Project Engineering
Management

Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)

GLOBAL TENDER FOR FUEL OIL HANDLING AND STORAGE SYSTEM OF 2 X 250 MW NEW NEYVELI TPP (SG)

Ref No. : PE/PG/NTI/E-4588/2014 **Date: 14.11.2014**

CORRIGENDUM/ ADDENDUM-4

Our Ref : TENDER ENQUIRY NO: PE/PG/NTI/E-4588/2014 Dt. 10-10-2014
Package : FUEL OIL HANDLING AND STORAGE SYSTEM
Project : 2 X 250 MW NEW NEYVELI TPP (SG)

This is in reference to the above Tender Enquiry No: **PE/PG/NTI/E-4588/2014, DTD-10.10.2014** please note that following clarification against above tender enquiry.

Sr. No.	Refer Clause	Clause Statement	Vendor's Clarifications required	BHEL Reply
1	Clause 1.11 Data sheet for Pressure reducing station, page 34 of 303	PRS rating not mentioned in technical documents (i.e 2X60% or 1X100%)	As per the industrial practice, we are presuming 2 X 60%. Kindly confirm.	**PRS configuration shall be : 2x60% self-actuated pilot operated PRV complete with isolation valve and manual bypass valve sized for same duty as PRV. The complete station shall have a manual bypass sized for 100% of steam flow rate. Two nos. relief valves with 100% relieving capacity shall be provided on the downstream header in series.** **100% capacity shall mean the total capacity considering the following simultaneous operation:** **a) One no HFO storage tank under initial heating** **b) One no. HFO tank under maintenance heating** **c) One no suction heater under operation** **d) Steam tracing of various pipes & equipment.** **e) 48 nos railway wagons with heating arrangement under simultaneous unloading** **Plus 10% margin on above.**

Please reply to:
Kamal Kishore (Engr/PG-II-2)
Power Project Engineering Institute Building
HRD & ESI Complex Plot No. 25, Sector -16 A,
BHEL-PEM,Noida-201301 (U.P.)
Tel No. 0120-43638508

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2	Painting requirements, Clause no 5.0, Page 138 of 303	Painting as per the manufacture recommendations	For HFO Tank (External Surface)- Zinc silicate primer @ 1 coat For LDO Tank (External Surface)- Zinc silicate primer @ 1 coat Intermediate (Epoxy High Solid) 1 coat Finish (Comp. Polyurethane) 1 coat For Piping - Zinc silicate primer @ 1 coat Intermediate (Epoxy High Solid) 1 coat Finish (Comp. Polyurethane) 1 coat Insulation Piping - Zinc silicate primer @ 1 coat Kindly confirm.	Bidder to painting spec. attached under Annexure-I.

Thanking You,

With Regards,
For & on behalf of BHEL

14/11/14

Kamal Kishore
Sr. Engineer/PG-II-2

Please reply to:
Kamal Kishore (Engr/PG-II-2)
Power Project Engineering Institute Building
HRD & ESI Complex Plot No. 25, Sector -16 A,
BHEL-PEM,Noida-201301 (U.P.)
Tel No. 0120-43638508

(Annex - I)

PAINTING

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11.1 General

1. The term "Painting" referred herein covers rust preventive, preventive and decorative coating along with surface of the following areas.
   a) All Mechanical equipment, Technological structures, chutes, piping, ducts etc.
   b) Various types of static and rotary equipment inclusive of electric motors etc.
   c) Steel tanks and vessels
   d) Pipe work including trestles, supports, hangers, etc.
   e) Metallic duct work such as ventilation ducts, gas ducts including supports, hangers, etc.
2. Surfaces made of aluminium, brass, bronze, stainless steel, cast iron and other corrosion resistant alloys are not required to be painted unless specified except for identification bands or for aesthetic purposes.
3. All machined mating surfaces (e.g. flanges) will be properly cleaned, greased and protected before despatch.
4. The complete paint system for any item includes the following basic activities:
   a) Proper surface preparation
   b) Application of primer coats
   c) Application of intermediate coats
   d) Application of finished coats

All the above coats will be of quality paint products and the scope of work will also include supply of all paint materials as per specification.

11.2 Painting for mechanical & electrical equipment, mechanical structures, piping, ducts etc.

1. This section covers the painting requirements for the equipments, structures, piping, duct etc. and any other surface required to be painted for all the equipments in the section-1 of this specification.
2. Codes and Standards

   Painting of equipment will be carried out as per the specifications indicated below and will conform to the relevant IS specification for the material and workmanship.

   The following Indian Standards may be referred to for carrying out the painting job:

Table 11.1
Codes and Standards for Painting

S.No	Code	Description
1.	IS:5	Colours for ready mixed paints and enamels
2.	IS 1303	Glossary of terms relating to paints

S.No	Code	Description
3.	IS 2379	Colour code for identification of pipelines
4.	IS 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
5.	IS 2524	Code of practice for painting of non-ferrous metals in buildings (Part I & II)
6.	IS 2395	Code of practice for painting of concrete, masonry and plaster surfaces (Part I & II)
7.	IS 2338	Code of practice for finishing of wood based materials (Parts I & II)
8.	IS 6278	Code of practice for white washing and colour washing
9.	IS 3140	Code of practice for painting asbestos cement building products
10.	IS 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
11.	IS 2074	Ready mixed paint, air drying, red oxide, Zinc Chrome, priming
12.	IS 104	Ready mixed paint, brushing, Zinc Chrome, priming
13.	IS 2932	Enamel, synthetic, exterior (a) undercoating (b) finishing specification.

3. **Preparation Of Surfaces**

a) Surface preparation being a pre requisite for any paint application, will be such as to clean the surface thoroughly of any materials which will be conducive to premature failure of the paint substrates and the surface preparation will be as per the painting scheme elaborated subsequently.

b) Solvent cleaning (SP 1)

The surface will be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning will not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning will be followed by other cleaning procedures as stated below.

c) Hand tool cleaning(SP2)

The surface will be cleaned by vigorous wire brushing done manually to St-2 quality. This method effectively removes loosely adherent materials, but would not affect residues of rust or mill scales that are intact and firmly adherent.

d) Power tool cleaning(SP3)

The surface will be cleaned by electric or pneumatic tools to St-3 quality. The tools will be used carefully to prevent excessive roughing of surface and formation of ridges and burns. This method will remove

loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

e) Blast cleaning (SP4)

The surface will be cleaned by impingement of abrasive materials, at high velocity created by clean and dry compressed air blast. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning and excessive surface scales are removed by hand tools or power tool cleaning. The surface will be cleaned to Sa-2 1/2 quality (SP 4) which means that to 95% of surface area is free from all rust, mill scales and visible residues, foreign materials, etc. The blast cleaning is not recommended for sheet metal work.

f) Blast cleaning (SP5): In this process the surface will be cleaned to 35 to 50 Microns.

4. **Primer Paints (P)**

After the surface is prepared in a manner acceptable to Owner/ consultant, two (2) coats of Primer paints will be applied only on dry and clean surfaces. Second coat of red oxide primer will be applied only after first coat has dried up completely. Coating of primer will in general conform to IS:2074-92 and will be applied by brushing to ensure a continuous film without "holidays".

a) Primer paint P1: (Epoxy based)

A two pack air drying epoxy polyamide resin based red oxide –zinc phosphate (primer):

Epoxy content (% wt)	15 to 18
Air drying time	About 30 minutes (touch dry) Over night (hard dry)
Dry film thickness (DFT/coat)	30 microns (min)
Temperature resistance	Upto 120°C dry heat

b) Primer paint P2 (Epoxy based)

A two pack air drying epoxy polyamide with zinc dust of at least 92% zinc dust on the dry film.

Epoxy content (% wt)	8 to 10
Air drying time	About 10 minutes (touch dry) 2 hours (hard dry)
Dry film thickness (DFT/coat)	40 microns (min)
Temperature resistance	Upto 300°C dry heat

c) Primer paint P3 (Ethyl zinc silicate, EZS, based)

A two pack heavy duty zinc dust rich silicate primer:

Total solids (% wt)	84 + 2

Air drying time	16 hours
Density	3.07 + 0.005
Dry film thickness (DFT/coat)	60 microns (min)
Temperature resistance	Upto 450°C dry heat

d) Primer paint P4 : Double boiled linseed oil as per IS – 77 : specification for linseed oil, boiled for paints

e) Primer paint P5: In organic Zinc silicate with suitable air drying time. 40 microns per coat

f) Primer paint P6 : Red oxide Zinc phosphate as per IS 12744 with DFT 30 microns per coat

g) Primer paint P7 : Red oxide Zinc chrome primer(alkyd based) as per IS 2074 with DFT 40 microns per coat

5. **Intermediate paints (I)**

These paints will be applied over primer coats as an intermediate layer to provide weather proof seal of primer coats.

a) Intermediate paint (I1)

A two pack air drying high build epoxy resin based paint with MIO.

Air drying time	6 to 8 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	100 microns
Temperature resistance	Upto 180 deg.C dry heat
Compatible with	Primer P1 and P2

Intermediate Paint I2: Synthetic Enamel (long oil alkyd) to IS 2932, 1 coat = 20 Microns per coat.

6. **Finish Paint (F)**

Finish paint coats will be applied over primer coats and intermediate coats after proper cleaning and touch up of primed coats. Synthetic enamel paint comprising of IS: 2932-95 will be used for finish coats.

a) Finish paint (F1)

A two pack air drying epoxy polyamide enamel suitably pigmented.

Air drying time	2 to 3 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	40 microns
Temperature resistance	Upto 130°C dry heat
Compatible with	Primers Intermediate
Color	Generally all shades

b) Finish paint (F2)

A single pack synthetic rubber based enamel paint.

Air drying time	2 hours (touch dry)

	24 hours (hand dry)
Dry film thickness (DFT/coat)	25 microns
Temperature resistance	Upto 200°C dry heat
Compatible with	No primers
Color	Generally all shades

c) Finish Paint F3

A single pack heat resistant silicon resin based paint with leafing aluminium.

Air drying time	3 to 4 hours (touch dry) 24 hours (hard dry)
Dry film thickness (DFT/coat)	20 microns (min)
Temperature resistance	upto 400°C dry heat
Compatible with	no primer paint except P3
Colour	smooth aluminium

d) Finish Paint F4: Heat resistant Alumina Paint IS 13183 Gr II, DFT 20 microns per coat.

e) Finish Paint F5: Heat resistant Silicone Aluminium Paint with suitable air drying time as per IS 13183 Gr I, 25 microns per coat.

f) Finish Paint F6: Aliphatic acrylic polyurethane paint, DFT = 30 microns per coat.

g) After cleaning the dust on the dried up primer/ intermediate paint, first coat of synthetic enamel will be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint will be applied only after gently removing the gloss of first coat from entire surface and it is dusted off the surfaced. The requirement of workmanship will be as per IS: 1477-71.

h) Equipment No. and the name of the equipment will be painted on the surface of the equipment on visible locations. Service of the Pipe/Line designation with arrow identification for the direction of flow will be painted on all pipes at visible locations at an interval of 20 metres. Wherever pipelines are insulated, the service of the piping and arrow mark will be painted over the clad surface.

i) The color code to be followed during painting of piping will be in line with IS 9404:2002 (Identification of pipelines used in Thermal Power Plants – Color Code).

j) For painting of structure, equipment, tanks & vessels etc. suggested color code is given in Table 11.3.

k) For insulated pipeline the finish paint will be applied at that place where color band is to be painted on the aluminium sheeting. The finished paint (color band) will be of 2m length at that place.

l) Color band for piping will be applied at these following locations-

- At start and end point.
- At every 50m intervals.
- At every T joints and cross connection of piping.
- At every battery limit of pipeline.
- Near valves located at terminal points.

m) Width of band

Table 11.2

Width of band

S.No.	Size of pipe including insulated pipe line outside diameter	Width of band
1	80mm and below	25 mm
2	Above 80 mm upto 150 mm	50 mm
3	Above 200 mm upto 300 mm	75 mm
4	Above 350 mm	100 mm

n) Direction of flow will be indicated by black or white arrow in contrast to the base color on the pipeline. Length of the arrow will be minimum 125 mm and width will be minimum 65 mm. These will be put at an interval of 10 m.

7. **Suggested Colour Codes for Painting of Structures, equipments, tanks & vessels etc.**

Table 11.3

Colour of Specific Items

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark admiralty grey	632	-	-
2.	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.	Fans, pumps, motors, compressors, Mills.	Light grey	631	-	-
a)	Outdoor ,Stand pipes, vent pipes	Aluminium	-	-	-
b)	Indoor Tanks	Aluminium	-	-	-
4.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
5.	Switchgear	Light grey	631	-	-

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
6.	MCC/PDB, Local control panels, Bus Ducts	Light grey	631/7078 of IS:1650	-	-
7.	Transformers	Dark admiralty grey	632	-	-
8.	Machinery guards	Signal red	537	-	-
9.	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water(if applicable)	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166
10.	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
11.	Oil system				
a)	Fuel oil	Light brown	410	French	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
12.	Fire services	Fire red	536	-	-
a)	Ash slurry pipes	Black	-	-	-
b)	Vacuum pipes	Sky blue	101	Black	-
c)	Fuel pipes (Lignite)	Light brown	410	-	-
d)	Drainage	Black	-	-	-
e)	Stand pipes and all Vent pipes	Aluminum	-	-	-
f)	Bottom Ash system	Light Grey	631	-	-

n) In components, where ver plates/sheets of thickness less than or equal to 5mm, pipes, rods are used, power tool / hand tool cleaning to SP3/SP2 will be followed and the painting will be done as per the painting scheme adopted for components that are coming in the flue gas path.

o) All weld edge preparation for site welding will be applied with one coat of weldable primer.

p) For internal protection of pipes/tubes, VCI pellets will be used at both ends after sponge testing and ends capped. VCI pellets will not be used for SS components and composite assemblies.

q) Wherever inside surfaces of ducts need protection till erection, two coats of red oxide zinc phosphate primer (P1) paint to IS 12744 to a DFT of 60 microns will be applied after power tool cleaning.

9. **Painting scheme**

a) Type of paint products like P1, P2, P3,P4,P5,P6,P7, I1, I 2,F1, F2 and F3,F4,F5,F6 has been specified elsewhere in the specification.

b) For a complete painting scheme of any item being painted, all types of paints are to be procured from the same manufacturer as approved by the Owner.

10. **Legends**

Sa - 2 .5 – The quality of surface cleaning, i.e 95 % of the surface area is free from all rust, mill scales and visible residues, foreign materials etc.

SP1-Solvent Cleaning

SP2- Hand tool cleaning

SP3 – Power tool cleaning

SP 4: Blast cleaning (Sa 2.5)

SP 5: Blast cleaning (35 to 50 microns surface cleaning)

SP 6 – Phosphating

SP - surface preparation quality

2P1 - Two (2) coats of primer paint type P1

1I1 - One (1) coat of intermediate paint type I1

2F1 - Two (2) coats of finish paint type F1

DFT - Dry film thickness

CRT - Clean and retouch.

The painting scheme to be followed for various mechanical/ electrical equipment / structures is briefly given below for guidance to the Contractor.

8. **Paint Application**

a) Paint will be applied in accordance with manufacturer's recommendations. The work will generally follow IS 1477 (Part II) for jobs carried out in India and SSPC-PA-I or DIN 55928 or equivalent for jobs carried out outside India. Touch up paint to be applied to cover scratches after erection and assembly of equipment at site.

b) Paint will not be applied when the ambient temperature is 5°C and below. Also paint will not be applied in rain, wind, fog or at relative humidity of 80% and above.

c) Each coat of paint will be continuous, free of pores and of even film thickness without thin spots. The first coat of finish paint at site will be applied preferably within three months of the shop paint.

d) Each coat of paint will be dry sufficiently before application of next coat.

e) Surface which cannot be painted but require protection will be given a coat of rust inhibitive grease according to IS:958-75 or solvent deposited compound according to IS:1153-75 or IS:1674-60.

f) Surfaces which will be inaccessible after assembly will receive minimum coats of specified primer. Surfaces to be in contact with wood, brick or other masonry will be given one shop coat of the specified primer.

g) Parts of steel structure to be embedded in concrete will be given a protective coat of Portland cement slurry immediately after fabrication and thoroughly cleaning the surfaces from grease, rust, mill scales etc. No paint will be applied on this part.

h) The Contractor will furnish paint manufacturer's test report or technical data sheet pertaining to the paint selected. The data sheet will indicate among other things the relevant standards, if any, composition in weight percent of pigments, vehicles, additives, drying time, viscosity, spreading rate, flash points, methods of application quality of surface preparation required, corrosion resistance properties and colour.

i) Rust preventive coating should be given to HSFG bolt and nut threads.

j) Machined surfaces/weld edges are to be applied with a coating of temporary rust preventive oil.

k) All threaded and other surfaces of foundation bolts ands its materials, insulation pins, anchor channels, sleeves will be coated with temporary rust preventive fluid and during execution of civil works; the dried film of coating will be removed using organic solvents.

l) No painting is required for stainless steel components.

m) The temporary rust preventive coating that already been applied on any components, tubes, pipes etc., will be removed by suitable solvents/ heating to 350-400°C for an hour before primer paint application-but, in case, it should be ensured that the minimum surface cleanliness required for primer paint application will be Sp2 (equivalent to hand tool cleaning).

Table 11.4

Painting Scheme and Total DFT in Microns

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
1.	Steel structures (for Boiler Proper, Lignite bunkers, Mills, mill maintenance building, Air heaters, aux. boiler, Fans, ESPs, etc)	SP-Sa 2 ½ 2P1 + 1I1	2 F1	240
2.	Separator and separator vessel	a) Surface preparation : Power tool cleaning to St-3 grade b) 2 coats of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 3 coats of long oil alkyd synthetic enamel finish paint (International Orange) to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 120 microns (min)	-	120
3.	Separator internals	SP 1 or SP 3 Rust preventive fluid of DFT = 25 µ/coat		25
4.	Following insulated parts viz., Piping,fitting/components, Pipe clamps, vessels/tanks, Equipments and ducts etc	SP 3 2P1, Total DFT – 60 microns P1 = pack of air drying alkyd red oxide zinc phosphate primer to IS 12744 – 2 coats, 30 microns per coat. Total DFT 60 microns (minimum)	-	60
5.	Following un insulated parts viz., Piping, fitting/ components, Pipe clamps, vessels/tanks, Equipments and ducts etc	a) Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat	1F2	70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
6.	Constant load hangers (CLH) & Variable Load hanger(VLH)	SP-Sa 2 ½ 1P2 + 1 F6	-	70
7.	Hangers mentioned other than (6) above	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)	-	70
8.	Valves			
9.	Cast carbon steel valves Cast alloy steel valves, API valves, QCNRV, SV and SRV, Silencers and soot blower components	SP3 2F4	-	40
10.	Forged valves	a)Surface preparation : Solvent cleaning to SSPC-SP1 Grade. b) Phosphating to 16.15 g/sq.m.		-
11.	Top covers of Soot blower	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per		70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
12.	Floor grills, hand rails and posts, ladders / rungs	Hot dip galvanizing to 610 gms/sq.m	-	-
13.	(a)Components coming in the flue gas path like water walls	a)Power tool cleaning to St- 2 / 3 b) One coat of dip – coat paint – Red oxide zinc phosphate primer (dip / brush) DFT = 30 microns		30
	(b)Components coming in the flue gas path, Surfaces in the flue gas path of ESP, Fans and APH	a) Power tool cleaning to St- 2 / 3 b) Two coats of dip – coat paint – Red oxide zinc PO4 to IS 12744DFT = 30 microns per coat		60

Note! **For components not covered above, Contractor's standard practice will be followed with Owner's / Consultant's approval.**

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