

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

CONTENTS

<u>PARA NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.0	<u>SCOPE</u>	2
2.0	<u>APPLICABLE CODES</u>	2
3.0	<u>PRIORITY OF REQUIREMENTS</u>	3
4.0	<u>GENERAL</u>	3
5.0	<u>EQUIPMENT</u>	4
6.0	<u>SURFACE PREPARATION</u>	4
6.1	General	4
6.2	Procedure of Surface Preparation	5
7.0	<u>PAINTING</u>	6
7.1	General	6
7.2	Application of Primer	6
7.3	Application of Finishing Coats	7
8.0	<u>MATERIALS</u>	8
8.1	Types of Primers	8
8.2	Types of Finish Coats	9
8.3	Notes	9
9.0	<u>TECHNICAL SPECIFICATION</u>	9
10.0	<u>INSPECTION AND TESTING</u>	10
11.0	<u>GUARANTEE</u>	11

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

1.0 SCOPE

This specification covers the preparation of surfaces, painting, procedures and paints of structural steel surfaces of Purlins, bracing, trusses, columns, beams, non-galvanised gratings, ladders, cage ladders, platforms, hand railing etc.

2.0 APPLICABLE CODES

Note :- Wherever reference is made to IS Codes, on any page of this Technical Specification, applicable year of publication of IS Code is as stated below.

The Indian Standard codes applicable to this section shall include but not limited to the following.

IS 5-1994	:	Colours for ready mixed paints and enamels
IS 51-1979	:	Zinc Chrome for paints.
IS 57-1989	:	Red lead for paints and other purposes
IS 82-1973	:	Method of sampling and test for thinners and solvent for paints.
IS 101-1964	:	Methods of test for ready mixed paints and enamels.
IS 102-1962	:	Ready mixed paint, brushing, red lead, nonsetting - priming.
IS 104-1979	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS 354 (Part 1) to (Part 7)	:	Methods of sampling and test for resins for paints.
IS 1200 (Part 15) 1987	:	Method of measurement of building and civil engineering works : Painting, polishing, varnishing etc.
IS 1303 – 1963	:	Glossary of terms related to paints.
IS 1477 (Part 1) 1971	:	Code of Practice for painting of ferrous metals in buildings : Pretreatment
IS 1477 (Part 2) 1971	:	Code of Practice for painting of ferrous metals in buildings : Painting
IS 2074-1992	:	Ready mixed paint, air drying, red oxide - zinc chrome, priming.
IS 3537-1966	:	Ready mixed paint, finishing, interior, for general purposes to Indian Standard Colours No. 101, 216, 217, 219, 275, 281, 352, 353, 358 to 361, 364, 388, 410, 442, 628, 631, 632, 634, 693, 697, white and black.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

- IS 3539-1966 : Ready mixed paint, undercoating, for use under oil finishes to Indian Standard Colours as required.
- IS 6714-1989 : Ready mixed paint, finishing, non-slip deck.
- IS 6951-1973 : Ready mixed paint, finishing, exterior for ships.
- IS 9954-1981 : Pictorial surface preparation Standards for painting of steel surfaces.

Other applicable codes :

- SIS-05-5900-1967 : Swedish Standard – Surface preparations Standard for Painting Steel Surfaces.
- SSPC-SP : Steel Structures Painting Council USA.
(Surface Preparation Specifications)

3.0 PRIORITY OF REQUIREMENTS

In case of any variation and discrepancy in condition between the special conditions, this specification and codes, order of priority shall be as under :-

- (1) Special conditions
- (2) This specification
- (3) Codes

4.0 GENERAL

The paint manufacturer's instructions shall be followed as far as practicable at all times. Particular attention shall be paid to the following.

- (a) Proper storage to avoid exposure, as well as extremes of temperature.
- (b) Surface preparation prior to painting.
- (c) Mixing and thinning
- (d) Application of paints and the recommended limit on time intervals between coats.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

5.0 EQUIPMENT

- 5.1 All tools, brushes, rollers, spray guns, blast material, hand / power tools for cleaning and all other equipments, scaffolding materials, shot/sand blasting equipments and air compressors etc. required to be used, shall be arranged by the CONTRACTOR on site and in sufficient quantity.

These shall be suitable for the works and in good conditions.

- 5.2 Mechanical mixing shall be used for all paint mixing operations except that the Engineer-in-charge may allow the hand mixing of small quantities at his discretion.

6.0 SURFACE PREPARATION

6.1 General

- 6.1.1 In order to achieve maximum durability, one or more of following methods of surface preparation shall be followed, depending on condition of steel surface and as instructed by Engineer-in-charge. Adhesion of the paint film to surface depends largely on the degree of cleanliness of the metal surface. Proper surface preparation contributes more to the success of the paint protective system. The classification of steel surface preparation as per SSPC - Steel Structures Painting Council Manual volume 2, chapter 2 -1982 is as follows:

- (a) Manual or hand tool cleaning
- (b) Mechanical or power tool cleaning
- (c) Blast cleaning

- 6.1.2 Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained.

The minimum acceptable standard as per IS 9954, shall be as stated below.

For manual or hand tool cleaning	: St 2 as per IS-9954
For mechanical or power tool cleaning	: St 3 as per IS-9954
For blast cleaning in normal conditions	: Sa 2.5 as per SIS-05-5900
For blast cleaning in highly corrosive conditions	: Sa 3 as per SIS-05-5900

Prior to surface cleaning, all contaminants, oil, grade, etc shall be removed by use of an aromatic solvent.

- 6.1.3 Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

6.1.4 Irrespective of the method of surface preparation, the first coat of primer shall be applied by brush on dry surface. This shall be done immediately and in any case within 4 hours of cleaning of surface. However, at times of unfavourable weather conditions, the Engineer-in-charge shall have the liberty to control the time period, at his sole discretion and/or to insist on recleaning, as may be required, before primer application is taken up. In general, during unfavourable weather conditions, blasting and painting shall be avoided as far as practicable.

6.2 Procedure of Surface Preparation

6.2.1 Manual or hand tool cleaning

Hand tool cleaning normally consists of the following:

- (a) Hand descaling and/or hammering
- (b) Hand scraping
- (c) Hand wire brushing

Rust, mill scale spatters, old coatings and other foreign matter, shall be removed by hammering, scrapping tools, emery paper cleaning, wire brushing or combination of the above methods. On completion of cleaning, loose material shall be removed from the surface by clean rags and the surface shall be brushed, swept, dedusted and blown off with compressed air / steam to remove all loose matter. Finally the surface shall be washed with water and dried before application of paint.

6.2.2 Mechanical or Power Tool cleaning

Power tool cleaning shall be done by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes. Excessive burnish of surface shall be avoided, as it may reduce paint adhesion. On completion of cleaning, the detached rust mill scale etc. shall be removed by clean rags and/or washed by water or steam. The surface shall then be thoroughly dried with compressed air jet before application of paint.

6.2.3 Blast cleaning

The surface shall be blast cleaned using one of the abrasives : sand or chilled cast iron or malleable iron and steel, at pressure of 7 kg/cm^2 maintaining constant velocity and pressure. Chilled cast iron, malleable iron and steel shall be in the form of shot or grit of size not greater than 0.055" maximum. Compressed air shall be free from moisture and oil. On completion of blasting operation, the blasted surface shall be cleaned and freed from any scale or rust and shall show a grey white metallic lustre. Primer or first coat of paint shall be applied within 4 hours of surface preparation.

Blast cleaning shall not be done under the following conditions :

- (a) Outdoors in bad weather without adequate protection.
- (b) Dew on the metal, which shall be cleaned.
- (c) During humid weather condition, with humidity exceeding 85%.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

7.0 PAINTING

7.1 General

- 7.1.1 All materials shall be applied in strict accordance with the manufacturer's directions, unless otherwise noted herein or directed by the Engineer-in-charge.
- 7.1.2 Painting and finishing products for all work, except as otherwise specified, shall be the "best grade" or "first line" produced for each particular kind of material required herein.
- 7.1.3 Materials for succeeding coats on any one surface, shall be the products of the manufacturer furnishing the first or primer-sealer coat for that particular surface, except where shop primer is applied by others. All coats, however, must be compatible with prime coats.
- 7.1.4 All tools, equipment, scaffolding, staging, ladders, flooring, runways and any other temporary construction required for the safe execution of the painting work on the project shall be rigidly built, so as to support safely four times the weight of all materials, apparatus, equipment and men to be placed thereon or as required by State and Local Laws.
- 7.1.5 All work shall be performed, and all tools and equipment maintained, in such manner as to prevent any hazards that may endanger health or cause fire or injury to personnel.

7.2 Application of Primer

- 7.2.1 After completion of surface preparation and cleaning, the members shall be given a coat of primer applied thoroughly and evenly to dry surfaces, by brush, spray, roller coating, flow coating or dipping.

The method of application of Primer shall be approved by Engineer-in-Charge.

The primer coat shall be applied within 4 hours after surface preparation and shall be as per Clause 8.1 and drawings.

- 7.2.2 Following surfaces shall not to be painted in the shop:

- (a) Surfaces to be embedded in concrete.
- (b) Contact surfaces of friction joints.
- (c) Surfaces within 50 mm of any field weld location.
- (d) Closed internal surfaces of members forming perfect airtight spaces.
- (e) Parts specified in the drawings to be such.
- (f) Welds and adjacent parent metal shall not be painted prior to deslagging, inspection and approval by the Engineer-in-Charge.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

7.2.3 Inaccessible parts

Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint. This does not apply to the interior of sealed hollow sections.

7.2.4 Finished Surfaces

Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating, that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

7.2.5 Rub down and touch up of primer

The shop coated surfaces shall be rubbed down thoroughly with emery / abrasive paper to remove dust, rust, other foreign matters and degreased using white spirit and then cleaned with warm fresh water and air dried. The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry before giving one coat of an anti corrosive primer. The compatibility between shop coat and primer should be ascertained from paint manufacturer. In case degreasing with white spirit is not effective, the surface should be finally wiped clean with an aromatic solvent like xylol or light naphtha.

7.2.6 Non-compatible shop coat primer

The compatibility of finishing coat should be confirmed from the paint manufacturer. In the event of use of primer such as Zinc Rich epoxy, inorganic Zinc Silicate etc. as shop coat, the paint system shall depend on condition of shop coat. If the shop coat is in satisfactory condition, showing no major defects, the shop coat shall not be removed. The touch up primer and finishing coat(s) shall be identified for application by Engineer-in-charge.

7.2.7 Shop primed surfaces shall only be spot cleaned, in damaged areas by means of power tool brush cleaning or hand tool cleaning.

Surfaces shall then be spot primed before applying one coat of field primer unless otherwise specified.

If shop primer is not compatible with field primer, then the shop coated primer shall be completely removed before application of selected paint system for particular environment.

7.3 Application of Finishing Coats

7.3.1 Selection of finishing coat material shall be generally in accordance with Clause 8.2 and as specified in drawing or as directed by Engineer-in-charge.

7.3.2 All shop primed or painted metal surfaces shall be inspected prior to field painting. Surfaces that are scratched, marred, rusty or show other defects in the prime or paint film shall be repaired as follows :

- (a) Thoroughly clean shop coated metal surfaces of all dirt, oil, grease, etc. by wiping with rags, by dipping in suitable solvents, by sanding, or with power tools.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

- (b) Areas where interruptions in the prime-coat film occur or where field weld, fumes or spatter contaminate metal, shall be sanded.
- (c) All cleaned areas shall be re-primed and repainted with the same type and thickness of paint as used in the shop.

- 7.3.3 Painting shall not be done during rainy, damp, frosty or foggy weather. Painting shall not be done if the temperature is below 40°F or above 90°F or expected to change more than 20 degrees, unless permission is obtained from the Engineer-in-Charge. Application of paints and coating shall be avoided in cases, when the surface is damp or the humidity is high enough to cause moisture condensation on the surfaces or when winds are of such velocity so as to blow dust and dirt into the paint film.
- 7.3.4 The CONTRACTOR shall carry out painting work in all respects, with the best quality of approved material and workmanship in accordance with the best Engineering Practice.
- 7.3.5 All paint materials shall be examined and approved by Engineer-in-Charge before using. All paint materials shall be thoroughly mixed. Paint shall be thinned only when absolutely necessary and only immediately prior to application. Thinners and additions to ready-mixed materials shall be added only in accordance with the manufacturer's printed instructions.
- 7.3.6 All coats of paint shall be applied by brush, spray or roller. This shall be in agreement with the paint manufacturer's method of application and with local labour practices, unless otherwise stated herein. Painting shall be done in a manner so as to ensure an even integral coating of uniform thickness. Painting shall be without lifting or wrinkling of previous coats nor showing runs, sags, crawls or other defects.
- 7.3.7 Where two or more coats are specified, sufficient time shall be allowed between coats to permit hard drying. A minimum of 24 hours between applications on any one surface shall be allowed, unless otherwise specified by the manufacturer. However, each coat shall follow the preceding coat within two weeks. Each coat of paint shall have a slight variation in color to distinguish it from the preceding coat.

8.0 MATERIALS

8.1 Types of Primers

8.1.1 Primer (P-1)

Red oxide Zinc Chromate Primer

Type	Single pack
Composition	Modified phenolic alkyd pigmented with red oxide and zinc chromate
DFT	25 microns/coat (min)

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

8.1.2 Primer (P-2)

High build zinc phosphate primer

Type	Single pack
Composition	Chlorinated rubber medium pigmented with zinc phosphate
DFT	50 microns/coat (min)

8.2 Types of Finish Coats

8.2.1 Finish Coats (F-1)

Epoxy base paint

Type	Two pack, cold cured
Composition	Polyamide cured Micaceous - Iron Oxide. Pigmented Epoxy resin
DFT	75 microns/coat (min)

8.3 Notes

- 8.3.1 All primers and finish coats should be cold cured and air dried unless otherwise specified.
- 8.3.2 Technical data sheets for all paints shall be supplied at the time of submission of quotations.
- 8.3.3 All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship should be ensured.
- 8.3.4 Upon completion of all painting work all surplus material, empty containers, rags, dirt, and other debris resulting from this work, shall be removed from the premises. Daubs or spatters of paint or varnish on all walls, floors, hardware and other adjacent surfaces shall be removed.

9. **Technical Specifications -**

9.1. **Technical Specifications of Primer.**

- (1) Coverage : As per manufacturer's specification.
- (2) Dry time : Set-to-touch; 3 hrs hard dry; 10 hrs.

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

- (3) Nos. of Primer coats : 1 (Zinc chromate Primer – P1).
- (4) Nos. of coats Enamel coats: 2 (High build zinc phosphate primer – P2)

9.2. Technical Specifications of Final Coating.

- 1 All three coats including finish coat as per IS 1477 (Part I & II) and IS 8629.
- 2 Consumption rate To be as per relevant IS Code and Manufacturer's Instructions.
- 3. Time interval between each coat : not less than 18 hr.
- 4. No of coats : 3
- 5. Mix Proportion of thinner : 5-10% or as specified by Manufacturer.
- 6.
 - (1) Painting work shall not be carried out on wet surfaces. The surface to be painted shall be completely dry. Paints shall be sufficiently agitated to obtain uniform mix at regular time interval while painting.
 - (2) Any excess paint dripping on the surface shall be removed while still in wet condition.
 - (3) Time interval between undercoat and final finish coat not less then 18 hours.
 - (4) Brush or roller marks shall not be visible on final painted surface.
- 7. Shade - As per Colour Code indicated in Drawings, Specification or data sheet.

10.0 INSPECTION AND TESTING

- 10.1 All painting materials including primers and thinners brought to site by CONTRACTOR for application, shall be procured from reputed manufacturers as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates shall not be accepted.
- 10.2 Engineer-in-Charge at his discretion, may call for additional tests for paint formulation. The CONTRACTOR shall arrange to have such tests performed including batchwise test of wet paints for physical and chemical analysis. All costs shall be borne by the CONTRACTOR.
- 10.3 The painting work shall be subject to inspection by Engineer-in-charge at all times. In particular, following stagewise inspection shall be performed. The CONTRACTOR shall offer the work for inspection and approval at every stage before proceeding with the next stage. The record of inspection shall be maintained. Stages of inspection are as follows:
 - (a) Surface preparation
 - (b) Primer application
 - (c) Each coat of paint

AXIS CONSULTANTS

<u>STANDARD CIVIL ENGINEERING SPECIFICATION</u>		
ISSUED: 15-09-2012	GENERAL STEEL SPECIFICATION	REV. - 0

In addition to above, record should include type of shop primer already applied to structure.

- 10.4 Any defect noticed during the various stages of inspection shall be rectified by the CONTRACTOR to the entire satisfaction of Engineer-in-charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, CONTRACTOR shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period as defined in general conditions of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to OWNER/TEIL. The extra coat should have prior approval of Engineer-in-Charge.
- 10.5 After surface preparation, the primer should be applied to cover the crevices, corners, sharp edges etc. in the presence of Engineer-in-Charge.
- 10.6 The shades of successive coats, should be slightly different in colour in order to ensure application of individual coats. The thickness of each coat and complete coverage should be checked as per provision of this specification. This should be approved by Engineer-in-charge before application of successive coats.
- 10.7 The CONTRACTOR shall provide thickness-measuring instrument (ELCOMETER) with appropriate range(s) for measuring dry film thickness of each coat.
- 10.8 At the discretion of Engineer-in-charge, the CONTRACTOR shall arrange to provide from the paint manufacturer, the expert technical service at site as and when required. This service should be free of cost and without any obligation to the OWNER/TEIL, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out to their recommendations.
- 10.9 Final inspection shall include measurement of paint dry film thickness, Adhesion, check of finish and workmanship. The thickness shall be measured at as many points/locations as decided by Engineer-in-charge and shall be within +/- 10% of the dry film thickness specified in this specification.
- 10.10 The CONTRACTOR shall arrange for spot checking of paint materials for specific gravity, flow time and spreading rate.
- 11.0 GUARANTEE**
The CONTRACTOR shall guarantee that the chemical and physical properties of materials used are in accordance with the specifications contained herein to be provided during execution of work.