NEYVELI LIGNITE CORPORATION LIMITED
(NLC LTD)

NEYVELI NEW THERMAL POWER PROJECT
2x500 MW LIGNITE FIRED UNITS AT NEYVELI
(TURBINE GENERATOR PACKAGE)

PROJECT SPECIFIC
TECHNICAL SPECIFICATION FOR
CHAIN PULLEY BLOCK

SPECIFICATION NO.: PE-TS-402-563-A001

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERIING MANAGEMENT
NOIDA
INDIA

	Title	Specification no.: PE-TS-402-563-A001
	TECHNICAL SPECIFICATION FOR CHAIN PULLEY BLOCK 2X500 MW NNTPS (TG)	Rev. 00
		Date: JAN 2015
		Sheet 1 of 1

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VOLUME - IIB

SECTION – A

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.1 The specification is intended to cover design, engineering, manufacturing, inspection and testing, painting, supply/ delivery duly packed at FOR site including erection & commissioning spares, maintenance tools & tackles, all accessories (isolating switch and power cable from isolating switch to DSL rails) including freight in line with drawings/ documents/ test procedures approved by BHEL/ Customer for **CHAIN PULLEY BLOCK.**

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. **Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply of CHAIN PULLEY BLOCK.**

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.

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SECTION – B

PROJECT INFORMATION
(PROJECT SPECIFIC)

SECTION - 2

2 GENERAL PROJECT INFORMATION

2.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc, already exist.

2.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-1 Expansion and TPS-II.

2.3 Project & Site Information

(i).	Owner/Purchaser	:	Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India
(ii).	Consultant	:	Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India.
(iii).	Project Title	:	2x500 MW Neyveli New Thermal Power Station (NNTPS)
(iv).	Location	:	200 kms south of Chennai and 50 kms south-west of Cuddalore
(v).	Latitude	:	11° 34′ 00″ N to 11° 35′ 00″ N
(vi).	Longitude	:	79° 26′ 00″ E to 79° 27′ 00″ E
(vii).	Elevation above MSL	:	+67 m
(viii).	Nearest Railway Station	:	Neyveli,
(ix).	Nearest Sea Port	:	Chennai, at a distance of 200 km
(x).	Nearest Airport	:	Chennai, at a distance of 200 km
(xi).	Road Access/Approach to Site	:	Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads.The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road
(xii).	**Site Meteorological Data**		
	• Max ambient temperature	:	42.8° C

	• Min Ambient Temperature	:	26.9° C
	• Wet bulb temp	:	29° C
	• Max. Relative Humidity	:	92 % in the month of September
	• Min. Relative Humidity	:	23 % in the month of May
	• Rainfall	:	About 1265.7 mm annually (average)
	• Wind direction	:	South West to North East direction
	• Wind Speed	:	97.2 km/hr (maximum recorded) 4.3 km/hr (average wind speed)
	• Seismicity	:	As per IS: 1893 (part 4) (Zone-II) Importance factor: 1.75.
(xiii).	Languages spoken in the region	:	English, Tamil

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VOLUME - IIB

SECTION – C

SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE OF WORK

1.1 The specification is intended to cover design, engineering, manufacture, inspection and testing at vendor's / sub-vendor's works, painting, forwarding, proper packing and shipment and delivery at site as required on FOR site basis, demonstration test at vendor's works (as mentioned elsewhere in the specification) of **CHAIN PULLEY BLOCK** as per details in different sections / volumes of this specification for **2X500 MW NNTPS (SG)**

1.2 The equipment to be furnished by the bidder for the chain pulley blocks of different capacity and lift as specified in Annexure-I along with all accessories.

1.3 The chain pulley blocks offered shall have technical parameters as per the Data Sheet A enclosed herewith in section –D of Vol IIB

1.4 Any equipment/accessories not specified herein but required to make the equipment complete and efficient shall also be under bidder's scope of work.

The following shall be in the bidder's scope of work.

a. Chain pulley blocks with/without traveling trolleys as per the Annexure-I.
b. Maintenance Tools and Tackles as given at 4.0
c. Packaging.
d. O&M manuals, drawings and documents etc.
e. Inspection & testing of Chain Pulley Blocks as per QAP approved by BHEL /Customer during detail engineering. Prime inspection agency shall be BHEL / End Customer. Equipment being supplied shall be strictly in accordance with nomenclature & technical specification. Any additional testing requirement at any stage of inspection deemed necessary by Customer/BHEL shall be carried out without any commercial or technical or delivery implication.

2.0 TESTING AND INSPECTION

2.1 As per standard quality plan enclosed. Any additional inspection & testing requirement / CHP (customer's hold point) deemed necessary by customer/BHEL during detailed engineering shall also be complied with without any commercial or delivery implication.

2.2 Chain pulley block shall be completely assembled at manufacturer's works and minimum following tests shall be conducted at works

a. Over load test
b. Rated load test
c. Other tests as per IS-3832.

2.3 The scope of inspection shall include but not limited to the following:

i. Material identification / co-relation for important items like hook, load chain, hand chain, wheels, ratchet and pawl etc.
ii. Hardness for pawl and ratchet
iii. Dye penetration test/ UT test for hooks
iv. Operational test including operational effort, velocity ratio etc.
v. Proof load test upto 1.5 times of working load limit.
vi. Dimensional check of hook
vii. Marking

3.0 WORKS EXCLUDED

3.1 Supply of monorail for traveling trolley of chain pulley blocks.

4.0 MAINTENANCE TOOLS AND TACKLES

A complete unused one set of special purpose maintenance tools & tackles and accessories along with detailed instructions for maintenance and manual operation shall be supplied. Tools shall be of suitable sizes for maintenance of Chain Pulley Block of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use and size. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement.

i.	Adjustable spanner	One (1)
ii.	Wrench spanner	One (1)
iii.	Oil gun	One (1)
iv.	Set of Screw driver .	Min 6 nos. (of different sizes suiting various types and capacities of Chain Pulley Blocks)
v.	2 lb hammer with wooden handle	One (1)
vi..	Grease Gun	One (1)

Note: All maintenance tools & tackles are to be supplied in a tool box.

Any other item required for maintenance shall also be provided.

5.0 Mandatory Spares –

NA

6.0 DRAWINGS/DESIGN DOCUMENTS FOR SUBMISSION (during detailed engineering)

A. For Approval

a. G.A. drawing showing clearances, assembly, cross section details, materials of construction, lifts & approaches etc.
b. Quality plan
c. Test certificates & reports on various shop tests.

7.0 NO.OF DRAWINGS/DOCUMENTS FOR SUBMISSION (as per attachment in Volume IIB, Section C, Annexure V)

8.0 DEVIATIONS

8.1 If the offer submitted has got any deviations from technical specification in the tender document. Bidder shall tabulate the same in the 'Schedule of Deviations" furnishing full particulars of such deviations. Deviations are to be furnished with mention to specific clause numbers notes/ comments e.g. "Refer to forwarding letter" etc. is not acceptable. Cost of withdrawal of deviations to be put against each deviation.

8.2 If there are no deviations from the tender document, bidder shall indicate so.

9.0 FUNCTIONAL TESTS

9.1 The chain pulley blocks along with other accessories shall be guaranteed for the rated capacity. The minimum following tests shall be conducted at works – Overload test, rated load test and other tests as per IS-3932. Pull on the hoist and trolley shall not increase during full load operation.

9.2 The bidder shall have full responsibility for the safe and efficient operation of the chain pulley blocks and traveling trolley with associated accessories as a single unit.

9.3 If the shop performance tests indicate the failure of any of the components to achieve the functional performance, the deficiency shall be made good at bidder's cost.

9.4 Performance tests shall be carried out each time after the rectification modification is carried out.

10.0 MAKE OF SUB-VENDOR ITEMS (*)

Following makes of bought out items shall be considered:

Steel	SAIL/IISCO/TISCO
Steel Forgings	Chowdhary/Western India Forgings/ Hindustan Steel Forgings/ Ruby Forgings or as approved by BHEL.
Hook	Herman Mohata/Moozumdar & Moozumdar/ Steel . Forgings/ Karachiwala/Smriti/Nasik Forge.
Brakes	BHEL approved make

(*) The sub-vendor list is indicative and will be subject to customer approval during detail engineering of the package without any commercial implication on account of the same.

11.0 PAINTING SPECIFICATION

As per attached painting specification in Annexure IV of this volume.

12.0 Packing

In general packing shall be wooden box packing.

SCOPE OF CHAIN PULLEY BLOCKS

ANNEXURE-1

A	Chain pulley blocks (CPB)					
S No.	Area	Type	Capacity (T)	Lift(m)	Qty	Remark
1	TG BLDG. Sump Pumps	CPB + TT	1	10	4	
2	Lube Oil Unloading IN B-C Bay	CPB + TT	1	10	1	
3	AHU ROOM AT 8.5 M	CPB + TT	2	6	1	
4	AHU ROOM AT EACH FLOOR OF SERVICE BLD.	CPB + TT	2	6	10	
5	AHU ROOM AT 24 M	CPB + TT	2	8.5	1	
6	AIR WASHER ROOM-1	CPB + TT	2	8.5	2	
7	AIR WASHER ROOM-2	CPB + TT	2	8.5	2	
8	AIR WASHER ROOM-3	CPB + TT	2	8.5	2	
9	AIR WASHER ROOM-4	CPB + TT	2	8.5	2	

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-402-563-A001 **REV**.:0, **Date.: JAN 2015, PAGE**: 1 OF 4	**PROJECT : 2X500 MW NNTPS (TG)** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
1	**RAW MATERIAL & B/OUT ITEMS:**											
1.1	HOOKS	DIMENSIONS,	MA		One sample	IS: 15560	IS: 15560	MTC	P	V	V	UT FOR SHANK DIA 50MM AND ABOVE
		CHEMICAL COMPOSITION, MECHANICAL, PHYSICAL PROPERTIES	MA	LAB ANALYSIS	PER LOT	Material specification as per approved drawings		T.C.	P	V	V	
		IDENTIFICATION & COMPLIANCE WITH TC.	MA	VISUAL	100%	HOOK TC FROM COMPETENT AUTHORITY		IR	P	V	V	
		INTERNAL DEFECTS	MA	UT	100%	ASTM A-388 (REFER NOTE 1)		TC	P	V	V	
		PROOF LOAD TEST	MA	REVIEW	100%	IS 15560		TC	P	V	V	
		NDT AFTER PROOF LOAD	MA	DPT	100%	ASTM E-165	NO RELEVANT IDENTIFICATION	TC	P	V	V	
1.2	LOAD CHAIN	- DIMENSIONS	MA	MEASUREMENT	100 %	IS: 6216 &	IS: 6216 &	IR	P	V	V	
		- BREAKING STRENGTH	MA	-TENSILE TEST	1/LOT	APPD. DRGS.	APPD. DRGS.	MTC	P	V	V	
		- PROOF LOAD	MA	-TENSILE TEST	100%			MTC HT	P	V	V	
		-HEAT TREATMENT	MA	REVIEW	100%			CHA	P	V	V	
		-GRADE	MA	REVIEW	1/BATCH			RT MTC	P	V	V	
1.3	RAW MATL. FOR GEAR/ RATCHET PAWL / RATCHET WHEEL	CHEMICAL COMPOSITION, MECHANICAL PROPERTIES	MA	LAB ANALYSIS	ONE SAMPLE PER LOT	MATERIAL SPECIFICATION AS PER	MATERIAL SPECIFICATION AS PER	MTC	P	V	V	TC or inspection report for components

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-402-563-A001 **REV**.:0, **Date.: JAN 2015, PAGE**: 2 OF 4	**PROJECT : 2X500 MW NNTPS (TG)** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
						APPROVED DRAWING	APPROVED DRAWING					shall be given.
		INTERNAL DEFECTS	MA	UT	10%	ASTM A-388 (REFER NOTE 1)		IR	✓	P	V	V	
1.4.	LOAD CHAIN WHEELS	- CHEMICAL COMPOSITION MECHANICAL PROPERTIES	MA MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	APPD. DRG.	APPD. DRG.	MTC	✓	P	V	V	
1.5	BEARINGS	MAKE, TYPE, CATALOGUE NO.	MA	VISUAL	RANDOM	APP DRG / MFR"S CATALOGUE	APP DRG / MFR"S CATALOGUE	IR	✓	P	V	V	
1.6	HAND CHAIN WHEEL	CHEMICAL MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	
1.7	HAND CHAIN	GRADE/ DIMENSION	MA	GRADE DIMENSION	100 %	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	
1.8	TROLLEY GEARS, PINION,WHEELS, AXLE	CHEMICAL & MECHANICAL	MA	LAB ANALYSIS,	100%	APPVD DRGS	APPVD DRGS	IR/TC	✓	P	V	V	
2	**IN PROCESS**											
2.1	RATCHET PAWL / RATCHET WHEEL	-HARDNESS	MA	HARDNESS	100%	IS:3832 / APPD DRG.	IS:3832/ APPD. DRG.	IR	✓	P	V	V	

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

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Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
		-SURFACE CRACK	MA	DPT	100 %	ASTM E165	NO DEFECT	IR	✓	P	V	V	
2.2	GEARS AND PINIONS AFTER MACHINING	SURFACE HARDNESS HEAT TREATMENT, SURFACE CRACK, CASE DEPTH	MA	HARDNESS HT CHART, DPT FOR SURFACE CRACK	RANDOM ASTM E 165 FOR DPT	MFG STANDARD NO DEFECT	MFG STANDARD	IR IR	✓ ✓	P P	V V	V V	
3.0	**FINAL INSPECTION**												
3.1	COMPLETE ASSEMBLY	OVERALL DIMENSION	MA	MEASUREMENT	100 %	IS:3832 /APPD DRG	IS:3832 /APPD DRG	IR	✓	P	W	V	
		PROOF LOAD TEST	CR	LOAD TEST	100%	-DO-	No cracks, flaws & other defects	IR	✓	P	W	V	
		LIGHT LOAD TEST	MA	LOAD TEST	100%	IS 3832	IS 3832	IR	✓	P	W	V	
		HEIGHT OF LIFT	MA	MEASUREME NT	100%	-DO-	-DO –	IR	✓	P	W	V	
		SWIVELING OF HOOK	MA	VISUAL	100 %	-DO-	-DO-	IR	✓	P	W	V	
		EFFORT	MA	PULL ON CHAIN	100%	-DO-	-DO-	IR	✓	P	W	V	
3.2	PAINTING	-CLEANING	MA	VISUAL	AT RANDOM	APPROVED	APPROVED	IR		P	--	--	
		- SHADE & DFT OF PAINT (Blue / Black)	MI	VISUAL	AT RANDOM	DRAWING/ SPECIFICATION	DRAWING/ SPECIFICATION	IR		P	W	-	

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
3.3	NAME PLATE	VERIFICATION	MA	VISUAL	100%			IR		P	V	--	
3.4	PACKING	-VERIFICATION	MI	VISUAL	100%	SPECS.	SPECS.	IR		P	--	-	
3.5	REVIEW OF QA DOCUMENTATION	VERIFICATION	MA	VISUAL	100%	APPD. QP	APPD. QP		✓	V	V	V	

CR – CRITICAL, MA – MAJOR , MI – MINOR

NOTE 1: BACK WALL ECHO SHALL BE ADJUSTED TO 100% OF FULL SCREEN HEIGHT IN SOUND (DEFECT FREE) AREA. DEFECT ECHO HEIGHT MORE THAN 20% OF SCREEN HEIGHT SHALL BE TREATED AS UNACCEPTABLE. BACK WALL ECHO SHALL NOT BE LESS THAN 80% OF SCREEN HEIGHT IN ANY CASE.

NOTE 2: RECORDS IDENTIFIED WITH TICK SHALL BE ESSENTIALLY INLCUDED IN QA DOCUMENTATION.

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

ANNEXURE IV

PAINTING SCHEME

TABLE OF CONTENTS

17.1 General

17.1.1 This specification covers the materials, tools, facilities and quality requirement for surface preparation and painting of steel structures, mechanical & electrical equipments, technological structures, piping, ducts, chutes etc. for 2 X 500 MW Thermal Power Plant as elaborated in the further text.

This specification will be read in conjunction with other parts/ volumes of the Tender specification where other related project requirements have been indicated.

The term "Painting" referred herein covers rust preventive, preventive and decorative coating along with surface preparation of the following areas.

a) All Mechanical equipment, Technological structures, chutes, piping, ducts etc. unless otherwise specifically indicated in the relevant section

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.

This is a general guideline to the paining scheme to be followed. However, in case if a specific painting procedure is stipulated in any tendering specification, then this general guideline will be superseded. Any special case which may arise from time to time will be dealt with individually on the merits of each case.

17.1.2 Surfaces made of aluminium, brass, bronze, stainless steel, and other corrosion resistant alloys are not required to be painted unless specified except for identification bands or for aesthetic purposes.

17.1.3 All machined mating surfaces (e.g. flanges) will be properly cleaned, and will be provided with protective coating before despatch.

17.1.4 The complete painting scheme for any item includes the following basic activities:

i) Proper surface preparation

ii) Application of primer coats

iii) Application of intermediate coats and

iv) Application of finish coats

All the above coats will be of quality paint products and of approved make as stipulated in this specification. The scope of work will also include supply of all paint materials as per specification described herein and of approved quality/ specifications.

17.2 Painting For Mechanical & Electrical And Other Equipment, Mechanical Structures, Piping, Ducts Etc.

17.2.1 This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted.

17.2.2 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 :

IS:5 :	Colours for ready mixed paints and enamels
IS:1303:	Glossary of terms relating to paints
IS:2379:	Colour code for identification of pipelines
IS:1477:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:6278 :	Code of practice for white washing and colour washing
IS:3140:	Code of practice for painting asbestos cement building products
IS:158 :	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
IS : 2074:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS : 104:	Ready mixed paint, brushing, Zinc Chrome, priming
IS : 2932:	Enamel , synthetic, exterior (a) undercoating (b) finishing specification.

17.2.3 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.

b) All surfaces to be painted will be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes will be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, sand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents will be resorted to only in such areas where other methods specified above have not achieved the desired results.

Cleaning with solvents will be adopted only after written approval of the Purchaser/ consultant.

c) The workmanship will, in general, be in accordance with IS: 1477-1971. Surface of all the steel works to be painted will be thoroughly cleaned and degreased in accordance with IS:1477(Part-I) by means of mechanical and power tool cleaning or shot blasting. The cleaning quality will conform to second quality blast cleaning as per BS-4332 or to SA 2.5 of Swedish Standards Institution SIS 055900. Cleaning of surface will ensure primer coat is rigidly anchored to the virgin metal surface. Primer paint will be applied not later than 2-3 hours after preparation of surface, unless otherwise specified.

17.2.4 The acceptable surface preparation quality/grade are described under each painting scheme. The procedures covered are solvent cleaning, hand tool cleaning, power tool cleaning and blast cleaning

a) **Solvent** cleaning **(SP 1) (If applicable)**

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.

b) Hand tool cleaning (SP 2)

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.

c) **Power tool cleaning (SP 3)**

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.

d) Blast cleaning (SP 4)

The surface will be cleaned by impingement of abrasive materials, such as graded sand 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 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.

17.2.5 Primer Paints (P)

After the surface is prepared in a manner acceptable to purchaser/ 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 deg.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 deg.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 deg.C dry heat

17.2.6 Intermediate paints (N)

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

a) Intermediate paint N1

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)	80 microns
Temperature resistance	Upto 180 deg.C dry heat
Compatible with	Primer P1

17.2.7 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)	30 microns
Temperature resistance	Upto 130 deg.C dry heat

Compatible with	Primers P1 and P2 Intermediate N1
Colour	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 deg.C dry heat
Compatible with	No primers
Colour	Generally all shades

c) Finish Paint F3

A single pack heat resistant silicon Aluminum paint.

Air drying time	3 to 4 hours (touch dry) 24 hours (hard dry)
Dry film thickness (DFT/coat)	25 microns (min)
Temperature resistance	upto 400 deg.C dry heat
Compatible with	Primer paint P3
Colour	smooth aluminium

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

d) 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 surface. The requirement of workmanship will be as per IS:1477-71.

e) Equipment No. and the name of the equipment will be painted on the surface of the equipment on visible locations in English. 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.

f) For painting of structure, equipment, tanks & vessels etc. suggested colour code is given in clause 17.2.8. For items not specified, the colour code to be followed for piping will be in line with IS 9404:2002 (Identification of pipelines used in Thermal Power Plants – Colour Code).

g) For insulated pipeline the finish paint will be applied at that place where colour band is to be painted on the aluminium sheeting. The finished paint (colour band) will be of 1m length at that place.

h) Colour band for piping will be applied at these following locations-

- At start and end point.
- At every 10m intervals.
- At every T joints and cross connection of piping.
- At every battery limit of pipeline
- Near valves before connection with the consumer.

i) Width of band

Size of pipe including insulated Pipe line outside diameter	Width of band
80 mm and below	25 mm
Above 80 mm upto 150 mm	50 mm
Above 200 mm upto 300 mm	75mm
Above 350 mm	100 mm

j) Direction of flow will be indicated by black or white arrow in contrast to the base colour 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.

17.2.8 Suggested Colour Codes For Painting of Structures, equipments, tanks & vessels etc.

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLUR (BAND	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark admiralty grey	632	-	-
2.	Fans, pumps, motors, compressors.	Light grey	631	-	-
3.	Outdoor ,Stand pipes, vent pipes	Aluminium	-	-	-
4.	Indoor Tanks	Aluminium	-	-	-
5.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
6.	Tanks (without insulation and cladding)	Aluminium			
7.	Switchgear	Light grey	631	-	-
8.	MCC/ PDB, Control, relay panels, Bus duct	Light grey	631/7078 of IS:1650	-	-

9.	Transformers	Dark admiralty grey	632	-	-
10.	Machinery guards	Signal red	537	-	-
11.	Turbine	Golden Yellow	356		
12.	Generator & exciter	Light grey	631		
13.	Piping (without insulation and cladding)				
14	Feed water	Sea green	217	Light brown	410
15	Condensate	Sea green	217	Light brown	410
16	D M Water	Sea Green	217	Light orange	557
17	Soft water	Sea green	217	French blue	166
18	Bearing cooling water	Sea green	217	French blue	166
19	Potable & filtered water	Sea green	217	French blue	166
20	Service & clarified water	Sea green	217	French blue	166
21	Condenser and Auxiliary Cooling water	Sea green	217	French blue	166
22	Service air	Sky Blue	101	-	-
23	Instrument air	blue	101	White	-
24	Lubricating oil	Light brown	410	Light grey	631
25	Control oil	Light brown	410	Light	557

				orange	
26	Transformer oil	Light brown	410	Light orange	557
27	Hydrogen	Canary yellow	309	Post office red	538
28	Carbon dioxide	Canary yellow	309	Light grey	631
29	Vacuum pipes	Sky blue	101	Black	-
30	Drainage	Black	-	-	-
31	Stand pipes and all Vent pipes	Aluminium	-	-	-

Notes:

Where band colour is specified, same will be provided at 10 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

17.2.9 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 deg. 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) Surface which will be inaccessible after assembly will receive minimum coats of specified primer. Surfaced 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 will be given to HSFG bolt and nut threads.

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

k) All threaded and other surfaces of foundation bolts and 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) 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 Deg.C for an hour before primer paint application-but, in case, it will be ensured that the minimum surface cleanliness required for primer paint application will be Sp2 (equivalent to hand tool cleaning).

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

n) 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.

o) 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.

17.2.10 Painting scheme

a) 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 purchaser.

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

Legend

SP	Surface preparation quality
P	Primer Paint
2P1 stands for	Two (2) coats of primer paint type P1
N	Intermediate paint
1N 1	One (1) coat of intermediate paint type 1
F	Final Paint
2F1 stands for	Two (2) coats of finish paint type F1
DFT	Dry film thickness
CRT	Clean and retouch
Sa - 2.5	Quality of surface cleaning (i.e. 95 % of the surface area is free from all rust, mill scales and visible residues, foreign materials etc.

c) Painting Scheme

Sl no.	Description	Surface Preparation	Painting Scheme		Total DFT in micron
			At shop	At site	
1.	Steel Structure	Sa 2½	2P1 + 1N1	2F1	200
2.	Mechanical equipment (temp. not over 80 deg. C) Both static and rotary equipment	Sa 2½	2P1 + 1 N1	2F1	200
3.	Equipment with hot surfaces (temp. upto 400	Sa 2½	2P2	2F2	130

	deg. C)				
4.	Equipment with hot surfaces (temp. above 400 deg.C)	Sa 2½	2P3	2F3	170
5.	Non insulated pipe/ duct works - Temperature not over 80 °C - Temperature upto 200 °C - Temperature upto 400 °C	Sa 2½	2P1 + 1N1 2P2 2P3	2F1 2F2 2F3	200 50 170
6.	Insulated pipe/duct works	St3	2 coats of Alkyd Red Oxide Zinc Phosphate primer to IS 12744 – DFT 30μ/ coat	Not required	60
7.	Condensate piping, ACW, DMCW, service water, potable water and minor structures etc.	Hand tool/ Power tool cleaning to SSPC-SP2	2 coats of HB Chlorinated rubber based red oxide zinc phosphate primer each 50μ	2 coats of Chlorinated rubber based finish paint each	160

				30μ	

PAINTING SCHEME (METALLIC STRUCTURAL WORKS)				
SURFACES TO BE PAINTED	**SURFACE PREPARATION**	**PAINTING SCHEME**		
		PRIMER AT SHOP	**INTERM. AT SHOP**	**FINISHING AT SITE**
1) CARPENTRY ANCHOR PLATES AND PIPELINE SUPPORT				
- OUTSIDE	SA 2.5	2P1	1N1	2F1
- INSIDE	SA 2.5	2P1	1N1	2F1
2) BRIDGE CRANE				
- STRUCTURE FOR BEAMS	SA 2.5	P1 + P1(S)	1N1 (S)	2F1
- TROLLEY	SA 2.5	2P1	1N1	2F1
3) HOISTS AND MONORAILS				
- MONORAILS	SA 2.5	2P1	1N1	2F1
- HOISTS	SA 2.5	2P1	1N1	2F1

PAINTING SCHEME (THERMAL CYCLE)

SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM. AT SHOP	FINISHING AT SITE
1) INSULATED PIPE LINE AND VALVES				
STEAM	SA 2.5	2P1/2P2/2P3	--	--
FEEDWATER	SA 2.5	2P1/2P2/2P3	--	--
DEAERATOR AND FEED TANK				
FEED TANK - INSIDE - OUTSIDE	SA 2.5 SA 2.5	Temporary rust preventive paint 2P3 or 2 coats of Heat resistant aluminium paint.		
DEAERATOR - OUTSIDE	SA 2.5	2P2 or 2 coats of Heat resistant aluminium paint.		
3) HEAT EXCHANGER				
- INSIDE	SA 2.5	--	--	--
- OUTSIDE	SA 2.5	2P1	1N1	--
4) HEATER				

PAINTING SCHEME (THERMAL CYCLE)				
SURFACES TO BE PAINTED	**SURFACE PREPARATION**	**PAINTING SCHEME**		
		PRIMER AT SHOP	**INTERM. AT SHOP**	**FINISHING AT SITE**
- INSIDE	SA 2.5	--	--	--
- OUTSIDE	SA 2.5	Heat resistant Aluminum paint	--	--
5) PUMPS	SA 2.5	2P1/2P2	1N1	2F1/2F2
6) VENT				
7) NON INSULATED PIPELINE AND VALVES	SA 2.5	2P1/2P2/ 2P3	--	2F1/2F2/2F3
8) DRAINS, PIPELINE AND VALVES TRAPS ETC				
- INSULATED	SA 2.5	2P1/2P2/ 2P3	--	--
- NON INSULATED	SA 2.5	2P1/2P2/ 2P3	--	2F2
8) TANKS				
- OUTSIDE	SA 2.5	2P1/2P2	--	--
- INSIDE	--	--	--	--

PAINTING SCHEME (OIL + GAS-OIL CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM. AT SHOP	FINISHING AT SITE
1) CLEAN / DIRTY OIL TANK				
- INSIDE	SA 2.5	2P4	--	--
- OUTSIDE	SA 2.5	2P1	1N1	2F1
2) PIPE LINE AND VALVES				
- OUTSIDE	SA 2.5	2P1/2P2	1N1	2F1/2F2
- INSIDE	--	--	--	--
3) PUMPS				
- PUMPS	SA 2.5	2P1	1N1	2F1
4) FILTERS				
- OUTSIDE	SA 2.5	2P1/2P1	1N1	2F1/2F2
- INSIDE	--	--	--	--

PAINTING SCHEME (CIRCUALATING WATER AND SERVICE WATER)				
SURFACES TO BE PAINTED	**SURFACE PREPARATION**	**PAINTING SCHEME**		
		PRIMER AT SHOP	**INTERM. AT SHOP**	**FINISHING AT SITE**
1) CONDENSER - INSIDE - OUTSIDE	 SA 2.5 SA 2.5	 -- 2P1	 -- 1N1	 -- 2F1
- WATER BOX AND TUBE SHEET	SA 2.5	As per specification Volume IIA		
2) PUMPS	SA 2.5	2P1	1N1	2F1
3) PIPELINE AND VALVES - INSIDE - OUTSIDE (OVER GROUND)	 SA 2.5 SA 2.5	 -- 2P1	 -- 1N1	 -- 2F1

PAINTING SCHEME (DEMINERALISED WATER)

SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM. AT SHOP	FINISHING AT SITE
1) PIPELINE AND VALVES - INSIDE - OUTSIDE	-- SA 2.5	-- 2P1	-- 1N1	-- 2F1
2) PUMPS - PUMPS	SA2.5	2P1	1N1	2F1

PAINTING SCHEME (AIR CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM. AT SHOP	FINISHING AT SITE
1) PIPE LINE AND VALVES (SA) - OUTSIDE - INSIDE	SA 2.5 --	2P1 --	1N1 --	2F1 --
2) FILTERS / STRAINERS - OUTSIDE	SA 2.5	2P1	1N1	2F1

PAINTING SCHEME (AIR CYCLE)				
SURFACES TO BE PAINTED	SURFACE PREPARATION	PAINTING SCHEME		
		PRIMER AT SHOP	INTERM. AT SHOP	FINISHING AT SITE
- INSIDE	--	--	--	--

Note : For Piping, Supports, Hangers, CLH, VLH & Other piping system components/ items Painting Scheme as indicated in following table is also acceptable.

Sl. No.	**Description**	**Surface Preparation & Surface Profile**	Primer Coat		**Finish Coat**			
			Primer Coat	**No of coats & DFT**	**Paint**	**No of coats & DFT**	**Shade**	**Total DFT Microns (Min.)**
1	Insulated Piping, Components (MS/HRH/CRH/Aux Steam lines,.....)	SSPC-SP3/Power Tool cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	2 (30 microns per coat)	-----	-----	-----	60
2	Uninsulated Piping, components (Condensate, Boiler Filling, HP/LP dosing, Lube oil, Piping.....)	Hand Tool/Power Tool Cleaning to SSPC-SP2	HB Chlorinated Rubber based Red Oxide Zinc Phosphate Primer	2 (50 microns per coat)	Chlorinated Rubber based finish Paint	2 (30 microns per coat)	Smoke Grey Shade No 692 of IS 5	160
3	Structures	Hand Tool/Power Tool Cleaning to SSPC-SP2	HB Chlorinated Rubber based Red Oxide Zinc Phosphate	2 (50 microns per coat)	Chlorinated Rubber based finish Paint	2 (30 microns per coat	Smoke Grey Shade No 692 of IS 5	160

			Primer			)		
4	Hangers & Supports-(CLH,VLH)	Abrasive Blast cleaning to Sa 2 (35-50 microns)	Epoxy Zinc rich primer to IS 14589 Gr.II,% VS = 35 Min	1 (40 microns per coat)	Aliphatic Acrylic Polyurethane paint, % VS = 40 min	1 (30 microns per coat)	Phirozi Blue Shade No. 176 of IS 5	70
5	Pipe Clams	SSPC-SP3/Power Tool cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	1 (30 microns per coat)	Synthetic enamel paint long oil alkyd to IS 2932	1 (20 microns per coat)	Smoke Grey Shade No 692 of IS 5	70
6	Stainless steel/Galvanized items	No Paint	No Paint	No Paint	No Paint	No Paint	No Paint	No Paint

17.3 Painting Of Steel Structural Works

17.3.1 All structural steel works covered in the civil scope in Volume V will be painted as specified in Volume V (Design, Fabrication and erection of Structural steel works)

17.4 Submission Of Painting Schedule

Contractor will submit a comprehensive painting schedule indicating surface preparation quality, paint applied, total DFT, colour code etc. for Customer/ consultant's approval before the painting of any equipment/ component/ structure etc.

SECTION – D

GENERAL TECHNICAL REQUIREMENTS

GENERAL

This specification covers the design, manufacture, assembly, painting, inspection and testing at manufacturer's works of hand operated chain pulley block.

CODES AND STANDARDS

The design, manufacture, inspection and testing and performance of hand operated chain pulley blocks shall confirm to latest editions of the following standards : -

IS: 3832	Specification for hand operated chain pulley block.
IS 807:1976	Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists.
IS: 3109(Part II)	Calibrated load chain for pulley blocks and other lifting appliances
IS: 2429(Part II)	Calibrated hand chain for pulley blocks and other lifting appliances
IS: 4460	Method for rating of machine cut spur and helical gears
IS 6216 :1982	Short Link Chain, Grade T (8), Calibrated for Pulley Blocks and other Lifting Appliances
IS:15560: 2005	Point Hooks with Shank up to 160 Tonne - Specification

EQUIPMENT

Chain Pulley Block – The block shall be so designed that all components shall withstand without failure, an application to the block of a load equal to at least four times the working load limit.

Frame- Frame shall be robust in design and of welded construction .The frame shall be selected in such a way that head room requirement is minimum. Frame shall maintain alignment under all expected conditions of services.

Chain- The load chain shall be electrically welded, accurately calibrated, and pitched arid polished conforming to IS: 6216 Grade 80(T8)/ IS 3109 (Part 2).

i. The load chain shall be electrically welded, accurately calibrated, and pitched arid polished conforming to IS: 6216 Grade 80(T8)/ IS 3109 (Part 2).

ii. The hand chain shall also be electrically welded, calibrated, pitched and polished and shall conform to IS: 2429 (Part II) Grade 30. The length of chain and link dimension shall be as per IS: 3832.

Hook The forged hook shall be properly heat treated and so designed that in loaded condition, it is free to swivel without twisting the load chain. The hook shall conform to IS: 15560

Reduction Gear- The reduction gear shall be either spur or worm/ worm wheel type. The spur gear and worm shall be of high grade carbon steel and heat treated. The worm wheel shall be of bronze. A detachable steel cover shall be provided for total enclosure of the gear train

and ample lubrication to be provided.

Brakes- Brakes shall be of screw friction disc type self-actuating or any other superior type. Brake capacity shall be ample and humid atmosphere shall not affect materials used. The brake shall prevent self-lowering of load and arrest and sustain load in all working positions. The load brake shall also allow smooth lowering of the load without serious overheating which may impair working of block

Bearing- Bearing used shall be as per guidelines laid down in IS: 3832.

Chain Wheels- The load chain wheel shall be made of heavy duty malleable casting and shall be designed to ensure, effective operation of the chain. Load chain wheels shall be mounted on two ball bearings. Hand chain wheel shall be made from malleable casting/pressed sheet steel. The idler wheel shall be so shaped as to avoid the twisting of the chain during operation. The P.C.D of idler wheels shall be such that the bending action of the link is avoided. The hand chain wheel shall be provided with flanges and designed to ensure effective operation with hand chain.

Trolley Monorail trolley frame shall be of heavy section rolled steel, held together by bolts. Wheels shall be of high grade cast iron/steel mounted on ball bearings. Axles and shafts shall be of carbon steel, accurately machined and suitably supported. The trolley shall be suitable for variations in I section beams. The trolley shall be geared travel type.

Other components- All other components of chain pulley block such as anchorage, guide, pawl, stripper etc. shall be designed and provided as per IS: 3832.

The effort required for hoisting and travel shall be as stipulated in IS 3832.

DATA SHEET-A

1.00.0	Type	:	Hand operated chain pulley blocks
2.00.00	Capacity & Lift	:	As per Annexure I in Volume II B, Section C
3.00.00	Design	:	IS: 3832
4.00.00	Duty Class as per IS: 3832	:	Class -II
5.00.00	Hoisting Mechanism		
a)	Type	:	Hand operated gear transmission
b)	Load Chain	:	
i)	Type	:	Link type
ii)	Material	:	Alloy steel grade 80 as per IS: 6216 / IS3109
iii)	Conforms to (Std./Code):		IS: 6216/3109
c)	Hand Chain	:	
i)	Type	:	Link type
ii)	Material	:	Mild steel (grade 30) as per IS 2429 Part I
d)	Load Hook & Hook Block	:	
i)	Type of load hook	:	Plain shank- Trapezoidal section
ii)	Load hooks conforms to:		IS: 15560
iii)	Type of hook suspension	:	Swiveling
iv)	Type of make of bearing of hook suspension	:	Thrust ball bearing
e)	Gears / pinion	:	
i)	Type	:	Spur / Helical
ii)	Material	:	Alloy steel / carbon steel
iii)	Type of bearing used		: Antifriction ball bearing / Roller
f)	Sprockets		
i)	Type of bearings used	:	Antifriction ball bearing / Roller
g)	Method of lubrications Used		
i)	Bearings	:	Grease
ii)	Gearing & Pinions	:	Grease
iii)	Sprockets	:	Grease

h) Brakes :

i) Type : Screw and friction disc type

6.00.0 Trolley & Bridge Drive

a) Trolley

i) Type : Geared (Manually operated)

ii) Material of frame : Rolled structural steel (IS:2062 Grade A or B)

b) Drive Chain

i) Type : Link type

ii) Material : Steel Gr.30

c) Trolley Wheel

i) Number of pairs of wheel in each trolley/bridge : Two/four

ii) Flange : Single flanged

iii) Wheel material : As per IS 3832

iv) Type of bearings need : Antifriction

d) Gears/ Pinions

i) Type : Spur / helical

ii) Material : Alloy/ Carbon steel

iii) Type of bearings used : Antifriction

e) Method of lubrication for

i) Bearings : Grease

ii) Sprockets : Grease

f) Load chain wheel

i) Material : As per IS 3832

g) Hand chain wheel

i) Material : As per IS 3832

SPECIFIC NOTE:

1. Ball and roller anti frictional bearing only will be used. Suitable greasing points will be provided.
2. Swiveling type standard shank hook mounted on grease lubricated anti-friction thrust bearing will be used. Lifting hook will be solid, forged, heat treated alloy or carbon steel of rugged construction and provided with a standard depress type safety latch. Lock to prevent the hook from swiveling will be provided.
3. Load chain & operating chain will be of calibrated type as per relevant IS. The total length of the load chain will exceed the minimum length required to give the prescribed range of lift by not less than three links per fall to ensure that the slack end anchorage is not loaded. The load chain wheel will be of adequate strength

and will be suitably designed to ensure effective operation of the chain and will be properly secured with shaft, preferably with splines.

4. Pulley used for the operating mechanism will have suitable guards to prevent the operating chain from coming out. The length of the hand chain will be such that the lowest point of the suspended loop will hang 400 mm above the operating level. Hand chain wheels will be provided with flanges and designed to ensure effective operation with hand chain. Minimum diameter of pulling chains will be 6 mm.
5. Gears will be cut from solid cast or forged steel blanks or will be of stress-relieved welded steel construction or built-up from steel billets and welded together to form a one piece gear section. All open gearing will be suitably covered.
6. The hoist will also conform to various safety codes as applicable at the place of installation.
7. Shafts and axles will have ample strength and rigidity and adequate bearing surface for the intended duties.
8. Pulleys used for operation mechanism will have suitable guards to prevent the operating chain from covering off.
9. Brakes will be of automatic type that will stop and hold the load when hand-chain pull is released and will permit controlled lowering of the load when hand-chain pull is applied in the lowering direction.
10. Pawls will be of sufficient strength to arrest the full load from lowering due to gravity. The pawl and ratchet wheel will be of steel, hardened and tempered so as to attain required wear resistance and toughness.

Annexure- V

Master drawing list and submission schedule

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF P.O
1	PE-V0-402-563-A200	Manufacturing Quality Plan	APPROVAL	2
2	PE-V0-402-563-A201	GA Drawing for Chain Pulley Block with detail BOM with painting details	APPROVAL	2
3	PE-V0-402-563-A202	O & M Manual	INFORMATION	4
4	PE-V0-402-563-A204	Erection procedure	INFORMATION	4
NOTE	1. VENDOR SHALL RESUBMIT THE REVISED DRAWINGS WITHIN 7 DAYS OF RECIEPT OF COMMENTS.			
	2. INCOMPLETE DRAWINGS/DOCUMENTS SHALL NOT BE TREATED AS SUBMITTED.			
	3. MANUFACTURING SHALL BE STARTED ON RECIEPT OF CAT II APPROVED DRAWINGS.			

Note:
1.0 Bidder to note that all the drawings and documents shall also be submitted on CD's (compact disc) in following software.

a) All the drawings shall be prepared in AutoCAD.
b) All the documents shall be prepared MS word / EXCEL.
c) PDF files for all drawings/documents shall also be submitted.

Document Management System
Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
Internet explorer version – Minimum Internet Explorer 7
Internet speed – 2 mbps (Minimum preferred)
Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)".

DRAWING/DOCUMENT DISTRIBUTION LIST

All documents & drawings shall be in English and in metric units

SI		LII	NLC (HQ)	NLC-SITE	BHEL SITE	PMG BHEL	PEM/ UNITS/ PSSR	REMARKS
1	Master list of drawings / document (duly indicating schedule of submission)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
2	Drawings / document for Approval/Information (First Submission)	Soft copy + 2 prints	Soft copy + 3 prints	Soft copy + 1 print		Soft copy	Soft copy (S)	
3	Return with comments/approval	Soft copy (S)	Soft copy	Soft copy		Soft copy	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
5	Drawings / documents for distribution (Approved by NLC, in cat. 1 or Received for Information)	Soft copy + 2 print (HQ+ Site)	Soft copy + 3 prints	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
6	Erection Drawings / documents	-	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
7	As built Drawings / documents	Soft copy + 1 print	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
8	Operation & Maintenance Manual	-	Soft copy + 1 print	Soft copy + 10 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
9	Type Test Certificate	Soft copy	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	

NOTES:

1. The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches. QAP documents to be submitted as per distribution schedule.
2. Date of submitting soft copy is to be taken as date of submission.
3. S – Source for generation of document.

VOL -III

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

VOLUME III
DEVIATION SHEET (COST OF WITHDRAWAL)

PROJECT:- 2X500 MW NNTPS (TG)

PACKAGE:- Chain Pulley Blocks, SPECIFICATION NO.: PE-TS-402-563-A001

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under “exclusion” in section C and those resolved as per ‘Schedule of Deviations’, if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the ‘Schedule of Deviations’. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the ‘Schedule of Deviations’.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer’s decision shall be binding on the bidder whenever the deficiency is pointed out.

f) For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

g) The commissioning spares shall be supplied on ‘As per technical specification’ (if applicable) & prices for same included in the base price itself.

h) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.

i) Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.

j) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price and within purview of the contract specification even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities.

k) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL’s/ Customer’s/ Consultant’s office for across the table resolution of issues and to get documents approved in the stipulated time.

l) As built drawings shall be submitted as and when required during the project execution.

m) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

Annexure VI

DOCUMENTS TO BE FURNISHED WITH OFFER FOR TECHNICAL EVALUATION

1) SCHEDULE OF TECHNICAL DEVIATION (IF ANY) along with mention of “QUOTED” in front of each deviation in the specified column.

   OR

   ‘NO DEVIATION CERTIFICATE’ – Clearly mentioning that bidder has considered ‘No - Deviation’ from the technical specification provided by BHEL.

2) SIGNED AND STAMPED COPY OF COMPLIANCE CUM CONFIRMATION CERTIFICATE.
3) Unpriced schedule, duly mentioned ‘Quoted’ against each Sl.no. below each column.

NOTE:

i) NO OTHER DOCUMENTS OTHER THAN THOSE LISTED ABOVE ARE REQUIRED TO BE S UBMITTED FOR TECHNICAL EVALUATION. IN CASE ANY OTHER DOCUMENT IS FURNISHED, THE SAME WILL NOT BE TAKEN INTO CONSIDERATION FOR TECHNICAL EVALAUATION.

ii) BIDDER TO CLEARLY MENTION “QUOTED” AGAINST EACH ITEM. IN CASE ANY ITEM IS NOT APPLICABLE THEN “NA” SHOULD BE CLEARLY MENTIONED AGAINST THE SAME.

Project: 2X500 MW NNTPS (TG)

SUGGESTIVE PRICE FORMAT CHAIN PULLEY BLOCK

Sl No.	Description of equipment / item	Total quantity required	Total Price (Ex-works) i.e. (3 x 4)	ED	CST	FREIGHT	INSURANCE	TOTAL (FOR SITE) (5+6+7+8+9)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.0	Total lumpsum firm price for design, engineering, manufacture, inspection and testing at vendor's'/ sub-vendor's works, painting, forwarding, proper packing and shipment and delivery at site as required on FOR site basis, demonstration test at vendor's works including freight, for the following chain pulley blocks along with 1 Set of Maintenance tools & tackles (as per annexure-I) and all other accessories in line with drawings/ documents/ test procedures approved by BHEL/Customer for the total scope given below and technical parameters as per technical specification PE-TS-402- 563-A001 taking into account all clarifications, confirmations and agreements till date.	25 no.s						
	Break-up of 1.0 (1.1 to 1.14)							
1.1	11 no.s 2T cap, 6 M lift chain pulley block with travelling trolley for following areas- a) AHU room at 8.5m floor (1 no.) b) AHU room at each floor of service building (10 no.s)	11 No.s						
1.2	9 no.s 2T cap, 8.5 M lift chain pulley block with travelling trolley for following areas- a) AHU ROOM AT 24 M (1 no.) b) AIR WASHER ROOM-1 (2 no.s) c) AIR WASHER ROOM-2 (2 no.s) d) AIR WASHER ROOM-3 (2 no.s) e) AIR WASHER ROOM-4 (2 no.s)	9 No.s						
1.3	5 no.s 1T cap, 10 M lift chain pulley block with travelling trolley for following areas- a) TG BLDG. Sump Pumps (4 no.s) b) Lube Oil Unloading IN B-C Bay (1 no.)	5 no.s						
1.4	Total lumpsum firm price for one set of Maintenance Tools and Tackles as per Annexure A	1 set						
	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.							
	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.							
	In case, price indicated above does not match with the total of item wise break-up given from 1.1 to 1.4 the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.							
					(Bidder's Signature with Company Seal)			

ANNEXURE-A

Project: 2X500 MW NNTPS (TG)

PACKAGE:- Chain Pulley Blocks, SPECIFICATION NO.: PE-TS-402-563-A001

List of Maintenance Tools & Tackles

Sl.no	Description	Unit	Unit Ex-works price	Total ex-works price	ED	CST	FREIGHT	Total
1	2	3	4	5	6	7	8	4 to 8
1	Adjustable spanner	1 Set						
2	Wrench spanner	1 Set						
3	Oil gun	1 No.						
4	Set of Screw driver	Min 6 nos. (of different sizes suiting various types and capacities of Chain Pulley Blocks)						
5	2 lb hammer with wooden handle	1 No.						
6	Grease Gun	1 No.						
7	Any other item required for maintenance	As per vendor recommendation						

Note: - The tools shall be supplied in one tool box

Date: _____

Company Seal

Bidder's / bidder's representative signature