

BHARAT HEAVY ELECTRICALS LIMITED

Tiruchirappalli - 620 014



TELANGANA STATE POWER GENERATION CORPORATION LIMITED (TSGENCO) YADRADRI DIST., TELANGANA YADRADRI TPS 5 X 800 MW CUSTOMER NO: U8/1823 to 1827, UNIT – I to V PAINTING SCHEDULE

Prepared by	K. Srinivasan Senior Engineer/ Plant Lab		Document No: PL: C3 - PS / 1823
Reviewed by	D. Vijayakumar SM /PE/FB		Revision No: 00 Dated: 01.01.2018
Approved by	Dr. Anbazhagan. V SDGM / Plant Lab		Sheet No. 01 of 12.

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Executive Director

Thermal Projects Construction
TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	01.01.2018	New	Prepared in line with approved painting schedule meant for 1 X 800 MW TSGENCO - KOTHAGUDEM.- Cust. No. U8/1810 and BHEL standard painting scheme.


 Executive Director

Thermal Projects Construction
 TSGENCO, Vidyut Soudha,
 Bangalore-500 082.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 PS1JO	Collector & Separator Vessels (Except Internals), Supports 04 - 147,321,323,547;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 35 μm per coat	2	--	--	#Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 25 μm per coat #Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2* 1	Internat ional orange shade No:592 of IS 5	140
2 PS5	Collector & Separator Vessels internals and Dd items 04-347; 07-302,303, 331,360,361,362; 09-303, 304;12-306,314,317,324,327, 12-328,344,348,354,393; 17-304,306,319; 19-306,307;21-602,605;24-352,803,813 24-818,827,842;28-700;35-190,700,701; 36-700,701; 41-710; 42-710; 43-710; 45- 710;47-710;48-700; 65-710;67-710 Foundation materials: 35-010, 39-012	SSPC-SP1/ or SSPC - SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 - 04 DFT=25 μm per coat	1	--	--	--	--	--	25
3 PS 31D	Buck stays 08 - 001, 003,006,007, 111; 08 - 380, 501,503,901, 910; Bunker structures 34-100,200,300,390,400,500 Boiler supporting structures, Columns, Girders, Bracings 35- 111,112,121,122,130,140,150, 35- 211,212,213,214,221,222,231,232 35- 311,312,321,322,331,332,341,342 35- 351, 352,361,362,381 to 387,390, 35- 441 to 447, 451 to 457, 511 to 517, 35- 521 to 527, 531 to 537	Blast cleaning to SA2 ½ or SSPC-SP10 (Near white metal) with surface profile 35 μ	Epoxy based Zinc Phosphate Primer to IS13238 DFT 30 μm	1	Epoxy based MIO pigmented intermedi ate coat DFT 75 μm	1	Epoxy based Finish paint to IS14209 DFT 30 μm Aliphatic acrylic Polyurethane paint to IS 13213 DFT 30 μm	1 1	Smoke grey to shade no. 692 of IS 5 Light Grey Shade No: 631 of IS 5	165

Out of 3 coats of finish paint, *first coat of synthetic enamel finish paint to 25 microns shall be given at shop / subcontracting works. Second coat of synthetic enamel finish to 25 microns and third coat of synthetic enamel paint to 20 microns shall be applied at site.



Executive Director

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
3 PS 31D (Contd.)	Galleries, Stair-ways & inter connecting Walkways 36-110,150,311,312,313,314,315,316,321,322; 36-323,324,325,326,331,332,333,334,335,336; 36-337,341,342,343,344,345,346,347,351,352; 36-353,354,355,356,361,362,363,364,365,366; 36-371,372,373,374,375,376,391,392,393,394; 36-395,610,620,621,740,38-210,299,310,381; 38-410,510,610,611,710; ID system structures, 39-101,102,141,142,150,299,300,301; 39-304,305,306; Duct supports 48-015,115,145,205,225, 265,385; 48-435,465,485,495,665;	Blast cleaning to SA2 $\frac{1}{2}$ or SSPC-SP10 (Near white metal) with surface profile 35 μ	Epoxy based Zinc Phosphate Primer to IS13238 DFT 30 μm	1	Epoxy based MIO pigmented intermediate coat DFT 75 μm	1	Epoxy based Finish paint to IS14209 DFT 30 μm	1	Smoke grey to shade no. 692 of IS 5	165
4 PS3	Components >95° C Insulated other than components in Sl.No.7 & 9 Ring Headers, Down Corners, Hot air Headers outside the gas path etc. 05-155,227,231,251,327,330,350; 07-102,110,125,223,231,232,317; 10-135,174,178,191,195,235,274,278,283; 10-284,285,291,295,315,687;12-178,850,852; 12-900;15-136,178,236,278;17-476; 18-001,002,010,701;19-701,702,903; 21-600,602; 24-800,803,805,806,807,808, 24-809, 811,815,823,840,842 42-020,030,070,120,128,158;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
⁴ PS3 (Contd.)	Hot Air: 48-018, 202,204,207,208,212,214, 222,224, 262,264,662,664,667. Flue Gas: 48-342,344,352,354,362,364,372,382,384,386, 48-432,434,462,464,482, 484,492,494, 498;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60
⁵ PS9	<u>Components uninsulated other than components coming in gas path.</u> Temp: >95°C & <400°C 20-511; 24-820,822,824,827,835; 42-200; Instrument tappings, doors 48-200,915;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. II DFT 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. II DFT 20 μm per coat	1	Aluminium	40
⁶ PS10	<u>Components uninsulated other than components coming in gas path.</u> Temp: >400°C & <600°C 09-003,004,005; 28-220;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT 20 μm per coat	1	Aluminium	40
⁷ PS2	<u>Loose tubes, SH, RH & Eco. coils</u> 11- 074,078, 374,378,406, 11 - 416,467,469,478,484,487,491,494, 11 - 606,608, 684,694,716, 11 - 717,718, 767,768, 769,787,791,916,917, 11 - 918,967, 968,969,987,991; 12 - 184,187,368,403,405,514,515,524,544, 12 - 554,803,805,903,914,917,924,927,928,944; 12 - 948,954,968;16-079,201,202,203,403,379; 17 - 476; 19 - 814,824, 884,914,924,984;	SSPC - SP2 or SSPC - SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 - 03 DFT=35 μm per coat	1*	--	--	No paint	No paint	Red Oxide	35

*-In lieu of dip painting, 2 coats of brush painting of Red oxide Zinc Phosphate primer to a coating thickness of 60 μm is also permitted in line with Sr.No.9.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat		Total DFT μm (min)
8	Components < 95° C - Other than components in SL.No.3.	SSPC-SP3/ Power Tool Cleaning	Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	
PS73	07-409,431,460,461,462, 07-502,503, 531, 560; 12-906, 916,907; 17-919; 21-601,604; 24-350, 351, 352, 353,801,804, 24-813, 817, 818 24-825, 826, 836, 841, 842, 950; 30-233,234; 35-995; 36-396, 613; 39- 302; 41- 350,390, 500; 42-001,002,005,010,046,065,070,120,128, 42-152,154,157; 43-004,104,200; 45-200,801,802,804,805,858; 47-261,263,858; 48 - 022, 345, 355, 365; 65-736; 67-204,272,276,277, 283, 67-801,802,803; 95-088,089,091,485; 96-186; 97-097, 585,591,592; Duct plates, expansion joints 48-911,912; Handling equipments: 99-100,300, 400, 502,600; Impulse lines: 24-800 Seal air ducting: 43-005, 105; Cold Air:48-012,014, 112,114, 141 Tempering Air: 48-142,144;	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 30 μm per coat	2	Smoke Grey Shade No: 692 of ISS	120

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
9	Components >95° C coming in the gas path, Headers, Commissioning Spares & erection Materials etc., PS3 05-137,147;06-400,401, 451, 500,501; 06-731,732,734,737,741,744, 747; 06-751,752,753,755; 07-315,316,318,423,993; 10-182,183,184,185; 12 - 993; 17-174,504,506,900,903,993; 19-753,763,783,793,802, 19-850, 851,852; 20-988,998;21-987,988; 24-960,987, 989,993; 30-103, 215,219,223,224,235; 31-010,104,993; 32-010,210; 35-993;37- 010, 810; 39-993; 41-988; 42-858, 988; 48-993; 96-193; 97-282,590; 99-099;	SSPC-SP3/Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60
10	Hand rails and posts, ladders / rungs PS6 34 - @820, 850;35 - @821,822, @823,851; 36 - 820,821,851,852,853; 38 - @820,850; 39 - @820,850; Floor Grills, Step treads 34-810; 35 - 811,812;36-811,812,813,814 38 - 810, 39 - 810		Hot dip Galvanizing to a coating weight of 610 g/m ² (minimum) and to a coating thickness of 85.0 microns (minimum).							

Refer Notes given below **

Notes **: The Guard plates, Hood Ladders and Stringer channels shall be painted as per painting scheme prescribed in Sl. No: 03

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μ m (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
11	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, OCNRV, SV & SRV Silencers, 21-800; 24-885; Safety valves & ERV 21-850; 24-880, 883;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	1 DFT= 20 μ m per coat	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.I	1 DFT = 20 μ m per coat	Aluminium	40
PS 10	24-860; 42-300,358;		Heat Resistant Aluminium Paint to IS 13183 Gr.II	--	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.II	--	--	--
PS 9	24-860; 42-300,358;	Phosphating	To a coating weight of 1500 mg per Sq.ft.	--	--	--	--	--	--	--
1AS2	Forged valves									
	Soot Blower components 20-051,054,201,204,794,962.	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μ m per coat	2	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μ m per coat	2	Verdigris Green Shade No. 280 of IS5	100
	HP / LP system	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I DFT= 20 μ m per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.I DFT= 20 μ m per coat	1	Aluminium	40

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
12 PS15C	For CLH & VLH* PGs 07,08,12,17,19,21,24,47,48 &80 07-402,403, 405,505; 17-904,906 19-506,507,904,905, 906,907; 24-801,810; 48-206,395;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Epoxy zinc rich primer To IS 14589 Gr. II %VS=35, (min) DFT=50 microns per coat	1	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT= 35.0 microns per coat	2	Phirozi Blue Shade No. 176 of IS5	120
13 PS8A	Components > 95°C, un-insulated Fuel pipes 47-266,267,268,269;	SSPC-SP3/ Power Tool Cleaning	General purpose Aluminium paint to IS 2339 DFT= 20 μm per coat	1	--	--	General purpose Aluminium paint to IS 2339 DFT= 20 μm per coat	1	Aluminum	40

*- For components other than CLH & VLH, Painting scheme shall be as given in Sl. No. 8.



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TSGENCO, Vidyut Soudha,
Khairatabad, Hyderabad-500 082.

NOTES:

1. Rust Preventive Coating should be given on HSEF Bolt and nut threads.
2. Machined surfaces and all retainers are to be applied with a coating of Temporary Rust Preventive oil.
3. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves shall be coated with Temporary Rust Preventive Fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.
4. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per tender/ approved painting schedule.
5. PGMA's under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGMA's mentioned above falling under the scope of BHEL, the same scheme as for main equipment as covered in this document shall be followed.
6. This painting Schemes is valid for only Customer No: U8/1823 to U8/1827, Yadradri TPS-5X800 MW.
7. No painting is required for Stainless Steel, non-ferrous & galvanized components.
08. Wherever inside surfaces of components under PGMA 48 – XXX & others, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.
09. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkylid based red oxide paints over the coating is permitted. In case, the coating has peeled off over a large area, then the coating is to be removed by suitable solvents / heating to 350 – 400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC – SP3 / SP2 shall be followed and the painting shall be done as described in SL.No.8.
11. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
12. Touch-up painting of damaged areas shall be carried out as per clause 3.4.0, of Vol. VII-C, Section-X Technical Specification for erection of structural steel work– TSGENCO, KOTHAGUDEM TPS- I (1x800MW).
13. All components covered under different PGMA's are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.
14. For very small components like clamps etc. SL.No.8 shall be followed.
15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer.
16. Painting scheme for all temporary structures like 04-196 shall be PS 1AE i.e. 1 coat of Red oxide Zinc Phosphate primer (Alkylid Base) to IS 12744-DFT-30µ and 2 coats of Synthetic Enamel paint (Long Oil Alkylid) to IS 2932-DFT-2X20µ Shade Yellow –Shade No. 356 of IS 5- Total DFT 70µ. These are to be cut & removed at site after erection. (It excludes components covered under Sr. No. 3 & 10 of description table)
17. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/ draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 g/ Cu.m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self-indicating Silica Gel (colourless) shall be 250 g/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each). VCI pellets shall not be used for stainless steel components and its composite associates.
18. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns minimum thickness.
19. Soot blower components i.e Valve head assembly having high surface temperature (> 200 and <600 deg. C) shall be applied with protective coating as per PS9 (up to 400 deg C) and PS10 (up to 600 deg C)
20. Corner plate, sheet channel and fixing pins of PGMA 32-510 shall be painted as per scheme PS3 to total DFT of 60 microns.
21. It is mandatory that for finish coat each layer shall have a permanent DFT and free from any paint defects like sags, wrinkles etc. Total DFT of a component correspond to respective painting scheme has to be ensured and recorded by inspection agency as per QP.

22. Handrails of PGMA under Sl. No. 3 shall be hot dip galvanized as per PS6 – Sl. No. 10.
23. Inside surfaces of fabricated structure (e.g. Box type column) shall be painted with two coats of red oxide primer paint during fit up stage.
24. For DD items, DUs other than threaded/ machined surfaces shall be painted as per scheme of Sl. No. 8, PS73.
25. For chequered plates having thickness $\leq 5\text{mm}$, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 8.
26. All Columns below '0' level (embedded in concrete) PGs 34,35,36,38 39 – two coats of temporary Rust preventive fluid to PR: CHE: 09 – 04. DFT= 40 μ .
27. Faying surfaces of bolted connection (Friction Grip, Slip- Critical) shall be masked to prevent application of coating except primer. Only primer shall be used on all friction grip type (Slip-Critical) bolted connections for all structural steel. After bolting this area shall be coated in accordance with the specified painting system.

Durability of paint system

1. The durability of the coating system is only a typically expected to be as per ISO 12944-5, clause 5.5.
2. It is to be noted that the durability (as noted in ISO) is not a guarantee time.
3. The Durability is indicated in this document only as a technical consideration that can help the owner to plan a maintenance painting programme.
4. It is emphasized that ISO guidelines of durability can be met only if painted components are stored properly; taking due care of all the precautions to ensure that components are not directly in contact with soil & (rain) water (or) any corrosion medium and are stacked properly without damaging the paint coating.
5. The durability is linked to the painting system essentials, which encompasses the condition of the surface painted; surface preparation methodology; type of paint system and coating thickness; care with which the surfaces are handled; the care with which they are stored. Hence due care has to be taken in all aspects. When there is a local damage is done, and maintenance coating is done; it is to be noted that the durability as originally stated cannot be expected.
6. As a good practice, considering the above, it is suggested that sites should inspect the paint condition of the components every three months till erection and do the needful to protect any damaged regions, by suitable maintenance coating. It is necessary for sites to define and adhere to a methodology for proper storage.
7. The durability expected for painting scheme of structures (Sl. No.3) is 5 years against medium corrosive environment. Painting scheme "1JO, 73 & 1AS2" falls under Low durability category (L), 2 to 5 years in similar environment. Expected life of PS3 & PS2 is from six months to one year. 15C is having durability 5 years minimum under medium corrosive environment.


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 TSGENCO, Vidyut Soudha,
 Khairatabad, Hyderabad-500 082.

Painting Scheme – Details for procurement & application purposes

Sl.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns per coat (approx.)	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	35	40	Grey	--	Spray	24
2	Aliphatic acrylic polyurethane paint to IS 13213	12	2	40	30	Phirozi – Blue/ Light Grey	176/ 631	Spray	24
3	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
4	Red oxide zinc phosphate primer paint to IS 12744	10	1	--	30	-	--	Brush / Spray	12
5	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	--	---	Dip	12
6	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	--	20-30	Reqd. shade	Compdg. Shade no.	Brush / Spray	12
7	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	25	--	--	--	12
8	General purpose Aluminium paint to IS 2339	10	2	--	20	Aluminium	--	Brush	12
9	HB Chlorinated Rubber Based Zinc Phosphate Primer-Colour Grey	8	1	40	50	Grey	--	Brush / Spray	12
10.	Epoxy based polyamide cured MIO pigmented intermediate coat.	8	2	50	75	Brown	--	Spray	24
11	Epoxy based polyamide cured finish paint to IS14209.	13	2	40	30	Smoke grey	692	Spray	24
12	Epoxy based zinc phosphate primer to IS13238	11	2	40	30	Grey	--	Spray	24

Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. ** Values are indicative.

Sanjay