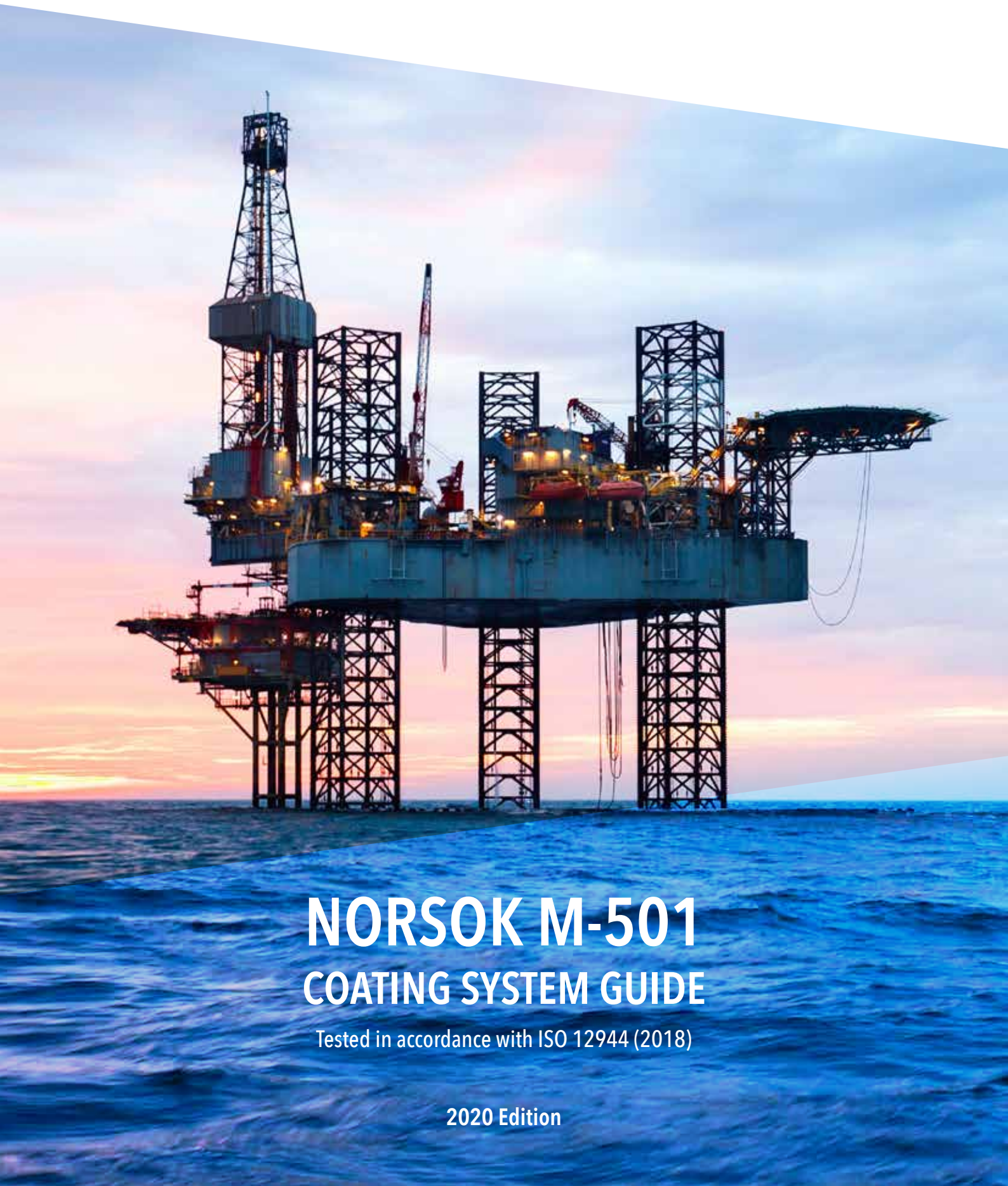
NIPPON PAINT



NORSOK M-501
COATING SYSTEM GUIDE

Tested in accordance with ISO 12944 (2018)

2020 Edition

CONTENTS

What is NORSOK M-501?

The NORSOK Standards were introduced in 1994 by the Norwegian offshore industry and continue to serve as global guidelines for adding value and ensuring cost-effective design, construction, operation and maintenance within aggressive offshore environments.

NORSOK M-501 provides the guidelines for the selection of coating systems, minimum dry film thickness and surface preparation to ensure quality standards for all aspects of the offshore industry.

Objectives

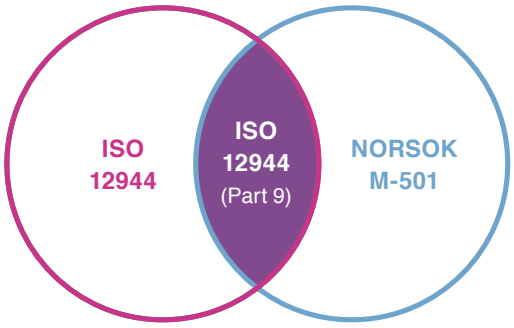
NORSOK M-501 is targeted at new construction projects in challenging environments where there is a need to ensure optimum corrosion protection to provide the following benefits:

- Obtain protective coatings systems which provide extended design life
- Reduce overall lifetime costs for the offshore installations and associated facilities
- Minimise health and safety concerns
- Minimise the need for maintenance, which is costly and inconvenient, and in some cases, not possible
- Minimise environment impact

Pre-qualification Requirements

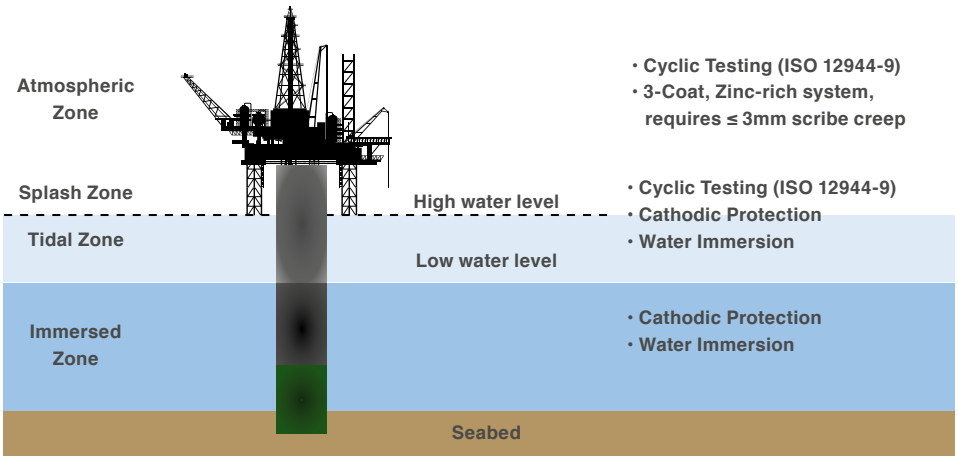
This brochure highlights the recommended protective coating systems offered by Nippon Paint, which corresponds to the different systems established by NORSOK. Coating System 1, 3B, 4, 5 and 7 requires pre-qualification based on ISO 12944-9 (superseded ISO 20340). ISO 20340 is replaced with ISO 12944-9 in 2018.

- International standard for both onshore and offshore testing
- Other land-based systems



- Other systems for offshore not covered in ISO 12944
- Based on ISO 20340

New Test Standard
Systems and tests for offshore



Exposure Conditions in Offshore Environment

All recommended Nippon Paint coating systems are subjected to laboratory testing described for each NORSOK system corresponding to the defined exposure conditions, where applicable.

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NORSOK COATING SYSTEM 1

CARBON STEEL WITH MAXIMUM OPERATING TEMPERATURE < 120°C

Pre-qualification Required

For structural steel and exteriors of equipment, vessels, piping and valves (not insulated)

Carbon Steel < 120°C (Zinc Epoxy Systems)			
Scheme No.	Surface Preparation	Coating System	DFT
1	Sa2.5	Zinky-22 Epoxy Zinc Rich Primer 80	60 µm
		Hi-Pon 30-02 Epoxy MIO 80	200 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat	60 µm
		TOTAL	320 µm

Carbon Steel < 120°C (Zinc Silicate Systems)			
Scheme No.	Surface Preparation	Coating System	DFT
2	Sa2.5	Zinky-13 Inorganic Zinc Rich Primer 85	60 µm
		Hi-Pon 30-02 Epoxy MIO 80	200 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat	60 µm
		TOTAL	320 µm

Carbon Steel < 120°C (Zinc Free Systems)			
Scheme No.	Surface Preparation	Coating System	DFT
3	Sa2.5	Zinky-10 Inorganic Zinc Shop Primer (Sweep Blast)	15 µm
		Hi-Pon 90-01 Epoxy Glass Flake 95	500 µm
		Hi-Pon 90-01 Epoxy Glass Flake 95	500 µm
		TOTAL	1015 µm

In a pre-qualified coatings system, the approved top coat may substitute for another pre-qualified top coat provided the primer/intermediate is the same and the DFT of the top coats is equal.

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NORSOK COATING SYSTEM 2

THERMALLY SPRAYED ALUMINIUM/ZINC AND ALLOYS OPERATING AT HIGH TEMPERATURE

Pre-qualification Not Required

All insulated surfaces of tanks, vessels, piping, flare booms and crane booms. Underside of bottom deck including piping jacket above splash zone lifeboat stations (to be decided in each project).

2A. Thermally Sprayed Aluminium or Alloys of Aluminium ≤ 120°C

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Thermally Sprayed Aluminium		200 µm
		Hi-Pon 20-03 Epoxy Red Oxide Primer		25 µm
			TOTAL	225 µm

2A. Thermally Sprayed Aluminium or Alloys of Aluminium > 120°C

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Thermally Sprayed Aluminium		200 µm
		Hi-Pon 300HT Top Coat		25 µm
		Hi-Pon 300HT Top Coat		25 µm
			TOTAL	250 µm
2	Sa2.5	Thermally Sprayed Aluminium		200 µm
		Hi-Pon 600HT Aluminium		25 µm
			TOTAL	225 µm
3	Sa2.5	Thermally Sprayed Aluminium		200 µm
		Hi-Pon 600HT Top Coat		25 µm
		Hi-Pon 600HT Top Coat		25 µm
			TOTAL	250 µm

2B. Thermally Sprayed Zinc or Alloys of Zinc ≤ 120°C (For Un-insulated Use)

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Thermally Sprayed Zinc		100 µm
		Hi-Pon 20-03 Epoxy Red Oxide Primer		25 µm
		Hi-Pon 30-02 Epoxy MIO 80		125 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat		75 µm
			TOTAL	325 µm

NOTE 4 - For insulated piping and equipment operating at < 120 °C, coating System No. 9 may be selected. Refer to NORSOK Standard M-501 – A.2 NOTE 4.

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NORSOK COATING SYSTEM 3

INTERNAL SURFACE OF CARBON STEEL TANKS

Pre-qualification Required for System 3B

3A. Portable Water Tanks

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-03 Epoxy Phenolic Primer		150 µm
		Hi-Pon 80-04 Epoxy Phenolic Top Coat		150 µm
			TOTAL	300 µm

3B. Ballast Water Tanks/Internal Seawater Filled Compartments

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Marine NOA 60HS (IMO PSPC-COT)		160 µm
		Marine NOA 60HS (IMO PSPC-COT)		160 µm
			TOTAL	320 µm

3C. Tanks for Stabilised Crude, Diesel and Condensate

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-03 Epoxy Phenolic Primer		150 µm
		Hi-Pon 80-04 Epoxy Phenolic Top Coat		150 µm
			TOTAL	300 µm
2	Sa2.5	Hi-Pon 80-05 Epoxy TL 70		125 µm
		Hi-Pon 80-05 Epoxy TL 70		125 µm
			TOTAL	250 µm
3	Sa2.5	Hi-Pon 20-04 STE IM 80		150 µm
		Hi-Pon 20-04 STE IM 80		150 µm
			TOTAL	300 µm
4	Sa2.5	Hi-Pon 80-16 Epoxy SF		500 µm
			TOTAL	500 µm
5	Sa2.5	Hi-Pon 80-17 Epoxy Phenolic SF		500 µm
			TOTAL	500 µm

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NORSOK COATING SYSTEM 3

INTERNAL SURFACE OF CARBON STEEL TANKS

3D. Process Vessels < 0.3 MPa < 75°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-02 Epoxy Novalac		150 µm
		Hi-Pon 80-02 Epoxy Novalac		150 µm
			TOTAL	300 µm
2	Sa2.5	Hi-Pon 80-18 Epoxy Novalac SF		500 µm
		Hi-Pon 80-18 Epoxy Novalac SF		500 µm
			TOTAL	1000 µm

3E. Process Vessels < 7 MPa < 80°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-02 Epoxy Novolac		150 µm
		Hi-Pon 80-02 Epoxy Novolac		150 µm
			TOTAL	300 µm
2	Sa2.5	Hi-Pon 80-18 Epoxy Novolac SF		500 µm
		Hi-Pon 80-18 Epoxy Novolac SF		500 µm
			TOTAL	1000 µm
3	Sa2.5	Hi-Pon 80-08 Novalac Vinyl Ester		500 µm
		Hi-Pon 80-08 Novalac Vinyl Ester		500 µm
			TOTAL	1000 µm

3F. Process Vessels < 3 MPa < 130°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-18 Epoxy Novolac SF		500 µm
		Hi-Pon 80-18 Epoxy Novolac SF		500 µm
			TOTAL	1000 µm

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NORSOK COATING SYSTEM 3

INTERNAL SURFACE OF CARBON STEEL TANKS

3G. Methanol Storage				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-03 Epoxy Phenolic Primer		150 µm
		Hi-Pon 80-04 Epoxy Phenolic Top Coat		150 µm
			TOTAL	300 µm
2	Sa2.5	Hi-Pon 80-08 Novalac Vinyl Ester GF		500 µm
		Hi-Pon 80-08 Novolac Vinyl Ester GF		500 µm
			TOTAL	1000 µm

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NORSOK COATING SYSTEM 4

WALKWAYS, ESCAPE ROUTES AND LAY DOWN AREAS

Pre-qualification Required

Heavy Duty			
Scheme No.	Surface Preparation	Coating System	DFT
1	Sa2.5	Zinky-10 Inorganic Zinc Shop Primer (Sweep Blast)	15 µm
		Hi-Pon 90-01 Epoxy Glass Flake 95	500 µm
		Hi-Pon 90-01 Epoxy Glass Flake 95	500 µm
		Anti-Slip Aggregate[1]	-
		Hi-Pon 90-01 Epoxy Glass Flake 95	100 µm
		TOTAL[2]	1115 µm

Medium Duty			
Scheme No.	Surface Preparation	Coating System	DFT
2	Sa2.5	Hi-Pon 90-05 Epoxy HB 85	500 µm
		Hi-Pon 90-05 Epoxy HB 85	500 µm
		Anti-Slip Aggregate[1]	-
		Hi-Pon 90-05 Epoxy HB 85	100 µm
		TOTAL[2]	1100 µm

[1]Aggregate particle size will be 1mm to 5mm.

[2]Total DFT excludes anti-slip aggregate.

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NORSOK COATING SYSTEM 5

EPOXY-BASED/CEMENT-BASED FIRE PROTECTION

Pre-qualification Required

Nippon Paint does not supply passive fire protection. Only approved primers and top coats can be used for passive fire protection systems.

5A. Epoxy-based Fire Protection

No recommendation for NORSOK System 5A. Consult Nippon Paint Protective Coatings for further advice.

5B. Cement-based Fire Protection

No recommendation for NORSOK System 5B. Consult Nippon Paint Protective Coatings for further advice.

Note: All primers and top coats for use in fire protection system must be approved. Consult Nippon Paint Protective Coatings for advice on fire protection systems or other alternative primers/top coats.

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NORSOK COATING SYSTEM 6

STAINLESS STEEL/ALUMINIUM/ GALVANISED STEEL PROTECTION

Pre-qualification Not Required

6A. Un-insulated Stainless Steel and Aluminium Protection < 120°C

Scheme No.	Surface Preparation	Coating System		DFT
1	Sweep blast with non-metallic abrasive	Hi-Pon 20-03 Epoxy Red Oxide Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat		75 µm
			TOTAL	225 µm
2	Sweep blast with non-metallic abrasive	Hi-Pon 20-03 Epoxy Red Oxide Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-07 Polysiloxane Top Coat		75 µm
			TOTAL	225 µm

6B. Galvanised Steel Protection < 120°C

Scheme No.	Surface Preparation	Coating System		DFT
1	Clean with alkaline detergent followed by hosing with fresh water	Hi-Pon 20-03 Epoxy Red Oxide Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat		75 µm
			TOTAL	225 µm
2	Clean with alkaline detergent followed by hosing with fresh water	Hi-Pon 20-03 Epoxy Red Oxide Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-07 Polysiloxane Top Coat		75 µm
			TOTAL	225 µm
3	Clean with alkaline detergent followed by hosing with fresh water	Hi-Pon 20-10 Epoxy Zinc Phosphate Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat		75 µm
			TOTAL	225 µm
4	Clean with alkaline detergent followed by hosing with fresh water	Hi-Pon 20-10 Epoxy Zinc Phosphate Primer		50 µm
		Hi-Pon 30-02 Epoxy MIO 80		100 µm
		Hi-Pon 50-07 Polysiloxane Top Coat		75 µm
			TOTAL	225 µm

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NORSOK COATING SYSTEM 6

STAINLESS STEEL/ALUMINIUM/ GALVANISED STEEL PROTECTION

Pre-qualification Not Required

6C. Insulated Stainless Steel Protection > 150°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sweep blast with non-metallic abrasive	Hi-Pon 200 CUI Epoxy Phenolic		125 µm
		Hi-Pon 200 CUI Epoxy Phenolic		125 µm
			TOTAL	250 µm
2	Sweep blast with non-metallic abrasive	Hi-Pon 300 CUI Epoxy Phenolic		125 µm
		Hi-Pon 300 CUI Epoxy Phenolic		125 µm
			TOTAL	250 µm

Note 3*: When coating stainless steel with a maximum operating temperature 150°C a high temperature modified coating suitable for the operating temperatures shall be used. Refer to NORSOK Standard M-501 – A.6 NOTE 3.

*Un-insulated Stainless Steel Protection > 150°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sweep blast with non-metallic abrasive	Hi-Pon 300HT Top Coat		25 µm
		Hi-Pon 300HT Top Coat		25 µm
			TOTAL	50 µm
2	Sweep blast with non-metallic abrasive	Hi-Pon 600HT Top Coat		25 µm
		Hi-Pon 600HT Top Coat		25 µm
			TOTAL	50 µm

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NORSOK COATING SYSTEM 7

CARBON AND STAINLESS STEEL IN THE SPLASH ZONE/SUBMERGED ZONE

Pre-qualification Required

For splash zone coating, system shall fulfil the pre-qualification requirements for System No. 1

7A. Carbon Steel and Stainless Steel in Splash Zone

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Zinky-10 Inorganic Zinc Shop Primer (Sweep Blast)		15 µm
		Hi-Pon 90-01 Epoxy Glass Flake HB 95		500 µm
		Hi-Pon 90-01 Epoxy Glass Flake HB 95		500 µm
			TOTAL	1015 µm
2	Sa2.5	Hi-Pon 90-01 Epoxy Glass Flake HB 95		500 µm
		Hi-Pon 90-01 Epoxy Glass Flake HB 95		500 µm
			TOTAL	1000 µm

7B. Carbon Steel and Stainless Steel in Submerged Zone ≤ 50°C

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 20-04 STE IM 80		200 µm
		Hi-Pon 20-04 STE IM 80		200 µm
			TOTAL	400 µm
2	Sa2.5	Hi-Pon 90-05 Epoxy HB 85		225 µm
		Hi-Pon 90-05 Epoxy HB 85		225 µm
			TOTAL	450 µm

7C. Carbon Steel and Stainless Steel in Submerged Zone > 50°C (BS 6920 approval at 60°C)

Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 80-05 Epoxy TL 70		175 µm
		Hi-Pon 80-05 Epoxy TL 70		175 µm
			TOTAL	350 µm

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NORSOK COATING SYSTEM 8

STRUCTURAL CARBON STEEL IN INTERNAL AND FULLY DRY AND VENTILATED AREAS

Pre-qualification Not Required

Structural Carbon Steel with Operating Temperature ≤ 80°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Zinky-22 Epoxy Zinc Rich Primer 80		60 µm
		Hi-Pon 20-03 Epoxy White Primer		25 µm
			TOTAL	85 µm
2	Sa2.5	Hi-Pon 20-04 STE 80		150 µm
			TOTAL	150 µm
3	Sa2.5	Hi-Pon 20-14 Epoxy U-Coat		150 µm
			TOTAL	150 µm
4	Sa2.5	Hi-Pon 40-02 Epoxy Top Coat		150 µm
			TOTAL	150 µm

NORSOK COATING SYSTEM 9

BULK-SUPPLIED CARBON STEEL VALVES WITH OPERATING TEMPERATURE ≤ 150°C

Pre-qualification Not Required

Bulk-supplied Carbon Steel Valves with Operating Temperature ≤ 150°C				
Scheme No.	Surface Preparation	Coating System		DFT
1	Sa2.5	Hi-Pon 200 CUI Epoxy Phenolic		150 µm
		Hi-Pon 200 CUI Epoxy Phenolic		150 µm
			TOTAL	300 µm
2	Sa2.5	Hi-Pon 300 CUI Epoxy Phenolic		150 µm
		Hi-Pon 300 CUI Epoxy Phenolic		150 µm
			TOTAL	300 µm

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MAINTENANCE COATING SYSTEM

RUSTED CARBON STEEL

Pre-qualification Not Required

Application over High-pressure Water Wash			
Scheme No.	Surface Preparation	Coating System	DFT
1	Free from dirt/oil/ loose rust	Nippon CRS	50 µm
		Nippon C2M	100 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat	75 µm
		TOTAL	225 µm
2	Free from dirt/oil/ loose rust	Nippon CRS	50 µm
		Hi-Pon 20-04 STE 80	100 µm
		Hi-Pon 50-01 AS Polyurethane Top Coat	75 µm
		TOTAL	225 µm

Please consult Nippon Paint Protective Coatings representatives for further advice on other coatings options.

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