



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT, NEW DELHI

BHEL Document No.	Rev.	Prepared by	Checked by	Approved by
TB-235-509-125	05	Name		
Type of Document	STANDARD SPECIFICATION	Sign	--sd--	--sd--
Title	GS FLAT & EARTH ELECTRODE FOR EARTHING SYSTEM	Date	17.08.07	17.08.07
		Group	TBEM	
		W.O. No		
Customer / Consultant				
Tender				

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05. 18.05.15 MS Flat of size 75x12 mm & 50x8 mm added.
Note 4 added in sketch 2.

04	26.11.12	Sd/-	Sd/-	Sd/-	Sd QP included.
03	09.11.12	Sd/-	Sd/-	Sd/-	POWERGRID requirement & Cut Lengths included.
02	10.06.09	Sd/-	Sd/-	Sd/-	Documents updated
01	14.08.07	Sd/-	Sd/-	Sd/-	Revised as per TBMM requirement.
Rev. No.	Date	Altered	Checked	Approved	REVISION DETAILS
Distribution			To		
			Copies		

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SECTION 1

SCOPE AND SPECIAL TECHNICAL REQUIREMENT

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of Earthing Strips & Earthing Electrodes, complete with accessories.

This section covers the general technical requirements of Earthing Strips & Earthing Electrodes. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

1.1 TECHNICAL REQUIREMENTS:

1.1.1 GALVANIZED MILD STEEL FLAT (Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- ii) Mass of protective zinc coating: 618 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.
- iii) Sizes:

Sl. No.	Description	Approx. Weight (kg)
1	Galvanised Steel Flat 75 x 12 mm	7.0663 kg/meter
2	Galvanised Steel Flat 75 x 10 mm	5.8893 kg/meter
3	Galvanised Steel Flat 50 x 6 mm	2.4008 kg/meter
4	Galvanised Steel Flat 25 x 3 mm	0.5894 kg/meter
5	Mild Steel Flat 50 x 6 mm	2.3316 kg/meter

- iv) Length: 4 m to 6 m
- v) Raw Material: Vendor to procure the raw material from Power Grid approved Sources with PG stamp.

1.1.2 GALVANIZED MILD STEEL FLAT (Other then Power grid Requirement)

- i) Chemical composition & mechanical properties: Grade –A (Item Designation – Fe410W) of IS: 2062.
- i) Mass of protective zinc coating: 1) 610 gm/sq.m and minimum thickness of coating shall be 85 microns for items thicker than 6 mm. For

less than 6 mm, the thickness shall be as per clause 4.0 of IS 4759, 1984.

ii) Sizes:

Sl. No.	Description	Weight (kg)
1	Galvanised Iron Flat 75 x 12 mm	7.065 kg/meter
2	Galvanised Iron Flat 75 x 10 mm	5.888 kg/meter
3	Galvanised Iron Flat 75 x 8 mm	4.710 kg/meter
4	Galvanised Iron Flat 65 x 10 mm	5.10 kg/meter
5	Galvanised Iron Flat 65 x 8 mm	4.082 kg/meter
6	Galvanised Iron Flat 50 x 8 mm	3.140 kg/meter
7	Galvanised Iron Flat 50 x 6 mm	2.4 kg/meter
8	Galvanised Iron Flat 25 x 3 mm	0.589 kg/meter
9	Mild Steel Flat 75 x 10 mm	5.7843 kg/meter
10	Mild Steel Flat 50 x 6 mm	2.3316 kg/meter
11	Mild Steel Flat 75 x 12 mm	7.065 kg/meter
12	Mild Steel Flat 50 x 8 mm	3.140 ka/meter

iii) Length: 4 m to 6 m.

1.1.3 EARTH ELECTRODE (Mild Steel iron)

i)	Applicable Standard	IS:1239
ii)	Sizes of Pipe	40 NB
iii)	Grade	Medium
iv)	Thickness of zinc -coating	460 gm/sq.m
v)	Reference Drg.	SKETCH SK-1 (Typical)

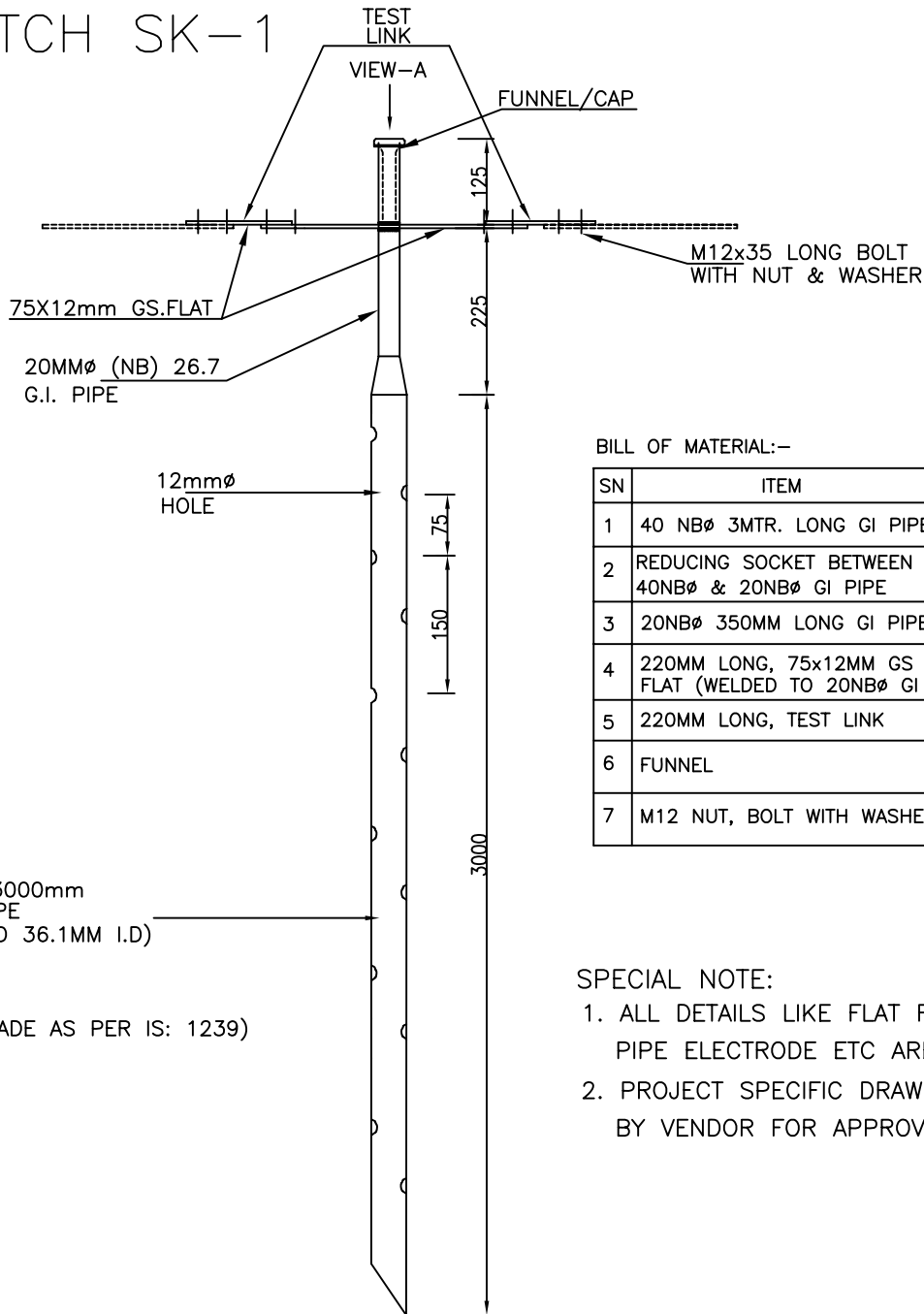
1.1.4 EARTH ELECTRODE (Cast Iron)

i)	Cast Iron pipe ID (mm)	100/150 mm
ii)	Thickness (mm)	12/10/13 mm
iii)	Reference Drg.	SKETCH SK-2 (Typical)

1.2 Manufacturing quality plan:

- Quality plan of GS flat is not required for power grid projects. Therefore, the inspection of GS flat & electrodes for power grid projects will be carried out as per relevant Indian Standards (latest version).
- The QP enclosed with standard specification is to be followed for Non Power Grid projects.

SKETCH SK-1



BILL OF MATERIAL:-

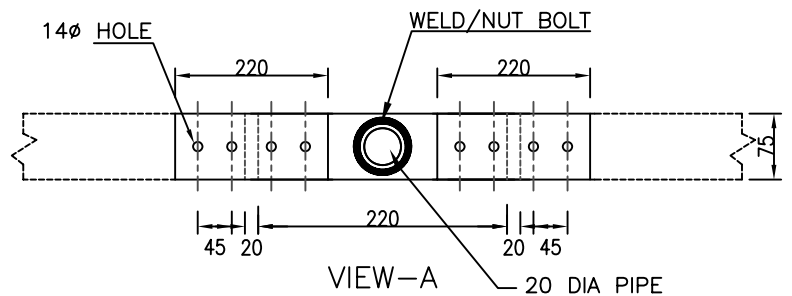
SN	ITEM	UNIT	QTY.
1	40 NB ϕ 3MTR. LONG GI PIPE	NOS.	01
2	REDUCING SOCKET BETWEEN 40NB ϕ & 20NB ϕ GI PIPE	NOS.	01
3	20NB ϕ 350MM LONG GI PIPE	NOS.	01
4	220MM LONG, 75x12MM GS FLAT (WELDED TO 20NB ϕ GI PIPE)	NOS.	01
5	220MM LONG, TEST LINK	NOS.	02
6	FUNNEL	NOS.	01
7	M12 NUT, BOLT WITH WASHERS	SETS	08

SPECIAL NOTE:

1. ALL DETAILS LIKE FLAT FIXING TO GI PIPE ELECTRODE ETC ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. STEEL TO CONFORM TO IS:2062, GRADE-A
3. ALL ITEMS TO BE HOT DIP GALVANISED.
4. SUPPLY OF FIXING BOLTS, NUTS, WASHERS FOR GI FLT EARTHING CONDUCTOR IS ALSO PART OF THE SCOPE
5. WASHER TO BE ELECTRO GALVANISED.



EQUIPMENT EARTHING DETAILS
DETAILS OF PIPE ELECTRODE
IN TREATED EARTH PIT

COMPUTERREF.NO.

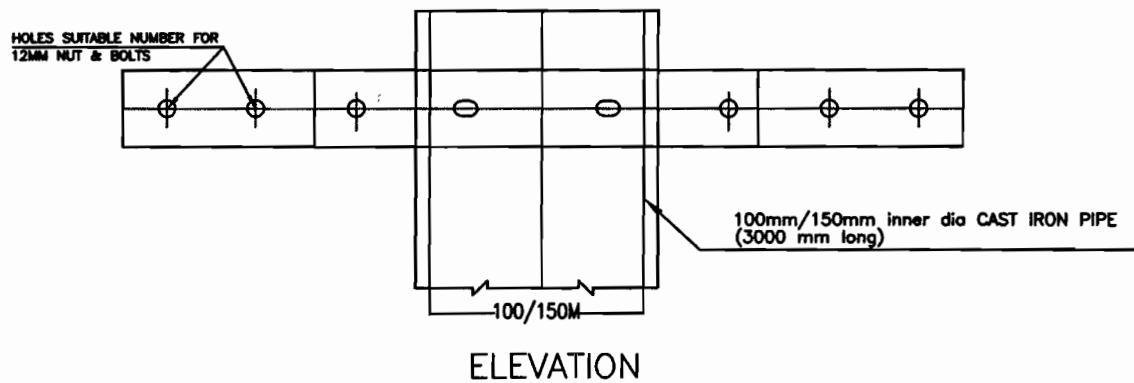
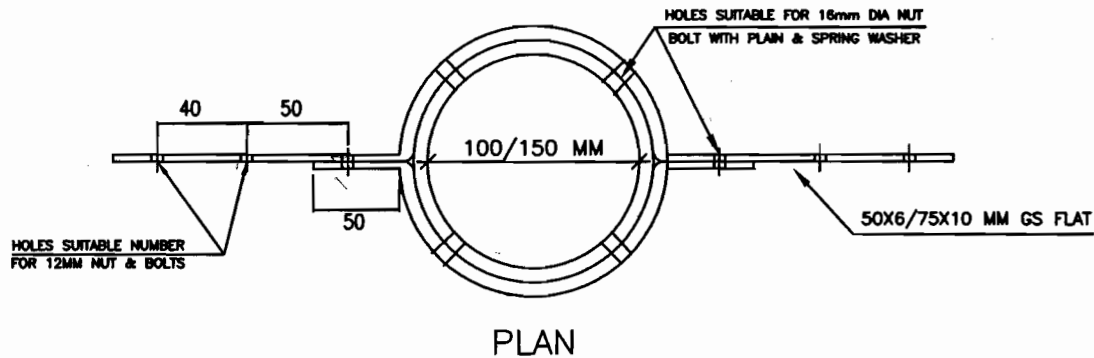
DRG. No.

SKETCH SK-1

REV. 01

SHEET No.

SKETCH SK-2



BILL OF MATERIAL:-

SN	ITEM	UNIT	QTY.
1	100/150MM INNER DIA CI PIPE CONFORMING TO IS :1536-1960	NO.	01
2	16MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER	SETS.	06
3	12MM NUT, BOLT INCLUDING 1 NO. PLAN WASHERS AND 1 NO. SPRING WASHER	SETS.	04
4	50X6 OR 75X10 MM GS FLAT (HALF RING)	PAIR	01

SPECIAL NOTE:

1. ALL DETAILS ARE TYPICAL.
2. PROJECT SPECIFIC DRAWING TO BE SUBMITTED BY VENDOR FOR APPROVAL.

NOTE:-

1. ALL DIMENSIONS ARE IN MM
2. ALL NUT AND BOLTS ARE HOT DIP GALVANIZED.
3. WASHERS SHALL BE ELECTRO-GALVANIZED.
4. Cast iron pipe shall be supplied with GS flat suitably wrapped and connected through welding/bolting to minimize contact resistance.



COMPUTERREF.NO.

DRG. No.

SKETCH SK-2

REV. 03

SHEET No.

SECTION - 2

STANDARD SPECIFICATION

2.1 APPLICABLE STANDARDS

The materials shall strictly conform to the following Indian Standards, as appropriate:

The materials shall confirm to the latest editions of the following Indian Standards:

- IS 2062: 2011 Steel for general structural purposes
- IS 1730: 1998 Dimensions for steel plate, sheets, strips and flats for general engineering Purposes.
- IS 1731: 1971 Dimensions for steel flats for structural and general engineering purposes.
- IS 2629: 1985 Recommended practices for Hot-dip galvanizing on iron & Steel
- IS 2633: 1986 Methods for testing uniformity of coating of zinc- coated articles.
- IS 1852: 1985 Rolling & Cutting Tolerance for hot rolled steel products.
- IS 1239 (Part 1): 1990 Specification for mild steel tubes, tubular and other wrought steel fittings (Mild Steel tubes)
- IS 1239 (Part 2): 1992 Specification for Mild steel tubes, tubular and other wrought steel fittings (Mild Steel Sockets)
- IS 4826 – 1979 Hot-dipped zinc coatings on mild steel tubes
- IS 4759: 1984 Hot Dip Coatings on Structural Steel and other allied Products
- IS 6745: 1972 Determination of mass of Zinc Coating on Zinc Coated Iron and Steel Articles
- IS 1536: 1993 Cast Iron Pressure Pipe -Specification

2.2 CONSTRUCTIONAL FEATURES

2.2.1 MILD STEEL FLATS

All steel required for earthing material shall confirm to Grade –A (Item Designation – Fe410W) of IS:2062: 2011.

2.2.2 EARTH ELECTRODES

- (1) The earth electrodes (Galvanised Iron) shall be perforated and fabricated out mild steel pipes and shall conform strictly to IS 1239 – 2004.
- (2) The earth electrodes (Cast Iron) shall be perforated and fabricated out cast iron pipes and shall conform strictly relevant IS: 3043-2006.

Note: Latest revisions shall be followed for all mentioned standard.

SECTION - 3

GENERAL SPECIFICATIONS

3.1 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type test/routine tests/acceptance tests as specified shall be conducted as per the details mentioned in the Purchase order for this equipment.

3.2 DOCUMENTATION SCHEDULE AT CONTRACT STAGE: (DOCUMENTATION REQUIREMENT SHALL BE SPECIFIED BY PROJECT PPE AT CONTRACT STAGE AND SHALL VARY FROM PROJECT TO PROJECT).

A (No. of Copies)	For Approval
	Copies of GA drawings with projects details, dimension, equipment weight, fixing details, tolerances and terminal details etc.
	Copies of GTP
	Copies of type test reports
	Copies of manufacturing quality plan.
B (No. of Copies)	After Approval and For Information/Distribution.
	Copies of GA drawings
	Copies of GTP
	Copies of type, Routine & Acceptances tests.
	Copies of manufacturing quality plan.
	Copies of shipping list detailing the description & quantities of all items being dispatched separately, with shipping weights, number of cases and dimensions.

3.3 Material shall not be dispatched without the approval of test certificates by purchasers.

3.4 MATERIALS AND WORKMANSHIP

Equipment materials and components shall be new, of high grade and good quality and be to the latest engineering practice. The material and workmanship throughout shall be in accordance with the purpose for which they are intended. Each component shall be designed to be consistent with its duty.

In general, screw threads shall be standard metric threads. The use of other thread from will be used only after prior approval. The supplier shall furnish locking devices for threaded fasteners, which will lock them in such a manner so as to prevent them from coming loose in transport and in service.

All joints and fastening shall be so designed, constructed and registered that the component part may be accurately positioned and restrained to fulfill their required function. The heads of all bolts shall register flush on the surface, which they fasten.

All the information concerning materials or components to be used in manufacturing, machinery, equipment, materials and components supplied, installed or used shall be submitted for approval. Without such approval the supplier shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the supplier.

Whenever possible, all similar parts of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

The supplier shall apply all lubricants used for installation and operation of the equipment. All consumable required for one-year operation shall be in the scope of supplier.

All components exposed to rain shall be designed with sloped upper surface to avoid water pools.

3.5 SURFACE TREATMENT

- 3.5.1** All metal surfaces shall be treated to provide anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High Tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition .

36 WELDING

All welding shall be done by a qualified welder.

3.7 PACKING AND MARKING

3.7.1 PACKING

GI Flat may be supplied in open condition. However, while stacking the materials for transportation it should be ensured that, similar items are grouped and tied with steel wires /

strips for convenient handling and shall be done in such away to avoid damage during transits.

3.7.2 MARKINGS

The following details shall be marked on the packing:

- i) Name and address of the consignee
- ii) Purchase Order No:
- iii) Name of supplier
- iv) Description of material
- v) Tare weight
- vi) Gross weight

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS for ELECTRODES

1.0 EARTH ELECTRODE (Galvanized iron)

- 2.1 Mild Steel pipe OD (mm)
- 2.2 Mild Steel ID (mm)
- 2.3 Thickness of zinc –coating
- 2.4 Weight of zinc coating
- 2.5 Applicable standards

2.0 EARTH ELECTRODE (Cast Iron)

- 3.1 Cast Iron Pipe OD (mm)
- 3.2 Cast Iron Pipe ID (mm)
- 3.3 Applicable standards

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:

(1)	(2)	(3)	(4)	(5)
S.No.	Parameter	Requirement	Yes / No	Remarks in case reply in Col (4) is NO
1.0	Weight of Zinc coating	Weight of zinc coating shall be as per clause 2.4 of Section-2		
2.0	Tolerance in the flat size	Tolerance in the flat size shall be as per IS:1852-1985		
3.0	Chemical composition of flat/CI Pipe/GI Pipe	Certified copy of the chemical composition of the material as per the relevant standards shall be supplied before the dispatch of the material.		
4.0	Earth electrode	Electrode arrangement shall be provided as per sketch no. SKTECH SK-1 / SKETCH SK-2		
5.0	PG stamp	Raw material shall be inspected at source by Powergrid/BHEL.		
6.0	Length	4 to 6 mtrs		
7.0	Conformance	With enclosed QP		

Date:

Signature of the authorized representative of Bidder

Company Seal



QUALITY PLAN

ITEM: CI PIPE ELECTRODE

OP NO: TBQM-STD-CIE
REV: 00
DATE: 15-01-11
Page 1 of 2

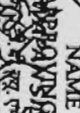
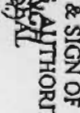
PROJECT:

PACKAGE/CONTRACT:

CONTRACTOR: BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10	11	12	13

1.0	INCOMING MATERIALS:											
1.1	MS FLATS	Freedom from defects	Major	Visual	100%	IS 2062	IS 2062	Internal Logbook	M		C	a) MS Flat to be taken from BHEL approved Sources.
		Dimensions		Measure ments	10 %	IS 1852	IS 1852		M		C	b) Correlation of Material Test Certificates to be maintained.
		Mech. Properties		Mech	As per IS 2062	IS 2062	IS 2062	Lab Report / Mfr. TC	Y	M	C	
		A. Yield Strength										
		B) Tensile Strength										
		C) % Elongation										
		D) Bend Test										
		4) Chem. Composition		Chem.	As per IS 2062	IS 2062	IS 2062	Lab Report / Mfr. TC	Y	M	C	
1.2	CI PIPES	Freedom from defects	Major	Visual	100%	IS 1536	IS 1536	Internal Logbook	M		C	a) CI Pipe to be taken from BIS licensees Manufacturer and a copy of valid licensees to be submit along with Test Report.
		Dimensions		Measure ments	10 %				M		C	
		Mech. Properties		Mech	As per IS 1536			Lab Report / Mfr. TC	Y	M	C	
		c) Hydrostatic Test	-do-	Mechani cal	As per IS 1536	IS 1536	IS 1536	"	M		C	b) Co-relation of Material Test Certificates to be maintained.
		4) Chem. Composition		Chem.	IS 1536	IS 1536	IS 1536	"	Y	M	C	
1.3	Hardware (Nuts, Bolts, Plane Washer &	Mechanical, Chemical and Galvanizing test	-do-	Review	IS 1367 - F-17	IS 1367 - P-17, IS 1367, IS 3063 & IS 2016	IS 1367 - P-17, IS 1367, IS 1363, IS 3063 & IS 2016	Lab Report / Mfr. TC	Y	M	C	Hardware to be taken from BHEL approved Sources.
BHEL SIGN & SEAL		LEGEND:		M - MANUFACTURER / SUB CONTRACTOR		P - PERFORMED BY		NAME & SIGN OF				
				C - BHEL / NOMINATED INSPECTOR AGENCY		W - WITNESSED BY						
				N - CUSTOMER / CUSTOMER NOMINATED AGENCY		V - VERIFICATION BY						

APPROVED BY: 
Name: 
Designation: 
Business Group



QUALITY PLAN

ITEM : CI PIPE ELECTRODE

Q.P. NO. : TBQM-STD-CIE

PROJECT :

REV. 00

PACKAGE / CONTRACT :

DATE : 15-01-11

CONTRACTOR : BHEL

FORMAT OF RECORD

AGENCY

REMARKS

Page 2 of 2

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	D 10 11 12	13

	Spring Washer)																		
2.0	FINAL INSPECTION																		
2.1	Calibration of measuring and testing eqpl..	Calibration	Major	Visual	100%	Periodicity of calibration not to exceed 12 months	Periodicity of calibration not to exceed 12 months	Calibration records	M	C	Calibration should have been done in reputed laboratory								
2.2	CI Pipe Electrode	a) Visual & Dimensions (OD / Thickness) including Uniformity of Cross Section and	-do-	Visual	100%	IS 3043 / IS 1536	IS 3043 / IS 1536	Inspection report	M	C	Final inspection by BHEL								
		b) Mechanical Test	-do-	Mechanical	As per IS 1536	IS 1536	IS 1536	"	M	C	Final inspection is a CHP								
		c) Hydrostatic Test	-do-	Mechanical	As per IS 1536	IS 1536	IS 1536	"	M	C									
		d) Chemical Composition	-do-	Chemical	One sample	-do-	-do-	"	M	C									
3.0	PACKING	Material, Sturdiness, marking, checking with Packing list	-do-	Visual	100%	BHEL Spec.	BHEL Spec.	Subcontractor certificate	M	C									

BHEL SIGN & SEAL

LEGEND:

M - MANUFACTURER / SUB CONTRACTOR

P - PERFORMED BY

NAME & SIGN OF APPROVING AUTHORITY & SEAL

C - BHEL / NOMINATED INSPECTOR N AGENCY

W - WITNESSED BY

SEAL



QUALITY PLAN

ITEM : GI FLAT / GI PIPE ELECTRODE

OP NO : TBQM-STD-01F
REV: 01
DATE : 12-01-11
Page 4 of 4

PROJECT :

PACKAGE / CONTRACT :

CONTRACTOR : BHEL

S.NO.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	D 10 11 12	13

4.0	FINAL INSPECTION							1984					
4.1	Calibration of measuring and testing eqpt..	Calibration	Major	Visual	100%	Periodicity of calibration not to exceed 12 months	Periodicity of calibration not to exceed 12 months	Calibration records	M		C		Calibration should have been done in reputed laboratory
4.2	a) Visual & Dimensions	-do-	Visual	100%	IS 2629/802-10985-1978	IS 2629/802-10985-1978	Inspection report	M	C				Final inspection by BHEL Final inspection is a CHP
		-do-	Measurement	as per IS 2500-1992 level S4	Appd. Drgs.	Appd. Drgs.		M	C				
	b) Mech. And Chem. Test as indicate in Cl. 1.1 & 1.2	-do-	Mechanical & Chemical	As indicated in cl. 1.1 & 1.2	As listed in 1.1 & 1.2	As listed in 1.1 & 1.2		M	C				
	c) Galvanizing. Tests as indicated in 3.3	-do-	Mechanical & Chemical	SS/lot offered	IS 6745-1972	IS 6745-1972		M	C				
5.0	Hardware (Nuts, Bolts, Plane Washer & Spring Washer)	Mechanical, Chemical and Galvanizing test	-do-	Review	IS 1367 - P-17	IS 1367 - P-17 IS 1367, IS 1363, IS 3063 & IS 2016	IS 1367 - P-17 IS 1367, IS 1363, IS 3063 & IS 2016	Lab Report / Mfr. TC	M		C		Hardware to be taken from BHEL approved Sources.
6.0	PACKING	Material, Sturdiness, marking, checking with Packing list	-do-	Visual	100%	BHEL Spec.	BHEL Spec.	Subcontract certificate	M				

BHEL

SIGN & SEAL

LEGEND:

M - MANUFACTURER / SUB CONTRACTOR

C - BHEL / NOMINATED INSPECTION AGENCY

N - CUSTOMER / CUSTOMER NOMINATED AGENCY

P - PERFORMED BY

W - WITNESSED BY

V - VERIFICATION BY

Signature of P, W, V

Signature of General Manager, BHEL

Signature of Quality Control Engineer, BHEL

Signature of Material Inspector, BHEL

Signature of Process Engineer, BHEL

Signature of Production Engineer, BHEL

Signature of Maintenance Engineer, BHEL

Signature of Safety Engineer, BHEL

Signature of Environmental Engineer, BHEL

Signature of Health & Safety Engineer, BHEL

Signature of Quality Assurance Engineer, BHEL

Signature of Quality Improvement Engineer, BHEL

Signature of Quality Control Engineer, BHEL

Signature of Quality Assurance Engineer, BHEL

Signature of Quality Improvement Engineer, BHEL

Signature of Quality Control Engineer, BHEL

Signature of Quality Assurance Engineer, BHEL

Signature of Quality Improvement Engineer, BHEL

Signature of Quality Control Engineer, BHEL

Signature of Quality Assurance Engineer, BHEL