CORRIGENDUM-1 TO TENDER SPECIFICATION BHEL: PSSR: SCT: 1956

Sub: Erection & Testing of Sea water piping system and all associated Piping in tunnel, buildings & buried portion including related civil works like excavation, sand filling, construction of Inspection chamber at Kudankulam Nuclear Power Project Unit 3 & 4 Tamilnadu.

1. The following documents are enclosed under Annexures of VOLUME-IA PART-I CHAPTER – II SCOPE OF WORKS, for bidder's reference: -

(i) Annexure-VI List of NPCIL approved brands of welding consumables.
(ii) Annexure-VII Technical specification for Grit Blasting & supply and application of Painting.

Note:
1. All other conditions remain unchanged.
2. Bidders are requested to consider this corrigendum as part of tender specification and quote accordingly.

-sd-
T.K.Eashwar
Sr. Engineer/ SCT

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

NUCLEAR POWER CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

गुणवत्ता आश्वासन निदेशालय

Directorate of Quality Assurance

नाभिकीय ऊर्जा भवन, अणुशक्तिनगर, मुंबई-400 094

Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

Corporate Identification No. U40104MH1987GOI149458

आर.के. गुप्ता R.K. Gupta
अधिशासी निदेशक (गु.आ.) Executive Director (QA)

Phone: 022- 25995030/25558487
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सं.No. एनपीसीआईएलNPCIL/02500/क्यूएडी QAD/एमM/2019/161 दिनांक Date: December 17, 2019

विषय : वेल्डिंग कंज्यूमेबल्स के अनुमोदित ब्रांड की सूची।

Sub: List of approved brands of welding consumables

17/12/2019 की स्थिति में एनपीसीआईएल कार्यों के उपयोग हेतु वेल्डिंग कंज्यूमेबल्स के अनुमोदित ब्रांडों की सूची इसके साथ संलग्न है:

The lists of approved brands of welding consumables for use on NPCIL jobs as on 17/12/2019 are enclosed herewith.

1) अनुमोदित कार्बन स्टील एवं निम्न एलॉय स्टील वेल्डिंग इलेक्ट्रोड्स की सूची (2 शीट)
   List of Approved Carbon Steel & Low Alloy Steel Welding Electrodes (2 Sheets).
2) अनुमोदित स्टेनलेस स्टील एवं अन्य निकिल एलॉय इलेक्ट्रोड्स की सूची (2 शीट)
   List of Approved Stainless Steel & other Ni Alloy Electrodes (2 Sheets).
3) वायर के अनुमोदित ब्रांड एवं वायर फ्लक्स संयोजन की सूची (1 शीट)
   List of Approved Brands of Wire and Wire Flux Combination (1 Sheet).

वेल्डिंग कंज्यूमेबल्स (क्यूएडी/प्रापण/वेल्डिंग कंज्यूमेबल्स/002 संशो.: 2) के अनुमोदन के लिए प्रक्रिया में एवं एएसएमई खंड II भाग C के अद्यतन संस्करण में निर्धारित आवश्यकताओं के अनुसार अनुमोदन प्रदान किया जाता है। तथापि, विशेष मामलों में जहाँ कहीं भी बैच क्वालिफिकेशन अपेक्षित होगा, अलग से निष्पादित किया जाएगा।

The approvals are granted in conformance to the requirements stipulated in Procedure for approval of Welding Consumables (QAD/Proc/Welding Consumables/002 Rev:2) and latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

राकेश कुमार गुप्ता
(आर.के. गुप्ता R.K. Gupta) 17.12.19
अधिशासी निदेशक (गु.आ.) Executive Director (QA)

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड
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Directorate of Quality Assurance
नाभिकीय ऊर्जा भवन, अणुशक्तिनगर, मुंबई-400 094
Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

1) LIST OF APPROVED CARBON STEEL & LOW ALLOY STEEL WELDING ELECTRODES

(2 pages)

As on 17-12-2019

Sr. No.	Manufacturers	Brand name	AWS No.	Valid up to
1.	ADOR WELDING LTD., SILVASSA	SUPABASE X PLUS	E7018	FEB2024
2.	ADOR WELDING LTD., SILVASSA	MOLYTEN	E7018-A1	APR2020
3.	ADOR WELDING LTD., SILVASSA	CHROMOTEN	E8018 B2	APR2020
4.	ADOR WELDING LTD., SILVASSA	CHROMOTEN-C	E9018 B3	APR2020
5.	ADOR WELDING LTD., SILVASSA	TENALLOY Z PLUS	E7018-1	JUN2022
6.	D&H INDIA LTD., INDORE	SUPER -CR-1	E8018 B2	DEC2020
7.	D&H INDIA LTD., INDORE	SUPER -CR-2	E9018 B3	DEC2020
8.	D&H INDIA LTD., INDORE	SUPER –LH (SPL)	E7018-1 (DCEP Only)	FEB2021
9.	D&H INDIA LTD., INDORE	STANDARD	E6013	FEB2021
10.	D&H INDIA LTD., INDORE	SUPER LH	E7018 (DCEP Only)	FEB2021
11.	D&H SECHERON, INDORE	MEDIO	E6013	JUN2020
12.	D&H SECHERON, INDORE	EXOBEL	E6013	JUN2020
13.	D&H SECHERON, INDORE	SUPERTHERME	E7018	JUN2020
14.	D&H SECHERON, INDORE	MOLYTHERME	E7018-A1	JUN2022
15.	D&H SECHERON, INDORE	SUPERTHERME(SPL)	E7018-1	NOV2023
16.	HONAVAR ELECTRODES, THANE	REGULAR S	E6013	JAN2020
17.	HONAVAR ELECTRODES, THANE	ULTIMATE - 18	E7018	JAN2020
18.	HONAVAR ELECTRODES, THANE	ULTIMATE – 18 SPL	E7018-1	JAN2020
19.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -13R	E6013	SEP2020
20.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -18	E7018	SEP2020
21.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -18 PLUS	E7018-1	SEP2020
22.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -1 CR	E8018-B2	JUN2024
23.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -2 CR	E9018-B3	JUN2024
24.	RAJ KESARI ELECTRODES, UDAIPUR	SUPERLET 18	E7018	AUG2022
25.	RAJ KESARI ELECTRODES, UDAIPUR	SUPERLET 18 (SPL.)	E7018-1	AUG2022
26.	RAJ KESARI ELECTRODES, UDAIPUR	RAJCORD 13S	E6013	AUG2022
27.	RAJRATNA ELECTRODES, AHEMEDABAD	RATNA 7018 SPL.	E7018-1	MAR2020
28.	RAJRATNA ELECTRODES, AHEMEDABAD	RATNA 7018	E7018	NOV2023
29.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM SPL.	E7018-1	SEP2021
30.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL CHROM 1	E8018-B2	FEB2023
31.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL CHROM 2	E9018-B3	FEB2023
32.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM MOLY	E7018-A1	MAR2023
33.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM	E7018	DEC2023
34.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL S	E6013	DEC2023
35.	SUPERON SCHWEISSTECHNIK INDIA LTD. DELHI	GARANT MO	E7018-A1	SEP2020
36.	SUPERON SCHWEISSTECHNIK INDIA LTD., DELHI	SUPER CROMO 1B	E8018-B2	DEC2020

Sr. No.	Manufacturers	Brand name	AWS No.	Valid up to
37.	SUPERON SCHWEISSTECHNIK INDIA LTD., DELHI	SUPER CROMO 2B	E9018-B3	DEC2020
38.	VIJEY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 6013 X	E6013	SEP2020
39.	VIJEY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 7018	E7018	SEP2020
40.	VIJEY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 7018 - 1	E7018-1	SEP2020
41.	WELD FAST ELECTRODES, NAGPUR	WELDFAST LH 18	E-7018	MAR2020
42.	WELD FAST ELECTRODES, NAGPUR	WELDFAST LH-18-1	E-7018-1	MAR2020
43.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 0500	E7018-A1	FEB2023
44.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 1500	E8018-B2	FEB2023
45.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 2251	E9018-B3	FEB2023

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

17/12/19

(Anoop Singh)
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1) 17/12/19 17/12/19

Executive Director (QA) 17.12.'19

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड
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Directorate of Quality Assurance
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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

2) LIST OF APPROVED STAINLESS STEEL & OTHER NI ALLOY ELECTRODES

(2 Pages)

As on 17-12-2019

Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
1.	ADOR WELDING LTD., SILVASSA	BETANOX-DL	E 309L-16	SEP2020
2.	ADOR WELDING LTD., SILVASSA	SUPERINOX-2C	E 316L-16	SEP2020
3.	ADOR WELDING LTD., SILVASSA	SUPERINOX-1C	E 308L-16	SEP2020
4.	D&H INDIA LTD., INDORE	SV-308L	E 308L-15	DEC2022
5.	D&H INDIA LTD., INDORE	SV-309L	E 309L-15	DEC2022
6.	D&H INDIA LTD., INDORE	CROMALLOY-B	E 308L-16	DEC2022
7.	D&H INDIA LTD., INDORE	CROMALLOY 309L	E 309L-16	DEC2020
8.	ADOR FONTECH, BENGALURU	LH 511	E Ni Cu7	OCT2020
9.	ADOR FONTECH, BENGALURU	LH 521	E Ni Cr Fe 3	OCT2020
10.	D&H SECHERON, INDORE	CRONITHERME 25/12	E 309-16	JUN2022
11.	D&H SECHERON, INDORE	RUTOX-D	E 316L-16	JUN2022
12.	D&H SECHERON, INDORE	BATOX-B	E 308L-15	JUN2020
13.	D&H SECHERON, INDORE	RUTOX-B	E 308L-16	JUN2020
14.	D&H SECHERON, INDORE	D&H 309L	E 309L-16	NOV2023
15.	D&H SECHERON, INDORE	D&H 1250	E NiCu-7	JAN2021
16.	D&H SECHERON, INDORE	D&H 1212NS	E NiCr Fe-3	JAN2021
17.	D&H SECHERON, INDORE	RUTOX-A	E 308-16	NOV2023
18.	D&H SECHERON, INDORE	RUTOX-A St	E 347-16	NOV2023
19.	D&H SECHERON, INDORE	RUTOX-Mo	E 316-16	NOV2023
20.	HONAVAR ELECTRODES, THANE	SILVER SHINE 308L-15	E 308L-15	FEB2024
21.	HONAVAR ELECTRODES, THANE	SILVER SHINE 316L	E 316L-16	FEB2024
22.	RAJRATNA ELECTRODES, AHEMEDABAD	RATNA 308L	E 308L-16	MAR2020
23.	RAJRATNA ELECTRODES, AHEMEDABAD	RATNA 316 L	E 316L-16	MAR2020
24.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-A	E 308-16	JUN2024
25.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-AL	E 308L-16	JUN2024
26.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-AL-15	E 308L-15	JUN2024
27.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12	E 309-16	JUN2024
28.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12-L	E 309L-16	JUN2024
29.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12-Mo	E 309 Mo-16	JUN2024
30.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX Mo	E 316-16	JUN2024
31.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX MoL	E 316L-16	JUN2024
32.	ROYAL ARC ELECTRODES, VASAI,	ROYAL 1C	E 308L-16	OCT2024
33.	ROYAL ARC ELECTRODES, VASAI,	ROYAL 2C	E 316L-16	OCT2024

Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
34.	ROYAL ARC ELECTRODES, VASAI,	ROYAL-D2L	E 309L-16	OCT2024
35.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 308L	E 308L-16	JAN2021
36.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 316L	E 316L-16	JAN2021
37.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 309L	E 309L-16	JAN2021
38.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 309MoL	E 309LMo-16	JAN2021

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

17/12/19

(Anoop Singh)
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1) 17/12/19 17/12/19

Executive Director (QA) 17.12.19

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड
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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

3) LIST OF APPROVED BRANDS OF WIRE AND WIRE FLUX COMBINATION

(1 Page)

As on 17-12-2019

Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
1.	ADOR FONTECH, BENGALURU	TIG 120	ER 308L	OCT2024
2.	ADOR FONTECH, BENGALURU	TIG 121	ER 316L	OCT2024
3.	ADOR FONTECH, BENGALURU	TIG 123	ER 309L	OCT2024
4.	ADOR FONTECH, BENGALURU	TIG 120S	ER 347	OCT2024
5.	ADOR FONTECH, BENGALURU	TIG 521	ER NiCr3	OCT2024
6.	ADOR WELDING LTD., SILVASSA	TIGFIL 70S-2	ER 70S-2	FEB2022
7.	ADOR WELDING LTD., SILVASSA	TIGINOX-308L	ER 308L	SEP2020
8.	ADOR WELDING LTD., SILVASSA	TIGINOX-309L	ER309L	SEP2020
9.	ADOR WELDING LTD., SILVASSA	AUTOMIG 70-S6	ER 70S-6	DEC2023
10.	ADOR WELDING LTD., SILVASSA	AUTOMELT-B71 AUTOMELT-EH 14 WIRE	F7A2-EH14	FEB2024
11.	D&H INDIA LTD., INDORE	SUPER TIG 308L	ER 308L	DEC2020
12.	D&H INDIA LTD., INDORE	SUPER TIG 309L	ER 309L	DEC2020
13.	D&H SECHERON, INDORE	FILLER WIRE FW 308L	ER 308L	FEB2021
14.	D&H SECHERON, INDORE	FILLER WIRE FW 309L	ER 309L	FEB2021
15.	D&H SECHERON, INDORE	F 70 S2	ER 70S-2	JUN2022
16.	RAJRATNA ELECTRODES, AHEMEDABAD	RAAJTIG ER 308L	ER 308L	MAR2020
17.	RAJRATNA ELECTRODES, AHEMEDABAD	RAAJTIG ER 316L	ER 316L	MAR2020
18.	VENUS WIRES, KHOPOLI	VENUS 308L	ER 308L	SEP2021
19.	VENUS WIRES, KHOPOLI	VENUS 316L	ER 309L	SEP2021
20.	VENUS WIRES, KHOPOLI	VENUS 309L	ER 316L	SEP2021
21.	VENUS WIRES, KHOPOLI	VENUS 347	ER 347	SEP2021
22.	WELD FAST ELECTRODES, NAGPUR	TIG FAST-3	ER 70S-2	JAN2021
23.	WELD FAST ELECTRODES, NAGPUR	MIG FAST-1	ER 70S-6	JAN2021

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

17/12/19
(Anoop Singh)
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1) 17/12/19 17/12/19

Executive Director (QA) 17.12.19

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

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Directorate of Quality Assurance

नाभिकीय ऊर्जा भवन, अणुशक्तिनगर, मुंबई-400 094

Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

Corporate Identification No. U40104MH1987GOI149458

आर.के. गुप्ता R.K. Gupta
अधिशासी निदेशक (गु.आ.) Executive Director (QA)

Phone: 022- 25995030/25558487
Fax.No.: 022-25565354
e-mail: rk_gupta@npcil.co.in

सं. No. एनपीसीआईएलNPCIL/02500/क्यूएडीQAD/ईडीED(क्यूएQA)/एमM/2019/160 December 17, 2019

विषय : वेधी पदार्थों के अनुमोदित ब्रांड की सूची।

Sub: List of approved brands of penetrant materials

17-12-2019 की स्थिति में एनपीसीआईएल के उपयोग हेतु वेधी पदार्थों के अनुमोदित ब्रांड की सूची इसके साथ संलग्न है। यह अनुमोदन हमारी प्रक्रिया संख्या QAD/NDT-PROC-PT-05 (तरल वेधी परीक्षण के लिए उपयोग में आने वाले रसायन परिवार के अनुमोदन हेतु प्रक्रिया) कें अुनसार आवश्यकताओं के अनुरूप प्रदान किया जाता है।

The list of approved brands of penetrant materials for use on NPCIL jobs as on 17-12-2019 is enclosed herewith. The approvals are granted in conformance to the requirements as per our procedure no. QAD/NDT-PROC-PT-05 (Procedure for approval of Family of Chemicals used for Liquid Penetrant Examination).

राकेश कुमार गुप्ता
17.12.19

(आर.के. गुप्ता R. K. Gupta)
अधिशासी निदेशक (गु.आ.) Executive Director (QA)

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड
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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

LIST OF APPROVED PENETRANT TESTING MATERIAL

(As on 17-12-2019)

Sr. No.	Manufacturers	Brand name	Description	Valid up to
1.	DYEGLO PVT. LTD, PUNE	RP-81	Red Coloured Solvent Removable Penetrant	DEC2023
2.	DYEGLO PVT. LTD, PUNE	RP-90	Red Coloured Water Washable Penetrant	DEC2023
3.	DYEGLO PVT. LTD, PUNE	CL-01	Solvent Cleaner	DEC2023
4.	DYEGLO PVT. LTD, PUNE	RD-01	Solvent Base Developer suitable for RP-81 & RP-90	DEC2023
5.	DYEGLO PVT. LTD, PUNE	FP-01	Fluorescent Solvent Removable Penetrant	DEC2023
6.	DYEGLO PVT. LTD, PUNE	WD-01	Solvent Base Developer suitable for FP-01.	DEC2023
7.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-911, FC-811 FC-711	Solvent Removable (Visible)	FEB2022
8.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-931, FC-811	Water Washable (Visible)	FEB2022
9.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-941, FC-821	Water washable (Fluorescent)	FEB2022
10.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-921, FC-821, FC-721	Solvent removable (Fluorescent)	FEB2022
11.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-SP 1	Red Coloured Solvent Removable Penetrant	JUL2024
12.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKC-1	Solvent Cleaner	JUL2024
13.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKD-S2	Solvent Base Developer	JUL2024
14.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-WP2	Red Coloured Water Washable Penetrant	JUL2024
15.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-SP2	Red Coloured Solvent Removable Penetrant.	JUL2024
16.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 62	Solvent Removable Penetrant–Red	JAN2021
17.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 68 NF	Solvent Removable and Water Washable Penetrant–Red	JAN2021
18.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 67	Solvent Removable and Water Washable Penetrant–Red	JAN2021
19.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 672 F	Solvent Removable and Water Washable Penetrant–Fluorescent	JAN2021
20.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 85	Solvent Remover suitable for MR(R) 68NF, MR(R) 67, MR(R) 672F and MR(R) 62.	JAN2021
21.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 70	Non-Aqueous Developer suitable for MR(R) 68 NF, MR(R) 67 and MR(R) 672F	JAN2021

Sr. No.	Manufacturers	Brand name	Description	Valid up to
22.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR(R) 70 I	Non-Aqueous Developer suitable for MR(R) 62.	JAN2021
23.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-15/PP-15B	Red Coloured Solvent Removable Penetrant	SEPT2021
24.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-19/PP-19B	Red Coloured Water Washable Penetrant	SEPT2021
25.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PC-21/PC-21B	Solvent Cleaner	SEPT2021
26.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PD-31/PD-31B	Solvent Base Developer	SEPT2021
27.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-110/ PP110B	Red Coloured Solvent Removable Penetrant	SEPT2021
28.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PC 120/ PC-120B	Solvent Cleaner	SEPT2021
29.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PD 130 /PD-130B	Solvent Base Developer	SEPT2021
30.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	FPS46/FPS46B	Solvent Removable Fluorescent Penetrant	SEPT2021
31.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	FPS49/FPS49B	Water Washable Fluorescent Penetrant	SEPT2021
32.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Penetrant (NP Grade)	Red Coloured Solvent Removable Penetrant.	OCT2024
33.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Cleaner (NP Grade)	Solvent Cleaner	OCT2024
34.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Developer (NP Grade)	Solvent Base Developer	OCT2024
35.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Red Dye Penetrant-W	Water Washable Dye Penetrant	OCT2024

Note:-

1. Halogen content in Penetrant, Cleaner and Developer is 25ppm (max) and Sulphur content is 500ppm (max). However when using penetrant materials for Austenitic Stainless Steel, Titanium, Nickel base or other high temperature alloys, Halogen and Sulphur content shall not exceed 25ppm. Manufacture has to mention for each batch, the Sulphur and Halogen content in the label of each container for selection of Penetrant materials for the stated application.
2. Developer is to be used in Aerosol can to get the best results.

17/12/19

(Anoop Singh)
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1) 17/12/19 17/12/19

Executive Director (QA) 17.12.19

Sr. No.	QA unit	Test Lab.	Suitable for material testing		
			Physical	Chemical	Micro
1	Noida	M/s R.K. Inspection & Testing Services C-42, Manak Vihar Ext.(Tihar), Subhash Nagar, New Delhi-110018. Phone no. 011 -28122201 Fax No. 011-25122517 E mail-info@rkits.co.in	**1. 0 Physical Testing** 1.1 Tensile testing at room temp. with extensometer 1.2 Impact testing as per ASTM E-23 standard 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.4 Bend test, Flattening, Flaring,Proof load, Pull out load, Fillet test.	**2.0 Chemical Testing -** *2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.
2	Noida	M/s SPECTRO E-41, Okhla Indl. Area, Phase-II, New Delhi-110020 Phone no. 011 -40522000 Fax No. 011-40503150 E mail-kd@spectro.in	**1. 0 Physical Testing** 1.1 Tensile testing at room temp. 1.2 Tensile testing at elevated temp. subject to availability of extensometer for 0.2% yield stress measurement. 1.3 Impact testing testing as per ASTM E-23 standard 1.4 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.5 Bend test, Flattening, Flaring, Proof load, Pull out load, Fillet test.	**2.0 Chemical Testing** 2.1 Wet Analysis 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness mesurement

3	Noida	M/s IRC Engg. Services.India (P) Ltd. A-53,Sector-63, Noida, District : G.B.Nagar Phone no. 0120 -3352706 Fax No. 0120-4227940 E mail-	**1. 0 Physical Testing** *****1.1 Tensile testing at room & elevated temp subject to availability of extensometer for 0.2% yield stress measurement. 1.2 Impact testing as per ASTM-E-23 standard 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.4 Bend test, Flattening, Flaring, Proof load, Creep test, Stress rupture test, Pull out load, Fillet test.	**2.0 Chemical Testing -** ** 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.
4	Noida	M/s Inspection & Testing Engg., D-155,Sector-49. Noida, District :G.B.Nagar (UP), Pin-201 307 Phone no. 0120 -2500065 Fax No. 0120-4310675 E mail-	**1. 0 Physical Testing** 1.1 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.2 Bend test, Flattening	**2.0 Chemical Testing** * 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** - Nil

5	Kolkata	M/s Metals& Minerals Testing Laboratories 30/A, Naraasingha Dutta Road, Howrah-711101 Kolkata-26 Phone no. 033 26673185 Fax No. 033 26779422 E mail-	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness) 1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt & Fillet test.	**2.0 Chemical Testing** * 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A , Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement
6	Kolkata	M/s Aglow Quality Control Laboratories Pvt.Ltd. P 47,Kasba Industrial Estate,Kolkatta-107 Phone no. 033 40089633 Fax No. 033 40625177 E mail-	**1.0 Physical Testing** 1.1 For Rubber Testing : Tensile, Hardness, elongation, adhesion, Tension & compression, abrasion, flexing, load deflection, hydro testing, aging.	**2.0 Chemical Testing** 2.1 For Rubber Testing: Rubber polymer content, hydrocarbon Content, neoprene rubber, identification of rubber, resistance to oil, density, analysis of ash. 2.2 Painting related tests(Abrasion, cohesion , adhesion , impact resistance, % elongation, etc.)	**3.0 Corrosion Test & Micro Examination** 3.1 Not Application

7	Kolkata	M/s ID & RL Pvt. Ltd. 33/2A,atish Mukherjee Road, Kolkatta-26 Phone no. 033 24644527 Fax No. 033 24644812 E mail-	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt & Fillet test.	**2.0 Chemical Testing** 2.1 Wet Analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement
8	Kolkata	M/s Inspection Survey & Surveillance (India) Pvt. Ltd. 26D/27,Park Lane, Kolkatta-16 Phone no. 033 65454984 Fax No. 033 22297658 E mail- insurveylab@yahoo.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams) 1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.,	**2.0 Chemical Testing** * 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement
9	Kolkata	M/s TREATS, 14,Ramnath Pal Road, Kidderpore Kolkata-23 Phone no. 033 24584142 Fax No. 033 2495818 E mail-	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Rockwell, Microhardness up to 1000 grams)	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis.	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.

			1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.		3.2 Mass of zinc coating 3.3 Paint thickness measurement
10	Mumbai	M/s. TCR Engg. Services Pvt.Ltd., EL-182,TTC Ind.Area,Mahape, Vashi, Navi-Mumbai - 400 705, (India). Phone no- 27610921/22/23 Fax no.- 2761 2044 Email- sales@tcreng.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams. 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld ,Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth Measurement, ferrite content measurement 3.2 Mass of zinc coating
11	Mumbai	M/s. Subodh Technologiests R-874, M.I.D.C.,Rabale , Navi Mumbai - 400 701. Phone no- 27690817 Fax no.- 27690817 Email- sudhakar@subodhlabs.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams 1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.	**2.0 Chemical Testing** * 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, 3.2 Mass of zinc coating
12	Mumbai	M/s Geo Chem Laboratories Pvt Ltd., (Mumbai) 36, Raja Industrial Estate, Purushottam Kheraj Marg, Mulund (W), Mumbai 400 080. Phone no- 67974999 Fax no.- 67974616 Email-	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell) 1.3 Bend Test, Flattening, Flarring,	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Case depth Measurement, Micro, Macro 3.2 Mass of zinc coating

		laboratory@geochemgroup.com	Proof Load for nuts		
13	Mumbai	M/s. Jewel Metallochem Laboratory Pvt. Ltd., A-12, Ghatkopar Indl. Estate, Ghatkopar (W), Mumbai 400 086. Phone no. 25007745 Fax No. 25001263 E mail- info@jewelmetallochem.com jewelmetal@rediffmail.com www.jewelmetallochem.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickers, Rockwell, Microhardness 50 to 1000 grams. 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating
14	Mumbai	M/s. Metallurgical Services, Mehta House, Ashok Silk Mills Lane, L.B.S. Marg, Ghatkopar (W), Mumbai 400 086. Phone no. 25000240 Fax No. 25001740 E mail- info@metallurgicallab.com metallurgicalservices@gmail.com www.metallurgicallab.com	**1.0 Physical Testing** 1.1 Tensile testing at room & elevated temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness 50 to 1000 gm 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Creep test, Fracture toughness and stress rupture test, Reverse bend test , Fatigue test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement, ferrite content measurement 3.2 Mass of zinc coating

15-A	Mumbai	M/s Elca Laboratories Plot No.A-444, Road No.37, (Off Road No.28) Near Rubber Products, Wagle Estate, Thane – 400 094. Phone no. 25824499 Fax No. 25825394 E mail-info@elcalabs.com www.elcalabs.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness 50 to 1000 grams. 1.3 Bend test, Flattening, Flaring, Proof load for nuts, Pull out load, Fillet test.	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A & E, Micro, Macro 3.2 Mass of zinc coating
15-B	Mumbai	Elca Laboratories, Unit-II, W-361, TTC Industrial Area, MIDC, Rabale, Navi Mumbi-400701 25824499 25822047 25823142 25833410 Fax No. 25825394 E mail-rabale@elcalabs.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer 1.2 Impact testing 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness. 1.4 Bend test, Flattening, Flaring, Proof load for nuts, Pull out load, Fillet test.	**2.0 Chemical Testing** 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A
16	Mumbai	M/s Metal Analysis & Services Pvt.Ltd., 219, Bussa Udyog Bhavan, Tokersey Jivraj Road, Sewree (W), Mumbai 400 015. Phone no. 24131160 Fax No. 66624514 E mail-hmj@bom7.vsnl.net.in	1**.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams. 1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro 3.2 Mass of zinc coating
17	Mumbai	M/s Offshore Testing &	**1.0 Physical Testing**	**2.0 Chemical Testing**	**3.0 Corrosion Test & Micro**

		Inspection Services (India) Pvt .Ltd., W-147, M.I.D.C., Pawane, Thane Belapur Road, Navi-Mumbai 400 710. Tel. 022 4144414 /15/16/17 Fax : 022 27633982 /25560401	1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell) 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test	2.1 Wet analysis * 2.2 Spectrometer analysis	**Examination** 3.1 IGC practice A & E
18	Mumbai	M/s Reliable Testing Services, Unit Number 59, 2nd floor, Bindal Industrial Estate,Kurla Andheri Road, Sakinaka, Mumbai 400 072. Phone no. 28516406 Fax No. 42154942 E mail-reliable1983@rediffmail.com www.reliabletestingservices.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer.	**2.0 Chemical Testing** 2.1 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 Mass of zinc coating 3.2 IGC practice A &E

19	Mumbai	M/s. Soham Analytical Services, A-121/101, B33/35, Amargian Industrial Estate, Pokhran Road No.1, Khopoli, Thane (W), Maharashtra. Tel. 022-25471297/93/94 Fax : 022 25471295 Email : lab_support@sohmanalytical.com	**1.0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld, Fillet test, Reverse bend test, Through thickness tensile test, Nick break test (pipes), Compression test	**2.0 Chemical Testing** 2.1 Wet analysis 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A & E, Micro, Macro, Inclusion rating, Case depth Measurement, Ferrite content 3.2 Mass of zinc coating 3.3 Hydrogen Induced corrosion test, Ferrite Chloride pitting & crevice corrosion test
20	Chennai	M/s Chennai Mettex Lab P.Ltd. Jyothi Complex, No.83, M .K.N.Road, Guindy , Chennai – 600 032 Ph. 044-22323163, 42179490/91 Fax :044-43534270 email address test@mettexlab.com	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with and without extensometer. ** 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell) and Microhardness 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test 1.5 Tensile testing of rubber material	**2.0 Chemical Testing** * 2.1 Spectrometer analysis 2.2 Polymer identification (rubber)	**3.0 Corrosion Test & Micro Examination** 3.1 Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating

21	Chennai	M/s Micro Lab, SP.101, 2 nd Main Road , Ambattur Industrial Estate, Chennai – 600 058 Ph. 044-26242525, Fax :044-26244872 E mail: cre@micrilabchennai.com	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with and without extensometer. 1.2 Tensile testing at elevated temp with and without extensometer. 1.3 Impact test as per ASTM E-23 Standard. 1.4 Hardness test (Brinell, Vickess, Rockwell) and Microhardness 1.5 Bend test, Flattening, Flaring, Proof load, Pull out load, Reverse bend test	**2.0 Chemical Testing** 2.1 Spectrometer analysis (OES)	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating
22	Chennai	M/s. Commando Lab No. 3A 5th South Street, Avarampalayam, Coimbatore 641 006 Phone : 0422 2560907	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer as applicable. 1.2 Hardness test (Brinell,, Vickers, Rockwell) 1.3 Bend test, Reverse bend test, Flattening test, Flaring test, Proof load test, Pull out load test.		

23	Bangaluru	M/s Geological and Metallurgical Laboratories (GML) 105X, 3rd Main, 3rd Cross, II Stage, Yeshwanthpur Indl. Suburb, Goraguntepalya, BANGALORE - 560 022 Ph. 2347 1065 , 2347 2020 Fax 2347 1011	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams. 1.3 Bend test, Flattening, Flaring , Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis.	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement
24	Baroda	M/s Met Heat Engineers Pvt. Ltd, Vadodara 857/2,G.I.D.C. Industrial Estate, Makarpura , Vadodara -390 010 Ph. (0265)2643655, 3046493, 6548715-16 Fax email address: info@metheat.com	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams. 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement

25	Baroda	M/s TCR Advanced Engineering Pvt. Ltd. , 36/2/9, First Floor, Abhishek Complex, GIDC Estate, Makarpura, Vadodara-390 010 Ph. 0265 2657233, 2634375 Fax 0265 2643024 email address	**1. 0 Physical Testing** 1.1 Tensile testing at room temp with extensometer. 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams. 1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	**2.0 Chemical Testing** 2.1 Wet analysis * 2.2 Spectrometer analysis	**3.0 Corrosion Test & Micro Examination** 3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement. 3.2 Mass of zinc coating 3.3 Paint thickness measurement
26	Pune	M/s Elca Quality Systems & Calibration Pvt.Ltd. S.Np. 232/2, Pune Nasik Road, Bhosari, Pune 411 039. Phone no.-020 27129194, 27125024 e-mail- qc@elcalabs.com	**1. 0 Physical Testing** 1.1 Cold/Hot tensile 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness/Bend/Flattening etc.	**2.0 Chemical Testing** 2.1 Spectro 2.2 Wet	**3.0 Corrosion Test & Micro Examination** 3.1 IGC 3.2 Micro/Macro 3.3 Coating thickness etc.
27	Pune	M/s Perfect Laboratory Services, 58,59/13,14/Unit 2 DII Blolck, MIDC, Chinchwad, Pune 411 019. Phone no.-020 27458150, 27454716 e-mail- trust_perfectlab@yahoo.com	**1. 0 Physical Testing** 1.1 Room temperature Tensile testing 1.2 Impact test as per ASTM E-23 Standard. 1.3 Hardness/Bend/Flattening etc.	**2.0 Chemical Testing** 2.1 Spectro 2.2 Wet	**3.0 Corrosion Test & Micro Examination** 3.1 IGC 3.2 Micro/Macro 3.3 Coating thickness etc.

28	Hyderabad	M/s. Jyothi Spectro Analysis (P) Ltd., A-30, APIE, Balanagar, Hyderabad 500 037. Tel. No. 040- 23771193 23771194 23773676 23778042 E-mail : sdsingh@jyothispectro.com	**1.0 Physical Testing :** 1.1 Hardness test (Brinell, Vickers, Rockwell) 1.2 Bend test, Flattening, Flaring, Pull out load, Proof load test and Fillet test.	**2.0 Chemical testing** 2.1 Spectrometer analysis for low carbon, alloy steels, ASS and aluminium bronze.	**3.0 Corrosion Test & Micro Examination** 3.1 IGC Practice A&E, Micro, macro, Inclusion rating. 3.2 Mass of zinc coating.
29	Hyderabad	M/s. Lucid Laboratories (P) Ltd., B-1/A, TIE, Phase II, B alanagar, Hyderabad 500 037. Te. No. 040-23720678 23720680 23720681 23720406 E-mail : info@lucidlabsindia.com lucidlabs@rediffmail.com	**1.0 Physical Testing :** 1.1 Hardness test (Vickers, Rockwell) 1.2 Bend test, Flattening and Fillet test.	**2.0 Chemical testing** 2.1 Spectrometer analysis for low carbon, alloy steels and ASS	**3.0 Corrosion Test & Micro Examination** 3.1 Mass of zinc coating.

Annexure - VII

Technical specification for Grit Blasting & supply and application of Painting

GRIT BLASTING AND PAINTING

1.0 Scope

This specification defines the requirements for Surface preparation, Grit blasting, supply, application of Paint coating on Pipes, Pipe Fittings, Valves, and all their Support structures of piping and equipments.

2.0 Grit Blasting and Primer Application:

Pipelines/equipments and supporting elements should be grit blasted to the surface profile of 35-65 microns or as recommended in paint manufacturers datasheet. Mill scale, rust, rust scale and foreign matter shall be removed fully by blast cleaning and the blasted surface shall be clean and free from any scale or rust and must show a grey white metallic luster.

The blast cleaned surface shall be coated with one complete application of primer of Inorganic Zinc Silicate primer of minimum 75 microns dry film thickness (DFT) as soon as practicable but not later than 4 hrs from completion of grit blasting.

3.0 Low Temperature Application:

Pipelines, supports, structural sections and equipments subjected to temperature less than 50^0C ($\leq 50^0$C) are coated with 2 coats (each coat of 100 microns DFT) of low temperature paints with 200 microns dry film thickness (DFT). The paints are applied after surface cleaning of primer coated surface with soft brush and cloth for removing all deposited dust, oil and grease etc .The finish coat of 50 micron is applied over the first coat.

Paints for Low temperature application (T≤50^{0}C)

Type of coating	Approved Paints	Approved Brand	Application method	Minimum number of Coating	Minimum Dry Film Thickness in microns (DFT)	preparation of surface
First coat	INTERSEAL 670 HS	Akzo Noble	As recommended bypaint manufacturer	2 *(per coat 100 Micron)*	200	After Dust cleaning of primer coated surface.
	Or PROTECTOMASTIC	Berger				
	Or RUST-O-CAP	Asian Paints				
	Or NPCIL approved equivalents					
Finish coat	INTERGARD – 740	Akzo Noble	As recommended by paint manufacturer	1 *coat 50 Micron*	50	After Dust cleaning of coated surface.
	Or EPILUX155 or EPILUX 89 HB	Berger				
	Or APCODUR CF 693 LX	Asian Paints				
	Or NPCIL approved equivalents					

4.0 Medium Temperature Application:

Pipelines, supports, structural sections and equipments subjected to temperature range 50<t≤150^{0}C are coated with 2 coats of medium temperature

paints with dry film thickness(DFT) as mentioned in table below. The paints are applied after surface cleaning of primer coated surface. Only pipe/equipment supports like saddle, shoe, clamps that comes in contact with pipeline/equipment and are subjected to pipeline temperature range $50<t\leq150^0C$, should be coated with medium temperature paint. Other supporting elements that subjected to $t<50^0C$ should be coated with low temperature paint.

Paints for Medium temperature application ($50<t\leq150^0C$)

Type of coating	Approved Paints	Approved Brand	Application method	Minimum number of Coating	Minimum Dry Film Thickness in microns (DFT)	preparation of surface
Finish coat	INTERPLUS– 256	Akzo Noble	As recommended bypaint manufacturer	2 *(per coat 75 Micron)*	150	After Dust cleaning of primer coated surface.
	Or FERROTOL HR ALUMINUM PAINT	Berger		2 *(per coat 25Micron)*	50	
	Or RUST-O-CAP MIO	Asian Paints				
	Or NPCIL approved equivalents			2 *(per coat 75 Micron)*	150	

5.0 High Temperature Application:

Pipelines, supports, structural sections and equipments subjected to temperature range $t>150^0C$ are coated with 2 coats of High temperature paints with dry film thickness(DFT) as mentioned in table below. The paint are applied after surface cleaning of primer coated surface. Only pipe/equipment supports

like saddle, shoe, clamps that comes in contact with pipeline /equipment and are subjected to pipeline temperature i.e, t>150^{0}C ,should be coated with high temperature paint. Other supporting elements that subjected to t<50^{0}C should be coated with low temperature paint.

Paints for High temperature application (t>150C)

Type of coating	**Approved Paints**	**Approved Brand**	**Application method**	**Minimum number of Coating**	**Minimum Dry Film Thickness in microns (DFT)**	**preparation of surface**
Finish coat	INTERTHERM – 50	Akzo Noble	As recommended bypaint manufacturer	2 *(per coat 25 Micron))*	50	After Dust cleaning of primer coated surface.
	Or CORROHEAT ALUMINUM	Berger				
	Or HEAT RESISTING SILICONE ALUMINUM PAINT	Asian Paints				
	or NPCIL approved equivalents					

6.0 <u>Requirements for Grit blasting:</u>

1. The minimum acceptable standard for blast cleaning is Sa 2-½ as per Swedish Standard SIS-05 5900 (latest edition) or SSPC or ISO 8501-01.

2. In case manual or hand tool cleaning shall be St. 2 or equivalent, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent.

3. Before blast cleaning, visible deposits of oil, grease, or other contaminants

shall be removed and clean, dry compressed air shall be used for nozzle blasting.

4. The surfaces shall be blast cleaned using one of the abrasives like chilled cast iron or malleable iron, shall be in the form of shot or grit of size GP25/GP16 (G42 grade maximum) and S250 grade size of steel shots (maximum) to obtain a desired surface profile. The combination of steel grits and shots shall be normally in the ratio of 3:1.

5. The quality of abrasives shall be free from contaminants and impurities and shall meet the requirements of SSPC AB1.

6. Power tool cleaning shall be done only where blast cleaning is not possible like site weld joints of erected pipeline, structures etc. It involves cleaning by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes.

7.0 Requirements for paint application:

1. Airless spray /conventional air spray/brush/roller as recommended by paint manufacturer should be used for primer/paint application.

2. The paints used for first coat, intermediate and finish coats shall be from the same manufacturer and shall be compatible as per the manufacturers data sheet.

3. Unused and left over paints shall be immediately removed from the site, at the end of the each day and shall be disposed off properly.

4. Paint components such as base, epoxy, curing agents once mixed shall be consumed within the pot life period and also validity expired paints shall not be used for application.

5. Paint application by brush shall be used for touch up painting such as site weld joints.

6. Surface shall not be coated in rain, wind or in environment and when the steel surface temperature is less than 5^0F above dew point when the relative humidity is greater than 85% or when the temperature is below 40^0F and when the ambient/substrate temperature is below the paint

manufacturer’s recommended temperature for application and curing.

7. Each coat shall be in proper state of cure or dryness before the application of succeeding coat. No coat shall be applied until the preceding coat has dried.

8. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer's instruction shall be followed for inter coat interval.

9. No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

10. To the maximum extent practicable, each coat of material shall be applied as a continuous film of uniform thickness.

11. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.

12. The painting equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges.

13. Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.

14. Paint shall be applied in a uniform layer and spray patterns shall be adjusted so that the paint is deposited uniformly.

15. No drier shall be added to a paint on the job unless specifically called for in the manufacturer’s specification for the paint.

16. Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.

17. Where paint has been damaged in handling and in transportation, the repair of damaged coating should be cleaned by mechanical scraping or

grinding wheels or rotating steel wire-brushes and inorganic zinc silicate and subsequent coats shall be applied.

8.0 Testing:

1. Material test certificate as per the IS or relevant standards shall be submitted along the material supply for acceptance.

2. The cleaned surface shall be inspected visually and using press-o-film for the required roughness for application of the primer / paint coating.

3. The existing coated surface with paint/primer shall be inspected after surface cleaning visually for absence of any dust, oil or grease.

4. The applied paint coats shall be examined for its specified coating thickness (DFT) by the latest and NPCIL approved measuring instruments.

5. Adhesion test or any other relevant test shall be conducted at site on coated surface for verification as per relevant standards (ASTM D-3359, ASTM D3363) as per the instruction of NPCIL.

9.0 Color Coding:

The color of paint required for the major systems are furnished below.

Sl. no.	System/ Description	Ground Colour
1	Cooling water system (PGB)	French Blue
2	Ordinary (Raw) water	Grass Green
3	Domestic or Drinking water	Grass Green
4	Domestic hot water	Grass Green
5	De-mineralized water	French Blue
6	Condenser cooling water (Sea water) (PAB)	Oriental Blue
7	Sea water for normal loads	Oriental Blue
8	Condensate system water	Sky Blue
9	Boiler feed water	Sky Blue
10	Re heater return	Sky Blue
11	Fire fighting water	Signal Red

12	Drainage system (Inactive)	Black
13	Steam systems	Aluminium
14	Compressed Air (Instrument & Service)	White
15	Compressed gases	White
16	Vacuum system	White
17	Turbine oil systems	Light Brown
18	Acids	Light purple brown
19	Alkali	Light salmon pink
20	Hydrazine, Ammonia, Chemical waste	Lemon
21	Turbine & Generator	Orange

10.0 **Reference standards/codes**:

IS 101 - Methods of test for ready mixed paints and enamels.

IS 1200- for measurement of painted surface

ASTM D 1005 – 95 Standard Test Method for Measurement of Dry-Film thickness of Organic Coatings Using Micrometers.

ASTM D-3359-Standard Test Methods for Measuring Adhesion by Tape Test

ASTM D3363-Standard Test Method for Film Hardness by Pencil Test

11.0 **Measurement of finished area:**

Measurement of the finished painted area of the valves, Pipe Flange and Spring hanger of pipe support shall be as per the following methodology.

1. Valve:

The quantity of valves shall be measured in terms of numbers referred to the pipe outside diameter. The term valves shall be deemed to include all flanged component (all type of valves, sight glasses, strainers, level indicators, steam traps) irrespective of pressure rating and their installed length and including operating elements (hand wheels, levers). Valves with welding ends and threaded ends shall be considered as 0.8 piece. A valve up to size DN 50 shall be considered as straight pipe length of 1 m and a valve size above DN 50 shall

be considered as straight pipe length of 2 m of corresponding pipe size. This additional measurement is in addition to the total length of pipeline including the valve body.

2. Flange:

   The surface area of flange or blind flange shall be measured as a straight pipe length of 0.3 m of the corresponding pipe size of all pressure rating and type of flanges. This 0.3 m is in addition to the total length of pipe includes the flange length. The surface area of a flange is derived as $A = \pi DL$, where, D=Outer diameter of the pipeline (m) & L= 0.3mtr.

3. Spring hanger of pipe support:

   The surface area of spring hanger of a pipe support for any size of pipe line and of any size of spring hanger support shall be measured as $A = \pi DL$, considering πD= 0.2 m multiplied by the actual length L of spring hanger support. The area measured by this method of spring hanger support, including the area of EP, support plate, upper tie rod, spring assembly and lower tie rod. The area of bottom channel of spring hanger support is taken separately.

Annexure-VII (Rev.1)

Technical specification for Grit Blasting & supply and application of Painting

CONTENT

GRIT BLASTING AND PAINTING

1.0 Scope

This specification covers the general requirements for grit blasting and painting. For detailed specification of surface preparation, grit blasting, product qualification, supply, application, inspection & testing of paint coating on Pipes, Pipe Fittings, Valves, equipments, supports, structures shall as per as per I02.KK34.0.0.TH.TS.PR0017 attached.

2.0 Requirements for Grit blasting:

1. The minimum acceptable standard for blast cleaning is Sa 2-½ as per ISO 8501-01.

2. In case manual or hand tool cleaning shall be St. 2 or equivalent, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent.

3. Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed and clean, dry compressed air shall be used for nozzle blasting.

4. The surfaces shall be blast cleaned using one of the abrasives like chilled cast iron or malleable iron, shall be in the form of shot or grit of size GP25/GP16 (G42 grade maximum) and S250 grade size of steel shots (maximum) to obtain a desired surface profile. The combination of steel grits and shots shall be normally in the ratio of 3:1.

5. Power tool cleaning shall be done only where blast cleaning is not possible like site weld joints of erected pipeline, structures etc. It involves cleaning by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes.

3.0 Requirements for paint application:

1. Supports elements like saddle, shoe, clamps that comes in contact with pipeline/equipment and which are subjected to pipeline temperature range $50<t\leq300^0C$, should be coated with medium or high temperature paint. Other supporting elements that subjected to $t<50^0C$ should be coated with low temperature paint.
2. Airless spray /conventional air spray/brush/roller as recommended by paint manufacturer should be used for primer/paint application.

3. The paints used for first coat, intermediate and finish coats shall be from the same manufacturer and shall be compatible as per the manufacturers data

sheet.

4. Unused and left over paints shall be immediately removed from the site, at the end of the each day and shall be disposed off properly.

5. Paint components such as base, epoxy, curing agents once mixed shall be consumed within the pot life period and also validity expired paints shall not be used for application.

6. Paint application by brush shall be used for touch up painting such as site weld joints.

7. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer's instruction shall be followed for inter coat interval.

8. No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

9. To the maximum extent practicable, each coat of material shall be applied as a continuous film of uniform thickness.

10. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.

11. The painting equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges.

12. Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.

13. Paint shall be applied in a uniform layer and spray patterns shall be adjusted so that the paint is deposited uniformly.

14. No drier shall be added to a paint on the job unless specifically called for in the manufacturer’s specification for the paint.

15. Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.

16. Where paint has been damaged in handling and in transportation, the repair of damaged coating should be cleaned by mechanical scraping or grinding

wheels or rotating steel wire-brushes and **same primer** and subsequent coats shall be applied.

4.0 <u>Color Coding:</u>

The tentative color of paint required for the major systems are furnished below. However actual and final colour of paints to be used will be provided to the successful bidder(contractor) during the execution of work.

Sl. no.	System/ Description	Ground Colour
1	Cooling water system (PGB)	French Blue
2	Ordinary (Raw) water	Grass Green
3	Domestic or Drinking water	Grass Green
4	Domestic hot water	Grass Green
5	De-mineralized water	French Blue
6	Condenser cooling water (Sea water) (PAB)	Oriental Blue
7	Sea water for normal loads	Oriental Blue
8	Condensate system water	Sky Blue
9	Boiler feed water	Sky Blue
10	Re heater return	Sky Blue
11	Fire fighting water	Signal Red
12	Drainage system (Inactive)	Black
13	Steam systems	Aluminium
14	Compressed Air (Instrument & Service)	White
15	Compressed gases	White
16	Vacuum system	White
17	Turbine oil systems	Light Brown
18	Acids	Light purple brown
19	Alkali	Light salmon pink
20	Hydrazine, Ammonia, Chemical waste	Lemon
21	Turbine & Generator	Orange

5.0 **<u>Measurement of finished area:</u>**

Measurement of the finished painted area of the valves, Pipe Flange and Spring hanger of pipe support shall be as per the following methodology.

1. Valve:

The quantity of valves shall be measured in terms of numbers referred to the pipe outside diameter. The term valves shall be deemed to include all flanged component (all type of valves, sight glasses, strainers, level indicators, steam

traps) irrespective of pressure rating and their installed length and including operating elements (hand wheels, levers). Valves with welding ends and threaded ends shall be considered as 0.8 piece. A valve up to size DN 50 shall be considered as straight pipe length of 1 m and a valve size above DN 50 shall be considered as straight pipe length of 2 m of corresponding pipe size. This additional measurement is in addition to the total length of pipeline including the valve body.

2. Flange:

   The surface area of flange or blind flange shall be measured as a straight pipe length of 0.3 m of the corresponding pipe size of all pressure rating and type of flanges. This 0.3 m is in addition to the total length of pipe includes the flange length. The surface area of a flange is derived as $A = \pi DL$, where, D=Outer diameter of the pipeline (m) & L= 0.3mtr.

3. Spring hanger of pipe support:

   The surface area of spring hanger of a pipe support for any size of pipe line and of any size of spring hanger support shall be measured as $A = \pi DL$, considering $\pi D = 0.2$ m multiplied by the actual length L of spring hanger support. The area measured by this method of spring hanger support, including the area of EP, support plate, upper tie rod, spring assembly and lower tie rod. The area of bottom channel of spring hanger support is taken separately.

NUCLEAR POWER CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

KUDANKULAM NUCLEAR POWER PROJECT-3&4

TECHNICAL SPECIFICATION FOR PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS AREA (NON RADIOACTIVE)

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NPCIL PROPRIETARY

NUCLEAR POWER CORPORATION OF INDIA LTD.
(A Government of India Enterprise)

2 X 1000 MWe KUDANKULAM NUCLEAR POWER PROJECT
UNITS –3&4

DOCUMENT NO.: I02.KK34.0.0.TH.TS.PR017

TECHNICAL SPECIFICATION FOR PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS (NON RADIOACTIVE) AREA

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Revision No.	Description of Revision	Revised by Name & Signature	Checked by Name & Signature	Reviewed by Name & Signature	Approved by Name & Signature
1.	Parameter related to zinc dust has been included in Table No-1 of Annex.A Parameter related to zinc dust content in Table-2 of Annex.A	14/09/18 **P.C.Gaurav, EE(Engg.-LWR)**	14/9/18 **V.H. Scaria, Sr.EE (Engg.-LWR)** 21/09/18 **R.Gurnule, DCE (Engg.-LWR)**	24/9/18 **R. R. Sahaya,** **(CE -CONTT, RP&S & CFD - Engg.-LWR)** **S K Sinha CE (Engg.-LWR)**	**Smt Rajee Guptan** **(AD-PSA-Engg-LWR)**

CONTENTS

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1.0 SCOPE

This technical specification is intended to cover selection, supply of coating materials, coating application, inspection, testing, repair and handling of paint related work for all non-radioactive (free access) area such as UMA, UMV, UKD etc. except sea water system structures. For sea water systems & structures refer Technical Specification I02.KK34.0.0.TH.TS.PR009.

1.1 EXTENT OF SPECIFICATIONS

a. All Carbon Steel Storage Tanks , pipes, ducts, support, structures.

b All G.I. ducts, support, structures.

c. Painting of color bands on all piping as required for identification including insulated aluminum clad, SS, plastic or plastic coated and nonferrous piping/ equipment if any.(specification of identification and color coding to be given to the successful bidder at the time of execution of the work)

d. Identification lettering/ numbering on all painted surfaces of equipment/piping insulated aluminum clad, SS and non-ferrous piping.

e. Repair work of damaged pre-erection/ fabrication and shop primer and weld joints in the field/site before and after erection as required.

f. Supply, handling, storage of all primers, paints and all other materials required for painting.

1.2 EXCLUSION

a. Painting of Non-ferrous materials like aluminum, plastic material, Stainless steel and duplex steel structure until and unless specified by NPCIL.

2.0 COATING MATERIAL SPECIFICATION :

The coating material should be as per properties indicated in Annexure- A.

3.0 REFERENCE CODES & STANDARDS

CODE /STANDRAD	TITLE
ISO 12944	Paint and varnish – corrosion protection of steel structure by protective paint system.
ISO 8501	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness
ISO 8502-3	Preparation of steel substrates before application of paints and related products – Test for the assessment of surface cleanliness – Assessment of dust on steel surfaces prepared for painting, pressure sensitive tape method.
ISO 8503	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast cleaned substrates.
ISO 8504-2	Preparation of steel substrates before application of paints and related products – Surface Preparation Methods – Abrasive blast-cleaning.
ISO 1513	Paints and varnishes – Examination and preparation samples for testing.
ISO 2808	Determination of film thickness
ISO 2409	Cross cut test.
SSPC-SP	Steel Structures Painting Council, U.S.A.
ASTM G 62-85	Standard Test Methods for Holiday Detection in Pipeline Coatings
ASTM D520	Standard Specification for Zinc Dust Pigment
ASTM D521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
IS 101	Methods of sampling and test for paints, varnishes and related products
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D 5895	Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic

ASTM D 1200	Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D 1186	Standard Test Measurement DFT.
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM G-154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ISO 4624	Pull of test for adhesion

4.0 TECHNICAL REQUIRMENT FORPAINT APPLICATION

4.1 PRE-BLASTING :

4.1.1 Scope of work include treatment of surface for application of protective coating such as removal of dust,oil/grease contamination, removal of salt deposit and other water soluble compounds.

4.1.2 The surfaces shall be free from any foreign matter such as weld flux, residue, slivers, oil, grease, salt etc. prior to blast cleaning.

4.1.3 Surface preparation of Galvanized steel :

The surface shall be cleaned by using suitable detergent to remove oil and grease etc. Salt and other contamination may be removed by high pressure water cleaning.
Surface must be free from zinc salt. A dull rough profile on substrate is required for paint application.

4.2 BLAST CLEANING :

4.2.1 Blasting abrasives shall be dry, clean and free from contaminants which will be detrimental to the performance of the coating.

4.2.2 In case of rain or bad weather, surface preparation shall not be carried out outdoors.

4.2.3 When surface is wet, surface preparation shall not be carried out.

4.2.4 Surface preparation/Roughness profile of the cleaned surface shall conform to the paint manufacturer recommendations.

4.2.5 Substrate condition during blasting must be 3 degree Celsius above dew point temperature.

4.2.6 Irrespective of whether external or internal surface to be coated, blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceed 85%. Relative Humidity reading shall be recorded every 2 hour during the blasting operation in the immediate vicinity of operation.

4.2.7 If wet abrasive method is used for cleaning then the substrate shall be fully dried before application of any coating.

4.2.8 Compressed air used for blast cleaning shall be clean, dry and free of moisture and oil.

Moisture separators, oil separator, traps or other equipment may be necessary to achieve clean, dry air.

4.2.9 The maximum content of soluble impurities on the blasted surface as sampled using ISO 8502-6 and distilled water, shall not exceed a conductivity corresponding to a NaCl content of 20 mg/m^2. Equivalent methods to determine salt contamination, may be used.

4.3 PAINT APPLICATION :

4.3.1 Pre-fabrication primer is not a part of the paint system. It might need to be removed.

4.3.2 Paint/primer shall be applied after ensuring assessment of prepared surfaces as per ISO 8501-1 / ISO 8501-2 .

4.3.3 The elapsed time between the abrasive blasting of surface and coating shall not exceed the maximum as given in the following table

Relative humidity	Maximum Time elapsed
Above 80%	2.0 Hour
50% to 80%	3.0 Hour
Up to 50 %	4.0 Hour

4.3.4 At the end of pipe joint where welding is to take place a cut back (160 mm) may be allowed in the coating depending upon the field joint coating method selected. The actual distance if any, shall be agreed upon, prior to application.

4.3.5 Area not to be coated shall be masked with disposable plastic sheets, tapes, cardboards etc.

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

4.3.7 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the Steel surface temperature is less than 3° C. above dew point, when the relative humidity is greater than 85% or when the temperature is below 5 ° C

4.3.8 If wind speed exceed 10 km/h than proper shielding arrangement to be provided by

applicator.

4.3.9 All nameplates, manufacturer's identification tags, machined surfaces, instrument glass, finished flange faces, control valve items and similar items shall be masked to protect coating deposition. If these surfaces are coated, the component shall be cleaned and resorted to its original condition.

4.3.10 For top coating application, manufacturer's recommended over coat interval time to be followed.

4.3.11 No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.

4.3.12 Painted surface shall be protected from rain, condensation, contamination until dry to the fullest extent practicable.

4.3.13 The method of application shall be governed by the coating manufacturer's recommendation for the particular coating being applied.

4.3.14 In organic Zinc silicate primer shall not be applied below relative humidity of 65%.

5.0 GENERAL REQUIRMENT

5.1 The bidder shall provide comprehensive documentations detailing his previous experiences of using the specified coating systems. In particular this shall address internal lining of both large and small bore pipelines/ equipment's. This information shall be submitted with the bid.

5.2 The bidder may be required to set up a coating facilities at site complete with all necessary equipment, consumables and personnel to complete the work. The bidder is to confirm his intention to do this at the bid stage and submit details of the facility he proposes, including size of area required and utilities.

5.3 The bidder shall provide with his bid an inventory of the proposed equipment and personnel that will be used to execute the contract in line with the project schedule.

5.4 The bidder shall provide a comprehensive execution plan and methodology of coating with the proposal.

5.5 The bidder shall perform all work in accordance with this specification and other requirements noted herein.

5.6 The bidder shall also supply along with his offer copies of test reports conducted by reputed test agencies evidencing that materials conform to minimum performance requirements attached else where in this specification.

5.7 The contractor will be totally responsible for field coating, field weld joint coating including testing and inspection of coated area.

5.8 All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipments, scaffolding materials, shot & grit blasting equipment's & air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity/nos. The manufacturer's test certificates / data sheets for all the above items shall be reviewed by NPCIL Engineer-in-charge at site before start of work.

5.9 Mechanical mixer shall be used for paint mixing operations, except that the NPCIL `Engineer-In-Charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.

5.10 Where paint has been damaged in handling and in transportation, the repair of damaged coating of pre-erection / fabrication and Shop primer shall be done by contractor.

5.11 The contractor shall prepare a field weld joint coating and a repair procedure for review and approval by NPCIL Engineer-in-charge.

5.12 Defective work shall be rectified/repaired by the contractor at his own expenses.

6.0 INSPECTION AND TESTING

6.1 COATING PROCEDURE QUALIFICATION :

6.1.1 Prior to actual application on job, sample application shall be carried out to establish that the coating operation and coating material meet the requirements of this specifications.

6.1.2 Quality control tests shall be performed as follows :

- Blast cleanliness standard and profile inspection.
- Salt contamination test
- Visual testing.
- Thickness testing, holiday inspection, adhesion testing, curing testing as per approved standard specified in this specification.
- Repair procedure , as approved by NPCIL

6.1.3 No application/production shall commence until the Contractor has performed all the above tests to complete satisfaction of NPCIL Engineer-in –charge.

6.2 VISUAL INSPECTION

6.2.1 Assessment of the prepared surfaces shall be visually assessed as described in ISO-8501.

6.2.2 Testing for soluble salt and other invisible contamination on visually cleaned surface by physical and chemical method shall assessed as per ISO 8502.

6.2.3 The surface roughness profile accordance with paint manufacturer shall be assessed as per ISO 8503.

6.3 THICKNESS TESTS

6.3.1 The paint thickness shall be checked using non-destructive test.

6.3.2 Dry Film Thickness (DFT) Meter used shall be calibrated before each inspection and shall be witnessed by the Inspector. It is the duty of the Inspector to satisfy himself with the performance of the DFT Meter.

6.3.3 The Dry Film Thickness (DFT), as measured in accordance with ASTM D-1186, shall not vary by 10 % of the specified value.

6.3.4 The Area coverage of DFT measurement is as per SSPC-PA2.

6.4 HOLIDAY DETECTION

6.4.1 100% of the internally coated pipe shall be tested.

6.4.2 Holiday testing shall be done in accordance with ASTM G-62 after curing of paints.

6.4.3 No holidays are accepted and all holidays shall be repaired. The maximum repair rates allowable for holidays shall be 4 per day.

If number is exceeded, or the daily average if exceeded for any 5 consecutive days of production , then application shall cease and the cause shall be investigated and resolved.

6.5 **Adhesion test** is destructive test and shall be done on applied surface selected by NPCIL Engineer- in-charge, if required, as per ISO 4624 or ASTM D4541.

6.6 Environment condition test.

6.6.1 Following parameter to be checked

a. Air Temperature (Max. & Min.)
b. Relative humidity (Min. & Max.)
c. Dew Point Temperature.
d. Surface Temperature.
e. Wind Speed (Max.)

6.6.2 In an interval of eight hour, data to be collected and recorded in data sheet. More frequent measurement to be done if conditions are changing rapidly and will be decided by NPCIL Engineer-in-charge.

6.6.3 Sling Psychrometer to be used as per ASTM E337 to record wet & dry Temperature record Humidity. Alternatively, equivalent approved instrument may also be used.

7.0 QUALIFICATION REQUIREMENTS

7.1 Selection of products :

7.1.1 Selection of products shall be carried out based on certificate submitted by paint manufacturer as indicated in Annexure- A from an independent reputed Government lab agreed between contractor and NPCIL.

7.1.2 Test method mentioned in test certificate should be as per test standard mentioned in Annexure- A. However, equivalent standard other than specified in Annexure-A, may be followed subjected to NPCIL approval.

7.1.3 Only product approved by NPCIL as per Annexure- A shall be used for application.

7.1.4 Paint qualification cost, if applicable shall be borne by EPC contractor/ Paint Manufacturer.

7.2 Qualification of Personnel

7.2.1 Qualification of paint applicator

Applicator shall be qualified to perform the task viz blast cleaning, application etc. The personnel shall have relevant knowledge of health and safety hazard, coating materials, use of protection equipment, etc.

If not qualified, personnel shall carry out a test in accordance with the standard Coating Procedure Specification. The test shall be supervised by a qualified supervisor and inspected and accepted by qualified QC personnel. A test certificate shall be issued.

The test shall be carried out on a test panel (minimum 1mt x 1 mt),1 angle, 1 spool piece of pipe Alternatively a location providing similar geometrical complexity on the component to be coated may be used.

The acceptance criteria are the requirements to the coating system described in this document. Variation in the film thickness shall be within the limits described in this specification. Applicator failing to meet the requirements shall not be allowed to carry out work in accordance with thisdocument.

7.2.2 Qualification of procedures

Coating Procedure Specification (CPS)

Supplier shall establish a detailed CPS based on the requirements of this document.

The CPS shall contain the following:
- Identification of equipment for surface preparation and application.

- Information given on Coating System Data Sheet.
- Personal protective equipment to be used.
- Safety data sheets for each product.

The qualified CPS shall be followed during all coating work.
The following changes in the coating application parameters requires the CPS to be requalified.
- Any change of coating material.
- Change of method and equipment for surface preparation and coating application.

8.0 QUALITY ASSURANCE PLAN

QAP shall be submitted by vendor according to this specification. Acceptance is subjected to NPCIL approval.

9.0 RECOMMENDED PROTECTIVE COATING SYSTEM.

Sl.No.	Equipment's		System recommended	DFT/coat µm	No.of coats	Detailed specifications
1.0	**Pipeline**					
Material – Carbon Steel						
1.1	**Area -** Indoor & outdoor **Fluid-** Sea water **Application-** Internal surface.		Polyester Glass Flake **Total thickness (Min.)**	500-550 **1000-1100**	2	Table no-5 of Ann.-A
1.2	**Area-** Indoor & outdoor **Application-**External surface.	Temperature< 50°c	**Primer:** Inorganic Zinc Silicate. **Under coat:** Epoxy MIO intermediate coat. **Top coat:** Aliphatic Polyurethane **Total DFT (Min.)**	70-80 100-120 30 **230-260µ**	1 1 2	Table No.- 1,3,4 of Ann.-A
		Temperature up to 300°c (for under insulation paint)	**Primer :** Inorganic Zinc silicate **Top coat :** High temperature resistance silicone based ambient curing coating. **Total Thickness**	70-80 25 **120-130 µ**	1 2	Table-1,6 of Ann.-A

1.3	**Area-** Indoor & outdoor **Fluid-**DM water. **Application-**Internal surface	No coating required.			
1.4	**Area-** Under-ground **Application-** External surface	Polyester Glass Flake **Total thickness (Min.)**	500-550 **1000-1100**	2	Table no-5 of Ann.-A
Material – Galvanized steel.					
1.6	**Area-** outdoor **Application-**External surface	**Under coat-** Wash primer (poly vinyl butyral resin) **Top Coat –** Aliphatic Polyurethane **Total DFT (min.)**	8-10 µ 30 µ **68-70 µ**	1 2	Table- 3 of Ann.-A
2.0	**Tank**				
Material- Carbon steel.					
2.1	**Area-** Indoor & outdoor	**i). Fluid- Chemicals/ Acid**	Rubber lines. Thickness- 4.5 mm.	NA	NA	As per IS 4682

	Applicatio n-Internal surface	**ii). Fluid – Diesel oil, DM water, fire water.**	High Build epoxy phenolic tank liner. **Total thickness**	150 µ **300 µ**	2	Table – 8 of Ann.-A
		iii). Fluid-Potable water	Polyamine cured epoxy paint approval from CFTRI Mysore.	**Total thickness-** 225-250 µ	-	Table-9 of Ann.-A
2.2	**Area** – Indoor & outdoor **Applicatio n** –External surface (except bottom portion)	Temprature < 50°c	**Primer:** Inorganic Zinc Silicate. **Under coat:** Epoxy MIO intermediate coat. **Top coat:** Aliphatic Polyurethane **Total DFT (Min.)**	70-80 µ 100-120 µ 30 µ **230-260µ**	1 1 2	Table No.- 1,3,4. Of Ann.-A
		Temprature upto 200°c (For under insulation paint.)	**Primer :** Inorganic Zinc silicate **Top coat :** High temperature resistance silicone based ambient curing coating. **Total Thickness**	70-80 µ 25 µ **120-130 µ**	1 2	Table-1,6 of Ann.-A
2.3	**External surfaces of CS tank (soil side)**		Coal Tar Epoxy **Total thickness (Minimum)**	100 **200µ**	2	IS 14948:2001
Material- Stainless steel						
2.4	**Area-** Indoor & outdoor **Application-**Internal surface		No coating.			

2.5	**Area-** Indoor & outdoor **Application-** Internal surface	For Under insulation tank	Aluminum foil.			
		Others	Not Applicable.			
3.0	**Ducts.**					
3.1	**Material** – Carbon steel. **Area-** Indoor **Application-**External surface.		**Primer-** Zinc Rich Epoxy **Top Coat-** High build epoxy **Total thickness (Minimum)**	75-80 µ 125 µ **325-330 µ**	1 2	Table No.-2,7 of Ann.-A
	Material – Carbon steel. **Area-** outdoor **Application-**External surface.		**Primer-** Zinc Rich Epoxy **Under coat-** Epoxy MIO **Top Coat-** Aliphatic PU **Total thickness (Minimum)**	75-80 µ 100-120 µ 30µ **230-240 µ**	1 1 2	Table No.-2,3,4 of Ann.-A

3.2	**Material** – Galvanized Iron **Area-** Indoor & outdoor **Application-**External surface.		**Under coat-** Wash primer (poly butyl) **Top Coat** – Acrylic PU **Total DFT (min.)**	8-10 µ 30 µ **60-70 µ**	1 2	Table no- 3 of Ann.-A
4.0	**Metal Structures.**					
	Material - Carbon steel **Area** – Indoor & Outdoor	Structure where SA 2.5 could be achieved.	**Primer:** Inorganic Zinc Silicate. **Under coat:** Epoxy MIO intermediate coat. **Top coat:** Aliphatic Polyurethane **Total DFT (Min.)**	70-80 µ 100-120 µ 30 µ **230-260µ**	1 1 2	Table-1,3,4 of Ann.-A
		Structure where SA 2.5 could not be achieved. Forsuch structure at least St-3 is required.	**Primer-** Zinc Rich Epoxy **Top Coat-** Aliphatic Polyurethane **Total thickness (Minimum)**	75-80 µ 30 µ **135-140 µ**	1 2	Table No.-2,3 of Ann.-A

5.0	**Support**				
5.1	**Material-** Carbon steel **Area** – Indoor	**Primer-** Zinc Rich Epoxy **Top Coat-** High build epoxy **Total thickness (Minimum)**	75-80 µ 125 µ **325-330 µ**	1 2	Table No.-2,7 of Ann.-A
5.2	**Material-** Carbon steel **Area** – Outdoor	**Primer-** Zinc Rich Epoxy **Top Coat-** Aliphatic Polyurethane **Total thickness (Minimum)**	75-80 µ 30 µ 135-140 **µ**	1 2	Table No.-2,3 of Ann.-A
6.0	**Exhaust Duct of Diseal Generator**	**Primer :** Inorganic Zinc silicate **Top coat :** High temperature resistance silicone based ambient curing coating. **Total Thickness**	70-80 µ 25 µ **120-130 µ**	1 2	Table-1,6 of Ann.-A

10.0 PAINT DATA REQUIREMENT

DATA TO BE FURNISHED BY THE COATING CONTRACTOR AT THE TIME OF COATING SYSTEM APPROVAL.

Sl. No.	*Parameters	Test Code (As specified according to Standard specified in the specification or equivalent)	Value / Details
1.0	**Coating Details**		
1.1	Type		
1.2	Resin		
1.3	Pigment		
1.4	Volume of Solids		
1.5	Total coating thickness to be achieved as per Tender.		
1.6	No. of main coats considered for achieving required thickness		
1.7	Each coat thickness		
1.8	Primer required (Type)		
1.9	Primer coat thickness		
2.0	Blasting material to be used for carbon steel		
	Main Coat Physical Properties		
2.1	Impact Resistance		
2.2	Color		
2.3	Density		
	Service Properties		
2.4	Adhesion to Steel		
2.5	Abrasion Resistance		
2.6	Water vapor permeability/ Transmission rate		Not for zinc silicate primer.
2.7	Accelerated weathering		
2.8	Accelerated Salt Spray		
2.9	Chemical resistance immersion of 30 days in sea water -		
	% wt change		
	% hardness change		
	% tensile strength change		

	% bond strength change		
3.0	Application		
3.1	Flash point at 30 degree cel.		
3.2	Mixing ratio		
3.3	Practical spreading rate		
3.4	Curing time		
	- for next coat		
	- for full cure		
3.5	Pot life at 30 oC		
3.6	Thinner if any		
3.7	Storage life / Self life		
3.8	Cleaning fluid		

*Parameter which apply to the product, to be specified.

ANNEXURE –A

Table number- 01			
Inorganic Zinc Silicate			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
			Primer
1.0	**Coating Details**		
1.1	Type		Inorganic zinc silicate
1.2	Resin		EthylSilicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids % Total Zinc dust in dry flim	ASTM D 2369	> 80%, by weight > 84% by weight
1.8	Volume of Solids	ASTM – D-2697	> 65%
1.9	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
2.0	Pot life @ 30 deg.C		>4hour
2.1	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
2.2	Area Coverage (Theoretical)	IS 101, 1964	>8.5m^2/l @ 75 micron thickness
2.3	Practical Coverage		Min. 6.25 micron thickness @ 75 micron thickness
2.4	Application		spray
2.5	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr Hard dry < 18 hrs
2.6	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
2.7	Impact Resistance	ASTM D 2794	> 10 Joule
2.8	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.9	Thickness per coat	ASTM D 1186	70-80 μ
3.0	**Total thickness**		**70-80** μ

3.1	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
3.2	Accelerated Salt spray Test	IS 2074 or ASTM B117	The coated test panels dried for 48 hrs System should pass 3000hrs exposure without blistering and corrosion.
3.3(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
3.4(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%
3.5	Flexibility test panel bent 1 inch dia cylindrical mandrel	ASTM D-1979	System should pass free from detachment,crack,surface deformation, etc.

Table number- 02			
Zinc Rich Epoxy Primer			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
			Primer
1.0	**Coating Details**		**Zinc Rich Primer**
1.1	Type		
1.2	Resin		Epoxy
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM Type II high purity grade
1.7	Zinc dust content in dry flim	ASTM D 2369	> 80%
1.8	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
1.9	Pot life @ 30 deg.C		>3 hour
1.10	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
1.11	Volume of Solids	ASTM – D-2697	> 60%
1.12	Application		Airless spray
1.13	Impact Resistance	ASTM D 2794	> 10 J
1.14	Thickness per coat	ASTM D 1186	70-80 µ
1.15	**Total thickness**		**70-80** µ
1.16	Accelerated Salt spray Test	ASTM B117	System should pass 1500 hrs exposure without blistering and corrosion.
1.17	Practical Adhesion by sandwich pull off technique.	ISO 4624	> 100 kg/sq cm.
1.18	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 200 mg

Table number- 03			
Aliphatic Polyurethane.			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO_2
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	 3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 (Part 4/sec2) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 (Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 (Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 (Part 5/ Sec 1) : 1988	52
2.5	Accelerated tests:		
	a).Resistance to sulphuric acid b).Resistance to caustic potash c).Resistance to solvent.	IS 13213:1991	Shall not show any signs of blistering, wrinkling and lifting. Difference in gloss and color between immersed and unimmersed area of paint film shall be minimum.
2.6	Durability Test		
	a). out doorexposure	IS 13213:1991	Chalking 10

	b).Accelerated weathering test		Checking 10 Cracking 10 Flaking 10 Spotting 10 Blistering 10 Colour changes 7-8 Gloss :The film shall have a minimum gloss retention of 90 percent of its original value.

Table number- 04			
Epoxy MIO			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
1.0	**Coating Details**		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m2/liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram)	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/ sec. 2 IS 101	Pass
2.3	Resistance to humidity under condition of condensation at 500 hr. a). Resistance to humidity 500 hr.	IS 101 clause 2 of part 6 /sec.1	Pass
	b). Salt spray 500 hrs.	Clause 3 of part 6/sec 1.	Pass

Table number- 05

Polyester Glass Flake

Sl. No.	Parameters	*Method	Acceptance criteria
1.	Shelf life		>6 months
2.	Pot life		>45 min at 30 deg C
3.	Volume solids	ASTM D 2697	>95 %
4.	Cathodic Disbondment	ASTM G8	Typically less than 1 mm disbondment following 30 days exposure
5.	Immersion	ISO 2812 Part 2 (Modified)- "Resistance to sea water immersion @ 40 Deg C.	No film defects following 8000 hours exposure.
6.	Salt Spray	ASTM B 117 Resistance to neutral salt spray (fog) @ 35 Deg C.	No film defects, and no rust creep at the scribe following 10000 hours exposure.
7.	Abrasion	ASTM D 4060-	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.
8.	Adhesion	ISO 4624 /ASTM D 4541	Not less than 90 Kg/cm^2 when using a PAT adhesion tester on 5mm thick steel.

9.	Impact	ASTM D 2794	> 9 Joule.
10.	Tensile Strength	ASTM-D 2370	Not less than 200 Kg/cm2
11.	Elongation @ Break	ASTM-D 2370	> 0.5%
12.	Water vapour Permeability	ASTM- D 1653	< 0.2gm/m^2-hr/mil

Table Number-06			
Heat Resistance Silicone based paint			
Sl.no.	**Parameter**	***Method**	**Accept.Criteria**
1.	Curing method		Ambient curing
2.	Volume solids	ASTM D 2697	>40 %
3.	Shelf life		> 1 year
4.	Flash point	ISO 3679	> 25 °c
5.	Temperature resistance	ASTM D 2485	> 350 °c
6.	Pot life @ 25°c		> 45 min.
7.	Drying time @ 25°c a). Touch dry b). hard dry		30 min. 2 hour
8.	Adhesion	ASTM D 4541	Not less than 70 Kg/cm^2 when using a PAT adhesion tester on 5mm thick steel.
9.	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM D 4060	< 250 mg
10.	Resistance to thermal shock		No sign of cracking and flaking after 3 cyclic exposure from 300 °C to 30 °C

Table Number-07			
High Build Epoxy			
Sl.no.	**Parameter**	***Method**	**Accept.Criteria**
1.	Colour		As per color coding requirment
2.	Volume solids	ASTM D 2697	>80%
3.	Shelf life		> 1 year
4.	Pot life at 25 °c		> 1 hour
5.	Impact Resistance	ASTM D 2794	>6 Joule
6.	Adhesion	ASTM D 4541	> 10 Mpa
7.	Salt spray test	ASTM B 117	> 1000 hrs.
9.	Abrasion test	ASTM D 4060	< 200 mg [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]
10.	Tensile Strength	ASTM-D 2370	>100 Kg/cm2
11.	Elongation @ Break	ASTM-D 2370	> 6%
12.	Accelerated Weathering	ASTM D 4587	Should pass 500 hours a). Chalking b).Cracking and blistering.

Table Number-08			
Epoxy Phenolic tank liner			
Sl.no.	**Test**	***Method**	**Accept.Criteria**
1.	Color		As per requirement
2.	Volume solid	ASTM D 2697	>65%
3.	Pot Life @25°c		> 2 hour
4.	Shelf life		> 1 year
5.	Flash point	ISO 3679	> 25 °c
6.	Abrasion	ASTM D 4060-	< 200mg weight loss per 1000 cycles using CS17 wheels and a 1 Kg loading.
7.	Impact test	ASTM D 2794	> 7 Joule
8.	Adhesion	ISO 4624	>110 Kg/cm^2
9.	Tensile Strength	ASTM-D 2370	> 100 Kg/cm2
10.	Elongation @ Break	ASTM-D 2370	> 6%
11.	Immersion test a). DM Water b). Petrol	ASTM D-1308	500 hrs System should pass free from defult like blistering, loss of adhension
12.	Water vapour permeability	ASTM D 1653	< 4 gm/m^2-hr/mil.

Table number-09			
Potable water storage tank			
Sl. No.	**Parameters**	***Test Code**	Specification for coating system
a). Eplilux 78- Burger HBTL b). Apcodur CF699- Asian Paints c). Or equivalent approval from CFTRI Mysore.			

Note-

*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.

APPENDIX–B

COATING SCHEDULE

Project Name :
Client :
W.O. No. :

Inspection Agency :
Site :
Others :

SURFACE DESCRIPTION SURFACE A,B (ECT)	APPROX. SURFACE AREA SQUARE METER	SURFACE PREPARATION TYPE	PROFILE RANGE	FIRST COAT			SECOND COAT			THIRD COAT		
				TYPE	WFT / DFT	COLOUR	TYPE	WFT / DFT	COLOUR	TYPE	WFT / DFT	COLOUR

APPENDIX–C

COATING SYSTEM DAILY INSPECTION REPORT

DATE	REPORT NO.	PROJECT REF. NO.	PAGE OF
PROJECT DESCRIPTION	LOCATION	CONTRACTOR	
INSPECTION ORGANISATION	INSPECTOR	APPLICABLE SPECIFICATION NO.	
I. **DESCRIPTION OF ITEMS AND / OR AREAS**			
II. **DESCRIPTION OF WORK PERFORMED / REMARKS**			

II. **PRE-WORK SURFACE CONDITION**	**OBSERVED DEFECTS**	IV. **ENVIRONMENTAL CONDITIONS**
• SUBSTRATE _____ • GENERAL DESCRIPTION _____ _____ • PRIMED FOR SUBSEQUENT COATS. • REFERENCE REPORT DATED ---------- • PREVIOUSLY PAINTED – DEGREE OF CORROSION --------- ---------- • NEW METAL – DEGREE OF CORROSION --------	OIL & GREASE ** SHARP EDGES ** WELD SPATTER ** MOISTURE ** LAMINATIONS ** SOLUBLE SALTS ** ---------- ** ---------- **	TIME ---------- AIR TEM/^{O}C ---------- WET BULB TEMP ^{O}C ---------- RELATIVE HUMIDITY ^{O}C ---------- DEW POINT ^{O}C ---------- SURFACE TEMP MIN / MAX. ^{O}C ---------- REMARKS : _____ ----------

ANNEXURE -D

DRY FILM THICKNESS MEASUREMENT WORKSHEET

DATE	REPORT NO.	PROJECT REF. NO.	APPLICABLE SPECIFICATION	PAGE OF

ITEM / AREA DESCRIPTION	SPOT	SPOT READINGS (MICRON)			TOTAL	AVERAGE	% MIN	REMARKS
		1	2	3				
	A							
	B							
	C							
APPROX. SQ. MTR	D							
	E							
						TOTAL AVG		

SPECIFICED DFT---------- MICRON
RANGE ACHIEVED ---------- MICRON

REFERENCE REPORT DATED ---------- FOR APPLICATION RECORD

REMARKS

कुडानकुलम परियोजना प्रलेखीकरण केन्द्र
KK-3&4 I/H/TS/312/00/R1
दिनांक/DATE: 25/09/2018
एनपीसीआईएल / NPCIL
KUDANKULAM PROJECT DOCUMENTATION CENTRE

INSPECTOR'S SIGNATURE DATE

NUCLEAR POWER CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

KUDANKULAM NUCLEAR POWER PROJECT-3&4

TECHNICAL SPECIFICATION
FOR
PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES

Number of the Document	I02	KK34	0	0	TH	TS	PR009

Title	Total Number of Pages	Date	Revision Number
TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES	34	September , 2018	1

NPCIL PROPRIETARY

NUCLEAR POWER CORPORATION OF INDIA LTD.
(A Government of India Enterprise)

2 X 1000 MWe KUDANKULAM NUCLEAR POWER PROJECT
UNITS - 1&2

DOCUMENT NO.: I02.KK34.0.0.TH.TS.PR009

TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES

REVISION NO.	**:**	**R0**	R1		
DATE OF ISSUE (MONTH / YEAR)	**:**	**January ,2017**	Sept, 2018		

ORIGINAL

PREPARED BY : **P.C.Gaurav, EE(Engg.-LWR)** 17.01.17

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: **V.H. Scaria, Sr.EE (Engg.-LWR)** 24/01/2017

REVIEWED BY : **R.D.Bhatt, CE (BOP-TG&SS), Engg. LWR** 25-01-2017

APPROVED BY :**Y.S.Rao, AD (LWR-SA)** 25-01-17

(Name & Designation) **(Signature) (Date)**

(For Revisions See Revision Control Sheet)

REVISION CONTROL SHEET

DOCUMENT TYPE : **TECHNICAL SPECIFICATION**

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TITLE : **TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES.**

Revision No.	Description of Revision	Revised by Name & Signature	Checked by Name & Signature	Reviewed by Name & Signature	Approved by Name & Signature
01.	Parameter elated to zinc dust has been included in Table No-1 of Annex.A. Scope of prequalification of paint has been excluded. Section 8.1 has been modified. Section 11 deleted. Annexure-A Table 4 , 5, 6 has been added.	**P.C.Gaurav, EE(Engg.-LWR)**	**V.H. Scaria, Sr.EE (Engg.-LWR)** **R.Gurnule, DCE (Engg.-LWR)**	**R. R. Sahaya,** **(CE - CONTT, RP&S & CFD -Engg.-LWR)** **S K Sinha CE (Engg.-LWR)**	**Smt Rajee Guptan** **(AD-PSA-Engg-LWR)**

CONTENTS

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1.0 SCOPE

This technical specifications is intended to cover, supply of coating materials, coating application , inspection, testing, repair and handling of paint related work of sea water system and sea water metal structure.

1.1 EXTENT OF WORK

a. All Carbon Steel Storage Tanks , pipes.

b. All Carbon Steel, fittings, valves and flanges (including painting of identification marks).

c. Painting of color bands on all piping as required for identification including insulated aluminum clad, galvanized, SS, plastic or plastic coated and nonferrous piping/ equipment if any.(specification of identification and color coding to be given to the successful bidder at the time of execution of the work)

d. Identification lettering/ numbering on all painted surfaces of equipment/piping insulated aluminum clad, galvanized, SS and non-ferrous piping.

e. Repair work of damaged pre-erection/ fabrication and shop primer and weld joints in the field/site before and after erection as required.

f. Supply, application, handling and storage of all primers, paints and all other materials required for painting.

1.2 EXCLUSION

a. Pre-qualification test of Paint System as specified at section 10.

b. Plastic and/or Plastic coated materials – color of plastic shall be as per the color code. If not conforming , painting/ tapeing may be required for identification., Non-ferrous materials like aluminum, FRP/GRP piping and tanks color shall be as per the applicable color coding. If not conforming, painting/ tapeing may be required for identification.

c. Painting of Stainless Steel and Duplex Stainless steel structure.

2.0 REFERENCE CODES & STANDARDS

CODE /STANDRAD	TITLE
ISO 12944	Paint and varnish – corrosion protection of steel structure by protective paint system.
ISO 8501	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness
ISO 8502-3	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness - Assessment of dust on steel surfaces prepared for painting, pressure sensitive tape method.
ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast cleaned substrates.
ISO 8504-2	Preparation of steel substrates before application of paints and related products - Surface Preparation Methods - Abrasive blast-cleaning.
ISO 1513	Paints and varnishes - Examination and preparation samples for testing.
ISO 2808	Determination of film thickness
ISO 2409	Cross cut test.
SSPC-SP	Steel Structures Painting Council, U.S.A.
ASTM G 62-85	Standard Test Methods for Holiday Detection in Pipeline Coatings
ASTM D520	Standard Specification for Zinc Dust Pigment
ASTM D521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
IS 101	Methods of sampling and test for paints, varnishes and related products
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D 5895	Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders

ASTM D 1200	Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D 1186	Standard Test Measurement DFT.
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM G-154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ISO 4624	Pull of test for adhesion

3.0 EQUIPMENT

3.1 All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment's, scaffolding materials, shot & grit blasting equipment's & air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity/nos. The manufacturer's test certificates / data sheets for all the above items shall be reviewed by Engineer-in-charge at site before start of work.

3.2 Mechanical mixer shall be used for paint mixing operations, except that the Engineer-In-Charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.

4.0 GENERAL REQUIREMENTS :

4.1 The bidder shall provide comprehensive documentations detailing his previous experiences of using the specified coating systems. In particular this shall address internal lining of both large and small bore pipelines/ equipment's. This information shall be submitted with the bid.

4.2 The bidder may be required to set up a coating facilities at site complete with all necessary equipment, consumables and personnel to complete the work. The bidder is to confirm his intention to do this at the bid stage and submit details of the facility he proposes, including size of area required and utilities.

4.3 The bidder shall provide with his bid an inventory of the proposed equipment and personnel that will be used to execute the contract in the line with the project schedule.

4.4 The bidder shall provide a comprehensive execution plan and methodology of coating with the proposal.

4.5 The bidder shall perform all work in accordance with this specification and other requirements noted herein.

4.6 The bidder shall also supply along with his offer copies of test reports conducted by reputed test agencies evidencing that materials conform to minimum performance requirements attached anywhere in this specification.

4.7 The contractor will be totally responsible for field coating, field weld joint coating including testing and inspection of coated area.

5.0 COATING MATERIAL SPECIFICATION :

5.1 The coating material should be as per properties indicated in Annexure- A & B.

6.0 TECHNICAL REQUIRMENT OF PAINT APPLICATION

6.1 PRE-BLASTING :

6.1.1 Scope of work include treatment of surface for application of protective coating, is as follow :

a) Removal of oil/grease contamination

b) Removal of salt deposit and other water soluble compounds

c) Abrasive blasting

d) Removal of dust and abrasive product

6.1.2 The surfaces shall be free from any foreign matter such as weld flux, residue, slivers, oil, grease, salt etc. prior to blast cleaning.

6.2 BLAST CLEANING :

6.2.1 Blasting abrasives shall be dry, clean and free from contaminants which will be detrimental to the performance of the coating.

6.2.2 In case of rain or bad weather, surface preparation shall not be carried out outdoors.

6.2.3 When surface is wet , surface preparation shall not be carried out.

6.2.4 Surface prep./Roughness profile of the cleaned surface shall conform to the paint manufacturer recommendations.

6.2.5 Substrate condition during blasting must be 3 degree Celsius above dew point temperature.

6.2.6 Irrespective of whether external or internal surface to be coated, blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceed 85%. Relative Humidity reading shall be recorded every 2 hour during the blasting operation in the immediate vicinity of

operation.

6.2.7 If wet abrasive method is used for cleaning than the substrate shall be fully dried before application of any coating.

6.2.8 Compressed air used for blast cleaning shall be clean, dry and free of moisture and oil. Moisture separators, oil separator, traps or other equipment may be necessary to achieve clean, dry air.

6.3 PAINT APPLICATION :

6.3.1 Pre-fabrication primer is not a part of the paint system. It might need to removed.

6.3.2 The coating manufacturer shall provide a Data Sheet for each coating system to be used, containing at least the following information for each product:

- Surface pre-treatment requirements.
- Wet film thickness/dry film thickness (max, min. and specified).
- Maximum and minimum recoating intervals at 25 °C.
- Information on thinners to be used (quantities and type).
- Mixing, handling and application requirements/recommendations.
- Pot life 30 °C.
- Drying time at 25 °C

6.3.3 Paint/primer shall be applied after ensuring assessment of prepared surfaces as per ISO 8501-1 / ISO 8501-2

6.3.4 The elapsed time between the start of blasting and coating shall not exceed the maximum as given in the following table

Relative humidity	**Maximum Time elapsed**
Above 80%	2.0 Hour
Up to 80%	3.0 Hour
Up to 50 %	4.0 Hour

6.3.5 At the end of pipe joint where welding is to take place a cut back (160 mm) may be allowed in the coating depending upon the field joint coating method selected. The actual distance if any, shall be agreed prior to application.

6.3.6 Area not to be coated shall be masked with disposable plastic sheets, tapes, cardboards etc.

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

6.3.8 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the Steel surface temperature is less than 3 degree C. above dew point, when the relative humidity is greater than 85% or when the temperature is below 5 degree. C

6.3.9 When the successive coat of the same color have been specified, alternate coat shall be tinted, where practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life and shall be recommended by the original paint manufacturer.

6.3.10 Field paint application shall not be done when the wind speed exceeds 20KM per hour.

6.3.11 All nameplates, manufacturer's identification tags, machined surfaces, instrument glass, finished flange faces, control valve items and similar items shall be masked to prohibit coating deposition. If these surfaces are coated, the component shall be cleaned and resorted to its original condition.

6.3.12 No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats.

6.3.13 No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

6.3.14 No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.

6.3.15 Paint shall be protected from rain, condensation, contamination until dry to the fullest extent practicable.

6.3.16 The method of application shall be governed by the coating manufacturer's Recommendation for the particular coating being applied.

6.3.17 Roller application of the first primer coat is not acceptable. When paints are applied by brush, the brush shall be of a style and quality acceptable to the coating manufacturer. Brush application shall be done so that a smooth coat, as uniform in thickness as possible is obtained.

6.3.18 Zinc silicate primer shall not be applied below relative humidity of 65%.

6.3.19 Spray application shall be in accordance with the following:

a. Air spray application equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application.

b. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted.

c. Areas inaccessible to the spray gun shall be painted by brush.

d. Airless Spray Application shall be done with an equipment having pump ratios at least 45:1 or as recommended by product manufacturer.

6.4 FINAL SURFACE CONDITION :

6.4.1 The maximum content of soluble impurities on the blasted surface as sampled using ISO 8502-6 and distilled water, shall not exceed a conductivity corresponding to a NaCl content of 20 mg/m2. Equivalent methods may be used.

6.5 SURFACE PREPRATION AND PAINTING APPLICATION OF WELD/FLANGE JOINT :-

6.5.1 Painting of flange is to be done as per Annexure-F

6.5.2 All equipment's & pipeline flange faces, internal coating shall be terminated within groove as per Annexure-F.

6.5.3 In case of pipeline flange, internal coating to be continued on the flange faces also. External coating shall be carried out at all metal surfaces including bolt hole excluding

gasket area. Coating should never be terminated at edges/corners, it should be terminated at flat area.

6.6 REPAIR OF DAMAGE SURFACE :

6.6.1 Where paint has been damaged in handling and in transportation, the repair of damaged coating of pre-erection / fabrication and Shop primer shall be done by contractor.

6.6.2 The contractor shall prepare a field weld joint coating and a repair procedure for review and approval by Engineer-in-charge.

6.6.3 Defective work shall be rectified/repaired by the contractor at his own expenses.

7.0 INSPECTION AND TESTING

7.1 COATING PROCEDURE QUALIFICATION :

7.1.1 Prior to actual application on job, sample application shall be carried out to establish that the coating operation and coating material meet the requirements of this specifications.

7.1.2 Quality control tests shall be performed as follows :

- Blast cleanliness standard and profile inspection.
- Salt contamination test
- Visual testing.
- Thickness testing, holiday inspection, adhesion testing, curing testing as per approved standard specified in this specification.
- Repair procedure , as approved by NPCIL

7.1.3 No application/production shall commence until the Contractor has performed all the above tests to complete satisfaction of Engineer-in –charge.

7.2 VISUAL INSPECTION

7.2.1 Assessment of the prepared surfaces shall be visually assessed as described in ISO 8501.

7.2.2 Testing for soluble salt and other invisible contamination on visually cleaned surface by physical and chemical method shall assessed as per ISO 8502.

7.2.3 The surface roughness profile accordance with paint manufacturer shall be assessed as per ISO 8503.

7.3 THICKNESS TESTS

7.3.1 The paint thickness shall be checked using non-destructive test.

7.3.2 Dry Film Thickness (DFT) Meter used shall be calibrated before each inspection and shall be witnessed by the Inspector. It is the duty of the Inspector to satisfy himself with the performance of the DFT Meter.

7.3.3 The Dry Film Thickness (DFT),as measured in accordance with ASTM D-1186, shall not vary by 10 % of the specified value.

7.3.4 The Area coverage of DFT measurement is as per SSPC-PA2.

7.4 HOLIDAY DETECTION

7.4.1 100% of the internally coated surfaces shall be tested.

7.4.2 Holiday testing shall be done in accordance with ASTM G-62 after curing of paints.

7.4.3 No holidays are accepted and all holidays shall be repaired. The average and the maximum repair rates allowable for holidays shall be :

Average 4 per day.

If number is exceeded, or the daily average if exceeded for any 5 consecutive days of production , then application shall cease and the cause shall be investigate and resolved.

7.4 **Adhesion test** is destructive test and shall be done on applied surface selected by Engineer- in-charge if required. as per ISO 4624 or ASTM D4541.

7.5 Environment condition test.

7.7.1 Following parameter to be checked

a. Air Temperature (Max. & Min.)
b. Relative humidity (Min. & Max.)
c. Dew Point Temperature.
d. Surface Temperature.
e. Wind Speed (Max.)

7.7.2 In an interval of eight hour, data to be collected and recorded in data sheet. More frequent measurement to be done if conditions are changing rapidly and will be decided by Engineer-in-charge.

7.7.3 Sling Psychrometer to be used as per ASTM E337 to record wet & dry Temperature.

8.0 QUALIFICATION REQUIREMENTS

8.1 Qualification of products :

8.1.1 Pre-qualification of painting system shall be done by NPCIL. List of all such NPCIL approved paint products will be provided to EPC contractor.

8.1.3 Selection of Painting system shall be done by EPC contractor subjected to NPCIL approval.

8.2 Qualification of Personnel

8.2.1 Qualification of paint applicator

Applicator shall be qualified to perform the task viz blast cleaning, application etc. The personnel shall have relevant knowledge of health and safety hazard, coating materials, use of protection equipment, etc.

If not qualified ,personnel shall carry out a test in accordance with the standard Coating Procedure Specification . The test shall be supervised by a qualified supervisor and inspected and accepted by qualified QC personnel. A test certificate shall be issued.

The test shall be carried out on a test panel (minimum 1 x 1 m) , 1 angle, 1 spool piece of pipe Alternatively a location providing similar geometrical complexity on the component to be coated may be used.

The acceptance criteria are the requirements to the coating system described in this document. Variation in the film thickness shall be within the limits described in this specification. Applicator failing to meet the requirements shall not be allowed to carry out work in accordance with this document.

8.2.2 Qualification of procedures

Coating Procedure Specification (CPS)

Supplier shall establish a detailed CPS based on the requirements of this document. The CPS shall contain the following:

- Identification of equipment for surface preparation and application.
- Information given on Coating System Data Sheet.
- Personal protective equipment to be used.
- Safety data sheets for each product.

The qualified CPS shall be followed during all coating work.

The following changes in the coating application parameters requires the CPS to be requalified:

- Any change of coating material.
- Change of method and equipment for surface preparation and coating application.

9.0 QUALITY ASSURANCE PLAN

QAP shall be submitted by vendor according to this specification acceptance is subjected to NPCIL approval.

10.0 RECOMMENDED PROTECTIVE COATING SYSTEM.

Sl.No.	Equipment's	System recommended	DFT/coat µm	No.of coats	Detailed specifications
1	**Repair slide Gates, Embedded Guiding structure Embedded structuring cleaning machine (Rake)**	Primer: Inorganic Zinc Silicate	70-80	1	Table No.-1,2,3 of Annexure-A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		Total DFT (Min.)	**230-260µ**		
2	**Metal structure of Gate Storage Embedded Structure of gate storage.**	Primer: Inorganic Zinc Silicate.	70-80	1	Table No.-1,2,3. of Annexure-A,B
		Under coat: Epoxy MIO intermediate coat.	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		Total DFT (Min.)	**230-260µ**		
3	**Column Beam and steel structure of screen cleaning machine.**	Primer: Inorganic Zinc Silicate.	70-80	1	Table No.-1,2,3 of Annexure-A,B
		Under coat: Epoxy MIO intermediate coat.	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		Total DFT (Min.)	**230-260µ**		
4	**External surface of CS Pipeline and support.**	Primer: Inorganic Zinc Silicate	70-80	1	Table No.-1,2,3 of Annexure-A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		Total DFT (Min.)	**230-260µ**		
5	**Internal surface of CS pipeline**	Polyester Glass Flake	500-550	2	Table No.-04 of Annexure-A,B
		Total thickness (Min.)	1000-1100		

6	**External surface of Buried (Soil) carbon steel pipeline.**	Polyester Glass Flake **Total thickness (Min.)**	500-550 1000-1100	2	Table No.-04 of Annexure-A,B
7	**External Surface of accessible part of Condenser cooling water pipeline**	Polyester Glass Flake Top coat : Aliphatic Polyurethane (for color coding) **Total thickness (Min.)**	500-550 30 1060-1170	2 2	Table No.-04, 02 of Annexure-A,B
8	**External surfaces of CS Tank. (except bottom portion)**	Primer: Inorganic Zinc Silicate Under coat: Epoxy MIO Top coat: Aliphatic Polyurethane **Total DFT (Min.)**	70-80 100-120 30 **230-260µ**	1 1 2	Table No.-1,2,3 of Annexure-A,B
9	**External surfaces of CS tank (soil side)**	Coal Tar Epoxy **Total thickness (Minimum)**	100 200µ	2	Table No.-05 of Annexure-A,B
10	**Internal surfaces of CS tank (Potable water)**	Polyamine cured epoxy paint approval from CFTRI Mysore. **Total Thickness**	225-250 µ		Table No.-06 of Annexure-A,B
11	**Carbon steel Metal structure, platform, handrails, stairs, etc.**	Primer: Inorganic Zinc Silicate Under coat: Epoxy MIO Top coat: Aliphatic Polyurethane **Total DFT (Min.)**	70-80 100-120 30 **230-260µ**	1 1 2	Table No.-1,2,3 of Annexure-A,B

ANNEXURE –A
(For Pre-Qualification)

Table number- 01			
Inorganic Zinc Silicate			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
			Primer
1.0	**Coating Details**		
1.1	Type		Inorganic zinc silicate
1.2	Resin		Ethyl Silicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids % Total Zinc dust in dry flim	ASTM D 2369	> 80%, by weight > 84% by weight
1.8	Volume of Solids	ASTM – D-2697	> 65%
1.9	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
2.0	Pot life @ 30 deg.C		>4hour
2.1	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
2.2	Area Coverage (Theoretical)	IS 101, 1964	>8.5m2/l @ 75 micron thickness
2.3	Practical Coverage		Min. 6.25 micron thickness @ 75 micron thickness
2.4	Application		spray
2.5	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr Hard dry < 18 hrs
2.6	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
2.7	Impact Resistance	ASTM D 2794	> 10 Joule
2.8	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.9	Thickness per coat	ASTM D 1186	70-80 µ
3.0	**Total thickness**		70-80 µ
3.1	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
3.2	Accelerated Salt spray Test	IS 2074 or ASTM B117	The coated test panels dried for 48 hrs System should pass 3000hrs exposure

			without blistering and corrosion.
3.3(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
3.4(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%
3.5	Flexibility test panel bent 1 inch dia cylindrical mandrel	ASTM D-1979	System should pass free from detachment,crack,surface deformation, etc.

Table number- 02			
Aliphatic Polyurethane.			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO2
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	 3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 (Part 4/sec2) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 (Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 (Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 (Part 5/ Sec 1) : 1988	52
2.5	Accelerated tests:		
	a).Resistance to sulphuric acid b).Resistance to caustic potash c).Resistance to solvent.	IS 13213:1991	Shall not show any signs of listering, wrinkling & lifting. Difference in gloss and color between immersed and unimmersed area of paint film shall be minimum.
2.6	Durability Test		
	a). out door exposure b) Accelerated weathering test	IS 13213:1991	Chalking 10 Checking 10 Cracking 10 Flaking 10 Spotting 10 Blistering 10 Colour changes 7-8 Gloss :The film shall have a minimum gloss retention of 90 % of its original value.

Table number- 03			
Epoxy MIO			
Sl. No.	**Parameters**	***Test Code**	**Requirement/Value**
1.0	**Coating Details**		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m2/liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram)	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/ sec. 2 IS 101	Pass
2.3	Resistance to humidity under condition of condensation at 500 hr. a). Resistance to humidity 500 hr.	IS 101 clause 2 of part 6 /sec.1	Pass
	b). Salt spray 500 hrs.	Clause 3 of part 6/sec 1.	Pass

Table number-04				
POLYESTER GLASS FLAKE				
Sl.No.	**Test**	**Method**	**Test panels**	**Accept.Criteria**
1.	Pot life			>45 min at 30 deg C
2.	Shelf life			>6 months
3.	Volume solids	ASTM D 2697		>95 %
4.	Cathodic Disbondment	ASTM G8 "Cathodic Disbonding of Pipeline Coatings" Method A	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Typically less than 0.1 mm disbondment following 30 days exposure
5.	Immersion	ISO 2812 Part 2 (Modified)- "Resistance to sea water immersion @ 40 Deg C.	1x500 micron DFT applied directly to SA 2.5 blasted steel.	No film defects following 8000 hours exposure.
6.	Salt Spray	ASTM B 117 Resistance to neutral salt spray (fog) @ 35 Deg C.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	No film defects, and no rust creep at the scribe following 10000 hours exposure.
7.	Abrasion	ASTM D 4060- "Abrasion Resistance of	1x500 micron DFT applied	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.

		coatings via the Taber Abraser"	directly to SA 2.5 blasted steel.	
8.	Adhesion	ISO 4624-"Pull off test for adhesion" using portable adhesion testers.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Not less than 90 Kg/cm^2 when using a PAT adhesion tester on 5mm thick steel.
9.	Impact	IS 101 Part 5/sec3	1x500 micron DFT applied directly to SA 2.5 blasted steel.	Direct impact Resistane-Method A.
10.	Tensile Strength	ASTM-D 2370	1x500 micron DFT "free film"	200 Kg/cm2
11.	Elongation @ Break	ASTM-D 2370	1 x 500 micron DFT "free film"	> 0.5%
12.	Water vapour Permeability	ASTM- D 1653	1x500 micron dft "free film"	< 0.2gm/m^2-hr/mil

Table number-05			
Coal Tar Epoxy			
Sl. No.	**Parameters**	**Test Code**	Specification for coating system
Refer IS 14948:2001			

Table number-06			
Potable water storage tank			
Sl. No.	**Parameters**	***Test Code**	Specification for coating system
a). Eplilux 78- Burger HBTL b). Apcodur CF699- Asian Paints c). Or equivalent approval from CFTRI Mysore.			

Note-

*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.

ANNEXURE- B
(*For Batch Testing)

Table number- 01

Inorganic Zinc Silicate

Sl. No.	Parameters	*Test Code	Requirement/Value
			Primer
1.0	**Coating Details**		
1.1	Type		Inorganic zinc silicate
1.2	Resin		Ehhyl Silicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids % Total Zinc dust in dry flim	ASTM D 2369	> 80%, by weight > 84% by weight
1.8	Pot life @ 30 deg.C		>4hour
1.9	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
1.10	Volume of Solids	ASTM – D-2697	> 65%
1.11	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr Hard dry > 18 hrs.
1.12	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
1.13	Impact Resistance	DEF 1050	Direct Impact of 10.5 lbs weight falling from 23 inch height,ball 12 mm diameter.system should pass free from cracking, detachment, at the peak or periphery of the buldge.
1.14	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.0	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
2.1(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
2.2(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%

Table number- 02			
Aliphatic Polyurethane.			
Sl. No.	**Parameters**	***Method**	**Acceptance criteria**
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO2
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	 3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 (Part 4/sec2) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 (Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 (Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 (Part 5/ Sec 1) : 1988	52

Table number- 03			
Epoxy MIO			
Sl. No.	**Parameters**	***Test Code**	**Requirement/Value**
1.0	**Coating Details**		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m2/liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram)	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/ sec. 2 IS 101	Pass

Table Number-04				
Polyester Glass Flake				
Sl.no.	**Test**	***Method**	**Test panels**	**Accept.Criteria**
1.	Pot life			> 45 min at 30 deg C
2.	Shelf life			>6 months
3.	Volume solids	ASTM D 2697		>95 %
4.	Abrasion	ASTM D 4060-"Abrasion Resistance of coatings via the Taber Abraser"	1x500 micron DFT applied directly to SA 2.5 blasted steel.	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.
5.	Adhesion	ISO 4624-"Pull off test for adhesion" using portable adhesion testers.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Not less than 90 Kg/cm^2 when using a PAT adhesion tester on 5mm thick steel.
6.	Tensile Strength	ASTM-D 2370	1x500 micron DFT "free film"	200 Kg/cm2
7.	Elongation @ Break	ASTM-D 2370	1 x 500 micron DFT "free film"	> 0.5%

Table number-05			
Coal Tar Epoxy			
Sl. No.	**Parameters**	**Test Code**	Specification for coating system
Refer IS 14948:2001			

Table number-06			
Potable water storage tank			
Sl. No.	**Parameters**	***Test Code**	Specification for coating system
a). Eplilux 78- Burger HBTL b). Apcodur CF699- Asian Paints c). Or equivalent approval from CFTRI Mysore.			

Note-

*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.

APPENDIX–C

COATING SCHEDULE

Project Name :
Client :
W.O. No. :

Inspection Agency :
Site :
Others :

SURFACE DESCRIPTION SURFACE A,B (ECT)	APPROX. SURFACE AREA SQUARE METER	SURFACE PREPARATION TYPE	PROFILE RANGE	FIRST COAT			SECOND COAT			THIRD COAT		
				TYPE	WFT / DFT	COLOUR	TYPE	WFT / DFT	COLOUR	TYPE	WFT / DFT	COLOUR

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APPENDIX–D

COATING SYSTEM DAILY INSPECTION REPORT

DATE	REPORT NO.	PROJECT REF. NO.	PAGE OF
PROJECT DESCRIPTION	LOCATION	CONTRACTOR	
INSPECTION ORGANISATION	INSPECTOR	APPLICABLE SPECIFICATION NO.	

I. **DESCRIPTION OF ITEMS AND / OR AREAS**

II. **DESCRIPTION OF WORK PERFORMED / REMARKS**

III. **PRE-WORK SURFACE CONDITION**

- SUBSTRATE _____
- GENERAL DESCRIPTION _____ _____
- PRIMED FOR SUBSEQUENT COATS.
- REFERENCE REPORT DATED ----------
- PREVIOUSLY PAINTED – DEGREE OF CORROSION -- ----------
- NEW METAL – DEGREE OF CORROSION --------

OBSERVED DEFECTS

OIL & GREASE	*	*
SHARP EDGES	*	*
WELD SPATTER	*	*
MOISTURE	*	*
LAMINATIONS	*	*
SOLUBLE SALTS	*	*
----------	*	*
----------	*	*

IV. **ENVIRONMENTAL CONDITIONS**

TIME ----------

AIR TEM/^{O}C ----------

WET BULB TEMP ^{O}C --------

RELATIVE HUMIDITY ^{O}C ----------

DEW POINT ^{O}C ----------

SURFACE TEMP MIN / MAX. ^{O}C ----------

REMARKS :

ANNEXURE -E

DRY FILM THICKNESS MEASUREMENT WORKSHEET

DATE	REPORT NO.	PROJECT REF. NO.	APPLICABLE SPECIFICATION	PAGE OF

ITEM / AREA DESCRIPTION	SPOT	SPOT READINGS (MICRON)			TOTAL	AVERAGE	% MIN	REMARKS
		1	2	3				
	A							
	B							
	C							
APPROX. SQ. MTR	D							
	E							
					TOTAL			
					AVG			

SPECIFICED DFT---------- MICRON
RANGE ACHIEVED ---------- MICRON

REFERENCE REPORT DATED ---------- FOR APPLICATION RECORD

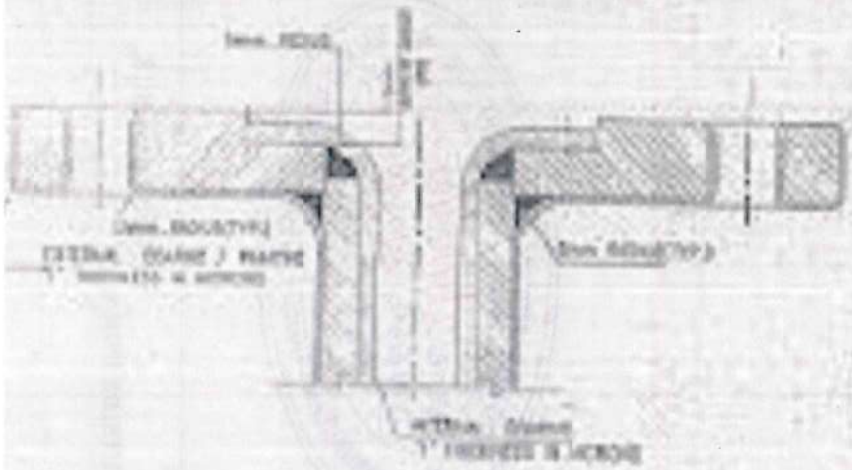
REMARKS

INSPECTOR'S SIGNATURE DATE

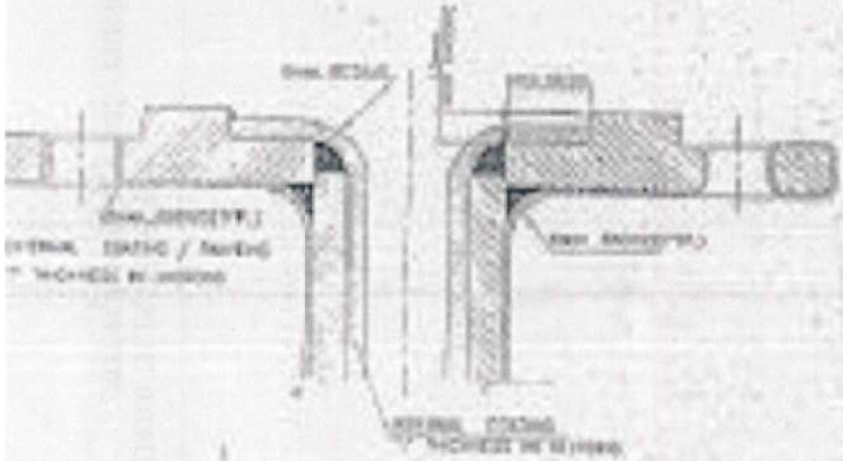
ANNEXURE- F

PAINTING ON FLANGE JOINT

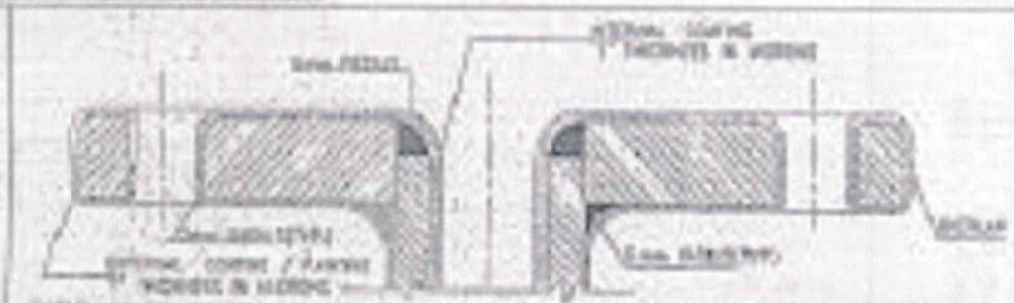
COATING METHODS ON FLANGE SURFACE



EQUIPMENT FLAT FACE FLANGE COATING



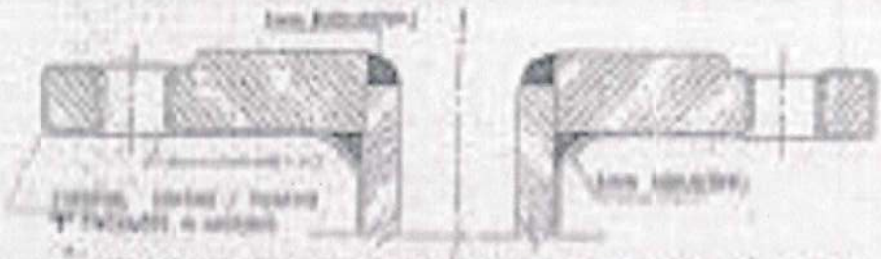
EQUIPMENT RAISED FACE FLANGE COATING



PIPE LINE FLATE FACE FLANGE INTERNAL & EXTERNAL COATING

PIPE LINE FLATE FACE FLANGE EXTERNAL COATING

PIPE LINE RAISED FACE FLANGE INTERNAL / EXTERNAL COATING



PIPE LINE RAISED FACE FLANGE EXTERNAL COATING