



**भारत हेवी इलेक्ट्रीकल लिमिटेड**  
**BHARAT HEAVY ELECTRICALS LIMITED**  
**पारेषण व्यापार अभियांत्रिकी प्रबंधन (TBEM)**  
**नोएडा / TBG, NOIDA**

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| TYPE OF DOC.             | TECHNICAL SPECIFICATION   | NAME               | MM            | AS            | AS       |
| GI SHIELD WIRE (7/9 SWG) | SIGN  | <i>M. S. Mehta</i> | <i>Intall</i> | <i>Intall</i> |          |
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|          |  |
|----------|--|
| PROJECTS | 400kV Switchyard Extension and<br>400kV GIS for 1x800 MW for Wanakbori Thermal Power Station<br>Extn. Unit-8 |
|----------|--|

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## SECTION – I

### SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

#### 1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 7/3.66 mm GI SHIELD WIRE/ earthwire.

The Equipment is required for the following projects

**Name of Customer :** Gujarat State Electricity Corporation Limited, Vadodara, Gujarat  
**Name of Project :** 400kV Switchyard (extn.) & 400kV GIS for 1x800 MW Wanakbori Thermal Power Station Extn. Unit-8  
**Name of Consultant:** Development Consultants Pvt. Ltd., Kolkata

#### 1.1 SPECIFIC TECHNICAL REQUIREMENT

Refer section 2.

#### 1.2 BILL OF QUANTITY

| Item                     | Unit   | Qty    |
|--------------------------|--------|--------|
| GI Shield wire (7/9 SWG) | meters | 2.5 km |

#### 1.3 TESTS

**Acceptance and routine test shall be performed by the bidder.**

#### 1.4 Mandatory type test

**UTS test** (as per clause 2.10.1)  
**DC resistance test** (as per clause 2.10.2)

#### 1.6 QUALITY PLAN:

Bidder shall follow BHEL/GSECL approved quality plan.

**SECTION II**

**STANDARD SPECIFICATION**

**2.0 GENERAL**

This section covers the standard technical specification for GI Shield Wire.

**TECHNICAL REQUIREMENTS:**

| Sl.No | Parameter                         | 7/8 SWG   | 7/9 SWG               |
|-------|-----------------------------------|---|-----------------------|
| 1     | Stranding and wire diameter       | 7/4.0 mm steel                                  | 7/3.66 mm steel       |
| 2     | Strand Arrangement                |   |                       |
|       | Steel core                        | 1   | 1                     |
|       | Outer Steel Layer                 | 6   | 6                     |
| 3     | Total sectional area              | 90.62 mm <sup>2</sup>                           | 73.65 mm <sup>2</sup> |
| 4     | Overall diameter                  | 12.0 mm   | 10.98 mm              |
| 5     | Approximate weight                | 687 kg/km                                       | 583 kg/km             |
| 6     | Calculated d.c. resistance at 200 | 2.09 ohms/km                                    | 2.5 ohms/km           |
| 7     | Minimum ultimate tensile strength | 77.7 kN   | 68.4 kN               |
| 8     | Direction of lay of outer layer   | Right hand                                      | Right hand            |
| 9     | Standard Drum Length              | 250/500/1000/2000/4000 meter                    |                       |
| 10    | Protective coating for storage    | Boiled linseed oil to avoid wet storage stains. |                       |

**2.1 EQUIPMENT SPECIFICATION**

This section covers the general technical requirements of the Galvanised Steel Wire. In case of any discrepancies between the requirements mentioned in this section and those specified in other sections of this specification, this shall prevail after Section 1 and shall be treated as binding requirements.

**2.2 APPLICABLE STANDARDS**

The Galvanised Steel Wire shall strictly conform to the following Indian and International standards, as appropriate:

|                 |  |
|-----------------|--|
| IS: 521(1991)   | Method for tensile testing of steel wire   |
| ISO/R89-1959    |  |
| IS: 1778-1980   | Reels and drums for bare conductors  |
| IS: 2629(1990)  | Recommended practice for hot dip galvanizing on iron and steel.                          |
| IS: 2633(1992)  | Method for testing uniformity of coating of zinc-coated articles                         |
| IS: 4826(1992)  | Hot dip galvanized coatings on round steel wires   |
| ASTMA-475-72a   |  |
| IS: 6745 (1990) | Methods for determination of mass of Zinc coating on zinc-coated iron and steel articles |

IS: 209(1992)            Zinc ingot  
 IS 398 (Parts-I to Aluminium conductors for Overhead transmission purposes  
 V): 1992

**2.3 TECHNICAL REQUIREMENT AND CONSTRUCTIONAL DETAILS**

**2.3.1** The galvanized steel stranded wire shall generally conform to the specification of ACSR core wire as mentioned in IS 398 (Part- II):1976 except where otherwise Specified herein.

**2.4 WORKMANSHIP**

**2.4.1** All steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.

**2.4.2** The finished material shall have minimum brittleness as it will be subjected to appreciable vibration while in use.

**2.4.3** The steel strands shall be hot dip galvanized (and shall have a minimum zinc coating of 275 g/m<sup>2</sup>) after stranding of the uncoated wire surface. The zinc coating shall be smooth, continuous, of uniform thickness, free from imperfections and shall withstand three and a half dips after stranding in standard Preece test. The steel wire rod shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands shall be of uniform quality and have the same properties and characteristics in ASTM designation B498-74.

**2.4.4** The steel strands shall be preformed and post-formed in order to prevent spreading of strands while cutting of composite stranded wire. Care shall be taken to avoid damage to galvanization during pre-forming and post-forming operation.

**2.4.5** To avoid susceptibility towards wet storage stains (white rust), the finished material shall be provided with a protective coating of boiled linseed oil.

**2.5 JOINTS IN WIRES**

There shall be no joint of any kind in the finished steel wire strand entering into the manufacture of the stranded wire. There shall be no strand joints or strand splices in any length of the completed stranded wire.

**2.6 TOLERANCE**

The manufacturing tolerances to the extent of the following limits only shall be permitted in the diameter of the individual steel strands and lay length of the stranded wire:

|            | Standard | Maximum | Minimum |
|------------|----------|---------|---------|
| Diameter   | 3.66mm   | 3.75mm  | 3.57mm  |
| Lay length | 181mm    | 198mm   | 165mm   |

## 2.7 MATERIALS

### 2.7.1 Steel

The steel wire strands shall be drawn from high carbon steel rods and shall conform to the following requirements as to the chemical composition:

| Element     | % Composition      |
|-------------|--------------------|
| Carbon      | Not more than 0.55 |
| Manganese   | 0.4 to 0.9         |
| Phosphorous | Not more than 0.04 |
| Sulphur     | Not more than 0.04 |
| Silicon     | 0.15 to 0.35       |

### 2.7.2 Zinc

The zinc used for galvanizing shall be electrolytic High Grade Zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS: 209-1979

## 2.8 STANDARD LENGTH

2.8.1 The stranded wire shall be supplied in standard drum lengths generally in the range of 250/500/1000/2000/4000 m. However, drum lengths where required to be supplied in lengths different from standard lengths specified above shall be provided.

## 2.9 TESTS

2.9.1 The G.S. Wire should have been type tested as per IEC/IS and shall be subjected to routine and acceptance tests in accordance with applicable IS specifications/ ISO/ ASTM recommendations. Type test reports of the tests conducted earlier (not more than five years earlier) on similar material shall be submitted. If the valid type test reports are not available with the bidder then the tests shall be conducted by the bidder free of cost.

2.9.2 If the purchaser insists to carry out the type test(s) afresh, the same shall be conducted on chargeable basis, for that the bidder shall submit the test charges in the price bid.

### 2.9.3 TYPE TESTS

In accordance with the stipulation of the specification the following type tests shall be conducted on the stranded wire.

- a) UTS test ) As per Clause 2.10.1
- b) DC resistance test ) As per Clause 2.10.2

### 2.9.4 ACCEPTANCE TESTS

- a) Visual check for joints, scratches etc. and length of stranded wire (As per Clause 2.10.3)
- b) Dimensional check(As per Clause 2.10.5)
- c) Galvanizing test (As per Clause 2.10.7)
- d) Lay length check (As per Clause 2.10.6)

- e) Torsion test (As per Clause 2.10.4)
- f) Elongation test (As per Clause 2.10.4)
- g) Wrap test
- h) DC resistance test ( IS 398(Part-III))1976
- i) Breaking load test ( IS 398(Part-III))1976
- j) Chemical Analysis of steel ( IS 398(Part-III))1976

#### **2.9.5 ROUTINE TESTS**

- a) Check that there are no cuts, fins etc. on the strands.
- b) Check for correctness of stranding.

#### **2.9.6 TESTS DURING MANUFACTURE**

- a) Chemical analysis of zinc used for galvanizing (As per Clause 2.10.8)
- b) Chemical analysis of steel (As per Clause 2.10.9)

#### **2.9.7 SAMPLE BATCH FOR TYPE TESTING**

The Contractor shall offer material for sample selection for type testing, only after getting quality assurance program approved by the Owner. The samples for type testing shall be manufactured strictly in accordance with the quality Assurance Program approved by the Owner.

### **2.10 TESTING PROCEDURE FOR STRANDED GALVANISED STEEL WIRE**

#### **2.10.1 UTS Test**

Circles perpendicular to the axis of the stranded wire shall be marked at two places on a sample of stranded wire of minimum 5 m length suitably compressed with dead end clamps at either end. The load shall be increased at a steady rate up to 34 kN and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter, the load shall be increased at a steady rate of 68.4 kN and held for one minute. The stranded wire sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

#### **2.10.2 D.C Resistance Test**

On a stranded wire sample of minimum five metres length, two contact clamps shall be fixed with a pre-determined Bolt torque. The resistance shall be measured by a Kelvin double-bridge by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20<sup>0</sup>C shall conform to the requirements of this specification.

#### **2.10.3 Visual Check for Joints, Scratches etc. and length of Stranded wire**

Stranded wire drums shall be rewound in the presence of the inspector. The inspector shall visually check for scratches, joints, etc. and see that the stranded wire generally conforms to the requirements of this specification. The length of stranded wire wound on the drum shall be measured with the help of counter meter during rewinding.

#### **2.10.4 Torsion and Elongation Tests**

The test procedures shall be as per relevant clause of IS 398 (Part V). The minimum number of twists which a single steel strand shall withstand during torsion test shall be eighteen for a length equal to 100 times the standard diameter of the strand. In case the test sample length is less or more than 100 times the standard diameter of the strand, the minimum number of twists will be proportionate to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 64% for a gauge length of 200 mm.

#### **2.10.5 Dimensional Check**

The individual strands shall be dimensionally checked to ensure that they conform to the requirements of this specification.

#### **2.10.6 Lay Length Check**

The lay length shall be checked to ensure that they conform to the requirements of this specification.

#### **2.10.7 Galvanizing Test**

The test procedure shall be as specified in IS: 4826-1968. The material shall conform to the requirements of this specification.

#### **2.10.8 Chemical Analysis of Zinc used for Galvanizing**

Samples taken from the zinc ingots shall be chemically/spectrographically analyzed. The same shall be in conformity to the requirements stated in this specification.

#### **2.10.9 Chemical Analysis of Steel**

Samples taken from the steel ingots/coils/strands shall be chemically/ spectrographically analyzed. The same shall be in conformity to the requirements stated in this specification.

**2.11** Following drawings/ documents shall be submitted for approval/ information for each project:

- i) Guaranteed and other technical particulars
- ii) Drum Drawing
- iii) Type, Acceptance, sample and routine test reports

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### SECTION-3

#### 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, equipments and services covered under other respective sections and are 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 PROJECT INFORMATION AND SYSTEM PARAMETERS

|   |   |   |
|---|---|---|
| a)  | Customer/ Purchaser/<br>Owner                           | Gujrat State Electricity Corporation Ltd. Vadodara  |
| b)  | Consultant  | Development Consultants Pvt. Ltd., Kolkata - 700 091  |
| c)  | Project Title   | 400kV Switchyard Extension and 400 kV Switchyard for GIS for 1x800 MW Supercritical Thermal Power Project   |
| d)  | Location  | Wanakbori is connected with roads by the National Highway, NH-8 (about 10 km from plant -Dakor-Godhra) and state highway SH-59 (about 2 km from plant -Balasinor- Sevalia). Wanakbori is connected with railways by Ahmedabad-Vadodara main Broad Guage line of Western Railway (about 8 km from Sevalia). Nearest Airports are Vadodara at distance of 85 Km from site and Ahemedabad at a distance of 100 Km from the Site. |
| e)  | Elevation above MSL                                     | 72.0 meters   |
| f)  | Transport Facilities                                    | Road/Rail, Nearest railway station is Sevalia. Nearest Airports are Vadodara at distance of 85 Km from site and Ahemedabad at a distance of 100 Km from the Site.   |
| g)  | Postal Address  | To follow   |
| <b>METEOROLOGICAL DATA OF SITE IS GIVEN BELOW</b> |   |   |
| a)  | Max. daily average temp                                 | 34 °C   |
| b)  | Min. daily average temp                                 | 11.7 °C   |
| c)  | Max. Ambient air temp.<br>(daily)                       | 34°C  |
| d)  | Max. Ambient air temp.<br>(yearly)                      | 30°C  |
| e)  | Max. Ambient air temp.                                  | 42°C  |
| f)  | Wet bulb temperature                                    | 28°C  |
| g)  | Design ambient temp.<br>for all electrical<br>equipment | 50°C  |
| h)  | Wind Design   | Basic Wind Speed, Vb = 39m/s  |

|    |                         |                 |
|----|-------------------------|-----------------|
| i) | Pollution Severity      | Highly Polluted |
| j) | Seismic Criteria        | III             |
| k) | Relative Humidity       | 100%            |
| l) | Average annual rainfall | 750 mm          |

### SITE PROFILE

|                                     |   |
|-------------------------------------|---|
| Location                            | Wanakbori, District-Kheda, Gujarat  |
| Access by – nearest railway station | Ahmedabad – Vadodara Main Broad Guage line, Sevaliya (8 KM)                                     |
| Nearest Airport                     | Ahmedabad and Vadodara  |
| Nearest sea port                    | Kandla  |
| Access by Road                      | 10KM from Godhra NH No.8;<br>02 KM from Balasinor-Sevaliya SH No.59                             |
| Major Towns / Cities                | 13KM from Balasinor and 10KM from Sevaliya  |
| Availability of Land                | Within existing Thermal Power Station   |
| Latitude                            | 22° -52'N   |
| Longitude                           | 73° -21'E   |
| Altitude                            | 80Meters from mean sea level for existing Units<br>70Meters from men sea level for 800MW Unit 8 |

### 3.2 SYSTEM PARAMETERS

|  |  |
|--|--|
| Nominal system voltage                             | <b>400 kV</b>  |
| Highest system voltage                             | 420 kV   |
| Rated lightning impulse withstand voltage          | a) $\pm 1425$ kVp between live terminals and earth.<br>b) $\pm 1665$ kVp impulse on one terminal and other terminal earthed (across isolating distance). |
| Rated one minute power Frequency withstand voltage | 630kVrms   |
| Rated switching impulse withstand voltage          | 1050 kVp (Phase to earth)<br>1575 kVp (Phase to Phase)   |
| Corona extinction voltage                          | 320 kV   |
| Frequency  | 50 Hz  |
| Rated short time withstand current capacity        | 40 kA for 3 sec  |
| Creepage distance                                  | 31mm/kV  |
| System Earthing                                    | Effectively Earthed  |

### **3.3 PACKAGING & MARKING**

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing. As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below:

- a) Width of the Package: 3.2 Meters (from centre-line of rails- 1.6 meters on both sides)
- b) Height of the package from rail top: 4.47 Meters

The above indicates the dimensions which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorized and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project

site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services if the Bidder. Bidder may consider entire material delivered up to site through rail transportation only. The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of

the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the

office placing the contract, nomenclature of contents and Bill of Material. For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

### **3.4 INSPECTION AND TESTING**

#### **3.4.01 Inspection and Tests during Manufacture**

- 3.4.02** The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.
- 3.4.03** The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.
- 3.4.04** Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.
- 3.4.05** Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results. The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the consultant for record purpose. Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library /record.
- 3.4.06** Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.
- 3.4.07** All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.  
Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to dispatch from place of manufacture.
- 3.4.08** All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser as per Owner's approved QAP. The certificates shall include tests for mechanical properties and chemical analysis of representative material.
- 3.4.09** All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

**3.4.10** All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

**3.4.11** All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radio graphed.

**3.4.12** Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

### **3.5 PACKING FOR SHIPMENT**

**3.5.01** The equipment complete with its accessories, spares, special tools and tackles shall be suitably protected by respective packing for shipment considering handling during transit, distance and weather conditions involved. The Contractor shall submit the packaging method for shipment to be adopted by him, if so desired by the Owner / Purchaser.

**3.5.02** Each consignment shall be marked with Equipment name, Owner /Purchaser's name & address, Project details, handling instruction etc. It shall be complete with part list and identification details. The copies of the part list of each consignment shall also be furnished to the Owner / Purchaser after dispatch.

**3.5.03** Equipment shall be packaged for transportation so as to meet the space and weight limitation of transport facilities. The contractor shall obtain approval from concerned authorities for transportation of over dimensioned consignment/package, if any, before starting manufacture of such equipment.

### **3.6 CODES AND STANDARDS**

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

### **3.7 MATERIAL/WORKMANSHIP**

### 3.7.01 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part 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.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

### **3.7.02 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE**

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

### **3.7.03 PROTECTION**

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

### **3.7.04 FUNGISTATIC VARNISH**

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

### **3.7.05 SURFACE FINISH**

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 631 of IS:5.

### **3.7.06 GALVANIZING**

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

### **3.7.07 PACKING**

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Net weight.
- f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

### **3.7.08 HANDLING, STORING AND INSTALLATION**

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The

Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

### **3.8 DOCUMENTATION**

#### **3.8.01 LIST OF DOCUMENTS**

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

#### **3.8.02 DRAWINGS**

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, GSECL contract no. , and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the

drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

### 3.8.03 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

|      |   |   |
|------|---|---|
| i.   | Approval/comments/by employer on Initial submission | Within 2 weeks of receipt   |
| ii.  | Resubmission  | Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time. |
| iii. | Approval or comments                                | Within 2 weeks of receipt of resubmission   |
| iv.  | Furnishing of distribution copies                   | 2 weeks from the date of last approval.   |

**Note:** The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings.

**Customer: Gujarat State Electricity Corporation Ltd.**

**Consultant: Development Consultants Pvt. Ltd., Kolkata**

**Project: 400kV Switchyard (extn.) & 400kV GIS for 1x800 MW Wanakbori Thermal Power Station Extn. Unit-8**

NOA NO.

### 3.8.04 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

### 3.8.05 DOCUMENTATION SCHEDULE

| S. No. | DESCRIPTION                       | TENDER STAGE | CONTRACT STAGE FOR APPROVAL | FINAL DOCUMENTATION |     |
|--------|-----------------------------------|--------------|-----------------------------|---------------------|-----|
|        |                                   |              |                             | Prints              | CDs |
| 1      | Drawings and Data Sheets          | 1            | 10                          | 13                  | -   |
| 2      | Drawings "As Built "              | -            | -                           | 13                  | 05  |
| 3      | Type Test Reports                 | 1            | 05                          | 13                  | -   |
| 4      | Erection Manuals                  | -            | 11                          | 13                  | -   |
| 5      | Operation and Maintenance Manuals | -            | 11                          | 13                  | -   |
| 6      | Manufacturing Quality Plan        | 1            | 11                          | 13                  | -   |
| 7      | Field Quality Plan                | 1            | 11                          | 13                  | -   |
| 8      | Inspection Test Reports           | -            | -                           | 13                  | -   |

Drawings will also be submitted in mini cartridges in AUTOCAD Release -2008 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

### 3.8.06 AS-BUILT DRAWINGS

The Contractor shall furnish drawings and document in as-built condition as stipulated in the specification.

On completion of the project, contractor should submit Three Sets of As commissioned drawings, Three Sets of as Installed Bill of Materials and Three Sets of As Commissioned Data/ Specification /Parameter Sheets Duly Signed by the Competent Authority.

### 3.8.07 DRAWINGS, DATA, INFORMATION AND MANUALS

**Drawings**, data, information & manuals shall be submitted as indicated below:

**To be submitted after award of the Contract.**

- Single line diagram giving rating of each equipment.
- Design calculations in support of selection of equipment rating and system design.
- Technical Data sheets, characteristic curves.

- d) Equipment layouts, layout of switchyard with sections.
- e) Grounding & lightning protection drawings and details.
- f) Cabling, cable trench and tray layouts with section and details with cable sizing calculation.
- g) Dimensional general arrangement drawing along with cross- sections for equipment.
- h) Foundation plan and loading data : design calculation and detail drawing of foundation.
- i) Design calculation and detail drawing for civil work related to this specification.
- j) Design calculation, GA drawing for GI structure and equipment supporting structure, and subsequently detailed drawings.
- k) Mounting details of equipment and structure.
- l) Fire fighting and sump arrangement.
- m) Control & operation write up/Block logic diagrams.
- n) Control schematic and wiring diagram.
- o) Cable schedule and interconnection and cable routing.
- p) Relay co-ordination.
- q) Civil & structural analysis, design calculations and working drawings including bar bending schedule and fabrication.
- r) Erection and maintenance manual.
- s) Any other drawings & data as required for satisfactory installation, operation & maintenance.

### **3.8.08 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVALPROCEDURE**

- (i) Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:

- a) for approval and

- b)for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow four (4) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

- (ii) All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English.
- (iii) Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/ information of the Owner/Engineer.
- (iv) Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:
  - a) List of sub-vendors (from Owner only)

- b) System scheme and instrumentation diagrams
  - c) Design basis justifying selection of equipment & process parameters where not specified in the Contract
  - d) Equipment data sheets and general arrangement drawings
  - e) Materials of construction
  - f) Layout drawings.
  - g) Operation logic diagrams.
  - h) Typical control circuit.
  - i) Drawings of Instrumentation and control.
- (v) Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.
- a) Equipment foundation drawings.
  - b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
  - c) Predicted performance curves of equipment.
  - d) Various bills of quantity, schedules etc.
  - e) Piping fabrication drawings, isometrics etc.
  - f) Panel wiring diagrams.
  - g) Instruction/Operation manuals.
  - h) Service manuals and trouble shooting guide for C & I system including field instruments.
  - i) Cable schedule and interconnection chart.
  - j) Drive/feeder wise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

- (vi) Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

- a) Approved.
- b) Approved except as noted, forward final drawing
- c) Approved except as noted, resubmission required.
- d) Disapproved.
- e) For information/reference only.

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

- (vii) Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.
- (viii) For review by the Consulting Engineer, the Contractor shall furnish softcopies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorized revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.
- (ix) In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.
- (x) For details of documentation for Civil, Structural and Architectural works, Vol.II-G may be referred.

### **3.9 QUALITY ASSURANCE**

- 3.9.01** The Contractor shall follow his standard procedures for quality assurance and control. A copy of the said standard procedures shall be submitted to the Owner / Purchaser for his reference. However, Owner / Purchaser reserves the right to review the same and give his observations, if any, for compliance.
- 3.9.02** The procedures shall be in such a form as to clearly delineate the manufacturing sequence, inspection points, tests and test procedures, acceptable ranges / values, reference drawings etc.
- 3.9.03** The Owner / Purchaser shall inform the Contractor as to which of the inspection points and tests shall be witnessed. As a minimum, inspection and testing of the finished equipment shall be made prior to shipment, unless specifically waived by the Owner / Purchaser. The contractor shall give at least fifteen (15) days advance notice regarding readiness of the equipment.
- 3.9.04** Manufacturing and quality control procedures shall be available for audit to the Owner / Purchaser and/or its representative at the place of manufacture.
- 3.9.05** The Owner / Purchaser reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.
- 3.9.06** The Owner / Purchaser may inspect the Contractor's facilities prior to award of contract.
- 3.9.07** The Owner / Purchaser may witness any or all of the tests stipulated in the relevant standards and this specification.
- 3.9.08** The Owner / Purchaser may conduct surveillance of the Contractor's facilities for compliance to his standard procedures of Quality Assurance and Quality Control while work on the specified equipment is in progress.

### **3.10 QUALITY ASSURANCE REQUIREMENTS**

#### **3.10.01 QUALITY ASSURANCE PROGRAMME**

To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorized representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

- a) His organization structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.

- c) Qualification data for Bidder's key personnel.
- d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and all site related works.
- h) Control of calibration and testing of measuring and testing equipments.
- i) System for quality audit.
- j) System for indication and appraisal of inspection status.
- k) System for authorizing release of manufactured product to the Owner.
- l) System for handling storage and delivery.
- m) System for maintenance of records.
- n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section.

### 3.10.02 GENERAL REQUIREMENTS - QUALITY ASSURANCE

- a) All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorized representative for approval. Schedule of finalization of such quality plans will be finalized before award.
- b) Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization, the relevant reference documents and standards, acceptance norms,

inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

- c) Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organization, during various stages of site activities from receipt of materials/equipment at site.
- d) The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorized representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorized representative and beyond which the work will not proceed without consent of Owner/Authorized representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorized representative for approval and dispositioning.
- e) No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorized representative, and duly authorized for dispatch issuance of Material Dispatch Clearance Certificate (MDCC).
- f) Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner's approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.
- g) Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.
- h) All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorized representative.

- i) For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.
- j) All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American

Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

- k) All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalized with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalized and approved by the Owner/Authorized representative and form part of the Purchase Order between the Contractor and the Vendor.
- l) All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalized with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.
- m) Quality requirements for main equipment shall equally apply for spares and replacement items.
- n) Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.
- o) For quality assurance of all civil works refer to the specifications for civil works.

#### 3.10.04 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after dispatch of the equipment:

- a) Material mill test reports on components as specified by the specification.
- b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and

welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

i) When some important repair work is involved to make the job acceptable.

ii) The repair work remains part of the accepted product quality.

i) Letter of conformity certifying that the requirement is in compliance with finalized specification requirements.

#### 4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The Engineer, his duly authorized representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.02.00 The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/Inspector to issue such certificate shall not prevent the Contractor from proceeding with the

works.

The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

- 4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as maybe reasonably demanded by the Engineer/Inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/Inspector or to his authorized representative to accomplish testing.
- 4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

**ANNEXURE-I**

**FORMAT OF QUALITY ASSURANCE PROGRAMME**

| Name of Company/<br>Contractor | NAME OF CONTRACT PACKAGE |                 |       | QUALITY PLAN FOR           |                  |                    |                 |                  |        |         |
|--------------------------------|--------------------------|-----------------|-------|----------------------------|------------------|--------------------|-----------------|------------------|--------|---------|
|                                | Package No. : _____      |                 |       | QP No. : _____ Date _____  |                  |                    |                 |                  |        |         |
|                                | Contractor : _____       |                 |       | Rev. No.: _____ Date _____ |                  |                    |                 |                  |        |         |
| Sl. No.                        | Component & Operation    | Characteristics | Class | Type of Check              | Quantum of Check | Reference Document | Acceptance Norm | Format of Record | Agency | Remarks |

Note: All the information for QAP as stipulated above shall be finalized and agreed during contract execution.

**ANNEXURE-II**

**FIELD WELDING SCHEDULE**

PROJECT : FWS NO :  
 CONTRACTOR : REV NO. :  
 PACKAGE : FIELD WELDING CODE :  
 SYSTEM : PAGE NO. :

| Sl No. | Drawing No. for Weld Locations & Identification mark | Description of parts to be welded | Material specification | Dimensions | Process of Welding | Type of Weld | Electrode Filler Specification | WPS No. | Minimum Pre-heat Temperature | Heat Treatment Temperature [Holding Time in secs] | NDT Method Quantum | NDT Specification Number | Acceptance Norm Ref. | Remarks |
|--------|--|-----------------------------------|------------------------|------------|--------------------|--------------|--------------------------------|---------|------------------------------|---|--------------------|--------------------------|----------------------|---------|
|        |  |                                   |                        |            |                    |              |                                |         |                              |   |                    |                          |                      |         |

The Field Welding Schedule should be submitted for :

- o Pressure Parts
- o Tanks/Vessels
- o Piping
- o Heavy/Important Structural Steel
- o Heat Exchangers
- o Bus Ducts

**SECTION – IV**

**GUARANTEED AND TECHNICAL PARTICULARS OF STRANDED G. S.WIRE**

| S. No.     | Description  | Unit              | Particulars |
|------------|--|-------------------|-------------|
| <b>1.</b>  | <b>Name &amp; Address of manufacturer</b>  |                   |             |
| <b>2.</b>  | <b>Particulars of raw materials</b>  |                   |             |
| 2.1        | Aluminium  |                   |             |
|            | a) Minimum Purity of Aluminium   | %                 |             |
|            | b) Maximum Copper Content  | %                 |             |
| 2.2        | Steel wires/Rods   |                   |             |
|            | a) Carbon  | %                 |             |
|            | b) Manganese   | %                 |             |
|            | c) Phosphorous   | %                 |             |
|            | d) Sulphur   | %                 |             |
|            | e) Silicon   | %                 |             |
| 2.3        | Zinc   |                   |             |
|            | a) Minimum purity of Zinc  | %                 |             |
| <b>3.</b>  | <b>STEEL STRANDS BEFORE STRANDING</b>  |                   |             |
| 3.1        | Diameter   |                   |             |
|            | a) Nominal   | mm                |             |
|            | b) Maximum   | mm                |             |
|            | c) Minimum   | mm                |             |
| 3.2        | Minimum breaking load of strand  | kN                |             |
| 3.3        | Maximum Resistance of 1 M<br>Length of strand of 20°C  | Ohm               |             |
| <b>4.0</b> | <b>STEEL STRANDS AFTER STRANDING</b>   |                   |             |
| 4.1        | a) Nominal Diameter  | mm                |             |
|            | b) Maximum Diameter  | mm                |             |
|            | c) Minimum Diameter  | mm                |             |
| 4.2        | Minimum breaking load of strand  | kN                |             |
| 4.3        | Galvanising  |                   |             |
|            | a) Min. weight of zinc coating of uncoated wire surface  | g/ m <sup>2</sup> |             |
|            | b) Min. number of one minute dips that the galvanised strand<br>can withstand in the standard Preece test                      | Nos.              |             |
|            | c) Min. No. of twists in gauge length equal to 100 times the<br>dia of wire which the strand can withstand in the torsion test | Nos.              |             |
| <b>5.</b>  | <b>COMPLETED STRANDED WIRE</b>   |                   |             |
| 5.1        | UTS of stranded wire   | kN                |             |
| 5.2        | Lay length of outer steel layer  | mm                |             |
| 5.3        | DC resistance of stranded wire at 20°C   | Ω/km              |             |
| 5.4        | Direction of lay of outer layer  | -                 |             |
| 5.5        | Linear mass of earth wire  |                   |             |
|            | a) Nominal   | Kg/km             |             |
|            | b) Maximum   | Kg/km             |             |
|            | c) Minimum   | Kg/km             |             |
| 6.0        | Is drum as per I.S   | Yes/No            |             |
| 5.6        | Standard length of stranded wire in the drum   | m                 |             |

**ANNEXURE – A**

**NO DEVIATION CERTIFICATE**

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It is confirmed that there is no deviation and the offer is in full compliance with the specification. It is also confirmed that there are no deviations in any other form such as comments, variations and or exceptions. Further it is confirmed that at all drawings/ data sheets/ QP/ type tests reports shall be submitted to BHEL for organizing approval of ultimate customer. Also, furnishing of all relevant information/ repetition of type tests (if required for meeting the specification requirement) shall be carried out by us at no extra cost to BHEL and without affecting delivery requirements.  
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Signature of the authorized representative of Bidder

Name \_\_\_\_\_

Designation \_\_\_\_\_

Place \_\_\_\_\_

Date \_\_\_\_\_

Company Seal