

ST 16 MM0004 Technical Specification for Surface Treatment and Painting Metallic Surfaces

	Date/Author	Date/Checked	Date/Approved	Date/Issued	Notes
Orig	28 September 2022 S. Aikio	28 September 2022 N. Panttila	28 September 2022 L. Castrén	28 September 2022 S. Aikio	Final issue
Rev	Date/Author	Date/Checked	Date/Approved	Date/Issued	Notes

Contents

1	General.....	3
2	Reference Standards.....	3
3	Surface preparation	5
3.1	Shop Primer Treatment.....	5
4	Painting systems and coat thickness.....	6
4.1	Painting method and work.....	6
4.2	Preparations prior to Application.....	7
4.3	Painting Specification.....	7
4.4	Supply and Storage / Health and Safety	7
5	Touch-up paint.....	7
6	Hot dip galvanizing and painting of galvanized surfaces.....	8
7	Quality control, inspections, and work acceptance	8
7.1	Repair Works.....	9
7.2	Quality Control Book.....	9
8	Guarantee	10

Appendices

Appendix I – Painting Systems

Appendix II – Painting Work Inspection Report

Appendix III – Blasting Work Inspection Report

1 General

This specification presents standards and principles to be used for painting of metallic surfaces, and shall be applied for all constructions, tanks, piping, equipment and other metallic surfaces unless specifically ruled out by this document. The base line for this technical specification is the EN ISO 12944.

This specification is not applied to serial produced items, unless specified in the enquiry documents.

Local regulations concerning health and safety and environment protection shall be followed for painting on site.

This specification shall be followed if not otherwise agreed in the purchase contract or its technical part.

The following object surfaces shall not be painted unless required by safety regulations or architectural design:

- Tanks, pipes etc. made of stainless steel
- Structural steel embedded in concrete, the painted surface of steel partially embedded in concrete shall extend 50 mm inside the concrete
- Brass, bronze, copper and plastic surfaces, if they do not require additional corrosion protection in the environment they are used in
- Galvanized parts, unless required by notice colours or architectural design, or if separately agreed to in extremely corrosive environments (see section 6)
- Separately agreed series-produced products (such as electric motors, electric cabinets, valves, actuators etc) shall be delivered painted in accordance with the manufacturers painting system.

Aluminum and galvanized surfaces embedded in concrete should be protected with bituminous material, length 50mm below and above surface.

In an interface between painted surfaces and non-painted surface, the surface preparation and painting shall extend 50 mm over the non-painted surface.

Bolts, nuts washers and other fixing accessories should be galvanized unless they are made of stainless steel or otherwise required in specifications MM0001, Technical Specification for Piping, or MM0002, Piping standard.

2 Reference Standards

ST 04 MG0001	General Mill Standard
ST 04 MG0002	Units to be used
ST 13 MM0001	Technical Specification for Piping
ST 13 MM0002	Piping standard
EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
EN ISO 2808	Paints and varnishes. Determination of film thickness

EN ISO 4628-3	Paints and varnishes. Evaluation of degradation of coatings. Designation of quantity and size of defects, and of intensity of uniform changes in appearance. Part 3: Assessment of degree of rusting
EN ISO 8501-1	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
EN ISO 8501-2	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 2: preparation grades of previously coated steel substrates after localized removal of previous coatings
EN ISO 8501-3	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 3: Preparation grades of welds, edges and other areas with surface imperfections
EN ISO 8502-3	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness. Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
EN ISO 8502-6	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness. Part 6: Extraction of water soluble contaminants for analysis (Bresle method)
EN ISO 8502-9	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness. Part 9: Field method for the conductometric determination of water-soluble salts
EN ISO 12944	Paints and varnishes. Corrosion protection of steel structures by protective paint systems
EN ISO 16276-1	Corrosion protection of steel structures by protective paint systems. Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating. Part 1: Pull-off testing
EN ISO 16276-2	Corrosion protection of steel structures by protective paint systems. Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating. Part 2: Cross-cut testing and X-cut testing
EN ISO 29601	Paints and varnishes. Corrosion protection by protective paint systems. Assessment of porosity in a dry film
ISO 19840	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces

3 Surface preparation

All surface preparation is to be done according to EN ISO 12944-4.

Part of the structures may need to be painted on installation site. At least pre-treatment and pre-painting with workshop primer shall be done in the paint shop to prevent corrosion during manufacturing, transportation and storage.

Surface cleanliness shall be ensured prior to further treatment. Water-soluble and solid impurities and greases shall be removed from the surface. Sharp edges shall be rounded to prevent discontinuities and voids in paint surface.

Solid impurities, such as concrete and paint residues and weld spatter shall be removed by scraping, brushing or grinding.

Water-soluble impurities, such as salts, shall be removed by washing and brushing with water, high-pressure water, or by steam. EN ISO 8502-6 or EN ISO 8502-9 testing shall be performed when separately agreed.

Greases and oils shall be removed by alkaline, emulsion or solvent washing. Solvent washing is recommended. Chemicals used for oil removing shall be thoroughly rinsed off the treatable surface.

Surface preparation of carbon steel, low alloy steels and cast iron shall be carried out in accordance with EN ISO 12944-4, and fulfil the following:

- Pre-treatment level of imperfections and welds according to EN ISO 8501-3 P2, but also edges shall be rounded to 2 mm radius
- Preparation grade of uncoated surfaces shall be assessed visually applying pictures in standard EN ISO 8501-1 (or EN ISO 8501-2 as applicable)
- Degree of cleaning at least Sa 2½
 - Surface roughness shall be "medium"
 - Surface roughness shall be verified with a profile meter.
 - Blasting of carbon steels shall be performed with steel particles.
 - Cleanliness of the blasting medium shall be monitored (grease and salts).
 - Special attention shall be paid to blast cleaning of welds and smoothness of welds.
- Chemical de-rusting methods shall not be used.
- Dust and residues caused by cleaning shall be removed before applying the primer. Pre-treatment level shall be assessed after blasting in accordance with EN ISO 8502-3.

With approval from the Purchaser, thin plates can be treated by water blast-cleaning with immediate drying, or by mechanical cleaning to grade St 2 of EN ISO 8501-1.

Hot-dip galvanized surfaces shall be roughened by sweep blast-cleaning before painting, if e.g. notification colours are required.

Pneumatic cleaning, e.g. sand blasting, should be done with: dry air without moisture and oil, dry abrasive material, relative air humidity below 80 %, pneumatic air temp. above 5° C.

Equipment on the work location that is not being painted, shall be protected from the abrasives or paint.

3.1 Shop Primer Treatment

Priming shall be made immediately after blasting in accordance with the standard EN ISO 12944-5, Annex F. No corrosion products shall have formed before the painting, or the

cleaning shall be repeated. Under no circumstances should the blast cleaned steel be left unpainted for more than 4 hours.

Selection of the shop primer shall be made considering suitability for the painting system to be applied over it, properties required for the shop primer (see EN ISO 12944-5, Annex F) and loading during the protection time. The shop primer shall be epoxy based unless otherwise agreed in writing.

When choosing the shop primer, the final painting system and the wear of the primer protection shall be considered. If the shop primer does not match with painting system it must be removed thoroughly before final painting and the surface treated to the required grade.

Uniform, stationary shop primer surfaces shall be roughened by blasting before painting.

4 Painting systems and coat thickness

Painting system specifies priming and top coats, amount of layers, and nominal dry film thicknesses. The painting system shall be chosen according to Appendix 1.

The painting systems have been selected applying EN ISO 12944-5 corrosivity categories.

The Supplier's choice of paint suppliers shall be subject to approval by the Purchaser.

Spray can painting shall be subject to approval by Purchaser and can only be used in complicated geometries where specified dry film thickness cannot otherwise be guaranteed.

Paint manufacturer's instructions shall always be followed.

4.1 Painting method and work

Relative humidity and temperature limits given by the paint manufacturer shall be followed. The painting conditions shall be arranged so that they meet requirements of both this specification and instructions of the paint manufacturer.

In general, no painting shall be done:

- At temperature below 5 °C
- When the relative humidity is higher than 80 % RH
- When the metal surface temperature is less than 3 °C above the dew point of the air
- Surface temperature above 40 °C , or if surface temperature exceeds selected paint system preconditions.

Two-pack paints shall generally not be applied at temperatures below 10 °C unless otherwise recommended by the paint manufacturer.

If there is any dirt, grease, oil, salts or other impurities between painting of the layers, they shall be removed by a suitable emulsifying agent and fresh water, or by steam cleaning.

If the corrosivity category has been defined as C4 or higher, reinforcement painting shall be applied on 25 mm to both directions of the edges.

Painting work shall be performed by professional personnel. The Purchaser has the right to evaluate the personnel's skill and restrict their contribution to the work if necessary. Proper tools recommended for the painting system by the paint manufacturer shall be used.

The Purchaser has the right to make quality and other supervision at scope of their own judgment. Any supervision performed by the Purchaser does not relieve the Supplier of their responsibilities.

4.2 Preparations prior to Application

A power mixer shall be used to stir the paint properly before application. Special care must be taken to ensure sufficient mixing of two-pack coatings and to follow directions for mixing ratio (paint/hardener) given by the manufacturer.

Diluents and/or other additives shall be of type directed by the paint manufacturer.

4.3 Painting Specification

The person doing the painting work shall have the painting specification which contains at least following information:

- paints in painting system listed in the application order with dry film thicknesses
- specification of paints in accordance with this specification
- total dry film thickness
- number of layers
- application area for the painting system
- base and surface preparation
- painting work instructions
- painting condition limits
- technical information on paints

The information shall be delivered to the supervisor.

4.4 Supply and Storage / Health and Safety

All paints, diluents and additives shall be supplied by the paint manufacturer in original and unopened tins carrying the label and instructions of the paint manufacturer.

All necessary and possible precautions shall be taken to avoid health and fire / explosion risks during storage, handling and application of paint.

Precautions and directions to avoid such risks shall be part of the label wording, and in accordance with valid, national regulations.

All paints and diluents shall be stored as recommended by the manufacturer.

5 Touch-up paint

Touch-up paint is the responsibility of the Supplier until hand over. If the piping is painted, the welds shall be touch-up painted locally after welding. The touch-up painting system shall match the painting system of the surrounding surfaces.

Before touch-up painting, the requirements for surface treatment in section 1 applies. Requirements of section 2 applies also to touch-up painting.

The area between prepared surface and the uniform painted surface shall be bevelled. Corroded points shall be prepared to the required surface preparation grade on so wide area that the primer at the edge of the touch-up painting area is well attached to the surface.

The touch-up area shall be isolated if needed to protect the surfaces during drying.

Touch-up painting shall be done with the original painting system up to the full film thickness following the boundaries of different paint layers.

Touch-up painting of galvanized surfaces shall be performed with zinc rich paint and coating thickness should comply to the original galvanization thickness.

6 Hot dip galvanizing and painting of galvanized surfaces

Hot dip galvanizing shall meet the standard EN ISO 1461. The thicknesses are presented in Table 1.

Table 1. Layer thickness of the hot dip galvanizing (informative based on EN ISO 1461).

Article and thickness	Local coating thickness (min. μm)	Mean coating thickness (min. μm)
Steel < 6 mm	70	85
Steel > 3 mm to \leq 6 mm	55	70
Steel \geq 1,5 mm to \leq 3mm	45	55
Steel < 1,5 mm	35	45
Castings \geq 6 mm	70	80
Castings < 6 mm	60	70

In extremely corrosive conditions (e.g. constantly wet areas and areas with high chemical load), a minimum of 140 μm coating thickness shall be applied instead of thicknesses in Table 1, or material changed to adequately corrosion resistant alloy. Painting (painting system according to Appendix 1) can be applied instead of thicker layer or material change only if separately agreed with the Purchaser.

7 Quality control, inspections, and work acceptance

The Supplier is responsible for the quality control of the work. The Purchaser entitled supervisor may at any time request to perform an inspection where all quality records shall be available, such as workshop environment Relative Humidity, dry and metallic surface temperature and Dew Point, along all the period necessary to carry out the painting, according to paint supplier instructions. The Purchaser reserves the right to perform additional inspections to the agreed inspection scope.

Standard EN ISO 12944-7 and instructions in the painting specification shall be followed. Painting work and inspection results shall be reported on supervision report template in Appendix 2 and surface preparation on template in Appendix 3.

The Purchaser will survey the work during the surface treatment of steel structures. The painting work shall be finally accepted during the handover of the purchase.

The quality control of surface preparation, painting work, inspection and their frequencies shall be agreed on separately. An inspection and testing plan (ITP) shall be delivered to the Purchaser before start of the work. All tests shall be included in the ITP.

Dry Film Thickness shall be monitored and compared against nominal dry film thicknesses (NDFT).

- The dry film thickness requirement is fulfilled when in the film thickness measurement at maximum 5 % of the measurement areas go under the nominal dry film thickness.
- The individual measurement area may go under the nominal dry film thickness at maximum 20 %. The maximum values shall be assessed for each layer separately.
- The maximum dry film thickness must not exceed the value given by the paint manufacturer. At maximum double the nominal dry film thickness can be accepted locally.

- Individual dry film thicknesses which go under the nominal dry film thickness more than 20 % are not accepted.
- The standard EN ISO 2808 and the measurement instrument manufacturer's instructions shall be applied in the film thickness measurement for smooth surfaces and methods and instructions of ISO 19840 on rough surfaces.
- Film thickness meter shall be calibrated according to manufacturer's instructions.
- The measurement scope shall be specified in the painting specification, however at least two measurement areas per square meter.
- When performing the measurements special attention shall be paid to sharp edges, welds and other discontinuities.

The following tests shall be performed with separately agreed scope:

- Low or high voltage porosity tests according to EN ISO 29601
- Adhesion tests by destructive methods according to EN ISO 16276-1 and EN ISO 16276-2

The measurements of relative humidity, air temperature/surface temperature and dew point conditions shall be done at least on start of shift and whenever conditions change significantly. The results shall be reported as part of the Quality Book.

7.1 Repair Works

Repairs in this section are related to efforts needed to correct the painting surface after non-acceptable inspection. All noticed defects shall be repaired before application of the next coat. The repairs shall be performed by removing the paint from the defect and surrounding area (at least 5 cm to each direction with bevelled edges of the paint). The painting system shall be equal to the surrounding painting system, and rules of the section 5 shall be followed. The repair method for inadequate NDFT can be an additional paint layer with the surface coat. The top layer needs to be clean before painting, and the paint manufacturer's instructions shall be followed.

7.2 Quality Control Book

All testing shall be reported in the Quality Control Book. The book shall contain at least:

- List of painted areas / components
- Painting systems including surface preparation
- Painting specifications
- Product certificates
- Quality plan
- Paint manufacturer datasheets, instructions and manuals
- RAL codes and colours of all layers
- Qualifications and certifications
 - Separate list of inspectors be included, linked to inspectors in Appendix 2
- Inspection and testing plans (ITP)
- Inspection reports and quality control documentation
 - Visual inspection reports
 - Painting and blasting inspection reports (templates in Appendix 2 and 3)
 - NDFT measurement procedure
 - NDFT measurement reports including acceptance criteria
 - Paint adhesion test procedures
 - Paint adhesion test reports
 - Other testing reports and procedures

- Relative humidity, air temperature/surface temperature, and dew point measurement reports
- Conformity certificate of the paint
- Conformity certificate for the painting work

8 Guarantee

Guarantee period is at least four (4) years starting from the acceptance, if not otherwise agreed.

At the end of the guarantee period the rusting grade of the painted surface shall be at maximum Ri 2 according to classification in EN ISO 4628-3 standard.