STEEL BRIDGES – SURFACE PROTECTION – GWS

TENDER

DECEMBER 2018

DISCLAIMER

The translation into English of Road Standards (Vejregler) and Tender Specifications is to be regarded entirely as a service. In the event of any discrepancy or shortcomings in the translation, the Danish version will prevail. At any time the Danish versions of Road Standards (Vejregler) and Tender Specifications are those in force.

VEJREGLER

TABLE OF CONTENTS

1 GENERAL

This “General Work Specification (GWS), Steel bridges - Structural Steel Work” deals with surface protection of outdoor steel structures – both workshops and site works.

1.1 References

The following standards (including amendment sheets) as well as the reference documents cited in the standards apply to the extent that these provisions do not replace corresponding provisions in the standards, and if they are relevant to the current specification:

DS/EN ISO 12944	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1-9
DS/EN 1090-2	Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures - Section 10, including Annex F.
DS/EN ISO 2063	Thermal spraying - Zinc, aluminium and their alloys – part 1-2
DS/EN ISO 1461	Hot dip galvanised coatings on fabricated iron and steel items - Specifications and test methods.

For new structures delivered in compliance with DS/EN 1090-1, the surface treatment shall be declared on the structure’s CE-marking and performance declaration.

Standard texts, including national annexes, shall be regarded as requirements. This means that "should be" in the text shall be understood as "shall", and annexes in the standards apply as code of practice, even if they are termed as "guidelines".

Codes of practice, standards and recommendations specified in the description as applicable to the work or parts thereof are listed in SWS Surface Protection, Appendix 1. In the subsequent work specification, references to DS/EN ISO 12944-X are stated as "12944-X". During the defects liability period, the Contractor shall remedy all defects to ensure that requirements for surface protection in item 4.6 have been met during and at the end of the defects liability period.

Please note that distinct Danish rules, executive orders and guidelines exist which are pertinent for surface protection. Including

- Executive order on work with substances and materials, no. 1793 of 18 December 2015
- Executive order on work with item numbered products , no. 302 of 13 May 1993

1.2 Quality Management

1.2.1 General

Before the work commences, the Contractor shall prepare a quality plan. The plan shall be prepared in accordance with DS/EN 1090-2, item 4.2.2 and subsequent provisions in this GWS and related SWS. Reference is also made to GWS and SWS Management and cooperation.

Normal milestones/frequencies of when and to which extent documentation shall be submitted to the Employer, shall appear from the control plan including references to the relevant items in the present work specification and the related standards.

1.2.2 Qualification requirements

The work shall be carried out by personnel who have passed adult vocational training courses or equivalent in the relevant work operations. Foremen shall have completed "Industrial surface protection" or be able to document equivalent experience.

It is a requirement that both the person responsible for quality assurance and the inspector have detailed knowledge to pre-treatment and application processes, materials and material properties and that they are capable of assessing completed work. The quality manager or his inspector shall be FROSIO certified or similar qualifications.

The Contractor shall submit documentation in the form of updated references/CVs/course certificates for key staff as specified above, and employees for whom special requirements apply with respect to training/experience.

1.3 Working Scope

The work comprises surface protection of steel structures to the extent specified in SWS Steel bridges - Surface Protection.

The corrosion load is defined in DS/EN ISO 12944-2 as environments and has been specified in SWS for the current structure. Coating systems shall be carried out with “very high” (VH) protection durability, cf. DS/EN ISO 12944-1.

The work also covers preparation of project for and delivery, erection and dismantling of scaffolding to be used for surface protection of the structures. Scaffolding shall be designed so as to absorb actions , e.g. loads from accumulated sandblasting material wind action, wind action on covers, equipment and materials etc. The Employer is entitled to demand presentation of the drawings and calculations of the projected scaffolding structures prior to execution. Reference is made to SWS - Steel Bridges - Surface Protection.

Temporary steel structures shall be surface dressed to prevent discolouration from rust on permanent structures.

After assembly, stainless steel or hot-dip galvanised bolting assemblies shall not be coated, unless stated otherwise in the GWS Steel bridges - Surface Protection – however, any mounting damage on coated surfaces shall be repaired. Any final surface protection of mounting bolts may only take place when the tightening of the bolts has been checked and accepted by the Employer.

For non-friction type connections (= tightened), surface protection on contact surfaces shall be corrosion protected by metal spraying an aluminium or zinc-based product or a zinc-rich primer to a NTFT between 100 and 75µm before mounting.

Where stainless steel has been welded together with steel, corrosion protection shall continue at least 20mm on the stainless steel measured from the weld seam.

Surfaces in contact with concrete, including embedded parts and composite structures, shall be sprayed with ZnAl15 in compliance with DS/EN ISO 2063 to obtain a minimum of 50mm finish coating for non-coated surfaces. However, this does not apply to hot-dip galvanized items or stainless steel.

Visible surfaces of corrosion-resisting steel shall be sand blasted to ensure uniform weathering.

2 MATERIALS

2.1 General

The contractor shall inform which principle system(s) is provided by referring to system number in 12944-5, Annexes C, D or E. However, alkyd-systems shall not be used for corrosion protection of steel structures.

A specific system shall be characterised by using its very system number designation in the corrosion category concerned, and specifying the individual layers with the Coating Supplier's product designation and total minimum film thickness.

The proposed systems are presented by completing a form corresponding to Annex F in 12944-8 (for new protection) or Annex G in 12944-8 (for maintenance). All coating products of a coating system shall be delivered by the same supplier

Data sheets on the applied coating products shall be submitted to the Employer.

2.2 Paint

Addendum to 12944-5
Minimum layers of coating (MNOC in 12944-5, Annex A) apply without including the top coat.

The proposed coating systems shall have been used for comparable projects for at least five years with satisfactory results. Reference list shall be submitted to the Employer for acceptance. If no satisfactory list of references can be provided for the product, the Employer may reserve the right to make additional warranty requirements and potential requirements for pre-testing.

The individual coats of primer and middle-coat – including stripe coats – shall have a clear difference in colour. The colour of the final coat is specified by the Employer.

If, during storage, the coating has hardened it will become grainy or deteriorated in any way and it shall not be applied.

2.3 Metallic coatings

Zinc, aluminium or zinc-aluminium alloys shall be used for metallic coatings, cf. DS/EN ISO 2063. Unless otherwise specified, ZnAl15 shall be used.

Friction joins shall be sprayed in compliance with DS/EN 1090-2 item 8.4 to min. Al 50 and max. Al 80, cf. DS/EN ISO 2063-1.

3 EXECUTION

3.1 General

Addendum to 12944-7, item 4.1
The Contractor shall prepare and submit descriptions of method as well as execution and control records to the Employer before work commences.

The work shall be organised as to ensure that as much as possible of the work is carried out at the workshop.

Addendum to 12944-7, item 5.2
During paint works at the work site, the Contractor shall ensure that all products are stored as prescribed by the local fire authorities.

Addendum to 12944-7, item 6.2
Programme for planned weather precautions and measures to protect against contamination of the surroundings (including any traffic) from spillage of coating, spray dust or the like shall be submitted to the Employer well before work commences.

During work that follows mounting, careful covering of adjacent structural elements shall be ensured to protect against drops and splashing. If, despite these measures, adjacent structural elements are still contaminated, the Contractor shall clean such elements.

3.2 Surface protection specification

The surface protection specification shall be prepared by the Contractor and be coordinated with the coating supplier and shall be submitted to the Employer before work commences.

As a basis for the preparation of a surface protection specification, the Contractor shall apply the Quality Control Requirements and the process diagrams in DS/EN ISO 12944-8, Annexes C and D or a more detailed specification.

A surface protection specification shall be prepared for each individual system – including coating on hot-dip galvanising, metal spraying, stainless steel and similar, as well as for repair of the individual systems.

The surface protection specification for the protection systems shall, as a minimum, include the below mentioned, in that the individual activities should be described with reference to the relevant item in 12944. The surface protection specification shall be structured according to the principle illustrated in 12944-8, Annexes F and G; however, all of the following information shall be included:

Pretreatment method and means, 12944-4:
- Degreasing method, item 6.2
- Cleaning method and agent, item 6.3
- Grade and roughness of pre-treatment, items 7 and 8

Paint system: 12944-5

Application method and equipment: 12944-7, item 6.3

Application conditions (climate during execution): 12944-7, item 6.2

Reparation procedures for each system as well as overlap requirements between the individual layers

Special safety regulations, including requirements from local and national authorities.

Measures to observe regulatory requirements raised together with the issuing of work permit (copy of work permit) to be appended to the tender documents.

3.3 Preparation methods

3.3.1 Requirements - Steel Substrates

Addendum to 12944-7, item 4.2
Incoming inspection of the steel shall be done by the inspection performed by the Contractor on steelworks and the Contractor on surface protection works, and which the Employer shall, well in advance, be notified of and be entitled to take part in. After sand blasting the inspection shall be repeated by the one in charge of surface protection.

It shall be checked that the steel used does not exceed rust grade C (cf. DS/EN ISO 85011).

It shall be checked that steel substrates – regardless of whether it is construction or maintenance – are pre-treated to the following preparation grades according to DS/ISO 8501-3:

- Welds: P3
- Edges: P3
- Substrates: P3.

For elements delivered for assembling/mounting with surface protection, it shall be checked by random sampling that the required film thickness is present. By means of inspection, it shall be ensured that the surface protection is intact all over.

If the inspection finds any errors to be remedied, the inspection shall be repeated after the errors have been remedied.

3.3.2 Cleaning

Reference is made to 12944-4
Before sand blasting, the steel substrates shall be free from oil, grease, salts and other impurities

The method applied shall be one or more of the ones stated in 12944-4, item 6.2.1, 6.2.3 or 6.2.4. If cleaning is performed in one operation, this shall be done as a combination of the methods specified in items 6.2.1 and 6.2.3 by using high-pressure hot water. Tap water shall be used for the final cleaning.

Weld seams, where covered electrodes are used, shall be checked for alkaline deposits after the required cleaning. If pH is greater than nine, measured directly on the contaminated surface, cleaning shall be done according to a method which has been accepted by the paint supplier. At least one test shall be carried out per welding method per control area. For each seam, pH shall be checked with pH paper, cf. Appendix 2, both at start up and completion along and across the weld seam. If cleaning proves necessary, the entire control area shall be cleaned.

Regardless of the agents used, the surfaces shall be given a final cleaning of all harmful residues by rinsing with clean water.

3.3.3 Mechanical Cleaning

Mechanical cleaning shall be executed as dry impulse blasting pursuant to 12944-4, item 6.3.3.1.2.

Grit blasting compounds and their use shall be in accordance with the requirements of DS/EN ISO 8504-2.

Grit blasting compounds shall be of the type G (grit = sharp-edged, irregular grains) or C (cylindrical sharp-edged grains) and result in a roughness and preparation grade corresponding to primer requirements as stated in the surface protection specification. Contractor's proposal shall be approved by the paint supplier.

Contact surfaces, which are included in friction-grip joints, shall be covered with tape to avoid contamination during coating.

Areas for subsequent welding shall be covered up to 150 mm on each side towards the weld. The covering shall be made with tape or similar, which shall only be removed during welding. However, covering is not necessary when weldable shop primer is applied.

Addendum to 12944-4, item 6.3.3.4.1
If flicking is used, the Contractor shall prepare a description of method, including all parameters and a test area shall be carried out in the presence of the Employer.

Addendum to 12944-4, item 6.3.3.4.2
If spot blasting is used (e.g. at repairs), the area between the cleaned area and the intact coating layer shall be polished and levelled. Working procedures relating to this shall be included in the surface protection specification, and a test area shall be carried out under the supervision of the Employer.

Addendum to 12944-4, item 7
Any mounting welds shall be pre-treated in the same way as the structure in general.

3.3.4 Cleaning with machine tools

Cleaning with machine tools (grinding) may only be done on weld seams, and where abrasive blast-cleaning is not possible (areas with difficult access, spot repairs, etc.).

Cleaning with machine tools shall be carried out in accordance with DS/EN ISO 8504-3, and manual equipment shall not be used. This work shall be completed with grinding to a roughness N10 according to Rugo-test No. 2 or a similar ISO comparator.

3.4 Paint

Coating works shall be carried out according to the prepared surface protection specification, see item 3.2).

Addendum to 12944-4, item 7.4
Shop primer shall be removed completely prior to application of primer.

Addendum to 12944-7, items 6.1 and 6.3.3
The first coat of primer shall be applied by spraying. Then, subsequent stripe coating shall be applied with a brush and in a different colour on all weld seams, plate and profile edges, corners, any rivets and other areas that are difficult to reach. Bolts and washers shall also be stripe coated but only if required in SWS Steel Bridges - Surface Protection, cf. item 1.3, or if the bolt goods are neither rustproof nor hot-dip galvanised.

For all subsequent coats, stripe coating shall be applied in a different colour with a brush before spray application, except for the last top coat.

Each coating shall always cover the previous coating completely (also stripe coating).

Along welded mounting assemblies, see item 3.3, overlaps between coatings shall be stepped at least 100mm.

Surface protection damaged by moisture, dust, etc. shall be removed, and the relevant surfaces shall be treated again in accordance with the stated quality criteria.

3.5 Metallic Coatings

3.5.1 Hot-Dip Galvanising

Hot-dip galvanising shall be carried out in accordance with DS-EN/ISO 1461 on structural steel in strength class up to and including S355. Hot-dip galvanised steel of higher strength shall only be carried out in exceptional cases - see Steel Bridges - Structural Steel Work - GWS.

If the hot-dip galvaniser considers that the structure is unsuitable for hot-dip galvanising (risk of deformation), he shall inform the purchaser of this. If it is then still agreed that the hot-dip galvanising will be carried out, the hot-dip galvaniser shall use the most suitable dipping method to try to minimise the risk of deformation during the process.

Coating thickness shall be min. 115 µm applicable to all materials – no matter the thickness of the item unless specified otherwise in the SWS Steel Bridge - Surface Protection. The entire hot-dip galvanised surface is significant.

The Hot-Dip Galvanising Contractor shall issue a certificate pursuant to DS/EN ISO 1461, Chapter 7, as well as a measurement report under the present GWS.

Sharp points, lumps, flux, zinc ash and clear discolouration from the process are not allowed, and any such occurrences shall be removed before delivery (all surfaces are significant).

Drop formations, which are significant to the function of the item, shall be removed by manual filing. This applies to e.g. joint faces, bolt holes or fittings for bolts, washers and nuts.

Hot-dip galvanising shall be carried out on as large items as possible, thus minimising the number of mounting assemblies.

Hot-dip galvanising of cold-deformed material is subject to approval of procedure testing.

If hot-dip galvanised items shall be painted, this shall be specified in the surface protection specification, cf. item 3.2, and be carried out immediately after hot-dip galvanising.

In connection with transportation and outdoor storage, stacks of hot-dip galvanised items shall be well drained and ventilated.

In case of buckling or deformation of welded elements during galvanising, the Employer shall be notified, and any requisite measures shall be taken to remedy the damage subject to agreement with the Employer.

No more venting holes must be made than specified on the drawings and approved by the Employer. If any wishes for changes on the scale of venting holes, this shall be specified on the drawings and approved by the Employer.

Vent holes in hot-dip galvanised items shall be closed, except for holes facing downwards. Scope of and method for closing shall be submitted to the supervision for acceptance.

3.5.2 Metal Spraying

Metal spraying shall be made in pursuance of DS/EN ISO 2063-2.

Minimum film thickness shall be 150 µm, unless otherwise specified in SWS Steel Bridges - Surface Protection – except for friction joints, cf. item 2.3.

Metal spraying shall be sealed with a "tie coat".

3.6 Repair of Damages

3.6.1 Paint

Where damages in the coating protection have caused corrosion, the surface shall be abrasive blast-cleaned to clean metal. In case of minor damage < 100 mm^2, the surface can be cleaned by grinding to clean metal. The transition to the surrounding coating shall be ground evenly. Then, the surface shall be repaired in pursuance of the surface protection specification.

If the damaged area is large (> 10,000 mm^2), any overlaps between the coats shall be stepped as for welded splices.

In connection with repair of minor damage (< 10,000 mm^2), only stepping towards primer/metal spraying is required.

If the priming treatment is intact, repairs may be completed with the top coat alone, provided the requirements for the total dry film thickness are observed.

Minor, superficial damage shall be remedied using the relevant intermediate coat/top coat after cleaning. If a structural element or individual, large surfaces show defects extensively, so that spot repair will not be able to meet the output requirements, the actual element or surfaces shall be subjected to renewed cleaning and surface protection.

In case of doubt, a specific repair procedure shall – in addition to the procedures included in the surface protection specification – be presented to the Employer.

3.6.2 Metallic Coatings

Damage greater than 1000mm^2 to individual elements shall be repaired by re-galvanising. Repair with ZnAl15 of hot-dip galvanising and spray coating shall be carried out by metal spraying.

Individual minor local damages, less than 500mm^2, may be repaired using zinc ethyl silicate or zinc epoxy paint. The total dry film thickness shall be 150% of the hot-dip galvanising. The zinc ethyl silicate paint shall be sealed with a suitable top coat. Repair procedures shall be submitted to the Employer.

Any damage – regardless of size – occurring before the item is delivered to the Orderer shall be repaired at the Galvaniser by re-galvanising.

4 CHECKING

4.1 General

Addendum to 12944-3
On receipt, the Painting Contractor shall check the steel for the conditions listed in section 5.5, regarding pretreatment.

Addendum to 12944-7, section 7
The Process Inspection is intended to establish and maintain a given quality level and, in continuation thereof, establish occurrence of and prevent repetition of errors at the technically most appropriate time.

Construction Inspection shall be documented, and it comprises both incoming inspection of materials and inspection of the quality of the completed work.

Final Inspection is intended, through inspection of the completed work, to determine whether the surface protection has achieved the specified quality.

Inspection at the end of the defects liability period is intended to determine whether the completed surface protection complies with the requirements made in respect of durability.

4.2 Procedure Testing

4.2.1 Pretesting

Addendum to 12944-6, Section 5:
The Contractor shall provide and process a number of test steel plates (200 x 300mm) as specified in SWS Steel Bridges - Surface Protection. Repair systems and overlaps shall also be shown on the test plates, possibly on plates showing only repairs. The test plates shall be prepared to the specified cleaning grade and roughness, and all protections shall be exposed in widths of at least 30mm, even the prepared, but not yet painted surface. The plates shall be used as reference plates, i.a. for the colour and gloss of the top coat, during and after the carrying out of the work.

Pre-testing of hot-dip galvanising, to ensure that the steel is capable of accepting the required film thickness, shall be performed to determine the required dipping time, and any pretreatment with blast-cleaning for the characteristic test specimens made of actual materials.

4.2.2 Reference Fields

Reference fields are usually made for corrosion categories C3 to C5, and Im1 to Im3, cf. DS/EN 1090-2, item F7.3.

Reference is made to 12944-7 section 8
The Contractor may make proposals for the location of reference fields. These shall be made subject to 12944-7, Section 8, and 12944-8, Annex B, including form to be used.

4.3 Process Control

4.3.1 The Paint Contractor's Control

Addendum to 12944-7, item 4.1
Both the person responsible for quality assurance and the inspector shall be able to document that they have, for the past two years, performed regularly inspection work on similar projects.

4.3.2 The Paint Supplier's Control

The Paint Supplier shall perform random process controls and final controls during the execution of the work.

The Paint Supplier shall effectively check the materials and submit inspection declarations to the Contractor.

4.3.3 Checking Plan

The checking plan shall be prepared on the basis of the present GWS and associated SWS-P, as well as 12944-8, Tables 1, 2, 3 and 4 and, as a minimum, contain the specified activities; however, non-required treatments and activities may be omitted. Moreover, the plan shall contain forms corresponding to at least the ones shown in Annexes H and I.

The size of the inspection area is defined as being the individual structural element, which is assembled in the workshop, e.g. bridge deck element, pier element, girders or similar.

The inspection area is divided into a number of measuring areas (structural elements/surfaces), which, in regard to materials and workmanship, provide uniform conditions for carrying out coating work, and which thus can form the basis for a statistical processing of the measuring areas.

It shall be specified for the individual inspection areas, which inspection activities serve as point of reference.

The inspection plan shall be submitted to the Employer and shall not be deviated from without the Employer's acceptance.

4.3.4 Reporting

At the commencement of the Work, the Contractor shall create a QA Log and maintain it throughout the contract period.

The QA Log shall, as a minimum, include the above inspection plan in the accepted format – and the inspection plan entirely completed. The most recent update shall correspond to the time of handover.

Copy of inspection reports shall be submitted for the Employer's acceptance, and, on completion of the contract, the QA log shall be handed over to the Employer.

4.3.5 Equipment

Make, type and specifications, as well as calibration routines for applied measuring instruments, shall be submitted for the Employer's acceptance.

Appendix 2 provides a list of selected equipment as well as required measuring tolerances.

4.4 Execution Checking

4.4.1 General

Reference is made to 12944-7

Construction checking shall be performed by the Contractor in accordance with the incheking plan, for which checking forms for completion will be prepared. The forms can be divided into activities and shall contain inspection points for all requirements listed in the inspection plan.

The Contractor shall notify the Employer of the individual activities so that the Employer – if he so desires – and by giving reasonable notice, may perform samples at hold points of the individual activities (pre-treatment, abrasive blast-cleaning, stripe coating, application of individual coats, etc.).

4.4.2 Steel substrates

Before the paintwork commences, the Contractor shall perform a 100% visual inspection of the surface and, likewise, regularly during the cleaning process. If, due to certain areas or faulty points, the Contractor believes that the specified output requirements for the paintwork cannot be met using the specified or agreed methods, this shall be noted and notified to the Employer.

Degreasing of steel substrates shall be checked by sampling in 3 places per inspection area with a water beading test, cf. Appendix 1. The same degree of inspection using a tape test shall be carried out to ensure that the surface is dust free, in pursuance of Appendix 1.

4.4.3 Dry Film Thickness of Individual Layers

Dry film thickness of each coat of paint shall be carried out subject to the method in DS/EN ISO 19840, where surface roughness of steel is corrected for. Measurements shall be carried out, in particular where experience entails the greatest challenge in order to obtain correct and homogeneous layers because of access, working position etc. Areas for stripe coating shall constitute separate measuring areas.

The number of measuring areas and measurements, as well as acceptance criteria, for paint or metallic surfaces is specified in Appendices 3 and 4. In connection with metallic coatings, measurements are made before and after tie-coat.

If the primer is a zinc-dust primer or metallic coating, the film thickness of the primer shall be checked separately before application of the first coating.

4.4.4 Porosity

Usually, no requirements are made in respect of testing for porosity of coatings.

Sealing of metal spraying shall be inspected randomly subject to agreement with the Employer.

4.4.5 Climate control

Addendum to 12944-7, item 5.2 and section 7
For each process, the Contractor shall check and document that the climate criteria specified in the surface protection specification are observed, and work shall be stopped immediately, if a climate criterion is exceeded.

Example of a form that may be completed is appended as Appendix 5.

Concerning workshop activities, the air temperature and humidity shall be recorded continuously. Concerning outdoor work, the air temperature and humidity shall be recorded at least every three hours, as well as at the commencement of the work and in case of weather changes. All readings shall be recorded.

Dew point temperature may e.g. be determined following the tables in DS/EN ISO 8502-4, Annex A.

4.4.6 Incoming Checking

Addendum to 12944-7, section 5
The incoming inspection of coating materials for surface protection shall include the checking of:
- Batch No.
- Colour
- Viscosity.

Colour and viscosity shall be controlled for conformity with the surface protection specification for minimum 1 bucket per batch of each type.

4.5 Final Checking

4.5.1 General
Completion inspection shall be carried out by the Contractor in the presence of the Employer.

On completion of the works, but before handover, the completed work shall be inspected. The inspection shall comprise
- Dry film thickness,
- Visual checking

and the result shall be reported by completing a form corresponding to 12944-8, Annex J, forms A, B and C.

There shall be no areas > 10% of the individual inspection areas where the gloss is less than specified.

There shall be no runners to a significant extent on visible surfaces.

There shall be no visible difference in colour when comparing the test plate with the completed work. In case of doubt, the colour shall be measured in accordance with the specification.

4.5.2 Dry Film Thickness of the Overall Paint System
The dry film thickness, NTFT, of the overall paint system shall be assessed using the method specified in Appendix 3.

The earliest time for completion inspection shall be agreed with the Paint Supplier.

4.5.3 Adhesion

Usually no inspection is made of adhesion to the structure, but this may be done on test plates.

4.6 Checking at the Expiry of the Defects Liability Period

Inspection of painted and metallised surfaces:

During and at the end of the defects liability period, the assessment values for:

- Blistering shall not be greater than grade 2, size 2, pursuant to DS/ISO 4628-2,
- Corrosion shall not to be greater than degree Ri 1 pursuant to DS/ISO 4628-3,
- The number of cracks shall not be greater than grade 1, size 2, pursuant to DS/ISO 4628-4,
- The scope of flaking shall not be greater than grade 1, size 1, according to DS/ISO 4628-5.

For each defects type, areas with such defects shall not exceed 0.1% of the total surface of the inspection area.

If the paint manufacturer and paint products have been specified in SWS Steel Bridge – Surface Protection, the Contractor's liability for defects does not comprise defects that can be attributed to the choice of materials. This will be assessed by means of reference areas.

Remediation

If, within the rectification period, damage occurs to an extent greater than specified above, the damaged area shall be rectified in pursuance of the provisions of this description.

If more than one damage occurs in an inspection area (identical or different types of damage), the entire inspection area shall be repaired, i.e. the entire area shall be inspected for the purpose of recording the types of defects, and the repair determined on the basis of the types of damage found.

APPENDIX 1 TAPE TEST AND WATER BEADING TEST

Tape test
The purpose is to check for dust on sand-blasted or coated surfaces, immediately before coating, and of dry-sprayed coating before application of new coating.

The test shall be performed under DS/EN ISO 8502-3, and the result shall be class 0 or 1.

Water Beading Test
The test shall be carried out by spraying a fine mist of distilled water and observing how the water flows together.

a. If the water drops accumulate in defined areas that are hydrophobic, the surface is most likely contaminated by oil or grease.
b. If the drops flow together into an even film without suddenly spreading across the area, the surface is clean.

APPENDIX 2 LIST OF USEFUL EQUIPMENT

Equipment	Method and standard	Requirements for tolerances and comments
Sling psychro-meter Capacitive gauge	Air temperature, relative air humidity	± 3%
Surface thermometer	Steel temperature	± 0.2˚C
Electromagnetic film thickness gauge with memory, statistical programme and printout	DS/EN ISO 2808	± 3% Calibrated on smooth surface
Wet film gauge, metal	DS/EN ISO 2808	
Roughness comparators	DS/EN ISO 8503-1 – 5 DS/EN ISO 4287	Ref.: Test sample Press-0-Film Replica Tape
Saeberg adhesion tester	DS/EN ISO 4624	
Thermometer	Temperature of coating	± 1°C
Viscometer	Paint supplier's directions	
Cup	Paint supplier's directions	
pH paper	Any alkaline residue by welds	± 1 pH unit
Glossmeter	DS/EN ISO 2813, 60° angle	± 1 %
Colour meter	DS/ISO 7724 (L, a and b)	Measuring geometrics shall be 45°/0° or 45°/0° diffuse

APPENDIX 3 CHECKING PROCEDURE FOR MEASURING OF DRY FILM THICKNESS

Checking procedure for measuring dry film thickness of coating and metal spraying.

The structure shall be divided into inspection areas of a maximum of 1000m² or 1000m in pursuance of DS/EN ISO 19840.

Every inspection area shall be divided into measuring areas of 10m² surface/-10m edge length/ three-dimensional structural element each. A lot consists of a number of measuring areas.

For each lot size, measuring areas shall be designated in accordance with DS/ISO 2859, simple sampling set up following limiting quality (LQ) (Procedure A) LQ = 5%, cf. Table A in DS/ISO 2859-2:

Sample plan for corrosion categories C3, C4 and C5:

Inspection area in total: • area (m²) • edge length (m)	Lot size: Number of measuring areas in the checking area N	Sample size: Number of measuring areas for investigation n	Approval number: Ac
0-250	0-25	n=N	0
251-500	26-50	28 (max. N)	0
501-900	51-90	34	0
901-1000	91-150	38	0

In the measuring area, at least 20 readings (individual measurements) shall be made of the film thickness, evenly distributed over the measuring area and adjusted according to the surface roughness of steel, in pursuance of DS/EN 19840, Section 7. A maximum of 4 repeated measurements is allowed within a measuring area in pursuance of DS/EN 19840, item 6.3.

a. At the first measurement, a maximum of 10% of the measurement results are between 80 and 100% of the specified dry film thickness and none are < 80% ⇒, the measuring area is approved
b. At the first measurement, a maximum of 20% of the measuring results are between 80 and 100% of the specified dry film thickness and none are < 80% ⇒, the measurements shall be repeated, but in a new area with twice the number of measurements compared to the first set
c. At the second measurement, a maximum of 20% of the measurement results are between 80 and 100% of the specified dry film thickness and none are < 80% ⇒, the measuring area is approved, otherwise rejected. No further measurements may be carried out prevailing for the same measuring area
d. If one or more measuring results are below 80%, or more than 20% are between 80 and 100% of the specified dry film thickness ⇒, the measuring area shall be rejected. No further measurements may be carried out to apply to the same measuring area
e. The inspection area will be approved if the number of rejected measuring areas is less than or equal to approval number, Ac.

A non-approved lot shall not be presented for new approval unless:

a. Accepted by the Employer
b. A 100% inspection has been made and all deviating units have been removed or the deviations have been corrected.

APPENDIX 4 CHECKING PROCEDURE FOR LAYER THICKNESS MEASUREMENTS

Checking procedure for measuring the film thickness of hot-dip galvanising.

The total number of hot-dip galvanised steel parts dipped at the same time (in one batch) constitutes the lot size.

For each lot size, measuring areas shall be selected in pursuance of DS/ISO 2859, simple sampling set up according to limiting quality (LQ) (Procedure A) LQ = 5%, cf. Table A in DS/ISO 2859-2:

Lot size: Number of items (inspection areas) N	Sample size: Number of measuring areas for investigation n	Approval number: Ac
0-25	n=N	0
26-50	28	0
51-90	34	0
91-150	38	0
151-280	42	0
281-500	50	0
501-1200	80	1

For each item, the measuring areas are defined relative to design, steel grade and metal thickness, since inspection of film thicknesses is performed on the part of the measuring area with the smallest film thickness.

Through indicative thickness measurements, the area representing the lowest zinc thickness will be localised. At least 0.1m² is used as measuring area.

In the measuring area, at least 20 readings (individual measurements) shall be made of the film thickness evenly distributed over the measuring area.

a. At the first measurement, a maximum of a) If on first measurement 10% of the measurement results are between 90 and 100% of the specified thickness and none are < 90% ⇒, the measuring area is approved
b. At the first measurement, a maximum of 20% of the measuring results are between 90 and 100% of the specified thickness, and none are < 90% ⇒, the measurements shall be repeated but in a new area with twice the number of measurements compared to the first set
c. At the second measurement, a maximum of 20% of the measurement results are between 90 and 100% of the specified thickness and none are < 90% ⇒, the measuring area is approved or otherwise rejected. No further measurements may be carried out to apply to the same measuring area
d. If one or more measuring results are below 90%, or more than 20% are between 90 and 100% of the specified dry film thickness ⇒, the measuring area shall be rejected. No further measurements may be carried out prevailing for the same measuring area.

   The inspection lot will be approved if the number of rejected measuring areas/items are less than or equal to approval number, Ac.

A non-approved lot shall not be presented for new approval unless:

a. Accepted by the Employer
b. A 100% inspection has been made and all deviating units have been removed or the deviations have been corrected.

APPENDIX 5 CLIMATE MEASUREMENTS

CLIMATE MEASUREMENTS
Daily report

Employer:

Contractor:

Surface Protection
Relevant Structural Element
Paint system

No.: _____
Date: _____
Case: _____

WIND DIRECTION FROM: _____

Measurement, at						
Air temperature (°C)						
Humidity (% RH)						
Dew point temperature(°C)						
Steel temperature (°C)						
Difference (°C)						
Wind speed *(m/s)						

* is measured at a height of 10m

SPECIFICATION OF THE DAY'S ACTIVITIES

	Work completed:					
Location						
Manual cleaning						
High pressure cleaning						
Spot priming/stripe coating						
Spray application						
Brush application						
Glove application						
Rigging/moving						
Administration						

_____
Foreman's Signature

Vejdirektoratet
Danish Road Directorate

Havnegade 27
P.O Box 9018
DK-1058 Copenhagen K
Telephone +45 7244 3333

vd@vd.dk
vejdirektoratet.dk

vejregler@vd.dk
vejregler.dk

EAN 978-87-93674-86-8

Ministry of Transport and Building