled shapes shall be in accordance with IS:1852-1991.

No rolled or fabricated member shall deviate from straightness by more than 1/1000 of the axial length or 10mm whichever is smaller.

2.2 FABRICATION

GENERAL:

All the workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined true and square where so specified. All holes and edges shall be free of burrs. Shearing and cropping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Material at the shops shall be kept clean and protected from weather.

The fabrication of galvanized steel structures shall be carried out generally in accordance with IS:802 part. II, IS:800-1984. All materials shall be completely shop fabricated. Normally, butt splices shall be used. The components constituting the joint shall have a total strength greater than the heavier of the members connected. Lap splices may be used for connecting members of unequal sizes. The inside angle of lap splice shall be grounded at the heel to fit the fillet of the outside angle. The splices shall develop full strength of the members connected through bolts. Butt as well as lap splices shall be made as close to the main panel points as possible.

Joints shall be so designed and detailed as to avoid eccentricity as far as possible. However, where joints are such that the elimination of gusset plates would result into eccentric joints, gusset plates and spacer plates may be used in conformity with modern practices.

The use of filler in the connections shall be avoided as far as possible. The diagonal members in tension may be connected entirely to the gusset plate where necessary to avoid the use of fillers. Each diagonal shall be in one piece without splices or center gussets, and it shall be connected at the point of intersection by one or more bolts.

The gap between the ends of two connected members in butt joints shall not be more than 6 mm and less than 4mm.

The tower structure members shall be accurately fabricated to bolt together easily at site without any undue strain on them or the bolts.

Drain holes shall be provided at all points where pockets or depressions are likely to hold water.

For designing of towers, preferably rationalized steel sections shall be used. During execution of the project, if any particular section is not available same shall be substituted by higher section at no extra cost to owner and the same shall be borne by the bidder. However design approval for such substitution shall be obtained from owner before substitution.

STRAIGHTENING:

For rolled steel material, if straightening or flattening is necessary, it shall be done by methods that will not injure the materials.

CUTTING:

Cutting may be affected by chopping, cropping, sawing or machine flame cutting. Sheared or cropped edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.

PUNCHING AND DRILLING:

Holes in members may be punched full size through material not over 12mm thick. Holes must be cleaned of burrs and ragged edges. Drilled holes shall be preferred. Holes made by drilling shall also be cleaned of burrs and ragged edges. Where several parts are to be drilled, they shall be first assembled, tightly clamped together and drilled through.

Punched holes must be square with plates and the walls of the holes shall be parallel. The following maximum allowance in accuracy of punched holes is permissible:

- i) Holes must be perfectly circular and no tolerance in this respect is permissible.

- ii) The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0.8 mm, i.e. the allowable taper in punched holes should not exceed 0.8 mm in diameter.
- iii) Holes must be square with the plates. Holes at angle or slant shall not be permitted.

The minimum spacing of bolts and edge distances shall be as given below:

Bolt Diameter (mm)	Minimum Bolt Spacing (mm)	Maximum edge distance	
		Hole center To rolled Edge (mm)	Hole center to cut/ flame edge (mm)
16	40	20	23

WELDING:

The work shall be done as per approved fabrication drawings, qualified welding procedure specifications (WPS) and by qualified welders. Procedure qualification records (PQR) shall be maintained. Electrodes for shielded arc manual welds shall comply with the requirements of IS:814 - 1991. All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, under cutting, cracks etc. All welds shall be cleaned of all slag or flux before galvanizing.

MARKING OF MEMBERS FOR IDENTIFICATION.

All members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on. The erection mark shall be stamped with a metal dye with figures at least 16 mm high and to such optimum depth as to be clearly visible, even after a member is galvanized. All erection marks shall be on outer surface of all sections and near one end, but clear of bolt holes. Marking shall be so stamped that they are easily discernible when sorting out members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location.

Erection marks on like pieces shall be in identical locations. Members having lengths of 3.0 M or more shall have the erection mark at both ends.

PROTOTYPE ASSEMBLY:

Towers shall be trial assembled at shop before galvanizing i.e. prototype assembly keeping in view the actual site condition prior to dispatch to testing station/erection sites. The prototype assembly of each structure shall be got approved from BHEL/Customer as directed. Necessary match marks shall be made on each components before dismantling the prototype assembly and galvanizing. Any error shall be rectified at the expense of the contractor.

No extra charge on account of erecting the assemblies or getting them inspected will be permissible. It is however to be mentioned that the responsibility for proper fitting of various members for the erection of the structure in the field will rest with the supplier and any discrepancy found at the time of erection will have to be rectified by the contractor at his cost.

2.3 GALVANISING:

All structural steel works shall be hot dip galvanized after fabrication. Galvanizing of each members shall be carried out in one complete immersion and double dipping shall not be permitted.

Zinc required for galvanizing will have to be arranged for by the Contractor. Purity of zinc to be used for galvanizing shall be 99.5% as per IS:209-1992.

All burrs and irregular edges shall be ground smooth before galvanizing.

After all shop work is complete, all structural materials shall be punched with the Erection Mark and be hot dip galvanized. Before galvanizing the steel section shall thoroughly be cleaned of any paint, grease, rust, scale, acid/alkali or such other foreign matters as are likely to interfere with the galvanizing process or with the quality and durability of the zinc coating. Pickling shall be carefully done and shall be proper.

Minimum weight of zinc coating shall be 610gms/sqm. However, higher coating may be provided as per requirement.

The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel, globules, spiky deposits, blistered surface flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633 - 1986.

When the steel section is removed from the galvanizing kettle excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose.

Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specification, or lack of quality control in any manner in the galvanizing plant shall render the entire production in the relevant shift liable to rejection.

All the galvanized structural steel members and accessories shall be treated with sodium dichromate or an approved equivalent solution after galvanizing, so as to prevent white storage stains.

If the galvanizing of any member is damaged, BHEL shall be shown of the extent of damage and if so directed the galvanizing may have to be redone in the similar manner as stated above at no extra cost.

Contractor shall also furnish sufficient quantity of appropriate paint, free of cost, for repairing galvanized surfaces damaged in transit, and minor modifications done at site during erection.

Galvanizing tests shall be made from time to time on as many samples as may be considered necessary. The supplier shall supply all samples and equipment and carry out the tests without any extra cost.

2.4 INSPECTION OF MATERIALS

GENERAL:

Contractor shall give notice to BHEL/ Customer in advance for inspection of materials. All rejected material shall be promptly removed from the shop and replaced with new material for BHEL/ Customer approval/ inspection. The fact that certain material has been accepted at Contractor's shop shall not invalidate final rejection at site by BHEL/ Customer if it fails to be in proper condition or has fabrication inaccuracies which prevent proper assembly. No materials shall be painted, galvanized or dispatched to site without the inspection and approval by BHEL/ Customer unless such inspection is waived off in writing by BHEL/ Customer.

Shop inspection by BHEL/ Customer, for submission of test certificates and acceptance thereof by BHEL/ Customer shall not relieve contractor from the responsibility of furnishing material conforming to the requirements of these specifications, nor shall it invalidate any claim which BHEL/ Customer may make because of defective or unsatisfactory material and workmanship.

Contractor shall provide all the testing and inspection services and facilities for shop work. For fabrication work carried out in the field the standard of supervision and quality control shall be maintained as in shop fabricated work. The inspection and testing shall be conducted in a manner satisfactory to BHEL/ Customer.

The supplier shall submit QP (Quality Plan) detailing each stage of manufacturing i.e. raw-material, in process and final inspection for approval by BHEL/Customer in the prescribed format. The final Quality plan shall approved by BHEL/ Customer

MATERIAL TESTING

If mill test reports are not available for any steel materials the same shall be got tested by the contractor and demonstrate conformity with the relevant specification to the full satisfaction of BHEL/ Customer. The cost of such tests shall be borne by the contractor.

DIMENSIONS AND WORKMANSHIP:

The Structural Steel members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment and surface finish, are in accordance with the requirements shown in Contractor's approved shop drawings.

INSPECTION OF TEST FAILURE:

In the event of any failure of structural steel members to meet an inspection or test requirement, contractor shall inform BHEL/ Customer and must obtain permission from the BHEL/ Customer before repair is undertaken. The quality control procedures to be allowed to ensure satisfactory repair shall be subject to approval by BHEL/ Customer.

2.5 PACKING TRANSPORTATION AND DELIVERY

After completion of final inspection and marking, the fabricated galvanized structural items shall be packed and loaded for transportation.

Packing must be adequate to protect items against bending and any mechanical injuries and damage to galvanized film during loading and unloading. As far as possible, like member should be bundled together and tied.

Proper lifting devices shall be used for loading at shop and unloading at site in order to protect items against bending, mechanical injuries and damage to galvanized film.

Loading, transporting and unloading shall be done in compliance with transportation rules.

Slender and projected parts shall be braced properly with additional spacer steel bars, spacer wood etc, before loading for transportation, to protect against bending or any other damages during transportation.

If certain parts cannot be transported in the lengths stipulated in the design drawing, the position and type of additional splice joints shall be got approved from BHEL/ Customer.

Items must be carefully loaded and tied up properly to prevent bending, falling etc. during transportation.

The small parts such as plates, gussets, cleats etc. shall be securely tied with the wire, and packed in wooden boxes and properly identified.

As far as possible the delivery of fabricated galvanized structural steel shall be as per the order stipulated by BHEL/ Customer and to suit the erection sequence.

Contractor shall make good/ replace at his own cost any damage occurred during loading, transporting, unloading and stacking of fabricated galvanized steel structures as directed by BHEL/ Customer. No extra payment on this account shall be entertained under any circumstances.

2.6 APPLICABLE STANDARDS

Unless otherwise specified, materials, and workmanship shall conform to the following standards of their latest editions:

- | | | |
|-----|---|---|
| 1. | IS : 209 | - Zinc Ingot. |
| 2. | IS : 228 | - Method of chemical analysis of pig iron, cast iron, plain carbon and low alloy steel. |
| 3. | IS : 406 | - Methods of analysis of zinc (Spelter). |
| 4. | IS : 800 | - Code of practice for general construction. |
| 5. | IS : 802 - Part1 -
Part1/Sec.2
- Part 2
- Part 3 | - - Code of Practice for use of structural in over head Transmission line towers. |
| 6. | IS : 806 | - Code of practice for use of steel tubes in general building construction. |
| 7. | IS : 808 | - Dimensions for hot rolled steel beam, column, channel and angle sections. |
| 8. | IS : 814 | - Covered electrodes for manual metal arc welding of carbon and carbon manganese steel. |
| 9. | IS : 816 | - Code of Practice for use of metal arc welding for general construction in mild steel. |
| 10. | IS : 817 | - Code of practice for training & testing of Metal Arc welders. |
| 11. | IS : 1161 | - Steel tubes for structural purposes. |
| 12. | IS : 1599 | - Method of bend test |

- | | | |
|-----|-----------|---|
| 13. | IS : 1608 | - Method of tensile testing of steel products. |
| 14. | IS : 1852 | - Rolling and cutting tolerances for hot rolled steel products. |
| 15. | IS : 1978 | - Line pipe |
| 16. | IS : 2062 | - Steel for general structural purposes. |
| 17. | IS : 2074 | - Ready Mixed Paint, air drying red oxide zinc, chrome, priming. |
| 18. | IS : 2629 | - Recommended practice for hot dipped galvanising on Iron & Steel. |
| 19. | IS : 2633 | - Methods for testing uniformity of coating on zinc coated articles. |
| 20. | IS : 3502 | - Steel chequered plates. |
| 21. | IS : 4759 | - Hot dip zinc coating on structural steel and other allied products. |
| 22. | IS : 6745 | - Method for determination of mass of zinc coating on zinc coated iron and steel articles |
| 23. | IS : 8500 | - Specification for micro-alloyed structural steel |

SECTION – 2
Part – B (GI HARDWARE)

3.0 GENERAL

This section covers the standard technical specification for GI Hardwares.
Latest edition of applicable IS Codes to be followed.

2.1 BOLTS:

M16 bolts shall be used in all types of structures except equipment mounting/ earthing bolts which shall be as per equipment requirement.

All bolts for member connections in towers, beams & equipment support structures shall conform to IS: 6639 and for step bolts shall conform to IS: 10238.

The mechanical properties shall conform to property class 5.6 of IS:1367 (part 3).

All bolt heads shall have hexagonal shape, the heads being forged out of the solid material truly concentric and square with the shank, which must be perfectly straight.

Fully threaded bolts should not be used.

All bolts shall be threaded with metric standard thread to take the full depth of the nut and permit firm grip of the member.

All bolts shall be hot dip galvanized as per IS: 1367 (Part 13).

2.2 NUTS:

All nuts shall conform to IS: 1363 (Part 3).

The mechanical properties shall conform to property class 5 of IS:1367 (part 6).

The nuts shall be capable of being worked with fingers along the entire threaded portion of the bolt with a neat fit capable of developing the full strength of the bolt.

All nuts shall be hot dip galvanized as per IS: 1367 (Part 13).

2.3 PLAIN WASHERS:

All plain washers shall be punched washers, A type conforming to IS: 2016.

These shall be hot dip galvanized as per IS: 4759.

2.4 SPRING WASHER:

All spring washers shall be of spring steel, positive lock type and conforming to type B of IS: 3063. The thickness of spring washer shall be as specified under:

<u>Bolt Diameter</u>	<u>Thickness of Spring washers</u>
16 mm	3.5 mm

These shall be electro-galvanized as per IS: 1573.

2.5 UNIT WEIGHT OF BOLTS I/C NUT, PLAIN AND SPRING WASHERS:

For purpose of payment, following unit weights as indicated below shall be considered.

A.) STANDARD BOLTS I/C ONE NUT UNIT WEIGHTS

S. NO.	TYPE	SIZE OF BOLTS	TOTAL WT (KG)
1	M16	16 ϕ X 35 LG	0.117
2	M16	16 ϕ X 40 LG	0.125
3	M16	16 ϕ X 45 LG	0.133
4	M16	16 ϕ X 50 LG	0.141
5	M16	16 ϕ X 55 LG	0.149
6	M16	16 ϕ X 60 LG	0.157
7	M16	16 ϕ X 65 LG	0.164
8	M16	16 ϕ X 70 LG	0.172
9	M16	16 ϕ X 75 LG	0.180
10	M16	16 ϕ X 80 LG	0.188
11	M16	16 ϕ X 85 LG	0.196
12	M16	16 ϕ X 90 LG	0.204
13	M16	16 ϕ X 95 LG	0.212
14	M16	16 ϕ X 100 LG	0.220

B.) SPRING WASHER

S. NO.	TYPE	TOTAL WT (KG)
1	3.5mm thk (M16 bolt)	0.00891

C.) For supplies of bolts i/c nuts, plain washers and spring washer other than those listed above, payment shall be made based on unit weights worked out considering theoretical dimensions & density of steel as 7850kg/cum.

SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and is not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 QUALIFYING REQUIREMENT

The contractor shall have adequate galvanizing facilities to galvanize the longest single steel member of 7.5m length in one dip.

All structural assembly drawings shall be prepared in Auto Cad 2008 or Later.

3.2 SITE INFORMATION

SL.NO.	DESCRIPTION	
3.2.1	PROJECT INFORMATION	
	a) Customer	APGENCO, Hyderabad
	b) Project	1x600MW Rayalseema TPP, Stage-IV, Unit-6, 400/220kV Switchyard
	c) Project location	V V Reddy Nagar, Post-Karamala Distt- Kadappa, 480km from Hyderabad 350km from Channai
	d) Transport facilities Nearest Railway Station/Gauge Distance from Railway Station	Nearest rail head is Muddnur (10km from site)
	e) Access roads	

3.3 STANDARDS

All materials shall comply in all respect with the requirement of the latest edition of the relevant codes as listed in Section 2.

3.4 UNIT

Metric (System International) units of measurements shall be used in all drawings.

3.5 DRAWINGS, BILL OF MATERIALS AND CDs

At each stage following set of fabrication drawings/Bill of materials shall be submitted.

- | | | |
|-----|----------------------|----------|
| i) | Fabrication Drawings | : 4 sets |
| ii) | Bill of Materials | : 4 sets |

After final approval of proto –type assembly of structures, the drawings shall be updated as per proto and marked "PROTO CORRECTED". The following sets of fabrication drawings/shop drawings/bill of materials/CDs shall be submitted for distribution:

i)	Fabrication Drawings	: 1 set
ii)	Shop Drawings	: 1 set
ii)	Bill Of Materials	: 1 set
iii)	CDs	: 2 sets

3.6 CATEGORIES OF APPROVAL

CATEGORY I This means that the documents/drawings is approved.

CATEGORY II This means that the document/drawing is approved with comments i.e, some corrections are required but the contractor can go ahead with the manufacture after incorporating comments.

CATEGORY III This means that the document/drawing is not approved i.e major revisions are required and the contractor can not proceed with the manufacture.

3.7 ERRORS

Any error in fabrication work preventing proper assembly and fitting up of parts in the field, shall be classified as defective workmanship. All changes incurred by BHEL either directly or indirectly because of this shall be deducted from the amount due to the contractor.

3.8 PURCHASE ORDER NUMBER

The P.O No. shall be mentioned on all documents and drawings.

SECTION – 5

MANUFACTURING QUALITY PLAN

- 5.1** Material shall be inspected in accordance to the QP duly approved by BHEL/Customer

SECTION-6

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:

BIDDER:OFFER REFERENCE:

6.1 Deviations

Tick

☐ YES

☐ NO

If yes,

S.No.	Deviation	Clause No.
1		
2		
3		
4		

(Signature & Seal of Bidder)

GUARANTEED TECHNICAL PARTICULARS OF ACSR MOOSE CONDUCTOR REV.01

PROJECT: 400/220KV SWITCHYARD- RAYALSEEMA TPP STAGE-IV
 CUSTOMER: APGENCO, HYDERABAD
 CONSULTANT: DESEIN PRIVATE LIMITED, HYDERABAD
 PO NO.: 331P329 DATED: 19.03.2012

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Contractor : M/s. Bharat Heavy Electricals Ltd.
 Transmission Business Group (M.M)
 New Delhi

Guaranteed Technical Particulars of ACSR 'MOOSE' Conductor

Sl. No.	Description	Unit	Particulars
1.	Name & address manufacturer		Prem Conductors Pvt. Ltd 1078/2/2, Village Naroli Silvassa D & NH (U.T.)
2.	PARTICULARS OF RAW MATERIALS		
2.1	Aluminium		
	(a) Minimum Purity of aluminium	%	99.5
	(b) Maximum Copper Content	%	0.04
2.2	Steel Wires/Rods		
	(a) Carbon	%	0.50 to 0.85
	(b) Manganese	%	0.50 to 1.10
	(c) Phosphorous	%	Not more than 0.035
	(d) Sulphur	%	Not more than 0.045
	(e) Silicon	%	0.10 to 0.35
2.3	Zinc		
	(a) Minimum purity of zinc	%	99.95
3.	ALUMINIUM STRANDS AFTER STRANDING		
3.1	Diameter		
	(a) Nominal	mm	3.53
	(b) Maximum	mm	3.55
	(c) Minimum	mm	3.51
3.2	Minimum Breaking load of strand		
	(a) Before stranding	kN	1.57
	(b) After stranding	kN	1.49
3.3	Maximum Resistance of 1 m length of strand at 20 deg. C.	ohm	0.002921

For, Prem Conductors Pvt. Ltd.

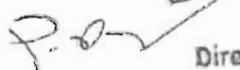
P. M.
 Director



DESEIN PRIVATE LIMITED CONSULTING ENGINEERS	
A. Agreement/Proposed with instruction.	☒
B. Agreement with drawings/Specified with item with allowing of our standards & conditions for project.	☐
C. Issued of drawing.	☐
D. Submittal of Test report.	☐
E. Issued of Test report with photo.	☐
Letter No. 0313	Date 23-4-12
By APD	
THIS CERTIFICATE IS VALID ONLY IF THE SIGNATURE OF THE CONSULTANT IS VERIFIED BY THE SUBSTANCE OF THE PROJECT AND IS NOT TO BE USED FOR ANY OTHER PURPOSE.	

Sl. No.	Description	Unit	Particulars
4.	STEEL STRANDS AFTER STRANDING		
4.1.	Diameter		
(a)	Nominal	mm	3.53
(b)	Maximum	mm	3.59
(c)	Minimum	mm	3.47
4.2	Minimum Breaking load of strand		
(a)	Before stranding	kN	12.86
(b)	After stranding	kN	12.22
4.3	Galvanizing		
(a)	Minimum mass of zinc coating per sqm. Of uncoated wire surface.	gm	275
(b)	Minimum number of one minute dips that the galvanized strand can withstand in the standard preece test	Nos	3
(c)	Min.no. of twists in a guage length equal to 100 times dia of wire which the strand can withstand in the torsion test.	Nos	16-after stranding 18-before stranding
5.	ACSR CONDUCTOR		
5.1	No. of Strand	Aluminium Wires Steel Wires	54/3.53 mm 7/3.53 mm
5.2	Total Sectional area	mm.sq	597.0
	Sectional area of Aluminium	mm.sq.	528.5
5.3	Overall diameter	mm	31.77
5.4	UTS of Conductor	kN	161.2
5.5	Lay ratio of conductor	Minimum	Maximum
(a)	Outer Steel layer	16	18
(b)	12 Wires aluminium layer	12	14
(c)	18 Wire aluminium layer	11	13
(d)	24 Wire aluminium layer	10	12
5.6	Maximum DC resistance of conductor at 20°C	ohm/km	0.05552

For, Prem Conductors Pvt. Ltd.



Director



Sl. No.	Description	Unit	Particulars
5.7	Minimum Corona Extinction Voltage (line to ground) under Dry condition.	kV (rms)	320
5.8	RIV at 1 MHz at 305 kV (rms) under dry conditions	micro volts	Below 1000
5.9	Standard length of conductor	meters	1800 / 1500
5.10	Maximum length of conductor that can be offered as single length	meters	2000
5.11	Tolerance on standard length of conductor	%	±5
5.12	Direction of lay for outside layer		Right
5.13	Linear mass of the Conductor		
	(a) Standard	kg/km	2004
	(b) Minimum	kg/km	1962
	(c) Maximum	kg/km	2032
6.0	Drum is as per specification		Yes
7.0	No. of cold pressure butt welding Equipment available at works.	Nos.	2 Nos.
8.0	Modulus of Elasticity	Kg / sq.cm	686000 [R1]
9.0	Temperature coefficient of resistance at 20°C	per Deg C	0.00403 [R1]
10.0	Coefficient of linear expansion	per Deg C	0.00001991 [R1]
11.0	Type of Paper and Water Proof Material used In packing	a) double corrugated paper on barrel b) bitumen paper on inside of flanges c) 100 GSM craft paper in between layers of cond. d) 300 gauge polythin sheet on outermost layer of cond	[R1]

For, Prem Conductors Pvt. Ltd.

Date : 18.04.2012

(Signature)..... [Signature] Director

Place : AHMEDABAD

(Printed Name) P.A. MEHTA

(Designation) DIRECTOR

(Common Seal)..... 

BHARAT WIRE ROPES LTD.

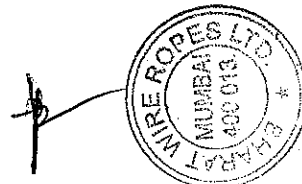
GUARANTEED TECHNICAL PARTICULARS

Contractor : Bharat Heavy Electricals Limited.

Project: APGENCO Rayalseema STAGE- IV

Galvanised Steel Earth Wire of size 7/3.66 mm

Name and Address of Manufacturer • Office • Factory	Bharat Wire Ropes Ltd. Regd.Office :A-701,Trade World, Kamla City, Lower Parel (W) Mumbai 400 013 Bharat Wire Ropes Ltd. Plot No.1 & 4, Atgaon Industrial Complex, Mumbai Nashik Road (NH 3), Taluka Shahapur, Atgaon (East), Dist.Thane 421 601 (Maharashtra) (India)
Particulars of Raw Materials	
<u>Steel Wires/Rods</u> Carbon Manganese Phosphorous Sulphur Silicon Lead Cadmium Iron	Not more than 0.55% 0.40% to 1.10% Not more than 0.05% Not more than 0.05% 0.15% to 0.35% N/A N/A N/A
<u>Zinc</u> • Minimum Purity of Zinc	99.95%
Steel Strands Before Stranding	
<u>Diameter</u> • Nominal • Maximum • Minimum	3.66 mm 3.74 mm 3.58 mm
<u>Tensile Strength</u> • Before Stranding • After Stranding	981 N/mm ² 931 N/mm ² .



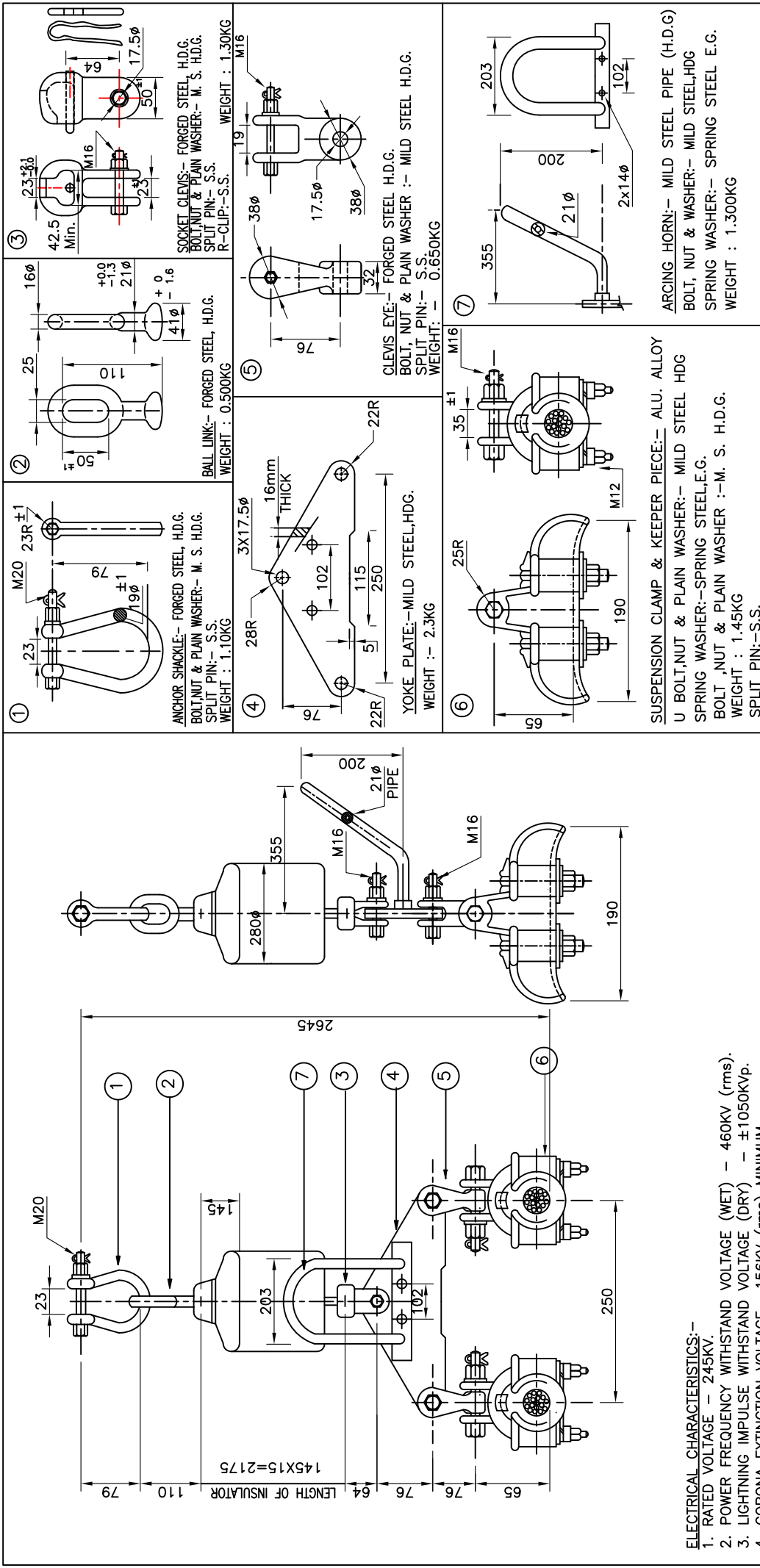
BHARAT WIRE ROPES LTD.

Galvanizing	
- Minimum Weight of Zinc Coating per sq.meter on uncoated wire surface - Minimum Number of One Minute Dips that the Galvanised Strand can withstand in the Standard Preece Test - Minimum Number of Twists in Gauge Length equal 100 times the dia.of the Wire which the Strand can withstand in the Torsion Test	Before Stranding : Min. 250 gm. After Stranding : Min. 238 gm. Before Stranding : 1 Min.= 3 Dips After Stranding : 1 Min. = 2 Dips 1/2 Min. = 1 Dip Before Stranding : 20 Nos. After Stranding : 18 Nos.
Stranded Earthwire	
No.of Strands	Steel Core = 1 & Outer Steel Wire = 6
Stranding and Wire Diameter	7/3.66 mm
Total Sectional Area	73.61 mm ²
Overall Dia.of Earthwire	10.98 mm
UTS of Earthwire	64.8 kN
Lay Length of Outer Steel Layer	Min. 143 mm and Max. 307 mm
DC Resistance of Earthwire at 20 Deg.C	Max. 2.51 ohm/km
Standard Length of Earthwire	2000 meter
Tolerance	+ 100 meter
Direction of Lay of Outer Layer	Right Hand
Linear Mass of Earthwire	
- Standard - Minimum - Maximum	575 kg/km (Approx.) 604 kg/km (Approx.) 553 kg/km (Approx.)
Elongation of Wire	Before Stranding- 4% After Stranding- 3.5%
Modulus of Elasticity	19 x 10 ³ kgf/mm ²
Maximum Temp	Ambient Temp
Specification	IS : 12776 of 2002 & Tech.Spec with enquiry

For **BHARAT WIRE ROPES LTD.**

Authorized Signatory





ELECTRICAL CHARACTERISTICS:-
 1. RATED VOLTAGE - 245KV.
 2. POWER FREQUENCY WITHSTAND VOLTAGE (WET) - 460KV (rms).
 3. LIGHTNING IMPULSE WITHSTAND VOLTAGE (DRY) - ±1050KVp.
 4. CORONA EXTINCTION VOLTAGE - 156KV (rms) MINIMUM.
 5. RIV AT 156KV rms- 1000 MICROVOLTS MAXIMUM.

- NOTE:-**
 1. ALL DIMENSION IN mm.
 2. GENERAL TOLERANCE:- ±3%.
 3. BALL AND SOCKET SIZE:- 20mm AS PER IS:2486(PT-II).
 4. MIN.BREAKING STRENGTH OF STRING:-120KN.
 5. MIN. BREAKING STRENGTH OF THE CLAMP:-70KN.
 6. ALL FERROUS PARTS HOT DIP GALVANISED AS PER IS:2633.
 7. NUTS, BOLTS & WASHERS BELOW M12 WILL BE ELECTRO GALVANISED.
 8. TOTAL WEIGHT:- 11.00kg.(Approx.).
 9. EACH INSULATOR STRING COMPRISES OF 15NOS.DISC INSULATORS.
 10. TOTAL CREEPAGE DISTANCE >6125mm.
 11. ALL HARDWARE SHALL BE BOLTED TYPE.
 12. ALL FORGING COMPONENTS ARE MADE BY DROP FORGING METHOD AS PER IS-2004

NAME OF CUSTOMER: APGENCO, Hyderabad
 NAME OF PROJECT : 400/220kV Switchyard-Rayalseema TPP stage-IV (600MW Unit#6)
 NAME OF CONSULTANT : Desin Pvt. Ltd., Hyderabad
 CONTRACTOR : Bharat Heavy Electricals Ltd.

SUSPENSION CLAMP & KEEPER PIECE:- ALU. ALLOY
 U BOLT,NUT & PLAIN WASHER:- MILD STEEL HDG
 SPRING WASHER:-SPRING STEEL,E.G.
 BOLT ,NUT & PLAIN WASHER :-M. S. H.D.G.
 WEIGHT : 1.45KG
 SPLIT PIN:-S.S.

ARCING HORN:- MILD STEEL PIPE (H.D.G)
 BOLT, NUT & WASHER:- MILD STEEL,HDG
 SPRING WASHER:- SPRING STEEL E.G.
 WEIGHT : 1.300KG

ANCHOR SHACKLE:- FORGED STEEL, H.D.G.
 BOLT,NUT & PLAIN WASHER:- M. S. H.D.G.
 SPLIT PIN:- S.S.
 WEIGHT : 1.10KG

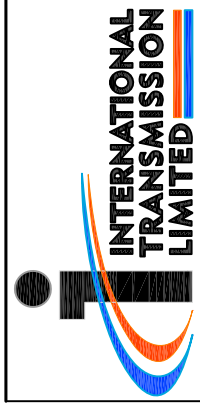
BALL LINK:- FORGED STEEL, H.D.G.
 WEIGHT : 0.500KG

SOCKET CLEVIS:- FORGED STEEL, H.D.G.
 BOLT,NUT & PLAIN WASHER:- M. S. H.D.G.
 SPLIT PIN:- S.S.
 R-CLIP:-S.S.
 WEIGHT : 1.30KG

YOKE PLATE:-MILD STEEL,HDG.
 WEIGHT :- 2.3KG

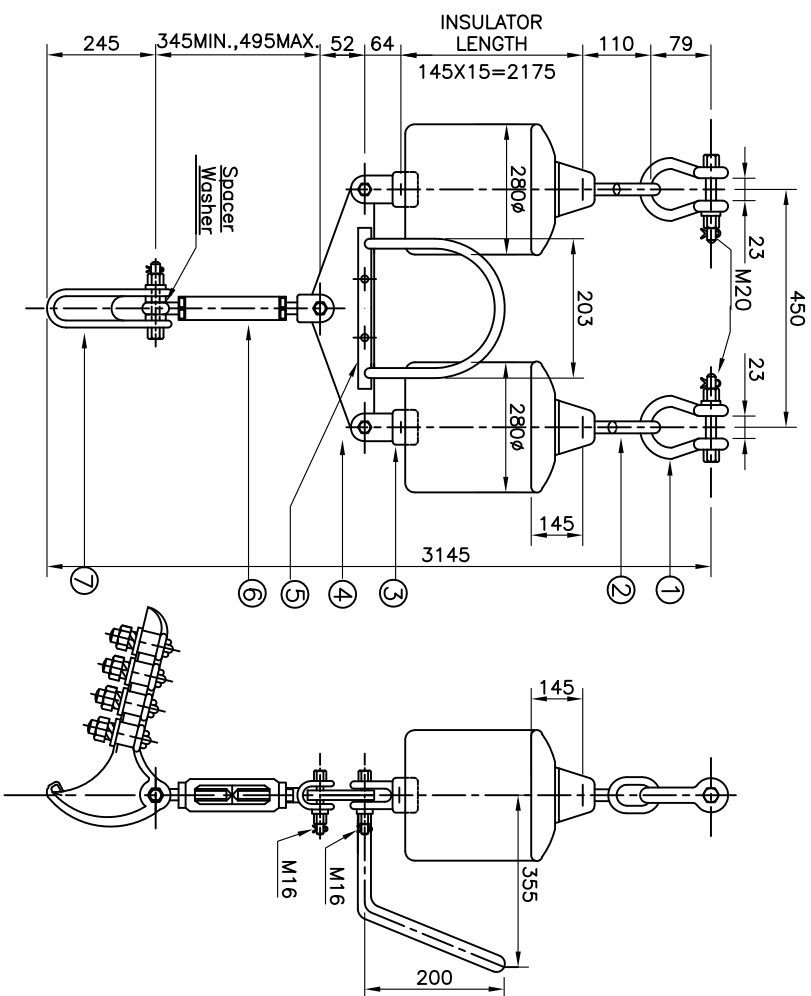
CLEVIS EYE:- FORGED STEEL H.D.G.
 BOLT, NUT & PLAIN WASHER :- MILD STEEL H.D.G.
 SPLIT PIN:- S.S.
 WEIGHT:- 0.650KG

ARCING HORN:- MILD STEEL PIPE (H.D.G)
 BOLT, NUT & WASHER:- MILD STEEL,HDG
 SPRING WASHER:- SPRING STEEL E.G.
 WEIGHT : 1.300KG



DRG. NO.:-	ITL/SS-TWIN-MOOSE	DATE	25.07.12
DRAWN	CHECKED	APPROVED	REV. 01
NAMRATA			
TITLE:-	245KV SINGLE SUSPENSION STRING WITH THROUGH CLAMP SUITABLE FOR TWIN 'MOOSE' ACSR.		
SCALE	N.T.S.		

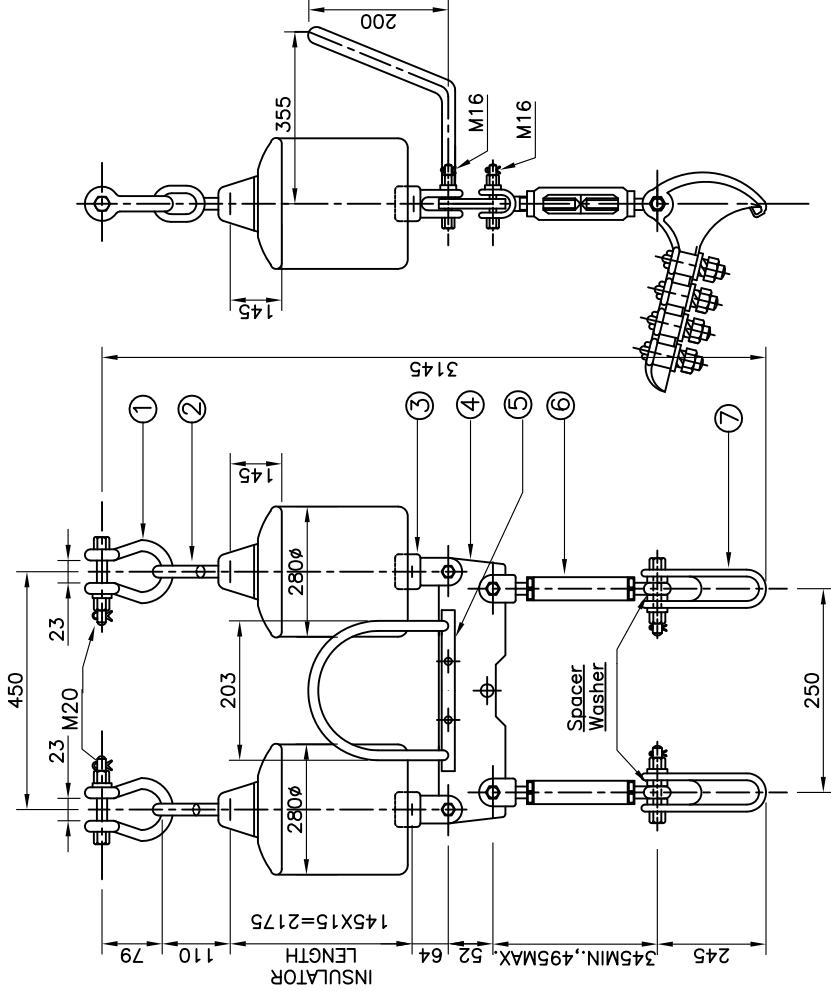
NO	DESCRIPTION	MATERIAL	U.S	QTY
7	ARCING HORN	MILD STEEL PIPE (H.D.G)	1.5	1
6	SUSPENSION CLAMP	ALU. ALLOY LM 6	70	2
5	CLEVIS EYE	FORGED STEEL H.D.G.	70	2
4	YOKE PLATE	MILD STEEL H.D.G.	120	1
3	SOCKET CLEVIS	FORGED STEEL H.D.G.	120	1
2	BALL LINK	FORGED STEEL H.D.G.	120	1
1	ANCHOR SHACKLE	FORGED STEEL H.D.G.	120	1
			U.S	QTY



ELECTRICAL CHARACTERISTICS:-

NOTES:-

7	TENSION CLAMP	ALU. ALLOY, LM-6	1	70
6	TURN BUCKLE	FORGED STEEL H.D.G.	1	120
5	ARCING HORN	MILD STEEL HOG (PIPE)	1	1.5
4	YOKE PLATE	MILD STEEL H.D.G.	1	120
3	SOCKET CLEVIS	FORGED STEEL H.D.G.	2	120
2	BALL LINK	FORGED STEEL H.D.G.	2	120
1	ANCHOR SHACKLE	FORGED STEEL H.D.G.	2	120
NO	DESCRIPTION	MATERIAL	QTY.	U.T.S. KN



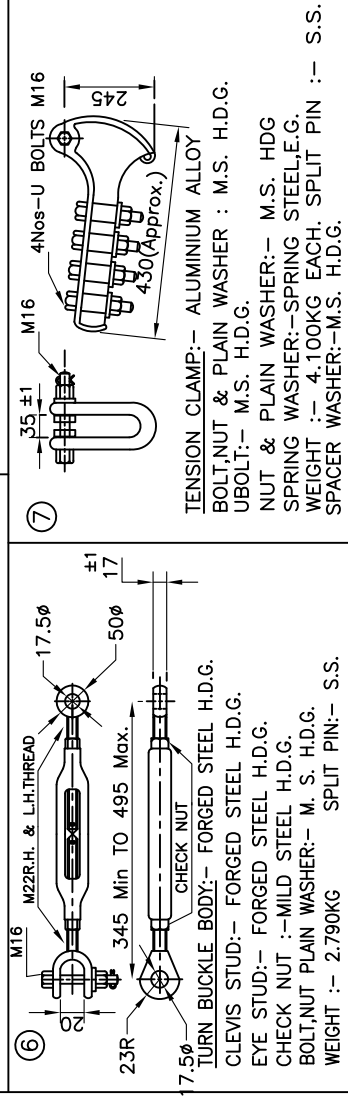
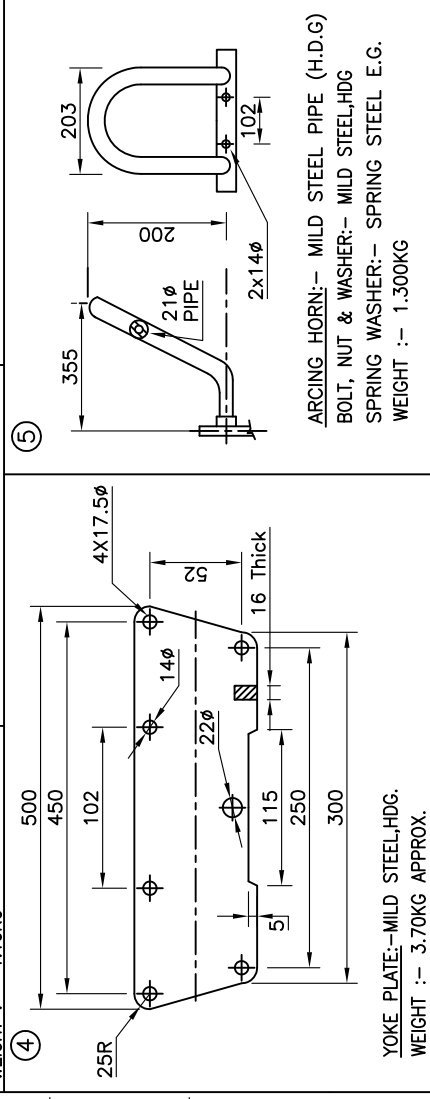
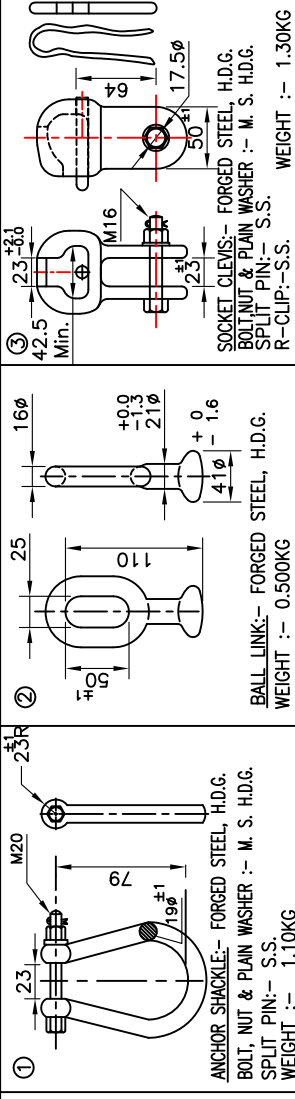
ELECTRICAL CHARACTERISTICS:-

1. RATED VOLTAGE - 245KV.
2. POWER FREQUENCY WITHSTAND VOLTAGE (WET) - 460KV (rms).
3. LIGHTNING IMPULSE WITHSTAND VOLTAGE (DRY) - ±1050KVp.
4. CORONA EXTINCTION VOLTAGE -156KV (rms) MINIMUM.
5. RIV AT 156KV rms- 1000 MICROVOLTS MAXIMUM.

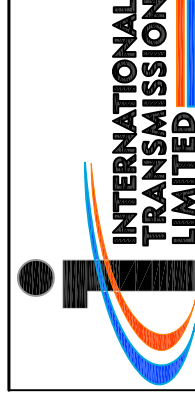
NOTES:-

1. ALL DIMENSIONS ARE IN mm.
2. GENERAL TOLERANCE ±3%.
3. BALL AND SOCKET 20mm. AS PER IS- 2486 (PT-II).
4. MIN. BREAKING STRENGTH OF STRING 120KN.
5. U.T.S. OF THE CLAMP:- 70KN.
6. TOTAL WEIGHT 25.00kg (APPROX.).
7. ALL FERROUS PARTS HOT DIP GALVANISED AS PER IS:2633/2629.
8. NUTS, BOLTS & WASHER BELOW M12 WILL BE ELECTRO GALVANISED AND FOR OTHERS HOT DIP GALVANISED.
9. EACH INSULATOR STRING COMPRISES OF 15NOS. DISC INSULATORS.
10. TOTAL CREEPAGE DISTANCE >6125mm.
11. ALL HARDWARE SHALL BE BOLTED TYPE.
12. ALL FORGING COMPONENTS ARE MADE BY DROP FORGING METHOD AS PER IS-2004

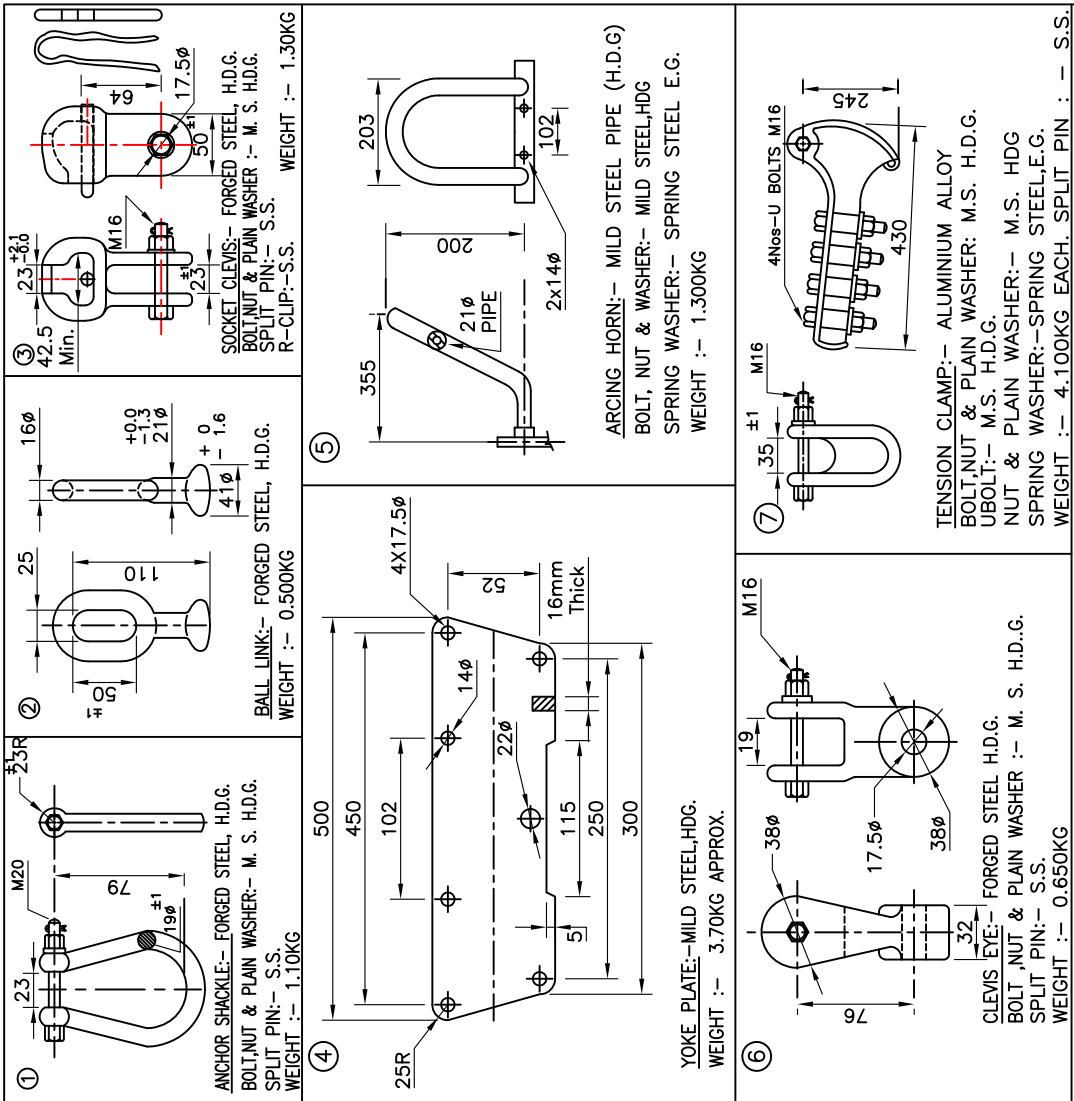
NO	DESCRIPTION	MATERIAL	QTY.	U.T.S. KN
7	TENSION CLAMP	ALU. ALLOY, LM-6	2	70
6	TURN BUCKLE	FORGED STEEL H.D.G.	2	120
5	ARCING HORN	MILD STEEL HDG (PIPE)	1	1.5
4	YOKE PLATE	MILD STEEL H.D.G.	1	120
3	SOCKET CLEVIS	FORGED STEEL H.D.G.	2	120
2	BALL LINK	FORGED STEEL H.D.G.	2	120
1	ANCHOR SHACKLE	FORGED STEEL H.D.G.	2	120



NAME OF CUSTOMER: APGENCO, Hyderabad
NAME OF PROJECT : 400/220kV Switchyard- Rayalseema TPP stage-IV (600MW Unit#6)
NAME OF CONSULTANT : Desein Pvt. Ltd., Hyderabad
CONTRACTOR : Bharat Heavy Electricals Ltd.



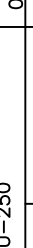
DRG. NO. :-	ITL/DTS-4U-250-TB	DATE	09.04.12
DRAWN	CHECKED	APPROVED	REV. 00
NAMRATA			
TITLE:-	245KV DOUBLE TENSION STRING WITH DOUBLE ANCHORING POINTS FOR TWIN MOOSE CONDUCTOR WITH TURN BUCKLE		
SCALE	N.T.S.		



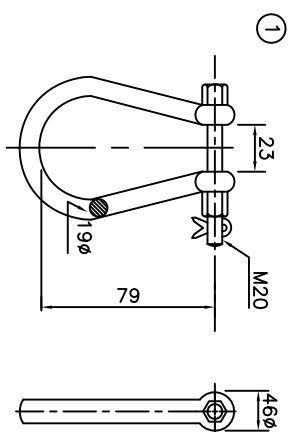
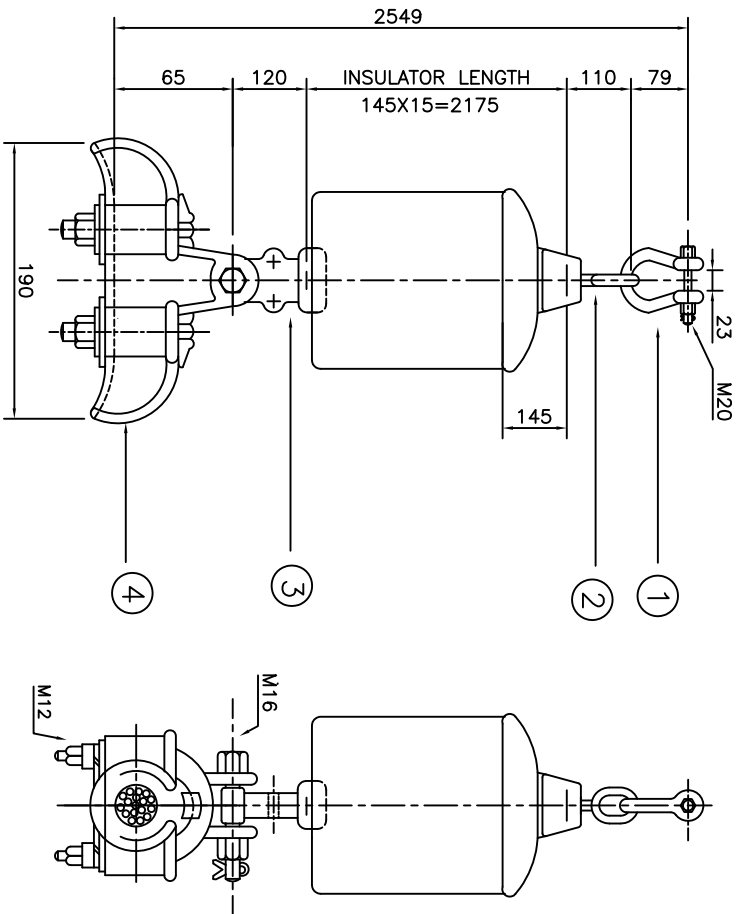
NAME OF CUSTOMER :	APGENCO, Hyderabad
NAME OF PROJECT :	400/220kV Switchyard- Rayalseema TPP stage-IV (600MW Unit#6)
NAME OF CONSULTANT :	Desein Pvt. Ltd., Hyderabad
CONTRACTOR :	Bharat Heavy Electricals Ltd.

NO	DESCRIPTION	MATERIAL	QTY.	U.T.S. KN
7	TENSION CLAMP	ALU. ALLOY, LM-6	2	70
6	CLEVIS EYE	FORGED STEEL H.D.G.	2	70
5	ARCING HORN	MILD STEEL HDG (PIPE)	1	1.5
4	YOKE PLATE	MILD STEEL H.D.G.	1	120
3	SOCKET CLEVIS	FORGED STEEL H.D.G.	2	120
2	BALL LINK	FORGED STEEL H.D.G.	2	120
1	ANCHOR SHACKLE	FORGED STEEL H.D.G.	2	120

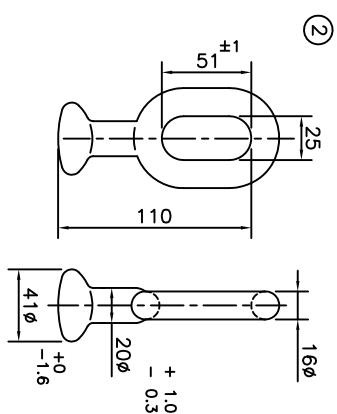
9. EACH INSULATOR STRING COMPRISES OF:
AND FOR OTHERS HOT DIP GALVANISED:
15 NOS. DISC INSULATORS.
10. TOTAL CREEPAGE DISTANCE >6125mm.
11. ALL HARDWARE SHALL BE BOLTED TYPE.
12. ALL FORGING COMPONENTS ARE MADE BY DROP FORGING METHOD AS PER IS-2004

 INTERNATIONAL TRANSMISSION LIMITED	<u>DRG. NO.:-</u> ITL/DTS-4U-250		<u>DATE</u> 09.04.12
	<u>DRAWN</u>	<u>CHECKED</u>	<u>APPROVED</u>
	NAMRATA		
	<u>TITLE:-</u> 245KV DOUBLE TENSION STRING WITH DOUBLE ANCHORING POINTS FOR TWIN MOOSE CONDUCTOR WITHOUT TURN BUCKLE		
			<u>REV.</u> 00
			<u>SCALE</u> N.T.S.

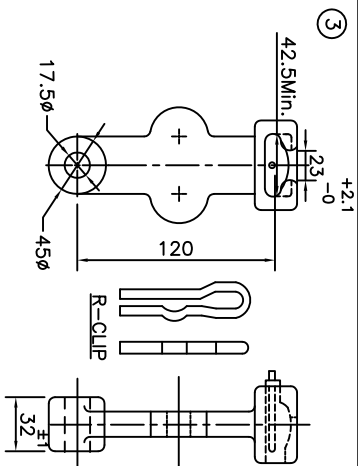




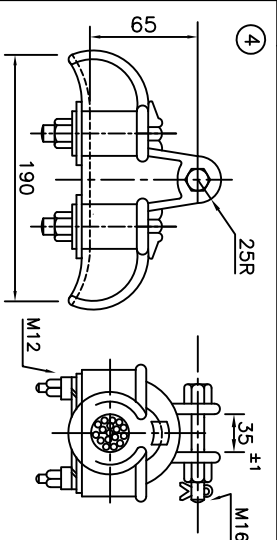
ANCHOR SHACKLE:- FORGED STEEL H.D.G.
BOLT AND NUT:- MILD STEEL H.D.G.
SPLIT PIN:- S.S.
WEIGHT : 1.10KG



BALL LINK:- FORGED STEEL, H.D.G.
WEIGHT : 0.50KG



SOCKET EYE:- FORGED STEEL, H.D.G.
R-CLIP:-S.S.
WEIGHT : 1.20KG



SUSPENSION CLAMP AND KEEPER PIECE:- ALU. ALLOY
U BOLT,NUT & PLAIN WASHER:- MILD STEEL H.D.G.
SPRING WASHER:-SPRING STEEL E.G.
BOLT AND NUT:-MILD STEEL,H.D.G.
SPLIT PIN:-S.S.
WEIGHT : 1.45KG

ELECTRICAL CHARACTERISTICS:-

1. RATED VOLTAGE – 245KV.
2. POWER FREQUENCY WITHSTAND VOLTAGE (WET) – 506kN (rms).
3. LIGHTNING IMPULSE WITHSTAND VOLTAGE (DRY) – ± 1175 kVp.
4. CORONA EXTINCTION VOLTAGE –156kV (rms) MINIMUM.
5. RIV AT 156kV rms– 1000 MICROVOLTS MAXIMUM.

NOTES:-

1. ALL DIMENSIONS ARE IN mm.
2. GENERAL TOLERANCE:- $\pm 3\%$.
3. BALL AND SOCKET SIZE:-20mm AS PER IS-2486 PART II.
4. MIN. BREAKING STRENGTH OF STRING 120KN.
5. MIN. BREAKING STRENGTH OF CLAMP 70KN.
6. ALL FERROUS PARTS HDG AS PER IS:2653/2629.
7. SPRING WASHER E.G.
8. EACH INSULATOR STRING COMPRISES OF 15NOS.DISC INSULATORS
9. NUTS, BOLTS & WASHER BELOW M12 WILL BE ELECTRO GALVANISED
10. FOR OTHERS HOT DIP GALVANISED.
11. TOTAL CREEPAGE DISTANCE >6125mm.
12. ALL HARDWARE SHALL BE BOLTED TYPE.
13. DROP FORGING METHOD AS PER IS-2004

NO.	DESCRIPTION	MATERIAL	QTY.	U.TS	KN.
1.	ANCHOR SHACKLE	FORGED STEEL, H.D.G.	1	120	
2.	BALL LINK	FORGED STEEL, H.D.G.	1	120	
3.	H. H. SOCKET EYE	FORGED STEEL, H.D.G.	1	120	
4.	SUSPENSION CLAMP	ALUMINIUM ALLOY, A6	1	70	

NAME OF CUSTOMER : APGENCO, Hyderabad
NAME OF PROJECT : 400/220kV Switchyard-Rayalseema TPP stage-IV (600MW Unit#6)
NAME OF CONSULTANT : Desein Pvt. Ltd., Hyderabad
CONTRACTOR : Bharat Heavy Electricals Ltd.



DRG. NO.:-	ITL/SS-M	DATE
DRAWN	CHECKED	REV.
NAMRATA	APPROVED	01
TITLE:- 245KV SINGLE SUSPENSION STRING WITH SUSPENSION CLAMP FOR SINGLE MOOSE ACSR.		SCALE N.T.S.



NAME OF CUSTOMER : M/s.APGENCO Ltd RTPP STAGE IV
NAME OF THE PROJECT : 400/220 KV Switchyard -Royalseema TPP Stage -IV
(600MW Unit #6)
NAME OF CONSULTANT : Desein Pvt Ltd, Hyderabad

GUARANTEED TECHNICAL PARTICULARS

SL.NO	PARTICULARS	UNIT	120 KN A/F Disc Insulator
1	Manufacturer's name & Address		Bharat Heavy Electricals Ltd., Electroceramics Division Bangalore 560012,INDIA
2	Type of insulator		Ball & Socket type
3	Size & designation of ball & socket parts and standard	mm	20 as per IS:2486- II, IEC - 120
4	Type of security clip		'R' Clip (s,steel)
5	Colour of glaze		Brown
6	Size of insulator: a) Diameter b) Spacing	mm mm	280±12 146±5
7	Total creepage distance(min)	mm	430+50 -00
8	Electromechanical failing load	kN	120
9	P.F. Dry flashover Voltage	kV(rms)	80
10	P.F. Dry withstand voltage	kV(rms)	75
11	P.F. Wet flashover voltage	kV(rms)	45
12	P.F.Wet withstand voltage	kV(rms)	40
13	Impulse flashover voltage – dry (+ ve & - ve)	kVp	130
14	Impulse withstand voltage – dry (+ ve & - ve)	kVp	120
15	Visible discharge voltage	kV(rms)	18
16	RIV test at 1 MHZ (Dry)	Micro volts	50
17	PF Puncture Voltage	kV(rms)	120
18	Weight of unit (approx)	kg	8
19	Standard testing spec.		IS:731/IEC:60383
20	Reference drawing (Unit)		4 980 17 01700/02

**DESEIN PRIVATE LIMITED
CONSULTING ENGINEERS**

A. Approved/Proceed with fabrication. ☐

B. Approved with comments/proceed with fabrication, considering our comments + resubmit for record. ☒

C. See attached memo. ☐

D. Resubmit for approval. ☐

E. Information furnished noted. ☐

Letter No. 02800 Date 29/2/12

By [Signature] For DESEIN

This approval is construed to apply to the contract arrangement only & shall not relieve the supplier from entire responsibility for the correctness of quantities and details and fulfillment of contract obligations.



11E – 5076

Page 2 of 2

**Guaranteed Technical Particulars of Insulator Strings
(With Disc Insulators) Along With Hardware Fittings**

Sl. No	Description	Unit	400KV (Twin ACSR Moose Conductor)		220KV (Twin ACSR Moose Conductor)	
			Single Suspension String 1x25	Double Tension string 2x25	Single suspension string 1x15	Double Tension string 2x15
1.0	Power frequency withstand voltage of string with arcing horns, corona control rings/grading rings under wet&dry condition	kV(rms)	680	680	460	460
2.0	Impulse withstand voltage (Dry)					
a)	Positive	kV(peak)	1550	1550	1050	1050
b)	Negative	kV(peak)	1550	1550	1050	1050
3.0	Minimum Corona extinction Voltage under dry condition	kV(rms)	320	320	156	156
4.0	RIV at 1 MHZ when the string is energized at 105 kV(rms) under dry condition	Micro volt	1000 (max)	1000 (max)	1000 (max)	1000 (max)
5.0	Maximum Voltage distribution across any disc of line to each voltage	%	9	10	13	14

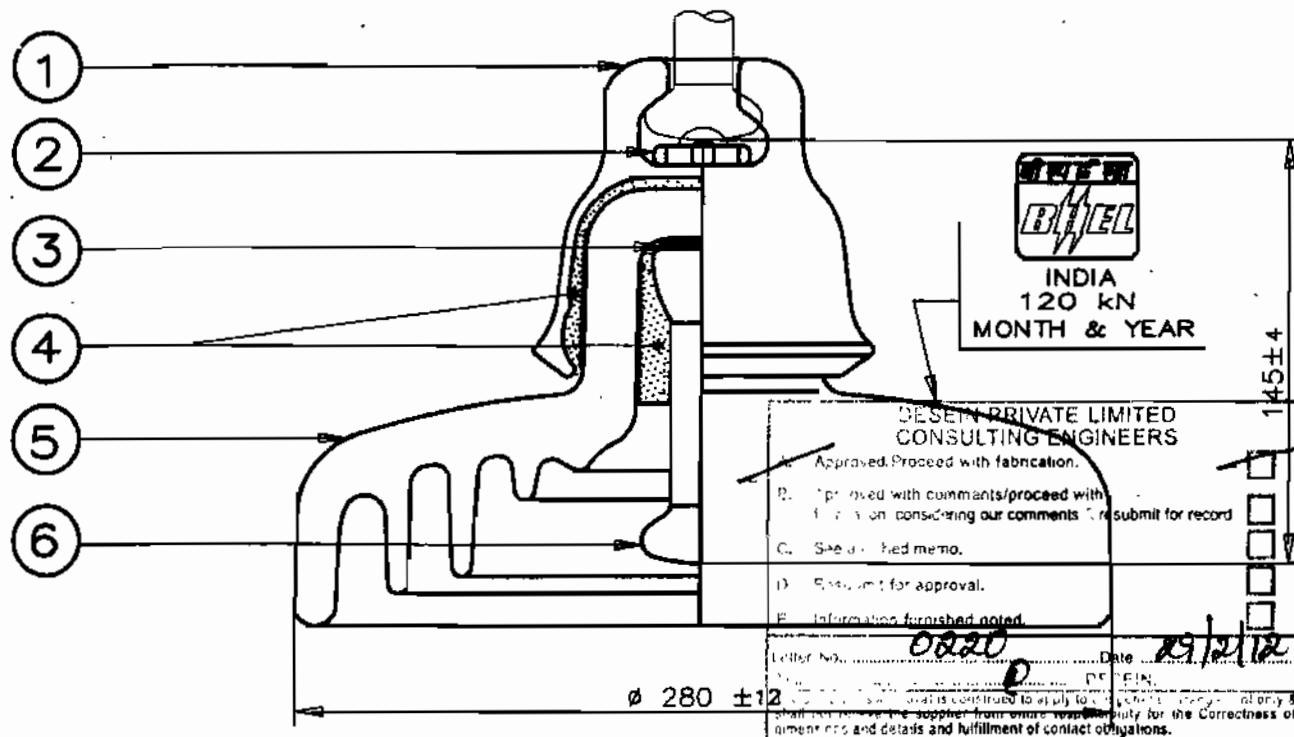
Date :
Place:

Signature :

Printed Name :

Designation :

Common Seal :



NOTES:

- 1 BALL AND SOCKET PARTS CONFORM TO 20 mm DESIGNATION OF IS:2486 (Part-II)-1989 OR BS:3288:Part 3-1989 OR IEC Pub 120-1984
- 2 PERMISSIBLE LIMITS OF VISUAL DEFECTS ON PORCELAIN CONFORM TO IS:13305-1992 OR JIS C 3802-1964

CONTROLLED COPY

FERROUS PARTS ARE
HOT-DIP GALVANIZED
AS PER IS:2629
TESTS CONFORM
TO IS:2633 /IEC 383/
BS EN ISO 1481(LATEST REVISION)

PORCELAIN BROWN
GLAZED

ITEM No.	DESCRIPTION	MATERIAL	QTY
6	BALL PIN	FORGED STEEL	1
5	SHELL	PORCELAIN	1
4	BINDING MATERIAL	PORTLAND CEMENT	-
3	CUSHION	SYN. FOAM/CORK	1
2	STANDARD SPLIT PIN ('R' TYPE)	STAINLESS STEEL	1
1	SOCKET CAP	S G IRON	1

NAME OF CUSTOMER

M/s APGENCO, HYDERABAD

NAME OF CONSULTANT

DESEIN Pvt Ltd., HYDERABAD

NAME OF PROJECT

400 KV/220 KV SWITCHYARD FOR RAYALSEEMA TPP STAGE-IV (600 MW UNIT# 6)



BHARAT HEAVY ELECTRICALS LTD.

ELECTROPORCELAINS DIVISION
BANGALORE 560 012

	NAME	SIGN	DATE
DRN	N K IDDALAGI	N K Idalagi	22 12 2011
CHD	B M H	B M H	23-12-2011
APPD	Y B R	Y B R	23-12-2011

DEPT
CODEGRADE OF
TOL. DIM.
C/M/FSCALE
NTSWEIGHT (kg)
8.0
(Approx)

REF. TO ASSY DRG.

ITEM
No.No. OF
ITEMS

TITLE

ANTIFOG DISC INSULATOR
FOR 120 kN EMSCARD
CODE

DRAWING No.

EL DG 4 980 17 01700

REV.

A0

SUB No. 126

No. OF SHEETS

SECTION – 3
PROJECT DETAILS AND GENERAL SPECIFICATIONS

SL.NO.	DESCRIPTION	
1.	PROJECT INFORMATION	
	a) Customer	APGENCO, Hyderabad
	b) Consultant	Desein Consulting Engineers, New Delhi
	b) Projects	1x600MW RayalseemaTPP, Stage-IV, Unit#6-400/220kV Switchyard
	c) Project locations	The project site is located in VV Reddy nagar, Post- Karamala Distt Kadapa (Formarely Cuddapah) about 30KM west-south of Proddatur & 20KM from Yerraguntla. Approx. 7 km north of Chillamkur Village. Nearest Rail head is Muddanur, which is approx. 10 km from Site. Site is approximately 480KM from Hyderabad and 350KM from Chennai.

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

2.	SITE CONDITIONS	
i.	Maximum Ambient air temp. (max.)	40.3 °C
ii.	Minimum Ambient air temp. (max.) °C	19.1 °C
iii.	Design ambient temperature	50 °C
iv.	Altitude above MSL	190m
v.	Basic wind speed	39m/s at 10m above retarding surface
vi.	Seismic acceleration	Zone-III As per IS-1893
vii.	Terrain Classification	Category-2
viii.	Average Rainfall	742.8 mm Average
ix.	Humidity	Max: 49-74% (June to Oct) Min: 35-60% (march to June)

3. Auxiliary Supply

Normal Voltage	Variation in Voltage	Frequency in Hz	Phase/Wire	Neutral Connection
415 Volts	± 10%	50 ± 5%	3 phsae/4 wire	Solidly earthed
240 Volts	± 10%	50 ± 5%	1 phase/2 wire	Solidly earthed
220 Volts	190V to 240V	DC	---	Isolated 2 wire system (ungrounded)

Combined variation of voltage and frequency shall be limited to ± 10%.

5. DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

- 1) Drawings.
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) Manufacturing Quality Plan

6. DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A : For & After Approval	Soft copies as per clause no. 5 in 1 set
B : For Approval	Hard copies as per clause no. 5 in 12 sets
B : After Approval	Bound sets of Approved Hard copies and Installation, Operation & Maintenance manual and all as built drawings in 20 sets
	3 Set of Computer CD-ROMs (with unbreakable CD Covers) containing all as-built drawings in Auto-Cad version 2006 or later with 2D and 3D drawings, Instruction Manual and GTP.

7. **Title block:** Title block shall be forwarded to successful bidder after placement of order.

8. All outdoor enclosures shall provide a degree of protection of not less than IP 55 as per IS-13947 & colour shade of RAL 7032 and one enclosures of each type shall be tested for the same or evidence of testing shall be furnished in lieu of type testing.

9. CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

All types of boxes, cabinets, etc. shall generally conform to & be tested in accordance with IS-5039/ IS 8623, IEC: 439, as applicable, and the clauses given below:

Control cabinets, junction boxes, Marshalling boxes and terminal boxes shall be made of sheet steel or aluminium enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The thickness of aluminium sheet shall be minimum 3mm. However the junction boxes & switch boxes shall be hot dip galvanized.

Protection Class shall be as follows:

- | | | |
|------|------------------------------|-------|
| i) | INDOOR Air conditioned area- | IP 31 |
| ii) | Indoor Non AC Areas- | IP 54 |
| iii) | Outdoor Areas- | IP 55 |
| iv) | Motors- | |
| | a) Indoor- | IP 54 |
| | b) Outdoor- | IP 55 |

Cabinet/boxes shall be free-standing, floor-mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangement for operating rods shall be provided in Marshalling boxes/Control cabinet to prevent ingress of rain water.

10. Quality plan:

BHEL or APGENCO approved QP shall be followed.

11. Type Test reports:

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) of the tests carried out within last seven (7) years from the date of bid opening (10.02.2011). The report should have been conducted on identical or similar equipment/ components to those offered. In case type test reports are more than 7 years old OR the reports of type tests are found to be technically unacceptable, the type test shall be conducted without cost and delivery implication to BHEL/APGENCO.

12. INSPECTION, TESTING AND INSPECTION CERTIFICATE

Inspection testing shall be done as per customer specification and inspection plan.

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