



TATA STEEL LIMITED

General Specification For Painting

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1.0 SCOPE

- 1.1 This specification covers paint materials, surface preparation and paint application techniques and quality requirements for painting of steelwork, equipment, piping, ductwork etc. included in various units of Tata Steel Limited. The term "Painting" referred to herein covers all organic and inorganic coatings for anti-corrosive identification of the following:
 - 1.1.1 Structures & Mechanical Equipment
 - 1.1.2 Static Wearing Surface
 - 1.1.3 Tanks (for Potable & Non-potable Water, Mild Alkali)
 - 1.1.4 Electrical, Instrumentation & Control Equipment
 - 1.1.5 Piping & Duct Work
 - 1.1.6 External Surface of Coke Oven Gas Piping
 - 1.1.7 Piping for other Gases (Laid in External & Underground)
 - 1.1.8 Piping for other Gases (Laid Partially Immersed in Water)
 - 1.1.9 Surfaces exposed to Extremely Corrosive Environment
- 1.2 The term "surface" used herein shall mean iron and carbon steel surfaces exposed to atmospheric action and/or to corrosive media unless otherwise stated. Painting shall be applied after specified surface preparation to protect all surfaces even in cases where no painting requirement is mentioned in any other General or Technical Specification.
- 1.3 Surfaces in direct bonded contact with concrete are not required to be painted.
- 1.4 Items made of asbestos, aluminium, brass, bronze. Galvanised steel, stainless steel and other corrosion resistant alloys, rubber, synthetic polymers, fibre reinforced or other plastics, and buried pipe work (for which separate protection not covered in this specification is to be provided) are not required to be painted except for aesthetic purposes and/or for identification base paints and bands where applicable.

Painting shall provide a continuous adherent organic / inorganic coating film of adequate thickness on the painted surface to protect it from attack due to exposure to the TROPICAL, INDUSTRIAL and CORROSIVE environment with presence of acids and alkalis at site.

1.5 The work shall include but not be limited to, supply of all paint materials of approved quality as described and of skilled labour and supervision required to provide complete paint systems for various groups of items listed in **Annex-1**. The complete paint system for any item includes

- i) Surface preparation of steel substrate.
- ii) Application of prime coats
- iii) Application of intermediate coats (where required), and
- iv) Application of finish coats.

1.6 In case the Vendor/Contractor proposes to adopt paint systems other than those specified herein (whose performance in his opinion will be equal to or better than that of the paint systems specified here), he shall obtain prior approval from the Purchaser.

1.7 This specification shall be read along with the following four annexes to this specification:

Annex1: Paint Materials & Painting System

Annex2 : Colour Code

Annex3 : List of applicable Standards

Annex4: Scope of Slag Blast Cleaning

Annex 5: Binder Specification

Annex 6: QAP for Surface Preparation & Paint Application (Separate attachment)

2.0 Facilities & equipment to be set up:

2.1 All tools, brushes, rollers, spray guns, abrasive materials, hand/ power tools for cleaning, scaffolding materials, instruments for measuring humidity, profile meter , Logo Marking machine etc required for the works shall be supplied by the Contractor and shall be considered in the rate.

3.0 SURFACE PREPARATION

3.1. All surface shall be cleaned of loose substances and foreign materials (such as dirt, rust, scale, oil, grease, welding slag, surface contamination like chlorides and corrosion products like oxides etc) and given an adequate anchoring profile , thus ensuring that the prime coat sticks rigidly to the surface.

3.2 Coating performance is, in general, proportional to the degree of surface preparation. Hence, surface preparation shall be such that as to clean the surface thoroughly of any materials which may lead to premature failure of the painting. Surface preparation shall be compatible with selected primer paint and expected life of paint system.

3.3 The surface preparation techniques covered following techniques, combination of these techniques may be adopted in order to attain desired surface quality: -:

- (i) Solvent Cleaning
- (ii) Power Tool Cleaning
- (iii) Copper slag/ Shot/Grit blasting
- (iv) Pickling

Desired Surface Preparation:

- Abrasive blast clean to Sa2.5 (ISO 8501-1:2007) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be re blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner.
- A sharp angular surface profile of 50-75 microns (2-3 mils) is recommended.
- Power Tool Cleaning as per SSPC-SP-3, ISO 8501 St.3 (only for not approachable areas with prior approval from Owner)

3.3.1. Solvent Cleaning (SSPC-SP1)

The solvent cleaning by wiping with, immersion in, spraying of or contact with vapours of solvent or washing with emulsions or alkaline solution or chemical paint strippers. To ensure that effectively removal of oil, grease, dirt, soil, drawing compounds, old paint and other similar foreign matters . Hydrocarbon solvents do not remove corrosive chloride and sulphate salts. Solvent cleaning is therefore normally followed by other cleaning procedures before application of paint.

3.3.2. Power Tool Cleaning (SSPC-SP3 , ISO -8501-ST3)

Oil and grease are removed by solvent cleaning and heavy rust and scale removed by hand tools prior to use of power tools. The surface is then cleaned by electric or pneumatic tools such as brushes, sanding machines, standing discs, abrasive grinders, chipping hammers, descalers , needle guns and rotary descalers ST-3 quality as required. The tools are used carefully to prevent formation of ridges and burrs and excessive roughening of surface. Care is also taken to avoid burnishing mill scales to a smooth, silk surface. This method effectively removes loosely adherent materials but does not remove rust or mill scales that are firmly adherent.

3.3.3 Copper slag blast cleaning

- The surface shall be cleaned of all dust and heavier layers of rust by copper slag blasting. The entire internal surface to photographic standard SIS: 055900-1967.
- The consumption rate of copper slag shall be 1.6 Kg/Sqm of the blasted area.
- All tools, equipment, base material, hand and power tools for cleaning, including scaffolding material, copper slag blasting equipment, air compressor etc. shall be arranged by the contractor at site in sufficient quantity.
- The compressor used shall be of size enough to produce displacement of 5.6 to 7.0 cum/Min of air at a pressure of 7 Kg/sqcm. Compressed air pressure shall be measured with needle pressure gauge by puncturing the hose near to the blast nozzle. Standard blasting equipment, hoppers, hoses nozzles and attachments shall be used to obtain best test results and to maintain safety standards. The rate of cleaning shall be about 15 sq.mt. per hour at a pressure of 7 Kg/sq.cm. Cleanliness of compressed air shall be monitored through Blotter Test as per ASTM D 4285. Any trace amount of oil or moisture will call for re blasting of all previously blasted surface.
- The abrasive used shall be of the physical properties as mentioned below and shall be free from oil and mud etc. Abrasives cleanliness shall be monitored with the simple vial test. Some of the abrasive will be dropped into a small vial of water with known pH (preferably distilled or deionized water with a pH of 7) and stirred/ shaken. Typically, the ratio should be one volume of abrasive to two volumes of water. Inspect the top of the water for a film of grease or oil. Check the water for visible turbidity (cloudiness due to sediment) which is usually a sign of excess dirt, dust, or clay in the abrasive. Use a litmus or pH paper test in the vial of water to tell whether the abrasive is acid or alkaline. pH paper indicates the actual value of acidity or alkalinity. If the abrasive is found dirty, acidic or alkaline, document these results and immediately report them to the owner's representative.
- The blast cleaned surface shall be blasted with dry compressed air before applying primer. This should be done even if the surface appears very clean and white in colour. The white colour may be due to deposition of silicon and reflection of light on the surface.
- Proper earthing and bonding arrangements shall be made to prevent any damage by sparks produced by static electricity. The bonding conductor should not be less than 16 SWG single strand copper cable.
- The time gap between blast cleaning and application of primer shall be at least 30 minutes earlier than re oxidation period. Blast cleaning work shall commence from top to bottom.
- The blast cleaning operation shall be carried out keeping the nozzle at an angle of 30 degree to the vertical in order to prevent rebounding abrasive from showing down the abrasives emerging from nozzle and from under cutting the material to be removed.
- Any blasting operation is prohibited in absence of DEAD MAN VALVE with the blaster.
- In absence of any cleanliness standard, minimum cleanliness is expected to meet the requirements of very through blast cleaning to SA 2 ½ as per ISO 8501-1 or near white metal blast cleaning to NACE-2/SSPC-SP 10 with random staining limited to 5% of each unit area. The blast surface shall be free from loose rust, mill scale, dirt, oil, grease etc when viewed without magnification. Surface roughness should be between 50 to 75 microns.

- Measurement of surface roughness by the contractor shall be limited to the use of digital profile gauge as per ASTM D 4417 Method B only. Anchor profile readings shall be recorded in prescribed format (available in Annexure)
- Arrangements for inspection of various stages of the job shall be made available by the Contractor so that the entire copper slag blasted area is available for inspection. Any defective work noticed shall be immediately rectified and even re-blasting shall be done if necessary. Countersigned photographic evidence by contractor and inspector are required during resolution of dispute arising for surface cleanliness.
- Vendor 's representative shall certify the anchor profile by use of use of digital profile gauge and replica tape as per ASTM D 4417 Method C or NACE SP0287.

- Physical Properties of Copper Slag:

Colour	Black
Grain shape	Granulated, Angular multifaceted
Hardness	5 to 7 Moh's scale
Sp. Gravity	3.2 to 3.7
Bulk Density	1.87 Kg/ltr.
Moisture Content	less than 1 %
Sieve Analysis of copper slag	
Sieve Size (mm)	Range(%)
-4.0 to +3.0	2 to 4
-3.0 to +2.36	3 to 12
-2.36 to + 1.0	40 to 55
-1.0 to + 0.5	15 to 30
-0.5 to + 0.212	6 to 12
-0.212 below	0.2 to 0.1

- Chemical Properties of Copper Slag :

Silicon Oxide (SiO ₂)	38.40%
Aluminum Oxide (Al ₂ O ₃)	3.35%
Titanium Oxide (TiO ₂)	0.35%
Iron Oxide (II) (FeO)	41.55%
Iron Oxide (III) (Fe ₂ O ₃)	3.15%
Manganese Oxide (MnO)	0.27%

Calcium Oxide (CaO)	5.86%
Magnesium Oxide(MgO)	2.15%
Potassium Oxide (K ₂ O)	0.53%
Na ₂ O Sodium Oxide(Na ₂ O)	0.40%
Copper Oxide(CuO)	0.47%
Lead Oxide (PbO)	0.04%
Zinc Oxide (ZnO)	1.68%
Sulfur (S)	0.96%
Total	98.84%

3.3.4 Pickling

Pickling involves chemical reaction in a bath of dilute sulphuric, hydrochloric or Phosphoric acid, with or without heating, followed by neutralization in a mild alkaline bath and through rinsing in water. Pickling in sulphuric acid may be followed by dipping in a phosphoric acid bath containing iron phosphate. prior to pickling heavy deposits of oil, grease, soil, drawing compounds and other foreign matters are removed by solvent cleaning. Pickling removes loosely adherent as well as adherent scales.

3.3.5 Degreasing, pickling & phosphating: -

Surface preparation for shop painting of sheet metal item like electrical control panels, desks etc may be done and pickling followed by giving the cleaned surface a thin coating of (not less than 5 mg per Sq mtr) Zinc, iron or manganese phosphate deposited either by immersion or powder spray. The phosphate coating shall be tested, when required, by a continuous salt spray as per ASTM B117, for a period not less than 96 Hours

4.0 **PAINT MATERIALS**

4.1 The paint material specified in Annexure -1 manufactured under condition of strict quality control shall be procured from approved paint manufacturers.

4.2 Manufacturer's recommendation shall be strictly adhered to in respect of subsequent storage and application.

4.3 The contractor shall furnish paint manufacturer's test report or technical data sheets and safety data sheets pertaining to the paint material selected. The data sheet shall indicate relevant standards, composition in weight per cent of pigments, vehicles, VOC, additives, drying time, viscosity, spreading rate, flash point, method of application, quality of surface preparation required, corrosion resistance properties and colour.

5. Storage and Coating Application (AS 1940-2004, SSPC-PA1-1999)

- Handling of paint coating materials: -

The following safety related & technical information and regulations to be considered while handling the paint coating materials:-

- Product Data Sheet
 - Instructions marked on the label (e.g. hazard warnings and safety instructions)
 - Material Safety Data Sheet
 - Applicator shall ensure that coating materials purchased and supplied comply with the specified requirements. Coating materials shall be stored in original sealed containers with intact labels in a facility designed and designated for the storage of coating materials in accordance with local regulation and provision of law in force. All containers shall be kept tightly closed and sealed until ready for use. All coating materials shall be sheltered from the direct sun and rain. The storage facility shall be maintained with dry, cool and well ventilated storage conditions separated from food and drink as well as from oxidizing materials. All ignition sources shall be eliminated. The containers shall be provided with identifying documents clearly stating their contents and shelf life. Before use coating materials have to be checked for compliance (name of product, manufacturer and batch number) and shelf life. Usage of coating materials shall be on a "first in, first out" basis. No coating materials shall be used after expiration of their shelf life.
 - Handling of opened containers should only be carried out by appropriate personal protective equipment (safety glasses, protective gloves). Eating drinking and smoking should be prohibited in area where the material is handled, stored and processed. Workers should wash hand and face before eating, drinking and smoking. Vapors should not be inhaled i.e product should only be used with adequate ventilation. Material should be kept tightly closed when not in use. Special precautionary measures against electrostatic discharge should be taken. Static discharge during material transfer should be dissipated by grounding of containers and equipment before transferring material.
- Preparation of Paint Coating Materials :-
 - Before use, each base component (A-component) should be agitated separately to a homogeneous state using an appropriate electrical or pneumatically operated agitator before adding the respective hardener (B-Component). This agitator should be clean, dry and capable of homogenizing the entire content of the container without excessively entraining air into the material. Too fast mixing shall be avoided as it may cause air void due to air entrapped in the coating.

5.3 The basic inspection steps for mixing coatings shall include: -

- Review of the manufacturers mixing instructions.
- Ensure that the correct materials and correct colour are used.
- Batch number is recorded.

- Just prior to mixing it is confirmed that the units and colours are correct for the area to be coated.
- Can tops are clean prior to opening.
- Inorganic zinc powder is sifted before it is added to mix.
- The addition of any thinner is documented. Confirm it is the approved thinner for the material, confirm that the quantity added is correct and that it does not exceed the allowable amount.
- The length of time spent mixing is documented.
- The coating is used within its pot life or if not, disposed of properly, also coating shall be applied as per specified induction time.

5.4 Application of Paint Coating Materials: -

- Paint coating works shall start within specified period after Copper slag blasting and achieving required surface profile (50 to 75 micron) to avoid any further settling of chloride and formation of moisture over surface cleaned.
- Before application of second layer of paint, the surface of first layer must be touch dry.
- Once surface preparation is complete and proven to be in conformance with the specification, coating shall be performed in the ambient condition preferably start from morning and end before early evening so as to safe guard paint film from forming coating defects like Non Drying Film(failure to cure) & blushing (amine sweating)
- Liquid coating shall be applied using airless spray system for larger portion of the surface whereas roller or brush is recommended for smaller surfaces.

5.5 In case of new fabrication drilled holes and nearby area for HSFG bolts needs to be protected from paints for proper gripping of HSFG bolts. It is shot blasted and antitrust is applied only. This area is to be covered with tapes or some other means from application of paints.

5.6. After Painting and making, the painted material to be loaded on Truck/ Trailer provided by Tata Growth shop with proper precaution so that the painting should not deteriorate during transportation .

5.7 SITE / FIELD PAINTING

5.7.1 After erection/assembly of fabricated structures at plant site, damaged and defective shop coats shall be cleaned and touched up with the same type of paint as used for shop coats. This 'clean and retouch' (CRT) work shall include removal of shop paint coating damaged (either due to erection or due to site fabrication), preparation of damaged area to St 3 quality and painting to cover-up all field connections, welds, rivets and all damaged or defective paint and rusted areas. If in the opinion of the Purchaser, damage to shop primer coats is extensive, then instead of spot touch up one overall coat of primer for each shop coat shall be applied after cleaning. The fabricated steel structures shall then be painted with intermediate (where applicable) and finish coats as specified.

- 5.7.2 This specification requires that equipment and large machineries shall be despatched from shop after application of two coats primer and finish paints applied at site. However, in case Vendors are permitted to despatch these items after finish painting at their request, these items shall be given one finish coat compatible with shop finish coats after cleaning and re-touch if necessary.
- 5.7.3 The first coats of paint at site shall be applied before weathering of the shop coat becomes excessive, preferably within three months of the shop coat. The finish coats of paint shall be applied after all concrete work has been completed and all cement and concrete spatters and drippings removed and damaged surfaces touched up before application of the finish coats.
- 5.7.4 Surfaces requiring painting which have not been painted in the shop shall be given the necessary surface preparation and prime coats before application of intermediate and finish coats and before any damage occurs to the surface from weather or other exposure.
- 5.7.5 Steel structures which are fabricated at site shall be painted with prime and finish coats after specified surface preparation on completion of fabrication and erection.
- 5.7.6 All cracks and crevices not detrimental from mechanical strength or other considerations shall be filled with compatible paint or putty.
- 5.7.7 All field welds and all areas within 50 mm of welds shall be cleaned before painting, using surface preparation method as specified to attain the specified surface quality grade. All welds shall either be blast cleaned, or thoroughly power wire brushed or chemically scrubbed or solvent cleaned depending on the nature of the weld deposits.
- 5.7.8 During application of paint at site care shall be taken to guard against any damage to building, floors, structures, electrical equipment including motors, valve stems, glass, moving parts, bearings, couplings, shafts, lubrication points and other sensitive parts. Any paint falling on or applied to such surfaces shall be removed.

6.0 PAIN T SYSTEMS

6.1 AIR DRYING

6.1.1 The paint system covering surface preparation (SP), application of specified primer coats (P), intermediate coats (I) and final coats (F) to develop the minimum Dry Film Thickness (DFT) on the outside surface of the steel substrate have been classified in accordance with the general exposure conditions. Paint systems for individual items / equipment located within the respective plant zones are listed.

6.1.2 The paint application systems other than Air Drying are described below.

6.2 SMALL ITEMS OF EQUIPMENT PAINTING

6.2.1 Standard bought-out Items and machines such as valves, pumps, cylinders, small motors which are mass production items and are being painted in a production line in the manufacturer's shop, may be painted as per respective manufacturer's standard but shall meet the requirement of the exposure condition and the specific system of painting thereof as stipulated in this specification. The colour to be adopted for such equipment shall be subject to approval by Purchaser before commencement of manufacture.

7.0 Warranty:

7.1. 'Defective areas' mean areas wherever bare metal is exposed and corroded in excess of grades 3 of this Warranty, due to normal atmospheric action.

7.2. It excludes other defects or damages such as accumulated dirt, spillage, colour fading, loss of gloss, mechanically damaged areas, fungal growth, fire, explosion and reduction in paint film thickness or failure of paint due to chemical contact or any other form of damage which cannot be attributed to the failure of the Coating System. Reference Area' means one or more of reference areas in accordance with ISO 12944 Parts 7 and 8 to be used for the purposes of this Warranty. This Warranty shall commence at the date of completion of application of the Coating System to the Property or where the Property is coated in sections, the date of completion of the application of the Coating System to each section of the Property ('the Commencement Date'):\

7.3 This Warranty shall be applicable only if aggregate Defective Areas as defined by reference areas for respective Property as defined by ISO 12944 Parts 7 and 8:

- 02 % of total of the executed area in the 1st year
- 05 % of total of the executed area in the 2nd year
- 07 % of the total of the executed in the 3rd year
- 09% of the total of the executed area in the 4th Year
- 12% of the total of the executed area in the 5th Year

7.4. Grading of corrosion under this Warranty shall be in the terms of the exponential function of the amount of rust and as described in the table in line with Ri3 as defined in ISO 4628-3.

7.5 The Contractor shall guarantee that chemical and physical properties of paint materials actually applied on surfaces being protected are in conformity with the requirements of this specification.

7.6 The Contractor shall submit internal test reports from the paint manufacturer regarding the quality of each batch or lot of paint supplied.

7.7 The contractor shall ensure that in addition to the requirements of this specification recommendations made by the paint manufacturer in respect of storage and application are followed strictly.

7.8 The purchaser reserves the right to have the quality of paint products tested at random by outside agencies and reject any particular batch or lot if the quality of that batch or lot is found to be inferior to what has been specified herein or approved by the Purchaser.

8. Testing during Inspection / execution :-

8.1. Following test must be carried out jointly and to be recorded in a Log Book which will act as a reference parameter during performance evaluation exercise :-

8.2. Daily Routine Test :-

- Batch Number (all supplied batches must be used within 6 months of manufacturing month)

- Pot Life

- Proper mechanised stirring of base & mix.

- Sp.Gravity of the base / or the Mix.

- Viscosity of the Base/ the Mix.

- Touch dry

- WFT –as per QAP

- DFT-as per QAP

- Gloss level for PU top coat-as per QAP

8.3 Weekly Spot test :-

- Adhesion Pull Off Test-as per QAP

- Salt contamination Test –as per QAP

8.4. Long Term Test- Once in a year

- Salt spray resistance

- Cyclic corrosion test

- QUV test for PU top coat

- ZP pigment content

- Flexibility

- Impact

9.0 QUALITY CONTROL

9.1 The contractor shall perform inspections as listed below and record the results on a coating works inspection technical format duly attached with this specification.

- All painting materials including primers and thinners brought to site by the Contractor for application shall be directly procured from approved manufacturers as per specifications and shall be accompanied by Manufacturer Test Certificates.

9.3 TSL may call for tests for the primers and paints including verification of batch wise tests for physical and chemical analysis. The Contractor shall carry out the same at his own cost and provide the results to Tata Steel.

- The painting work shall be subjected to inspection by Tata Steel at all times. Stages of inspection are as follows:
 - Surface Preparation
 - Primer Application
 - Each Coat of Paint

- All records of inspection shall be maintained in Registers and jointly signed by TSL and Contractor.
- Any defect noticed during the various stages of inspection shall be rectified by the Contractor to the satisfaction of TSL before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, Contractor shall be fully responsible for making good any defects found during Final inspection or during the Defect Liability period. DFT shall be checked and wherever found short, the same shall be made up with additional coats.

9.7 The shades of successive coats should be slightly different in colour in order to ensure application of individual coats & the same shall be done in consultation with paint manufacturer.

- Calibrated Digital Elcometers, surface profile gauges (calibrated Profilemeter) and any other inspection instrument required by TSL shall be provided by the contractor at site during inspection.
- The contractor shall arrange expert technical support at site by paint Manufacturer who will cross verify independently regarding surface preparation and DFT and quality and provide a report to TSL.
- Rust grade on surface shall be identified as per ISO 8501 and SSPC-VIS-3 before surface preparation

- ISO-Rust' grades are :-

A :Steel surface largely covered with adhering mill scale but little, if any, rust.

B :Steel surface which has begun to rust and from which the mill scale has begun to flake.

C:Steel surface on which the mill scale has rusted away or from which it can be scraped, but with slight pitting visible under normal vision.

D. Steel surface on which the mill scale has rusted away and on which general pitting is visible under normal vision.

- SSPC-VIS-3-Rust' grades are :-

- Rust Grade A: Steel surfaces completely covered with adherent mill scale: little or no rust visible.

- Rust Grade B: Steel surface covered with both mill scale and rust.

- Rust Grade C: Steel surface completely covered with rust: little or no pitting visible.

- Rust Grade D: Steel surface completely covered with rust: pitting visible.
- Environmental Readings shall be noted:-
 - Substrate temperature using magnetic surface thermometer
 - As per ASTM D3276, Standard guide for painting metal substrates-
 - Minimum surface temperature for coating application is usually 5° C (40°F)
 - Maximum surface temperature for coating application is usually 50°C (125°F)
 - Dew point, Relative Humidity, Dry Bulb (air temperature) using Sling Psychrometer and psychometric chart.
- Soluble Salts contamination in between coats (soluble salts initiate and accelerate steel corrosion if they deposit between coats, they can cause blistering and disbandment leading to coating breakdown) shall be avoided.
 - Test Methods (Any one of the quantitative test can be performed) are :-
 - Potassium ferricyanide
 - Bresle patch in accordance with ISO 8502-6 and ISO/DIS 8502-9
 - Sleeve test in accordance with ISO 8502-5, NACE 6G186, NACE 6, SSPC SP13 and SSPC Guide-15
- Dry film thickness per painting system shall be measured at the inspection stages of primer, intermediate & finish coats:-
 - Dry film thickness (DFT) measurement shall be as per SSPC-PA 2 Type 2 gauges.
 - It requires five spot measurements (a minimum of three readings per spot are needed) to account for surface irregularities within the 4 cm (1.5 inch) for each 10 meter square. Acceptance criteria is Level 2 of SSPC-PA 2 i.e. minimum DFT is as specified and maximum DFT is 120% of specified.
 - For areas over 100m² (1,000 ft²), measure first 100m² (1,000 ft²) described above, and provided DFT is OK for each additional 100m² (1,000 ft²), randomly select and measure one 10m² (100 ft²) area.

Holiday testing shall be performed on coating at various stages :-

Holiday testing is performed to find defects or discontinuities in coating film such as:

- Pinholes
- Fisheyes
- Cratering

Low voltage wet sponge, electronic devices powered by batteries with output voltages ranging from 5-120 V DC shall be used, refer to standard NACE SP0188 for details

Adhesion test shall be performed:-

- Adhesion of paint film using cross hatch cutter and tape as per ASTM D 3359 shall be done to check the film adhesion..

9.8 The Purchaser may get any of these samples tested for conformity with standards. In case any sample fails on such a testing the corresponding batch of paint would be liable to rejection and the Contractor would have to bear expenses of testing. Any samples not tested during the execution of the job would be retained by the Purchaser in the sealed containers. Such samples would be subject to testing at a later date in case painting in the area(s) where a particular batch of paint has been applied show(s) signs of premature failure. In case this testing reveals that the paint had not been as per the required standard the contractor would be liable to make good painting of the area showing defects at his cost.

10.0 DOCUMENTATION

10.1 Contractor shall submit a written Quality Assurance Plan with procedure for qualification trials and for actual work.

10.2 Daily progress Report with details of humidity, surface preparation, surface profile, Dry film thickness particulars of applications, number of coats applied, type of materials used, methodology-Air or Airless or Brush, progress of work vs programme.

10.3. Code and Batch numbers of primers and paint materials used.

- Type of testing equipment and their calibration.
- Elcometer and Profilemeter readings for the various components jointly recorded with Tata Steel.
- Paint consumption statement along with the theoretical consumption requirements.

11.0 LOGO, LETTERING & EXTERNAL ART WORK

11.1 LOGO AND LETTERING

- TSL shall provide their LOGO with sizing, Flow, colouring and same is to be provided to the gas holder.
- TSL will also convey to the Contractor in writing details of the lettering for product and gas holder details along with the desired color-coding and same has to be written on the gas holders by the Contractor.

11.2 COLOR CODE

Shades of finish paint coat to be applied shall be as per IS: 5-2007 or as per RAL colour reference. Shades of finish coats of major items like steel structures, equipment and piping are given in Annex-3. However, prior approval shall be taken from the Purchaser after placement of order before adopting final colour shade for any particular item being painted.

11.2.1 COLOUR CODE FOR PIPING

11.2.1.1 For identification of pipelines, the colour code as per Annex-2 shall be used unless otherwise specifically indicated by the purchaser.

11.2.1.2 The system of colour codes for pipework, individual or group, consists of a base colour and one or two band colours for proper identification in respect of nature of process fluids handled.

11.2.1.3 The base colour shall be applied either throughout the entire length of pipeline or, where the base colour is not applied throughout the entire length of the pipeline. It shall be applied over at least 2 (two) metres on either side of valves, junctions, joints, service appliances, bulk-heads, walls etc. In case the pipeline does not have valves, junctions, joints, service appliances, bulk heads, walls etc. within a distance of 100 (hundred) metres, the ground colour 4 (four) metres long should be applied at intervals of about 50 (fifty) metres.

11.2.1.4 When colour bands are superimposed on the base colour Ground colour shall extend over 2 (two) metres on both sides of-the colour bands to avoid confusion (see Fig 1).

11.2.1.5 When base colour is applied throughout the entire length of the pipeline, the colour bands shall be applied near the valves, junctions, walls etc. and at intervals of about 50 (fifty) metres.

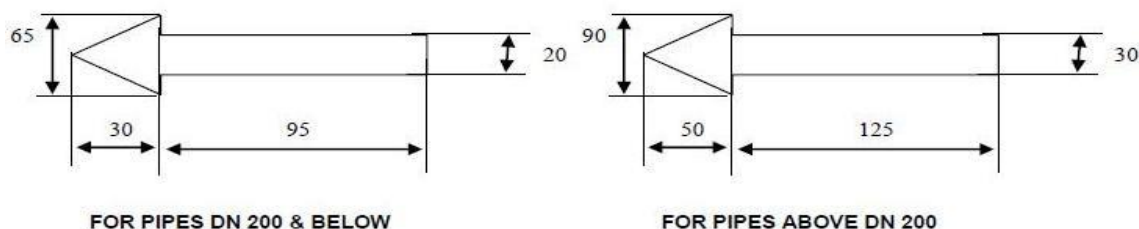
11.2.1.6 When the base colour is not applied throughout the entire length of pipeline the colour band should be at the centre of the 4 (four) metre long base colour wherever it is applied.

11.2.1.7 The relative proportional width of the first colour band and the second band should be 2:1 (see fig 1). The minimum width of the narrowest colour band shall be 50 (fifty) millimetres.

11.2.1.8 For steam, temperature and pressure shall be indicated after colour indication by lettering. Whenever lettering or stencilling bearing the name of the fluid is to be resorted to as an additional means of identification of the pipeline, the recommended sizes will be as follows:

<u>Outside dia of pipe or Covering millimetres</u>	<u>Size of legend millimetres</u>
From 20 up to 30	10
Above 30 up to 50	20
Above 50 up to 80	30
Above 80 up to 150	40
Above 150 up to 250	63
Above 250	90

11.2.1.9 Flow direction shall be indicated by arrows, as shown below. The arrow colour shall be either black or white (depending on which gives a better contrast to the pipe base colour on which it is superimposed)



For insulated pipes, nominal pipe size means the outside diameter of insulation. Nominal pipe size figures are in millimetres.

FIGURES RELATING TO PIPELINE IDENTIFICATION COLOUR SCHEME

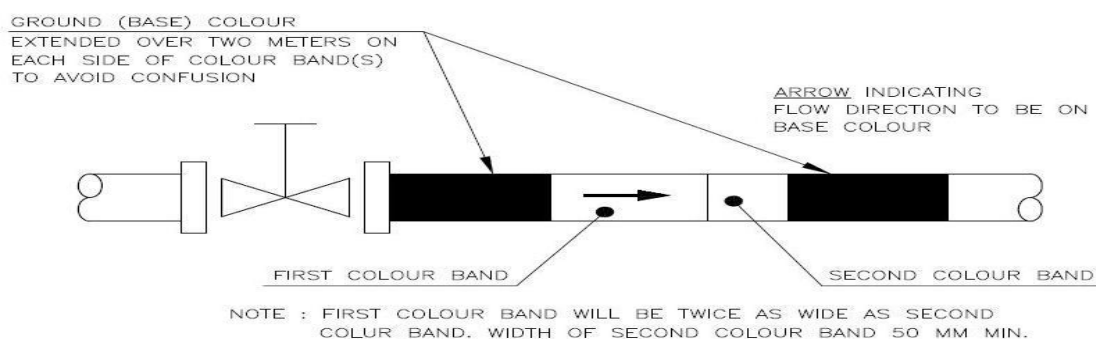


FIG. 1
ARRANGEMENT OF COLOURS BANDS



Fig. 2
STANDARD HAZARD MARKING

11.2.1.10 Product names shall be marked at principal equipment (like pumps, compressors, exhausters, blowers etc.), inlet, outlet and battery limit in a suitable size as approved by the Purchaser.

11.2.1.11 Equipment numbers as instructed by the purchaser shall be black or white on each vessel, tank, column equipment and machinery (insulated or un insulated) after final painting. Line number if any insulated by the' purchaser shall be stencilled in more than one location. Size of letter and numbers shall be as follows:

Columns, Vessels, towers, large sized items:	150 mm high
Crushers, compressors, pumps, exhausters, blowers etc.:	80 mm high
Tanks (to be stencilled on flag raised from the tank body:	150mm high

11.2.1.12 Attention should be given to the visibility of the colour markings and letterings. For instance, if the pipelines are located above the normal line of vision of the operator, the lettering should be painted below the horizontal plane of the pipe axis.

11.2.1.13 If the gas carried by the pipeline is hazardous additional marking shall be done as indicated in Fig 2.

As per TSL standard mentioned in Annexure -3 and relevant drawing.

11.3 EXTERNAL ART WORK

The gas holder shall be provided with external art work after due corrosion protection finish painting. TSL shall provide the necessary theme for the art work to the contractor.

11.4 Marking : Marking should be done on the painted structure with portable inject printer . Mark no to be reflected on each and every member. (Lettering Size : As per Owner Specification)

12.0 SAFETY

12.1 All people involved in surface preparation and protective coating shall follow all appropriate safety rules of Owner. The total crew of the contractor are required to attend Owner safety class before entering in to the site along with medical check-up as specified by company medical practitioner.

- Use of personal protective equipment (PPE) like protective clothing with florescent tape, air breather or nose mask, air plug, hand gloves, safety goggles, safety shoes and helmet is a must to wear by all the contracting crew during the work. The contractor has to deploy a certified safety personal at site to look after the conformance and non-conformance of site safety and shall directly report to owner designated safety person.
- Work Permit – Before start of the job, site in charge shall obtain the work permit from the concerned area in charge or the person designate by the owner. The work shall be performed only till the permit is allow to do.
- Six Directional Hazard – The contractor must draw six directional hazard of the work site before start of the job and submit to owner before start of the job.
- Check List – If owner specify any check list to be filled up before job the contractor shall full fill the check list and submit before obtaining work permit for the shift.
- Confined space safety – Confined space that require permits to enter have inherent hazards that all personnel involved in coating operations need to know and

understand. Personal who need to enter in the confined space must undergo confined space training from the owner designated safety in charge.

- Working at heights – those who work in height must obtain height training certified pass for owner designated class or school. If anyone of the workers of the contractor crew is afraid of heights he should not be allowed to work on high altitudes o the gas holder. Person working in height shall be provided a full body harness safety belt and fall arrester with complete safe platform and hand railing to stand safely.
- Scaffolding – Shall be provided for all work that cannot be done safely by workers standing on permanent or solid construction at least 50 cm (20 in) wide, except such work that can be safely done form ladders, must be constructed of suitable materials such as steel member of known strength characteristics. The erection and dismantling shall be performed under the supervision and direction of a qualified person.
- Surface preparation safety – Use common sense in detecting potential hazards. The power tool cleaning equipment must be covered with safety guard for possible hand injury. Nose mask shall were be person to save form inhalation of silica dust, dirt, oxide etc it may cause serious injury.
- Spray application safety- When coating application is being done, all personnel on site must be aware of the tremendous damage that can result for a small quantity of vaporized volatile substance (it is both a health and explosion hazard). Personnel need to be aware of the hazards to health inherent in solvent fumes, toxic fumes finely atomized metals, vapor mists and dust dispersed in the air. Static electricity discharges may also ignite solvent vapors. To reduce this hazard ground the spray equipment and ensure connections are electrically continuous. Airless spray tip shall cover by tip guard.
- Safe operating procedure (SOP) –shall be prepared and certified with owner designate safety personal before start of the job. All the personal should be distributed the copy of SOP the language of SOP as per preferred language of applicator personal. SOP shall be displayed in the job site.
- Material Safety- is the responsibility of contractor / applicator. However space will be provided onsite by the owner for proper stocking of required material in a well covered space. Contractor/applicator shall make the necessary covering for the space so as to ensure safe storage of the materials. The material must be kept as per manufacturer's guide lines with display of material safety data sheet (MSDS). The storage location must be well ventilated to provide easy accesses for solvent evaporation with good illumination and sufficient fire extinguishers.

SAFETY STANDARD – CONTRACTOR SAFETY MANAGEMENT
SS/GEN-54, Version-01 shall be read and abide by in conjunction to this specification.

13.0 ENVIRONMENT CONDITIONS

13.1 Surface Temperatures- The temperature of surface awaiting coating application, and the temperature of the air near that surface, can have great effect on the coatings

application itself. At night, steel usually radiates heat and cools to below air temperature. During the day, it absorbs heat and is usually warmer than the air temperature. Surface temperature is often different from air temperature, especially for work done outside. Both air and surface temperatures should be measured to avoid application problems.

13.2 Application at incorrect temperature can cause defects such as:-

- Blistering
- Pinhole
- Cratering
- Dry Spray
- Mud Cracking

Generally surface temperature for application of paint should be within 5° C to 50 ° C. Applicator shall apply coating only when the substrate is at least 3° C above the determined dew point. Above temperature restrictions in general need to be finally verified with paint material data sheet.

- Relative Humidity – too much or not enough relative humidity may create problem for solvent to evaporate from coating. Solvent remain in the coating can cause lack of curing. The coating only takes place when the relative humidity is equal to or near by 85%.
- Wind Speed – can adversely affect a coating operation in several way like it can cause excessive drift or overspray of the sprayed coatings, accelerated solvent evaporation after application, contribute to formation of dry spray, sea spray, salt, blast media, dust or sand might have on the coating job. If the wind speed is determined to be harmful, the coating operation shall stop until normal wind speed.

Annexure 1: Paint Material & Painting System

The Painting system specified here deals with corrosivity of (C-3 Medium, C5- High) and Hot Structure & equipment

- A high durability coating specification designed for environments classified by ISO 12944-2 as C3 medium corrosivity with a guaranteed life of 5 years for new structures and equipment for both indoor and outdoor condition i.e. Within factory or industry shade and outside factory or industry shade (under open atmosphere).

Min/Max Service Temperature: 0°C / 45°C

Substrate: Steel

Surface Preparation & Comments

Abrasive blast clean to Sa2.5 (ISO 8501-1:2007) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be re blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner. •A sharp angular surface profile of 50-75 microns (2-3 mils) is recommended.

Power Tool Cleaning as per SSPC-SP-3,ISO 8501 St.3 (only for not approachable areas with prior approval from Owner)

General Specification for Painting

Binder	% Volume Solids (Min)	DFT/Coat (microns)	No of Coats	Max Drying Time (Hrs.) for overcoat @ 40 DEG C.	Comments
SYSTEM NO. 1					
HB Zinc Phosphate Primer	63	60	1	2 Hrs.	Apply 1 coat at shop. Should contain >20% pigmentation.
HB Epoxy MIO intermediate	80	100	1	5 Hrs.	Apply 1 coat at shop.
PU Top Coat	57	50	1	4 Hrs.	Apply 1 coat at shop. Minimum gloss 80%.
TOTAL SYSTEM		210	3	11 Hrs.	Complete Paint at Shop and touchup/repair only at site.
SYSTEM NO. 2					
Fast drying, high solids, high build two component pure epoxy with MIO coating	72	140	1	2 hr	Apply 1 coat at shop.
PU Top Coat	57	60	1	4 Hrs	Apply 1 coat at shop. Minimum gloss 80%.
TOTAL SYSTEM		200	2	6 Hrs	Complete Paint at Shop and touchup/repair only at site.

- A high durability coating specification designed for environments classified by ISO 12944-2 as C5-I high corrosivity with a guaranteed life of 5 years for new structures and equipment for both indoor and outdoor condition i.e. within factory or industry shade and outside factory or industry shade (under open atmosphere).

Min/Max Service Temperature: 0°C / 45°C

Substrate: Steel

Surface Preparation & Comments

- Abrasive blast clean to Sa2.5 (ISO 8501-1:2007) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be re blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner.
- A sharp angular surface profile of 50-75 microns (2-3 mils) is recommended.
- Power Tool Cleaning as per SSPC-SP-3, ISO 8501 St.3 (only for not approachable areas with prior approval from Owner)

General Specification for Painting

Binder	% Volume Solids (Min)	DFT/Coat (microns)	No of Coats	Max Drying Time (Hrs.) for overcoat @ 40 DEG C.	Comments
SYSTEM NO.3					
Zinc Silicate Primer	60	60	1	8 hrs	Apply at Shop. Dry film must contain a minimum of 80 % zinc by weight. Specific gravity @ min 2.37KG/Ltr
HB Epoxy MIO intermediate	80	120	1	5 hr	Apply 1 coat at shop.
PU Top Coat	57	60	2	4 Hrs	Apply 2 coats at shop. Minimum gloss 80%.
TOTAL SYSTEM		300	4	21 Hrs	Complete Paint at Shop and touchup/repair only at site.
SYSTEM NO.4					
Two component , high solids, glass flake reinforced, abrasion resistant epoxy coating	75	240	1	6 hr	Apply 1 coat at shop.
PU Top Coat	57	60	1	4Hrs	Apply 1 coat at shop. Minimum gloss 80%..
TOTAL SYSTEM		300	2	10 Hrs	Complete Paint at Shop and touchup/repair only at site.
SYSTEM NO.5					
High build Epoxy zinc phosphate primer with MIO	80	200	1	4 hr	Apply 1 coat at shop.
Acrylic Polyurethane Top Coat	57	50	2	8 hr	Apply 2 coat at shop. Minimum gloss 80%..
TOTAL SYSTEM		300	3	12 Hrs	

- Hot Structures & Equipment

Max Service Temperature: Up to 540°C

Substrate: Steel

Surface Preparation & Comments

- Abrasive blast clean to Sa2.5 (ISO 8501-1:2007) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be re blasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner

- A sharp angular surface profile of 50-75 microns (2-3 mils) is recommended.
- Power Tool Cleaning as per SSPC-SP-3, ISO 8501 St.3 (only for not approachable areas with prior approval from Owner).

Binder	% Volume Solids (Min)	DFT/Coat (microns)	No of Coats	Drying Time (Hrs.) @ 40 DEG C	Comments
SYSTEM NO. 6 (up to 315°C)					
Single pack HR Aluminium	45	25	2	16 hrs	Apply 1 coat at shop & 1 coat at site before/after erection.
TOTAL SYSTEM		50	2	32 hrs	
SYSTEM NO. 7 (300°C to 540°C)					
Inorganic Zinc Silicate	60	60	1	8 hrs	Apply at Shop. Min 80% zinc contain in DFT by weight. Specific gravity @ min 2.37KG/Ltr
HR Silicone Aluminium	45	25	2	6 hrs	Apply 1 coat at shop & 1 coat at site before erection.
TOTAL SYSTEM		110	3	20 Hrs	

* Note:- 1. General selection of products & paint system as per guidelines of ISO12944 part 5.

2. Lab Product Prequalification testing as per ISO 12944 part 6.

3. For paint properties please refer to binder specifications in the annexure.

Corrosion Matrix and Applicable Paint System for TSK						
Area	Corrosivity category					Applicable Paint System
	C1	C2	C3	C4	C5	
RMHS			√			System 1 / 2
LCP			√			System 1 / 2
SP		√	√			System 1 / 2
CDQ			√			System 1 / 2
COBP			√			System 1 / 2
BPP(DASU, PCDC)				√	√	System 3 / 4 / 5
BF(Proper, GCP,SGP, BLT, Cooling Tower, Dewatering Bin)					√	System 3 / 4 / 5
BF (Stock House)			√			System 1 / 2
SMS			√			System 1 / 2
HSM			√			System 1 / 2
CRM			√			System 1 / 2
Palate Plant			√			System 1 / 2
WWTP, DM Plant, Cooling Plant					√	System 3 / 4 / 5
Utility & OHYP			√			System 1 / 2
Hot Structure & Equipment's (Above 80°C and up to 540°C)						System 7
All Equipment's						System 3 / 4 / 5
Internal Coating of Tank and vessel						System without Top Coat
Partially Immersed in Water						System 4 without Top Coat
Tank Bottom Plate Exposed to Soil						High Build Epoxy Glass Flake -480 Micron in Two Coat (From System 4)
Buried Pipe Line						High Build Epoxy Glass Flake -600 Micron in Two Coat (From System 4)

Annexure 2 for Colour Code

TSL Standard Doc no. GSP-01-00-00-14-000-001									
COLOUR CODE									
Sr. No.	Description	Base Colour	ISC No.	1st Band	ISC No.	2nd Band	ISC No.	Colour of Inscription	ISC No.
A	Piping								
1	Instrument Air/Dry air for instrumentation	Sky blue	101	White				White	
2	Compressed Air upto & Including 15 Kg/cm2	Sky blue	101					Black	
3	Compressed Air above 15 Kg/cm2	Sky blue	101	Signal red	537			Signal Red	537
4	LP Oxygen	Aluminium	Aluminium Paint to IS 2339	with word LP Oxygen					
5	HP Oxygen	Aluminium	Aluminium Paint to IS 2339	with word HP Oxygen					537
6	Argon	Deep orange	591	Brilliant green	221			Brilliant Green	221
7	Cooling Water Supply & Return	Brilliant green (Supply) Brilliant green (Return)	221	White White				White "Return" Golden yellow	356
8	Raw water	Sea green	217	White				White	
9	Treated water	Sea green	217	Light Orange	557			Light Orange	557
10	Effluent Water(HTDS)	Sea green	217	Signal red	537				
11	Effluent Water(LTDS)	Sea green	217	Canary Yellow					
12	Treated waste water	Sea green	217	Light Grey					
13	RO Reject	Sea green	217	French blue					
14									
15	Drinking Water	Brilliant green	221	French blue	166			French blue	166
16	Fire Water	Post office red	538					White	
17	Filtered water/ Service water	Brilliant green	221					Black	
18	Low Pressure Steam								
19	Medium Pressure Steam	Aluminum							

General Specification for Painting

20	High Pressure Steam								
21	Acetylene LP	Canary Yellow	309	Dark Violet	796			Black	
22	Hydrogen	Canary yellow	309	Signal red	537	French blue	166	Signal red	537
23	LP Nitrogen <5 kg/cm2	Canary yellow		Black				Black	
24	HP Nitrogen> 5 kg/cm2	Canary yellow	309	Signal Red	537			Signal red	537
25	Blast Furnace Gas	Light Grey	631	Venetian Red	445			Venetian Red	445
26	Coke Oven Gas	Coal Tar Black shop made primer						White	
27	Mixed Gas	Coal Tar Black shop made primer		Venetian Red	445			Venetian Red	445
28	Propane- Vapor	Dark Violet	796	Black				Black	
29	Propane- Diluted	Dark Violet	796	Canary Yellow	309			Canary Yellow	309
30	LD Gas	Light Grey	631	Golden Yellow	356			Golden Yellow	356
31	Benzol	Dark Violet	796	French blue	166			French blue	166
32	Ammonia	Dark Violet	796					White	
33	Ammonia Liquor	Dark Violet	796	Canary yellow	309			Canary yellow	309
34	Sulphur Dioxide	Dark Violet	796	Brilliant green	221			Brilliant green	221
35	Carbon Dioxide	Canary Yellow	309	Light Grey	631	Brilliant Green	221	Light Grey	631
36	Cold/Hot Blast Main Air	Light Grey	631					Black	
37	Hydrochloric acid	Dark Violet	796	French blue	166			French blue	166
38	Sulphuric Acid	Dark Violet	796					White	
39	Condensate	Brilliant Green	221	Light Brown	410			Light Brown	410
40	Condensate Return Line	Brilliant Green	221	Light Brown	410			"Return" Golden Yellow	356
41	Vaccum	Sky blue	101	Black				Black	
42	Tar	Black		Aluminium	Aluminium Paint to IS 2339			Light Grey	631

General Specification for Painting

43	Waste Water/Contaminated Water	Brilliant Green	221	Signal Red	537			Signal Red	537
44	Demineralized water/Demineralized Boiler Feed water	Brilliant Green	221	Light Orange	557			Light Orange	557
45	Demineralized water/Demineralized Boiler feed water return line	Brilliant Green	221	Light Orange	557			"Return" Golden Yellow	356
46	Chilled water/Chilled water line insulated(Supply)	Brilliant Green	221	Light Grey	631	French blue	166	Light Grey	631
47	Chilled water/Chilled water line insulated(Return)	Brilliant Green	221	Light Grey	631	French blue	166	"Return" Golden Yellow	356
48	Furnace Oil	Canary Yellow	309					Black	
49	Lubricating Oil	Canary Yellow	309	Light Brown	410			Light Brown	410
50	Soft Water/Base Exchange	Brilliant Green	221	Silver Grey	628			Silver Grey	628
51	Soft Water/Base Exchange Return line	Brilliant Green	221	Silver Grey	628			"Return" Golden Yellow	356
52	Hydraulic Power/Hydraulic	Brilliant Green	221	Black				Black	166
53	Hydraulic Power/Hydraulic Return Line	Brilliant Green	221	Black				"Return" Golden Yellow	356
54	Furnace Pressure & Draft impulse piping	French Blue	166	Aluminium	Aluminium Paint to IS 2339			Silver Grey	628
55	Caustic solution/Caustic Soda	Dark Violet	796	Aluminium	Aluminium Paint to IS 2339			Silver Grey	628
56	Lime	Dark Violet	796	Light Orange	557			Light Orange	557
57	Hydrazine	Dark Violet	796	Light Orange	557	Aluminium	Al Paint to IS 2339	Light Orange	557
58	Blast Furnace Gas Holder	Light Grey	631					Venetian Red	445
59	Coke Oven Gas Holder	Coal Tar Black						White	
60	LD Gas Holder	Light Grey	631					Golden Yellow	356
61	Oxygen Buffer Vessel	Aluminium	Aluminium Paint to IS 2339					Signal Red	537

General Specification for Painting

62	Nitrogen Buffer Vessel	Canary yellow ^(LP) Canary yellow ^(HP)	309	Black Signal Red				Signal red	537
63	Argon Buffer Vessel	Deep orange	591	Brilliant green	221			Brilliant green	221
64	Sewage Water	Sea Green	217	Canary Yellow	309	Signal Red	537	-	-
65	Dolomite Solution	Black		-		-		-	-
66	Soda ash Solution	Dark Violet	796	Jasmine Yellow	397	-		-	-
67	Antiscalent	Black		-		-		-	-
68	Sodium hypochlorite	Black		-		-		-	-
B	Structures								
1	Buidling frames including bracings,side girts,louvers etc	Respecive area Zonal Colour code(Please see sheet 2 for zonal colour code)							
2	Crane girders	Deep Orange	591						
3	Crane stops	Post office red	538						
4	Monorail with maintenance walkway	Deep Orange	591						
5	Gutters	Black bituminous							
6	Fire escape,platforms,ladders etc.	Signal red	537						
7	Vertical post of Handrailing	Lemon Yellow	355						
8	General hand railing,top runners / all types of runner	Lemon Yellow	355						
9	Staircases landing platforms, support structures in buildings	Respective area Zonal Colour code(Please see sheet 2 for zonal colour code)							

General Specification for Painting

10	Staircases landing platforms, support structures on vessels/ gas holders(Other than hand railing vertical posts, hand railing, top runners, toe guard, knee guard)	Respective Vessel/ Gas Holder Colour code							
11	Walk ways/ floor plates wearing surfaces	Respective area Zonal Colour code(Please see sheet 2 for zonal colour code)							
12	Rain water collector & Downcomers	Green with Blue & black band							
13	Rung ladders	Lemon Yellow	355						
14	All members blocking passages for movement	Lemon Yellow	355						
15	Trestles,towers & pipe bridges	Respective area Zonal Colour code(Please see sheet 2 for zonal colour code)							
16	Conveyor gallery structures	Respective area Zonal Colour code(Please see sheet 2 for zonal colour code)							
17	Steel Chimneys	Aluminium	Aluminium Paint to IS 2339						
18	RCC Chimneys	Alternate Red & White bands (please also see the photograph in sheet 2)							
C	Equipment and Machinery								
1	General indoor equipment	Light Grey	631						
2	General outdoor equipment	Dark admiralty grey	632						
3	Conveyor Technological structure	Aircraft grey	693						

4	Hoppers, chutes and bin structure (except supporting beams)	Post office red	538						
5	Crane bridges, trolleys etc	Lemon Yellow Stripes: Black (100 mm wide)	355						
6	Furnaces	Aluminium	Aluminium Paint to IS 2339						
7	Fire fighting Equipment	Signal Red	537						
Color band considered as per IS:2379 Content is not indicated in IS:2379, hence Black base color is considered as per TSL KPO BOD project.									

Annex3 : List of applicable Standards

CODES AND STANDARDS

- American Society for Testing and Materials (ASTM)
- NACE International – the Corrosion Society (NACE)
- SSPC – The Society for Protective Coatings (SSPC)
- International Organization for Standardization (ISO)
- Surface preparation standards
- Swedish Standard :ISO-8501-1-1988 and
- NACE/SSPC-VIS1
- Above standards contains photographs of the various surface preparation standards on four different degrees of rusted steel.
- Referenced standard for warranty is ISO 4268-1
- Manufacturer's brochures and instructions with respect to storage, surface preparation, mixing and thinning, application and curing intervals.

LIST OF STANDARDS

(Unless otherwise indicated, various standards specified here should be latest ones)

Sl. No.	Standard	Title
1.	IS:5	Colours for ready mixed paints and enamels
2.	IS: 101	All Parts and Sections for paint testing
3.	IS: 104	Ready mixed paint, brushing, Zinc Chrome, priming
4.	IS: 384	Brushes, paints and varnishes, flat

Sl. No.	Standard	Title
5.	IS:487	Brushes, paints and varnishes (i) oval ferrule bound and (ii) round ferrule bound.
6.	IS:958	Temporary corrosion preventive grease, soft film, Cold application corrosion preventive grease, soft film, Cold application.
7.	IS:1153	Temporary corrosion preventive fluid, hard film, solvent deposited
8.	IS: 1154	Temporary corrosion prevention fluid, soft film, solvent deposited, water displacing
9.	IS 1303	Glossary of terms related to paints
10.	IS: 1477 (1)	Code of practice for painting of ferrous materials in Building pre-treatment
11.	IS 1477 (2)	Code of practice for painting of ferrous materials in Building painting.
12.	IS 1674	Temporary corrosion preventive fluid, soft film, Solvent deposited
13.	IS 2074	Ready mixed paint, air drying, red oxide-zinc Chromate, priming
14.	IS 2339	Aluminium Paint for general purpose in dual container
15.	IS 2379	Colour code for identification of pipe lines
16.	IS 9954	Pictorial Surface preparation standard for painting of steel surfaces
17.	IS: 13183	Aluminium Paint, heat Resistant specification
18.	BS 7079 (1)	Specification of rust grades and preparation grades of uncoated steel substrates and of steel substrates after removal of previous coating
19.	BS 7079 Supplement 1	Representative photographic examples of appearance imparted to steel blast cleaned with different abrasives
20.	ISO 8501-1	Preparation of steel substrates before application of paints & related products visual assessment of Surface cleanliness
21.	ASTM B 117	Practice of operating salt spray (fog) testing apparatus
22.	SSPC-Vis 1	Description of visual standards
23.	SSPC-Vis 2	Rust protection manual
25.	SSPC-SP-1	Solvent cleaning
26.	SSPC-SP-2	Hand tool cleaning
27.	SSPC-SP-3	Power tool cleaning

Sl. No.	Standard	Title
28.	SSPC-SP-4	Flame cleaning of new steel
29.	SSPC-SP-5/NACE1	White metal blast cleaning
30.	SSPC-SP-6/NACE3	Commercial blast cleaning
31.	SSPC-SP-7/NACE4	Brush off blast cleaning
31.	SSPC-SP-8	Pickling
32.	SSPC-SP-10/NACE2	Near white blast cleaning
33.	SSPC-PA-1	Shop, field and maintenance painting
34.	DIN 55928-4/ Supple. 1	Corrosion protection of steel structures by application of organic or metallic coating; preparation and testing; preparation and testing of surfaces; representative photographic examination
35.	SIS: 55900	Swedish standard for blasting

Annexure -4

Scope of Shot Blasting Contractor or Approved agency:

1) Working Shed: Party has to arrange for a covered Shed for blasting along with lighting arrangement & exhaust fan facility etc as per standard of Tata Steel. Party has to arrange for own Store facility for keeping consumables, machine spares etc.

2) Equipment: Party has to arrange all suitable equipment for shot blasting. The party who will install Roller Conveyor Automatic Blasting Machine shall get preference. However, the party can supplement using Room Plant type Conventional Manual Blasting Machine to take care of irregular jobs and in times of exigencies. All the equipment and machine need to have a full shot/ grit recovery and recycling system with in-built pollution control device. The lay-out and equipment selection will be decided in consultation with TGS designated representative.

All the consumables of Equipment (whatever applicable) and the maintenance of equipment are in the scope of Party. All machineries are to be kept in good working condition; properly calibrated and in well maintained condition so that there should not be any idling of labour. If any machine like compressor, blasting gun, material handling equipment etc. be in non operating condition for more than 24 hrs, party has to replace the same without effecting the work progress. A list containing all such equipment, tools and tackles along with process is to be submitted by the party at the time of tendering.

3) Material Handling: The structure to be shot blasted will be delivered to the party near the blasting shed. Material handling equipment along with certified riggers etc required for handling the material for shot blasting are in the scope of the party.

4) Pre-blasting Preparations: The surfaces shall be free from any foreign matter such as weld flux, residue, slivers, oil, grease, salt etc. prior to blast cleaning. Any oil and grease contamination shall be removed by solvent or alkali cleaning prior to blasting operations.

5) Blasting Media: The shot blasting has to be done using copper slag/ shots/ grits as applicable and approved by TGS. The media should be recycled such that it should ensure quality of shot blasting & minimum dust accumulation inside the blasting shed. Disposal of media is in the scope of the party. Blasting abrasives shall be dry, clean and free from contaminants which will be detrimental to the performance of the coating.

Size of abrasive particles for blast cleaning shall be such that the prepared surface profile height (anchor pattern profile) is in accordance with the requirements for the applicable coating system. The surface profile shall be graded in accordance with ISO 8503.

6) Working Hours: Party has to mobilise shift operations as per site requirement.

7) Pre-qualification of workmen and supervisory staff: All the workmen and supervisory staff have to undergo skill test conducted by TGS training Department. Only the qualified workmen and staff in Category “A” will be allowed to work inside TGS premises. All necessary cost required for the test of the work men and staffs is to be borne by the party. TGS management will not be responsible for any kind of liability of the workmen and staff who failed in the qualification test.

8) Safety: The contractor needs to meet the Tata Steel safety standard –Contractor’s Safety Management (SS/GEN/54, version-01, dated 1st June 2015 as attached).

9) Quality Assurance:

I. Manufacturer’s Test Certificate for shots/ grits shall be submitted by the party.

II. Self-inspection is to be done by the party with all quality aspects prior to offer the same to TGS QA department. Approved TGS format for inspection report is to be used.

III. Shot Blasting has to be done as per SIS-05-5900/ ISO 8501-1/ ISO 12944-4 with a degree of purity SA 2.5.

IV. Test Equipment required at Site :

- a. Surface Profile Gauge.
- b. Surface Comparator.
- c. Dust Contamination checking equipment.
- d. Compressed Air quality checking instrument.
- e. Temperature and humidity measuring instrument.

V. Inspection Document should contain reading from surface profile gauge, surface comparator for surface preparation.

VI. Calibration certificate of each test instrument from approved NABL lab must be submitted.

VII. Transfer of Identification Mark, Drawing number etc on each member correctly before painting shall be in party's scope as per TSL standard letter size.

VIII. Party should deploy NACE qualified inspector at work place.

10) Statutory Requirements: Party shall comply with all statutory requirements as per the prevailing Acts and Regulation of the Government and as laid down by TSL.

Obtaining pollution clearance certificate from Regulatory Authorities will be the responsibility of the contractor.

Scope of TGS/TSL:

1. TGS shall provide space in the Open Yard Area of Tata steel Growth Shop, Gamharia, Seraikela-Kharsawan, Jharkhand, India.
2. TGS shall provide electricity and water at one point near working area free of cost. However, distribution of the same as per requirement of the job will be in party's scope.
3. TGS shall deliver material near the blasting shed to the party. However, the material handling for further processing of blasting is in party's scope of work.
4. TGS shall arrange for the inspection of blasting as and when offered by the party.
5. TGS shall arrange for Safety training on one time basis for workmen deployed by the party for blasting work.

Annexure 5 : BINDER SPECIFICATIONS

BINDER SPECIFICATIONS.

1. Technical Requirements for Epoxy Primer cum MIO intermediate with minimum volume solid of 72 %.			
Test Type	Test Method	Specification Details	Typical Results
Cyclic Corrosion	ASTM D5894 - "Cyclic Salt Fog / UV Exposure of a Coated Metal"	1 x 125µm dft applied directly to Sa2½ blasted steel.	No blistering, rusting, cracking etc and typically <3mm rust creep at the scribe following 1600 hours exposure.
Adhesion	ASTM D4541- "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"	1 x 125µm dft applied directly to Sa2½ blasted steel.	Not less than 8 MPa when using a PAT Model GM01 hydraulic adhesion tester on 5mm thick steel.
Salt Spray	ASTM G85, Annex A5 - "Modified salt spray or Prohesion test" Spray (Fog) Apparatus"	1 x 125µm dft applied directly to Sa2½ blasted steel.	No blistering, rusting, cracking etc and typically <5mm rust creep at the scribe following 720 hours exposure.

2. Technical Requirements for PU Top Coat for Finish with minimum volume solid of 57%			
Test Type	Test Method	Specification Details	Typical Results
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion	1 x 50-75µm dft applied directly over an epoxy primer.	Not less than 10MPa (1450psi) when using a PAT Model GM01 hydraulic adhesion tester on 5mm thick steel.
Gloss	ASTM D523 - "Standard Test Method for Specular Gloss"	1 x 50-75µm dft applied directly a glass panel.	88-92% (60° geometry)
Gloss Retention	ASTM G53 - "Fluorescent UV / Condensation Type Exposure"	1 x 50-75µm dft applied directly over an aluminium Q-panel.	Typical gloss retention of 90% following 1000 hours exposure to UV - A type Fluorescent Lamps.
3. Technical requirements for Zinc Phosphate Epoxy Primer cum finish with minimum volume solid 72%			
Test Type	Test Method	Specification Details	Typical Results
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion testers	1 x 150µm dft applied directly to Sa2.5 blasted steel.	Not less than 08 MPa.
Cyclic Corrosion	ASTM D5894 - "Cyclic Salt Fog / UV Exposure of a Coated Metal"	1 x 100µm dft topcoated with 100µm dft	No blistering, rusting or cracking and typically <3.0mm rust creep at the scribe following 1600 hours exposure.
Flexibility	ASTM D522 - "Mandrel Bend Test of Attached Organic Coatings", - Cylindrical Mandrel Test	1 x 100µm dft applied directly over abraded aluminium panel.	Pass at 25mm (1 inch) cylindrical mandrel diameter - No Cracks
Salt Spray	ISO 7253 - "Resistance to neutral salt spray (fog) @ 35°C"	1 x 150µm dft applied directly to Sa2.5 blasted steel.	No film defects , and an average of 1.5mm rust creep at the scribe following 720 hours exposure.
4. Technical Specification for HR Silicone Aluminium with min Vol.Solid of 45 %			
Type	directly to Sa2.5 blasted	Specification Details	Typical Results
Adhesion	steel. adhesion" using portable adhesion testers	1 x 125µm dft applied directly to Sa2.5 blasted steel.	Not less than 3.5MPa at 400 degree centrigade.

5. Technical Specification for Zinc Rich Silicate Primer with 60% volume solid and 80% zinc content on dry film			
Test Type	Test Method	Specification Details	Typical Results
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion testers Test	1 x 75µm dft applied directly to Sa2.5 blasted steel.	Not less than 4MPa (580psi) when using a PAT Model GM01 hydraulic adhesion tester on 5mm thick steel.
Hardness	ASTM D3363 - "Film hardness by Pencil Test"	1 x 75µm dft applied directly to Sa2.5 blasted steel.	Classification H - 2H.
Impact	ASTM D2794 - "Resistance to the Effects of Rapid Deformation (Impact)"	1 x 75µm dft applied directly to Sa2.5 blasted steel.	Direct Impact Resistance - 2 Joules.
Salt Spray	ISO 7253 - "Resistance to neutral salt spray (fog) @ 35°C"	1 x 75µm dft applied directly to Sa2.5 blasted steel.	No film defects , and no rust creep at the scribe following 1500 hours exposure.

6. HB Epoxy zinc phosphate primer. Volume Solid 63%

Test Type	Test Method	Specification Details	Typical Results
Abrasion	ASTM D4060 - "Abrasion Resistance of Coatings via the Taber Abraser"	1 x 75µm dft applied directly to Sa2.5 blasted steel.	Average of 230mg weight loss per 1000 cycles using CS10 wheels and a 1Kg loading.
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion testers	1 x 75µm dft applied directly to Sa2.5 blasted steel.	Not less than 8MPa (1160psi) when using a PAT Model GM01 hydraulic adhesion tester on 5mm thick steel.

7. HB Epoxy MIO Intermediate. Volume Solid 80%

Test Type	Test Method	Specification Details	Typical Results
Abrasion	ASTM D4060 - "Abrasion Resistance of Coatings via the Taber Abraser"	1 x 200µm dft applied directly to Sa2.5 blasted steel.	Average of 173mg weight loss per 1000 cycles using CS10 wheels and a 1Kg loading.
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion testers	1 x 200µm dft topcoated with 60µm dft.	Not less than 10MPa (1450psi) when using a PAT Model GM01 hydraulic adhesion tester on 5mm thick steel.

8.High build high solid glass flake reinforced abrasion resisitant epoxy coating with min. vol. solid of 75%

Test Type	Test Method	Specification Details	Typical Results
Adhesion	ISO 4624 - "Pull-off test for adhesion" using portable adhesion testers	1 x 150µm dft applied directly to Sa2.5 blasted steel.	Not less than 17.0 MPa.
Cyclic Corrosion	ASTM D5894 - "Cyclic Salt Fog / UV Exposure of a Coated Metal"	1 x 100µm dft topcoated with 100µm dft	No blistering, rusting or cracking and typically <3.0mm rust creep at the scribe following 4000 hours exposure.
Flexibility	ASTM D522 - "Mandrel Bend Test of Attached Organic Coatings" , - Cylindrical Mandrel Test	1 x 100µm dft applied directly over abraded aluminium panel.	Pass at 25mm (1 inch) cylindrical mandrel diameter - No Cracks
Salt Spray	ISO 7253 - "Resistance to neutral salt spray (fog) @ 35°C"	1 x 150µm dft applied directly to Sa2.5 blasted steel.	No film defects , and an average of 1.5mm rust creep at the scribe following min. 3500 hours exposure.

9. Technical Specification for single pack HR Aluminium with min Vol.Solid of 45 % .			
Test Type	Test Method	Specification Details	Typical Results
Temperature Resistance			Not less than 315 degree centrigade.

- The accepted DFT should be in the range of +_ 20 % of average DFT as mentioned above when measured at any point.
- The paint manufacturer will provide 3rd party test certificate for prequalification of products.
- Manufacturer should provide NACE qualified level 2 inspectors for inspection of paint application.
 - Top coats should be supplied as per relevant IS/ RAL Shade or as per requirement.