

Quality Requirement

Surface Treatments General Requirements

RIG/PLANT		
ADDITIONAL CODE	SDRL CODE	TOTAL PGS 10
REMARKS		
MAIN TAG NUMBER		DISCIPLINE
CLIENT PO NUMBER		
CLIENT DOCUMENT NUMBER		

REFERENCE TM01169	REFERENCE DESCRIPTION Quality Clause	
<p>This document contains proprietary and confidential information which belongs to National Oilwell Varco; it is loaned for limited purposes only and remains the property of National Oilwell Varco. Reproduction, in whole or in part; or use of this design or distribution of this information to others is not permitted without the express written consent of National Oilwell Varco. This document is to be returned to National Oilwell Varco upon request and in any event upon completion of the use for which it was loaned. © Copyright National Oilwell Varco - 2022</p>		<p>National Oilwell Varco LP 10353 Richmond Avenue Houston TX 77042 UNITED STATES</p> <p>Phone +1 713 346 7500</p>
DATA CLASSIFICATION Public		
DOCUMENT NUMBER 103188898	REV 2	



REVISION HISTORY

Rev	Date	Reason for issue	Prepared	Checked	Approved
2	9-Jun-2022	Approved for Use	LUMO	ROMK	HAH
1	19-Feb-2020	Approved for Use	VIHA	HAH	LUMO
0	13-Mar-2019	Approved for Use	HAH	VDA	LUMO

CHANGE DESCRIPTION

Revision	Change description
2	Changed Section 2.3 – Added pipe couplings Changed Section 2.4 – Formatting of Units Changed 2.6 – Added prior to start work Change Section 3 - Galvanizing requirements updated Changed section 3.2 – Formatting of Units and Testing requirements Changed Section 4 – Formatting Change Section 5.1 - Added requirement to galvanizing spray method
1	Overall revision
0	

TABLE OF CONTENTS

1	COATINGS	4
1.1	General.....	4
1.2	Overall requirements	4
2	QUALITY CONTROL	5
2.1	General.....	5
2.2	Ambient conditions	5
2.3	Surfaces to be protected from painting.....	5
2.4	Pre-blasting preparations	5
2.5	Blasting	6
2.6	Passivation and Pickling.....	6
3	COATING PROCESS.....	7
3.1	General.....	7
3.2	Acceptance criteria	7
3.3	Coating repair System	7
4	HOT DIP GALVANIZING	8
4.1	General.....	8
4.2	Suitability criteria for Hot Dip Galvanizing	8
4.3	Vent holes for galvanizing	8
4.4	Repair of galvanized surface.....	8
4.5	Coating of Galvanizing surfaces	8
5	THERMALLY SPRAYED COATING - METALIZING	9
5.1	General.....	9
5.2	Application of thermally sprayed coating - Metalizing	9
6	REFERENCE STANDARDS	10

1 COATINGS

1.1 General

It is the supplier responsibility to establish, document and implement internal procedures and instructions for the complete process of surface treatment.

The below specified requirements in addition to all PO documentation package requirements shall apply for the delivery of surface treatment process for all NOV equipment.

The Supplier shall determine and provide the needed infrastructure and equipment to achieve conformity to product requirements.

1.2 Overall requirements

No carbon steel shall be installed without previous surface preparation and primer application in areas where blast cleaning will be harmful to installed equipment.

Prior to the application of each coat, a stripe coat shall be applied by brush to all welds, corners, behind angles, edges of beams etc. and areas not fully reachable by spray in order to obtain the specified coverage and thickness.

Each coat shall be applied uniformly over the entire surface and preferably be spray-painted.

Skips, runs, sags and drips shall be avoided. Each coat shall be free from pinholes, blisters, holidays or any other paint defects.

Contamination of painted surfaces between coats shall be avoided. Any contamination shall be removed.

All hexagon socket screw (unbrako) bolt heads and other open treaded holes shall be filled with Silicone, marine seal e.g Sikaflex-521 UV or equivalent before final top coat

2 QUALITY CONTROL

2.1 General

The supplier is responsible for performing Quality control and keep the record of the activities as specified in the PO requirements. It shall, as a minimum, include:

- Daily log of environmental conditions (temperature, humidity etc.).
- Inspection of pre-treatment.
- Thickness measurement of each layer.
- Curing tests prior to following coats.
- Visual inspection.
- Brand name and batch number

Results of these tests shall be recorded in the daily log with traceability to the coated area.

2.2 Ambient conditions

No final blast cleaning or coating application shall be done if the relative humidity is more than 85% and when the steel temperature is less than 37°F (3°C) above the dew point.

No coating shall be applied or cured at temperatures below 50°F (10°C).

Recoating interval shall be according to recommendation given in technical data sheet for the actual product.

2.3 Surfaces to be protected from painting

The following items shall not be coated unless otherwise specified:

- All valve EI Activators / solenoids and labels/print information shall be protected from painting - Rest of valve body shall be painted as normal.
- Stainless steel (all unpainted stainless-steel surfaces shall be passivated by use of pickling).
- Chrome plated, copper, brass, plastic and similar.
- Galvanized bolts, nuts and washers.
- Grease nipples and pipe / tube fittings of stainless steel.
- Machined surfaces as contact surfaces for gaskets, threads.
- Friction surfaces for pipe couplings.
- Tag plates and signs.
- Valve stems, shafts or similar equipment, having surfaces with small working tolerances.
- Measuring instruments and glass
- Electric / instrument cables, cable trays.
- Safety equipment.
- Hoses.

Machined surfaces and unpainted non-austenitic steel surfaces shall be preserved according to applicable preservation procedure.

2.4 Pre-blasting preparations

Sharp edges, fillets, corners and welds shall be rounded or smoothed by grinding, minimum radius 2 mm (1/16").

- Threads, machined surfaces and other areas that not shall be painted must be sufficiently protected against the abrasive action and possible contamination from the sand/grit blasting. Suitable thread protection can be bolts, nuts, caps, screws, tape, plywood, cloth, tarp and the like.
- Hard surface layers, e.g. resulting from flame cutting, shall be removed by grinding prior to blast cleaning.
- The surfaces shall be free from any foreign matter such as weld flux, weld spatter, residue, slivers, oil, grease, salt etc. prior to blast cleaning.
- Solvent or alkali cleaning prior to blasting operations shall remove any oil and grease contamination. After finish cleaning, fresh water rinsing shall be done.
- Any major surface defects, particularly surface laminations or scabs detrimental to the protective coating system shall be removed by suitable methods. Where such defects have been revealed during blast cleaning, and dressing has been performed, the dressed area shall be re-blasted to the specified standard. All welds shall be inspected and if necessary repaired prior to final blast cleaning of the area.
- All welds shall be fully sealed to avoid penetration of water into crevices or inside sections. However, vent holes shall be drilled in the case of hot dip galvanizing.

2.5 Blasting

Blasting of all carbon steel surfaces shall be done using steel grit as medium unless otherwise agreed, in written, between the supplier and the buyer.

Unless otherwise specified by the PO or engineering documentation, the minimum surface roughness and cleanliness shall be as per below requirements:

- Blast Cleaning: Sa 2½ (ISO 8501-1) or equivalent
- Surface Roughness: Grade medium G, 50-85µm (ISO 8503) or equivalent

2.6 Passivation and Pickling

All Passivation and Pickling shall be performed to a documented procedure approved by NOV prior to start of work.

Stainless steel surfaces that have been subject to any kind of heat treatment or subject to any tool which may have left traces of other metal on the stainless steel shall be pickled and passivized according to material Contractor's description and applicable standard.

All welds shall be mechanically cleaned by stainless steel brush, fine grained flap disk or other suitable tool for SS material prior to pickling and passivation.

Any tools used on carbon steel shall not be used at stainless steel after.

3 COATING PROCESS

3.1 General

Unless specified, surface preparation, painting, repairs and reports shall be in accordance with manufacturer's recommendations and the NOV's specified paint system.

3.2 Acceptance criteria

For paint film thickness there shall be taken 5 measurements per 1m² (10 square feet), the average thickness shall not be lower than the specified DFT for each layer.

No individual measurements shall be below 20% of the specified DFT, and the maximum shall not exceed 2 times the specified DFT or the requirements in the Coating System Data Sheet (CSDS) from the Coating manufacturer.

NOV may, in some cases, require adhesion Pull - Off test as per the applicable recognized standards (ISO 4624 or equivalent). To verify the adhesion of the paint layer, the absolute minimum value of the test results is 5MPa.

3.3 Coating repair System

Repair of damaged coating system is Supplier's responsibility. The damaged area shall be removed and the edge around the area shall be cut back to solid materials. After removal of damaged coating, the area shall be blast cleaned to Sa 2½ and new corrosion protection applied.

4 HOT DIP GALVANIZING

4.1 General

Hot dip galvanizing shall be in accordance with ISO 1461, ASTM A123 or equivalent recognized standard. For structural constructions, the general requirements are a minimum coating thickness of 125 microns (μm).

For thicknesses ≤ 10 mm (3/8") the DFT coating requirements shall comply with ISO 1461.

4.2 Suitability criteria for Hot Dip Galvanizing

The galvanizing process shall not be performed for material where the carbon CEZ is $> 0,44\%$

Formula for CEZ (Zinc Carbon Equivalent):

$$\text{CEZ} = \text{C} + \text{Si}/17 + \text{Mn}/7.5 + \text{Cu}/13 + \text{Ni}/17 + \text{Cr}/4.5 + \text{Mo}/3 + \text{V}/1.5 + \text{Nb}/2 + \text{Ti}/4.5 + 420\text{B}$$

4.3 Vent holes for galvanizing

When vent holes for galvanizing are required, the location and quantity of vent holes shall be agreed with NOV engineering (through deviation request process) if not specified/clear in the drawings.

The Supplier shall add all necessary vent holes for galvanizing (and should be a minimum of 10 mm (3/8") diameter).

All holes shall be in accordance with good workmanship practices.

4.4 Repair of galvanized surface

All galvanized surfaces that require welding, cutting, drilling and other preparation and any galvanized surfaces which have been damaged, shall be repaired.

Reference standard for repair work is ISO 1461 or ASTM 153-16. Major damages above 10cm^2 (1 1/2") / $13,2 \times 3,2 \text{ cm}^2$ (1/2" x 1 1/4") shall be re-galvanized in accordance with above standards.

Minor damaged areas shall be thoroughly cleaned to remove oil, grease and other contaminations.

Areas with rust and damaged galvanizing shall be grinded down to bare steel by use of e.g. fiber-disk, 3M Clean & Strip disc or blast cleaning to Sa 2 1/2, SSPC-SP 10 or NACE #2.

Grinded/blast cleaned areas shall be applied first layer 1x 125 microns (μm) Zink Rich primer and second layer 1x60 microns (μm) Top Coat.

4.5 Coating of Galvanizing surfaces

When overcoating of galvanized surface is required it shall be done in accordance with an NOV specified system / process.

Prior to coating application, the galvanized surface shall be repaired as required, degreased, washed down with fresh water and allowed to dry completely. The painting shall be done within 48 hours of galvanizing or cleaning in accordance with the specified painting system.

The pre-cleaning process is essential to obtain adhesion between the galvanized surface and the coating. Oxides and hydroxides form immediately after galvanization and will create bonding problems if not removed.

5 THERMALLY SPRAYED COATING - METALIZING

5.1 General

All metalizing shall be performed in accordance with a written procedure.

Relevant requirements provided in this specification are applicable for thermally sprayed metallic coatings. Unless otherwise stated in the engineering documentation, the specific requirements valid for thermally sprayed metallic coatings are provided below:

Metalizing system		
Blast Cleaning :	Sa 2½ ISO 8501-1/ SSPC-SP 10/ NACE #2	
Surface Roughness :	Grad medium G 50-85µm (ISO 8503)	
Then Apply :	1 layer 99.9% Zinc content metallizing	200 µm DFT
	1 layer Tie-Coat	35 µm DFT
	1 layer Top coat	<u>50 µm DFT</u>
Total Dry Film Thickness (DFT)		<u>285 µm DFT</u>

All coating metals shall be supplied with product data sheets and quality control certificates, and be marked with coating Contractor's name, manufacturing standard, metal composition, weight, and manufacture date.

5.2 Application of thermally sprayed coating - Metalizing

Each coat shall be applied uniformly over the entire surface. The coat shall be applied in multiple layers and shall overlap on each pass of the spray gun.

Equipment for application should follow guidelines given in ISO 1395 or equivalent.

For items that will be welded after spraying, 50-100 mm (2- 4") measured from the bevel area shall be left uncoated.

The surface after spraying shall be uniform and free of lumps, loosely adherent spattered metal, bubbles, ash formation, defects and uncoated spots.

Before application of any further coat, any damage to the previous coat shall be repaired.

6 REFERENCE STANDARDS

Process	Document Title	Document Number
Coating	Code of practice for protection of iron and steel structures against corrosion	BS5493
Coating	Thermal spraying – Acceptance inspection of thermal spraying equipment	EN1395
Coating	Thermal spraying – wires, rods and cords for flame and arc spraying	EN ISO 14919
Coating	Metallic coatings – hot dip galvanized coatings on fabricated ferrous products	EN ISO 1461
Coating	Paint and Varnishes – Pull-off test for adhesion	ISO 4624
Coating	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness	ISO 8501-1
Coating	Preparation of steel substrates before application of paints and related products – Test for the assessment of surface cleanliness	ISO 8501-2
Coating	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast cleaned substrates	EN ISO 8501-3
Coating	Preparation of steel substrates before application of paints and related products – Surface preparation methods	EN ISO 8503-4
Coating	Surface preparation and protective coating	NORSOK M-501