Corrigendum - I dated 27/05/2024 to CPC Tender No. BHEL/CPC/TLR/FAB_STR/25/014

Corrigendum - I dated 27/05/2024 To CPC Tender No. BHEL/CPC/TLR/FAB_STR/25/014 for Fabrication and supply of finished factory fabricated structure up-to Project Site, based on input design & detailed drawing provided by BHEL for CHP-AHP & FGD and other structures as specified in scope for 2X660 MW Talcher Thermal Power Station."

A) Time Extension: Clause No. 1.0 Salient Features of NIT in NOTICE INVITING TENDER is revised as below**:**

Sl. No.	Clause No.	Existing in Tender	Revised As
1	Sl. No. v) DUE DATE & TIME OF OFFER SUBMISSION.	Date: 27/05/2024, Time: 10:00 Hrs	**Date: 03/06/2024, Time: 10:00 Hrs**
2	Sl. No. vi) OPENING OF TENDER	Date: 27/05/2024, Time: 16:30 Hrs	**Date: 03/06/2024, Time: 16:30 Hrs**

B) Some of the Bidders had asked queries in the published tender specification. The clarifications issued by BHEL are furnished below:

Sl. No.	Reference clause of Tender Document	Bidder's query	BHEL's Response
1	GCC Clause 2.12: Earnest Money Deposit: Clause 2.12.1	The EMD shall remain valid for a period of 45 days beyond the final bid validity period. Pls clarify the same.	For Validity of Offer refer clause no. 12 of NIT. Proforma of Bank Guarantee for EMD is as per Annexure-XXI of GCC.
2	Technical Conditions Of Contract (TCC): clause 4.1: Terms of Payment: Clause 4.2 (1)	95% Of Payment (excluding GST) against R.A. Bill as per Billing Schedule/price bid shall be released within 45 days after receipt & acceptance of material at site. Bidder is requested to an Advance Payment@20% against advance bank guarantee as project value is more and bidder has to submit multiple BGs for which Cash flow will be affected very badly either it is Mode 1 or Mode 2.	Tender Condition Shall prevail.
		95% of Payment (excluding GST) against R.A. Bill as per Billing Schedule/price bid shall be released within 45 days after receipt & acceptance of material at site. Bidder is requested to payment should release through Bill discounting scheme (like: RXIL, MARPA or JP Morgan	"Payment Terms as per Chapter IV of Technical Conditions of Contract (TCC) shall prevail. For MSME vendors bill discounting can be done through RXIL."

Sl. No.	Reference clause of Tender Document	Bidder's query	BHEL's Response
		Scheme) either it is Mode 1 or Mode 2 due to maintain the cash flow for such a high value of project.	
3	Technical Conditions of Contract (TCC) Chapter VIII: Price Bid & Modality Of award: Clause 8.3 (VI) Liquidated Damages/Penalty	Bidder is requested to LD should be maximum of 5% of the total Contract value instead of 10%. Pls consider.	Tender Condition Shall prevail.
4	Technical Conditions of Contract (TCC) Annexure B: Price Variation Compensation: Clause 2.17.5:	PVC shall not be payable for supplementary /additional items, extra works. However, PVC shall be payable for items executed under quantity variation Of BOQ items under originally awarded Contract. But it should be payable on Quantity variation limit of +-30% as mentioned in TCC Of Chapter III of Note 2. Pls Clarify & consider.	Refer clause 2.17.5 of Annex B of TCC: PVC will be payable for items executed under quantity variation of BOQ items.
5	"Technical Conditions of Contract (TCC) Chapter VIII: Price Bid & Modality Of award: Clause 8.3 (IV): "	Bidder is requested to provide us Excel Sheet as mentioned. Pls consider.	Excel Format shared on the basis of request mail from Bidders. Please Note these Excel sheet is for reference only and should not me made part of the Bid document
6	Annexure I of NIT	PQR	No relaxation in pre-qualification for MSME vendors for subject tender enquiry.
7	Volume - II	Price bid	Bidder to quote total amount towards execution of work of Package A for Mode 1 (in S.No. 1.01 Column no 7 of price bid) and Package A for Mode 2 (in S.No. 1.02 Column no 7 of price bid). **Refer Annexure: 'Clarification on price bid' for reference.**

Corrigendum - I dated 27/05/2024 to CPC Tender No. BHEL/CPC/TLR/FAB STR/25/014

Sl. No.	Reference clause of Tender Document	Bidder's query	BHEL's Response
8	Annexure I of NIT	PQR	Bidder to submit details of their credentials in the format attached **(Annexure-1)**
9	Documents along with tender document		Annexure E-59 and Annexure D-17 attached.

Note:

1) **All other terms and conditions against this NIT shall remain unchanged.**
2) **This corrigendum is to be submitted duly signed and stamped along with the Techno-commercial bid (Part- I).**

for BHARAT HEAVY ELECTRICALS LTD
AGM / Purchase - CPC

Annexure-1

Tender Enquiry No. BHEL/CPC/TLR/FAB_STR/25/014 for Fabrication and supply of finished factory fabricated structure up to Talcher Project																
S.No.	PO/WO details	PO/WO Date	Total quantity	Details of supply of Structure (Per Month Quntity in MT)												
				MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY	MM/YY
				...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....	...../.....
1																
2																
3																
4																
5																
6																
7																
8																

Clarification on Price Bid Format

Validate | Print | Help

Item Wise BoQ

Tender Inviting Authority: BHARAT HEAVY ELECTRICALS LIMITED, CENTRAL PROCUREMENT CELL (CPC), BHEL-PSHQ, Noida

Scope of Work: Fabrication and supply of finished factory fabricated structure up-to Project Site, based on input design & detailed drawing provided by BHEL for CHP-AHP & FGD and other structures as specified in scope for 2X660 MW Talcher Thermal Power Station

Tender Enquiry No: BHEL/CPC/TLR/FAB_STR/25/014

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

(DOMESTIC TENDERS - RATES ARE TO BE GIVEN IN RUPEES (INR) ONLY)

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

1.Taxes & Duties shall be as per Chapter - IX of Technical Conditions of Contract (TCC) of tender.

2. Modality of award shall shall be as per Clause No. 8.2 of TCC

3. BOQ along with weightage for Package A of Mode 1 is mentioned at 8.1 (a) of Chapter VIII of TCC

4. BOQ along with weightage for Package A of Mode 2 is mentioned at 8.1 (b) of Chapter VIII of TCC

5. Bidders shall mandatorily mentioned in their techno-commercial Bid (Part-1) whether they have submitted their offer for Mode 1 or Mode 2 or Both Mode 1 and Mode 2 as per Annexure –D1 of TCC.

6. Against Column no. 7 below, Bidders are requested to Quote Total price (excluding taxes) towards execution of work of Package A for Mode 1 (sl.no. 1.01) & Mode 2 (sl.no. 1.02).

NUMBER #	TEXT #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Modality	Quantity	UOM	TOTAL Price In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT Without Taxes col (13) = (4) x (7) in Rs. P	TOTAL AMOUNT In Words
1	2	3	4	5	7	13	15
1.01	Mode 1: Total price towards execution of work of Package A (refer BOQ S.No. 8.1 (a)): Fabrication and supply of finished factory fabricated structure (with surface finish and final painting) up-to Project Site, based on input design & detailed drawing provided by BHEL for structural buildings as specified in scope of Technical Specification for 2x660MW NTPC Talcher. Majority of raw material is in BHEL scope	Mode 1	1.00	Package A		0.00	INR Zero Only
1.02	Mode 2: Total price towards execution of work of Package A (refer BOQ S.No. 8.1 (b)): Fabrication and supply of finished factory fabricated structure (with surface finish and final painting) up-to Project Site, based on input design & detailed drawing provided by BHEL for structural buildings as specified in scope of Technical Specification for 2x660MW NTPC Talcher. All raw Material is in Agency Scope.	Mode 2	1.00	Package A		0.00	INR Zero Only
Total in Figures						0.00	INR Zero Only
Quoted Rate in Words						INR Zero Only	

Bidder to quote Total amount for Package A: Mode 1

Bidder to quote Total amount for Package A: Mode 2

Note: Bidder should not quote per MT rate in above Column no. 7.

SUB-SECTION–E-59

CIVIL WORKS WITH ANNEXURE-I

QA CIVIL WORKS

1.0 SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

a) Before execution of any civil work the contractor shall conduct full-scale suitability tests on various construction and building material such as soil, fine and coarse aggregates, cement, construction chemicals, supplementary cementitious materials and construction water to ascertain their suitability for use and the concrete mix designs conducted from reputed institutes such as NCCBM-Ballabgarh, CSMRS-Delhi, selected IIT's as agreed by the Employer. The test samples for such full-scale testing shall be jointly sampled and sealed by the Employer and contractor, thereafter these shall be sent to the concerned laboratory through the covering letter signed by field quality assurance department (FQA) representative of the Employer.

b) The contractor shall timely initiate the action with regard to the evaluation of aggregates and other building material including concrete mix design, so as to ensure completion of these tests before start of civil works at site, thereby not affecting any project work. The test reports and recommendations for suitability of the materials including concrete mix design shall be promptly submitted by the contractor to the Engineer-in-charge (EIC)/Head of Field Quality Assurance (FQA) Department of Employer.

2.0 LABORATORY AND FIELD TESTING

a) The field laboratory for QA and QC activities shall be established and installed with the adequate facilities to meet the requirement of envisaged day to day tests during execution of the work. Temperature and humidity controls shall be available wherever necessary during testing of samples. The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for EIC acceptance/ approval. The contractor shall establish the requisite laboratory equipment/set up and skilled QA&QC manpower within 30 days from the mobilization date of Main contractor at site.
The tests which cannot be carried out/do not have facilities for testing in the field laboratory shall be done at Employer acceptable third-party testing laboratory.

b) All equipment and instruments in the field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the EIC. The calibration certificates shall specify the fitness of the equipment and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipment and instruments by NABL or such accrediting agency complying with ISO/IEC-17025 accreditation and the calibration reports shall be submitted to EIC for their review and acceptance.

c) The QA and QC activities (include all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirements) in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / relevant standard codes / contract documents shall be carried out at no extra cost to the Employer.

d) The contractor shall carry out testing in accordance with the relevant IS/standards /codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions of the EIC.

3.0 FIELD QUALITY PLAN

a) Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans (FQP) and obtain approval of Employer, which shall detail out for all the works, equipment, services, quality practices and procedures etc. in line with the requirement of the technical specifications to be followed by the contractor at site. This FQP shall cover for all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site. An Indicative Field Quality Plan for civil works is enclosed at **Annexure I** for reference purpose.

4.0 PURCHASE AND SERVICE

a) To facilitate advance planning of material testing/ approval of bought out items (BOI), well before the start of activity as per L-2 network, representative samples shall be procured by the contractor from approved sub-vendors and submitted to the EIC for his approval before bulk procurement. In case of manufacturers test certificate (MTC) is submitted for acceptance, it shall be clearly traceable and correlated with the consignment received at site. MTC of all bought out items (BOI) shall essentially contain all the test parameters / characteristics specified in the technical specifications / standards / codes. In case the manufacturer's test certificate does not mention these details, sample from each lot shall be tested at the Employer acceptable third-party lab. Approval of material / sample by the Employer shall not relieve the contractor of his responsibility, for their conformance to the specification, as well as the requisite performance and quality of material.

b) Structural steel (plates and rolled sections i.e. channels, beams & angles) conforming to IS 2062 and Reinforcement steel conforming to IS 1786 supply if in the scope of the contractor shall be procured from Primary Steel Producers (Refer NOTE below). Currently, Primary Steel Producers acceptable are SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT bars), RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Arcelormittal Nippon Steel India Ltd. (for Flat products/ Steel Plates), ESL Steel Ltd. (for Reinforcement steel/TMT bars) and JSW Ispat Special Products Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequently, if any new Primary Steel Producer/s are proposed during execution of contract, the same may be considered for acceptance subject to meeting the following qualifying requirements:

i) The proposed supplier should be a Primary Steel Producer, having a minimum production capacity of one million tons per annum (MTPA).

ii) The proposed supplier should be a regular manufacturer of Steel Plates and / or Rolled Sections and / or Reinforcement Steel for the last two years as on date of submission of proposal.

iii) The proposed supplier should also be a registered licensee with Bureau of Indian Standards for BIS: 1786/2062 at the time of submission of proposal.

NOTE: The "Primary Steel Producer" shall mean Steel Producer of any capacity, irrespective of process route, starting their operations from iron making using iron ore, virgin or processed, with necessary refining facilities and rolling/processing facilities, at a single location or else in multiple locations provided that the entire gamut of iron & steel production, from iron making to finished steel production, is owned by the same company or its subsidiary company(ies). Provided that the iron making capacity is sufficiently matching the steel making capacity. Further, downstream units should use material from the upstream units of the same company or its subsidiaries.

In case of non-availability of certain steel section/s i.e. Angle smaller than 100x100x10 mm, MS flats, rounds, square bars and chequered plate from above acceptable primary steel producers, an option is given to the Main contractor to source these sections directly from SAIL Conversion/Wet Leasing agent subject to the conditions given at point no. A) below:

A) Approval conditions for procurement of structural steel sections through SAIL Conversion/Wet Leasing agent:

1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Employer supply.
2. Billets shall be procured from Employer approved Main Steel Producers. Proper records for traceability from raw material to final product shall be maintained.
3. 100% chemical analysis of the raw material (Billets) shall be carried out as per IS: 2830. Testing of one sample per 40 MT for each type of section or part thereof shall be carried out as per IS: 2062 on finished product.
4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC). MTC of finished sections shall be correlated with original MTC for Billets received from Main Steel Producer and Manufacturer Test Report of

chemical analysis of Billets mentioned at point no.3. MTC of finished sections shall include the reference of MTC for Billets from Main Steel Producer.
5. Employer will have access to carry out the surveillance checks for in-process stage.
6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Employer.

In case of non-availability of certain size/s of steel tubes conforming to IS:1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from above acceptable primary steel producers, the same may be sourced from BIS approved sources having valid BIS license subject to the conditions given at point no. B) below:

B) Approval conditions for procurement of Steel tubes conforming to IS: 1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from BIS approved sources:
1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Employer supply.
2. Raw materials shall be procured from Employer approved Main Steel Producers.
3. 100% chemical analysis of the raw material (steel) shall be carried out as per IS: 228. Testing of samples of steel tubes and hollow sections from each lot shall be carried out as per IS: 1161 & IS: 4923 respectively on finished product.
4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC).
5. Employer will have access to carry out the surveillance checks for in-process stage.
6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Employer.

The specific methodology to be followed for above procurement through conversion route/BIS approved sources route shall be subject to approval by Employer in advance.

5.0 CW LINER/DUCT

The following tests / checks shall be carried out for CW Liner works:

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
CW Liner Fabricated at Site (Field Shop) and Factory Fabricated CW Liner using Steel Plates with Longitudinal & Circumferential Weld Joints		
Option-1		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes up to 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200mm diameter
4.	UT	Not recommended.
5.	RT	5%
6.	DPT on finished butt welds	10%
7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher.
Option-2		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes up to 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200mm diameter

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
4.	UT	Not recommended
5.	RT	- 100 % RT on circumferential joints in the bottom 1/3 portion of CW liner for weld length as per Fig 1 - 5% RT on top 2/3 portion of circumferential joints and - 5% RT on longitudinal joints
6.	DPT on finished butt welds	10%
7.	Hydro test	No Hydro test
Factory fabricated CW liner using H.R. coils with spiral weld joints		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% DPT for pipes up to 1200mm diameter
3.	DPT after back gouging	100% DPT for pipes above 1200mm diameter
4.	UT	Not recommended.
5.	RT	5% RT
6.	DPT on finished butt welds	10% DPT
7.	Hydro test	Hydro test at 1.5 times the design pressure or 2 times the working pressure whichever is higher.
CW Liners erection site test		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes unto 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200mm diameter
4.	UT	Not recommended.
5.	RT	5%
6.	DPT on finished butt welds	10%
7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher. In exceptional cases where hydraulic test is not possible the same may be substituted with 100% RT in consultation with EIC.

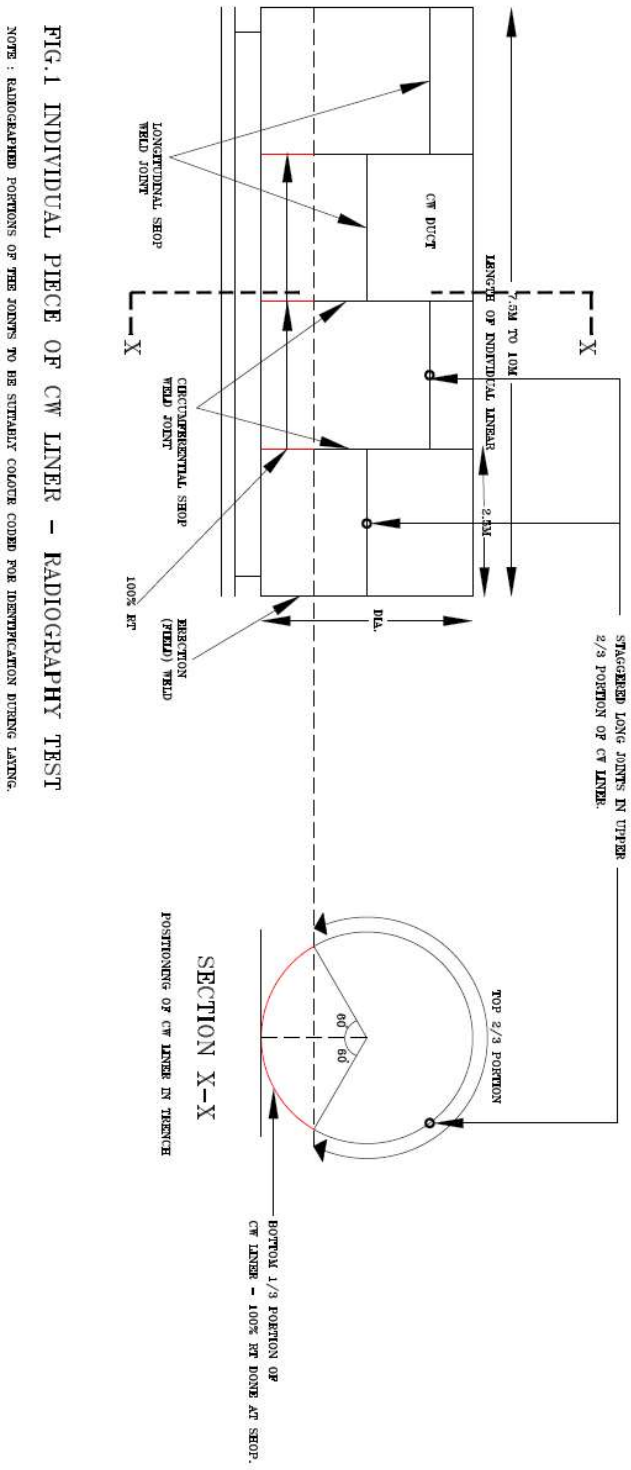

FIG.1 INDIVIDUAL PIECE OF CW LINER - RADIOGRAPHY TEST

NOTE : RADIOGRAPHED PORTIONS OF THE JOINTS TO BE SUITABLY COLOUR CODED FOR IDENTIFICATION DURING LAYING.

INDICATIVE FIELD QUALITY PLAN

Annexure I

SUPPLIERS NAME AND ADDRESS	ITEM : Civil Work	QP NO. :	PROJECT:	TALCHER TPP STAGE-III (2X660 MW)
		REV. NO. :	PACKAGE:	EPC PACKAGE
	SUB-SYSTEM : GEOTECH INVESTIGATION, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING ETC.	DATE :	CONTRACT NO. :	
		PAGE :	MAIN CONTRACTOR :	

Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	D*	Remarks
1	2	3		4	5	6	7	8	9	D*	10
1	GENERAL REQUIREMENTS										
A	Setting up of Field QA&QC laboratory, Availability of requisite laboratory set up and equipment in good working condition & duly calibrated well before commencement of concerned activity.		As agreed / required	B	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings		SR	√	The contractor shall establish the mobilize the requisite laboratory equipment/set up and skilled QA&QC manpower within 30 days from the mobilization date of Main contractor at site. Functioning & calibration status of laboratory equipment in proper working condition to be verified on monthly basis.
B	Submission of QA & QC manpower deployment schedule and availability of manpower		As agreed / required	B	Physical	Manpower shall be deployed progressively as per the work front and discipline wise progress	Tech Specs and Const. Drawings		SR	√	
C	Sampling for testing of construction materials (Coarse aggregate, fine aggregate etc.), materials for concrete mix design etc.		As agreed / required	A	Physical	Once per each source	Tech Specs and Const. Drawings		SR/TR	√	Test report along with the recommendations from Employer acceptable laboratories to be submitted to EIC/FQA head for their review and acceptance.
D	Submission of Monthly Test/QA reports/data		As agreed / required	A	Physical	Monthly	Tech Specs and Const. Drawings		SR/TR	√	
E	Stacking and storage of construction materials and components at site		As per IS:4082	B	Physical	Random in each week	Tech Specs and Const. Drawings, Manufacturer's guidelines and IS 4082		SR		
F	Survey										
	Construction of Bench Mark / Grid Pillars	To mark reference co-ordinate & elevation	As required / agreed	B	Physical	Each Bench Mark/ Grid Pillars	As per technical specifications/approved drawings		SR	√	Joint protocol for co-ordinate and elevation
2	EXCAVATION, FILLING/BACKFILLING AND COMPACTION WORKS										
2.1	Excavations-										
i		Nature, type of soil/rock before and during excavations	As agreed / required	B	Visual	Random	Tech Specs and Const. Drawings		SR		
ii		Initial ground level before start of excavations, shape, Dimensions of excavations & Side slope of final excavation and Final excavation levels.	As agreed / required	B	Measurement	100%	Tech Specs and Const. Drawings		SR	√	
2.2	Excavation in Hard Rock- If required										
i		Receipt, Storage, accountability of Explosive	As agreed / required	B	Physical	Random in each week	Indian Explosive Act 1940/all statutory norms, Tech Specs and Const. Drawings		SR	√	Employer approved specialist blasting agency such as CMRI, NIRM shall be deployed at site for trial blasts, design blasts, blast vibration monitoring etc. Seismographs shall be deployed at site for monitoring of blast operation vibrations.
ii		Execution of Blasting Operation	As agreed / required	B	Physical	Random in each shift	IS:4081, Tech Specs and Const. Drawings/ scheme		SR		
iii		Submission of Blasting report to EIC	As agreed / required	B	Physical	Each blast	Tech Specs and Const. Drawings			√	
iv		Excavation in Hard Rock (Blasting Prohibited)	As agreed / required	B	Physical	100%	As per approved drawing/ scheme, Tech Specs and Const. Drawings		SR	√	
2.3	Filling/ Backfilling										
i	Suitability of fill material	Grain size analysis, Organic Matter, Liquid Limit, plastic limit, Shrinkage limit & Free Swell Index and chemical analysis(like Organic Matter, Calcium carbonate, pH value, Total soluble sulphate etc.) as required in TS	As per IS: 2720	B	Physical	Once per each type of source or change of source subject to a min. of 2 samples	IS:2720 (Pt.IV), IS:2720 Pt.XXII, IS:2720 (Pt.XI)/relevant part, Tech Specs and Const. Drawings		SR/TR	√	Test report along with the recommendations regarding suitability of the fill material from NTPC acceptable laboratories to be submitted to EIC for review and acceptance. Geo technical investigation report may also be considered as basis for suitability of fill material if available as per the discretion of EIC.
2.4	Standard proctor Test	Optimum moisture content (OMC) and max. dry density (MDD) of filling/backfilling materials	As per IS: 2720	A	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings		SR/TR	√	

2.5	**Compaction of Filling / Backfilling Works**									
i	Moisture content	Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	IS 2720 (Pt.II), Tech Specs and Const. Drawings	SR/TR	√	
ii		Dry density by core cutter method ---- OR---- Dry density in place by sand replacement method ---- OR---- any other method as per IS 2720	As per IS: 2720	A	Physical	i) For foundation back fill: one for every 10 foundations for each compacted layer. ii) For area filling: one every 1000 SQM area for each compacted layer.	IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII)/ IS 2720 Relevant Part/ Tech Specs and Const. Drawings	SR / TR	√	
iii		Relative density (Density Index)	As per IS: 2720	A	Physical	----do----- (I) & (ii) above	IS 2720 (Pt. XIV), Tech Specs and Const. Drawings	SR/TR	√	
3	**RAW MATERIALS FOR CONCRETE**									
3.1	**CEMENT**									
i	Material	Physical and chemical properties as per relevant IS codes	As required/ agreed	A	Review of MTC/ test reports	for each manufacturing Week number	IS : 269/ IS:1489/ IS:455, Tech Specs and Const. Drawings	MTC	√	To be procured from BIS approved source having valid BIS License. Each consignment of cement shall be duly correlated with manufacturers' TC.
ii		Testing of cement for Setting time (Initial & Final) and compressive strength	As per IS:4031	A	Physical	one for each manufacturing Week number	IS : 269/ IS:1489/ IS:455, Tech Specs and Const. Drawings	SR/Test Report	√	Additionally, If the cement is stored more than 90 days in godown of contractor then the same shall be retested for Setting time & Comp. Strength.
3.1 b	**Fly ash**									
		Physical and chemical properties as per IS 3812 Part I (Table 1 and 2)	As per IS 3812 Part I	A	Physical	once in a week or change of source whichever is earlier	IS:3812 Part I and Tech. Spec./Design mix.	SR/Test Report	√	Batching plant shall have facility for mixing of fly ash.
3.2	**Coarse Aggregate**									
i		Moisture content	IS:2386	B	Physical	To be done every day before start of work	IS : 456/IS : 383/IS: 2386 Part-III/Tech Spec	SR/LB	√	During monsoon, frequency may be increased and accordingly water content in concrete will be adjusted.
ii		Sieve analysis, flakiness index, elongation index	IS:2386	B	Physical	One per 100 cum. or part thereof	IS: 2386 Part-I, IS:383 / Tech Spec	SR/LB/TR	√	
iii		Specific gravity, Soundness, Water absorption, Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale, Total of % of all deleterious materials),	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS: 2386 Part-II, IS: 2386 Part-V, IS:456, IS:383/Tech Spec	SR/LB/ TR	√	During Design mix, these tests may be carried out.
iv		Alkali aggregate reactivity and Petrographic examination	IS 2386	A	Physical	-do-	IS: 2386 (Part-VII/VIII), IS:383 /Tech Spec/ASTM C-1260 / ASTM 1293	SR/LB/ TR	√	
v		Crushing value, Abrasion value and Impact value	IS:2386	A	Physical	-do-	IS:383, IS-2386 Part IV/Tech Spec	SR/LB/ TR	√	
3.3	**Fine Aggregate**									
i		Moisture content	IS:2386	B	Physical	To be done every day before start of work	IS : 456/IS : 383/IS: 2386 Part-III/Tech Spec	SR/LB	√	During monsoon, frequency may be increased and accordingly water content in concrete will be adjusted.
ii		Sieve analysis, Silt content	As agreed / required	B	Physical	One per 100 cum. or part thereof	Tech Spec/ IS 2386 / IS 456/ IS 383	SR/LB/ TR	√	
iii		Specific gravity, Soundness, Water absorption, Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale, Total of % of all deleterious materials (excluded mica as well as included mica content)), organic impurities	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS: 2386 Part-II, IS: 2386 Part-V, IS:456, IS:383/Tech Spec	SR/LB/ TR	√	During Design mix, these tests may be carried out.
iv		Alkali aggregate reactivity and Petrographic examination	IS 2386	A	Physical	-do-	IS: 2386 (Part-VII/VIII), IS:383 /Tech Spec/ASTM C-1260 / ASTM 1293	SR/LB/ TR	√	

3.4	**Water**	Complete Testing as per IS:456-2000	As per IS:456	B	Testing	Once for each source and thereafter yearly in case of borewell. If water is used from open source like river, stream, canal etc., then water testing is to be done quarterly.	IS:456-2000/ Tech. spec.	TR	√	
3.5	**Admixtures for Concrete**	Material/Type of admixture and its suitability	As per IS:9103	A	Review of MTC/ test reports	For each lot received at site	As per Designed mix and IS:9103/ Tech. Spec.	Test Report/ MTC	√	
4	**CONCRETING (MIXING, CONVEYING, PLACEMENT, COMPACTION, CURING & TESTING)**									
4.1	**Batching Plant (if installed)**									
i		Calibration of Batching Plant		A	Physical	To be calibrated at the time of starting and subsequently once in three months in house, and shall conform to IS:4925	Review of calibration chart/ Certificate/IS 4925	Calibration Certificate	√	Batching Plant shall be calibrated regularly at least once in a 3 months in-house. The weights for batching plant calibration to be calibrated once in year by NPL/NABL accredited lab./Weights & Measures Dept.
4.2	**CONCRETE**									
i		4 Trial mixes to ascertain the workability and cube strength	After receiving the recommended mix design	A	Physical	4 trial mix. for each mix proportion	Tech. Spec.,IS 456/IS 10262	SR/LB	√	The concrete for field trials shall be produced by methods of actual concrete production.
ii		Concrete Cube strength Test	IS:516	A	Physical	One set of 6 cubes per 50 Cum or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, Tech. Spec.	SR/LB/ TR	√	Min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days & remaining 3 shall be for 28 days Comp. Strength.
iii		Workability - slump test	IS:1199	B	Physical	At the time of concrete pouring at site every two hrs.	IS:456/Tech. Spec.	SR/LB/ TR	√	
iv		Temperature Control of Concrete as per Tech. spec./IS standard	Thermometer	B	Physical	100%	Temperature as per technical specification/Relevant standard	SR	√	
v		Water Cement Ratio		B	Physical	For each batch of concrete	As per approved Design Mix	SR/Batch slip	√	
vi		Placement of concrete, Compacting, Curing	As required	B	Physical	At Random	IS:456, Period of curing as per IS 456	SR		
4.3	**TESTS / CHECKS ON RCC STRUCTURE IN HARDENDED CONDITION**									
i		Visual inspection of concrete surface just after removal of shuttering	As agreed / required	B	Visual	100%	As per IS:456/ tech. Specification.	SR		
ii		Dimensional check on finished structures	As agreed / required	B	Measurement	100%	As per IS:456/ tech. Specification and Const. Drawings	SR/LB	√	
iii		Position and alignment of embedded parts and inserts	As agreed / required	B	Visual	100%	As per provisions and tolerances of equipment supplier, Tech Specs and Const. Drawings			
iv		Embedment of inserts in concrete shall be checked for gap if any using hammer for all dynamic foundations	As agreed / required	B	Physical	100%	As per Technical Specification	SR	√	No hollow sound
v		Submission of grouting / repair methodology to EIC for approval if concrete surface / position and alignment of embedded parts / inserts are found defective	--	B	Review and approval	once for each type of defect	As per provisions and tolerances, Tech Specs and Const. Drawings		√	
vi		UPV Tests on top deck of TG foundation, Columns & Other Foundations as per Technical Spec.	IS:13311	A	Physical	As per Tech. Spec.	IS:13311/As per Technical Specification	Test Report	√	
vii		Core Test	IS:516	A	Physical	As required by Employer EIC.	As per IS:456, IS 516	SR/LB/ TR	√	Compressive strength based on core test is required to be carried out in case of doubt regarding the grade of concrete used, either due to poor workmanship or based on the results of cube strength test as per 3.5 ii) above and as per discretion of EIC.
viii		Rebound Hammer test	IS:13311	A	physical	As required by Employer EIC.	As per relevant Standard/ tech. Specification.	SR/LB/ TR	√	This test may be carried out to assess the strength of concrete in case of non-critical and lightly loaded structures as per the discretions of EIC

ix		Water Tightness Test of liquid retaining structure/ tanks	As required	A	Test	100%	IS:3370/ Tech. Specification	SR/LB	√	
5	**REINFORCEMENT STEEL AND ITS PLACEMENT**									
i	Material	Physical and chemical properties as per relevant IS codes and Tech spec.	As agreed/required	A	Review of MTC	Each batch/lot of delivery	As per IS 1786, IS 432, IS 1566, tech spec and cont. drawing	MTC	√	To be procured from Employer approved source.
ii		Freedom from cracks surface flaws, Lamination & excessive rust.	As agreed / required	B	Visual	Random in each shift	IS: 1852, IS:432, IS:1786, Tech Specs and Const. Drawings	SR		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.
iii		Bar bending schedule with necessary lap, Spacers & Chairs	As agreed / required	B	Physical & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS:2502	SR	√	
iv		Acceptance - disposition of cage w.r.t. reference axes, cover, spacing of bars, spacers and chairs after the reinforcement cage is put inside the formwork	Measuring tape & as required	B	Visual & Measurement	Random in each shift*	IS 456, Tech Specs and Const. Drawings	SR	√	* 'for foundations, frequency shall be Each foundation
6	**FOUNDATION SYSTEM**									
i		Foundation casting - Layout, Shape, dimensions, Reinforcement, concreting, curing etc.	As required / agreed	B	Physical	Each foundation	As per technical specifications and construction drawings	SR	√	lines and levels to be checked. Concrete Grade to be checked as per Mix Design
7	**STAGING AND FORMS**									
i		Materials and accessories	As agreed / required	B	Visual	Once before start of work	As per relevant IS, Tech Specs and Const. Drawings	SR		
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	As agreed / required	B	Visual	Once before start of work	As per manufacturer's spec.and as per 3696,4014, 4990, Tech Specs and Const. Drawings	SR		
iii		Acceptance of formwork before start of concreting : disposition w.r.t. reference axes, size, etc.	Measuring tape & as required	B	Physical / visual	Before start of each concreting	As per provisions and tolerances in IS 456, Tech Specs and Const. Drawings	SR	√	
8	**SLIPFORM SHUTTERING**									
i		Submission of Slip form Work system to be used	As required / agreed	B	Submission	Before Commencement of work	As per specifications	SR	√	
ii		Check for the Slip form shutters	As required / agreed	B	Physical	Before Commencement of work	As per specifications	SR		Check for water level system, Controls, Walkways etc.
iii		Details Positions and arrangement of Jack rods	-	B	Approval	Before Commencement of work	As per specifications	SR	√	Submitted to EIC for approval
iv		Details of Proposed arrangement for continuous readings	-	B	Approval	Before Commencement of work	As per specifications	SR	√	Submitted to EIC for approval
v		Check for All type of openings, Chases, Fixing of Blocks and similar built-up features	As required / agreed	B	Physical	100% during execution	Construction Drawings and specifications	SR		No any type of openings ,chases , blocks other than shown in the construction drawings or approved by EIC shall be executed in the concrete.
vi		Details of proposed method for concrete curing and protection	-	B	Approval	Before Commencement of work	Construction Drawings and specifications	SR	√	Submitted to EIC for approval
vii		Check of Concrete Curing and Protection	As required / agreed	B	Physical	At Random	Construction Drawings and specifications	SR	√	Concrete shall not remain uncured for period longer than 12 hours
viii		Check for Sliding Operation & Monitoring of Sliding Portion	As required / agreed	B	Physical	Each Sliding	As per specifications	SR		Rate of Sliding, Delays in sliding, Discontinuity or stop start sliding to be checked
ix		Progress Height	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	To be recorded in tabular form and on graphs immediately after each monitoring
x		Centre line in relation to the centres at the base	As required / agreed	B/A	Physical	Min. once per shift/ Min. once per day	As per specifications	SR	√	
xi		Internal wall faces in relation to the concrete at the base	As required / agreed	B	Physical	Once per shift	As per specifications	SR		
xii		Wall thickness	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	
xiii		Twist	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	

xiv		Verticality of the structure	As required / agreed	B/A	Physical	Every day in morning/ Random	As per specifications	SR	√	
xv		Check for Tolerances for chimney construction	As required / agreed	B	Physical	For every day monitoring	As per specifications	SR	√	
9	**EMBEDDED PARTS (INCLUDING LAYING OF RAILS & ANCHOR FASTENERS) –If Applicable.**									
i		Material	As agreed / required	B	Review of MTC/ test reports	Each batch/lot of delivery	As per Tech Specs and Const. Drawings	SR/MTC	√	
i		Position / alignment / levels of embedded parts / bolt hole / pipe sleeves / rails / PVC pipes / etc. as per TS and construction Drg.	As agreed / required	B	Physical/ measurement	100%	As per Tech Specs and Const. Drawings	SR/ Protocol	√	Exposed surface of the embedded parts other than holding down bolts are to be painted with as per technical specifications.
ii		Welding / tying of embedment to reinforcement	As agreed / required	B	Physical/ measurement	Random in each shift	As per Tech Specs and Const. Drawings	SR		
10	**JOINTS IN CONCRETE, DAMP PROOF COURSE**									
i	JOINTS IN CONCRETE	Joint material - bitumen impregnated fibre board, PVC water stops, Sealing compound, Expanded polystyrene board, Hydrophilic strip, Acrylic polymer etc. (as given in technical spec)	As per manufacturer Standards	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings, IS 1838, IS 1834, IS12200	SR/MTC	√	
ii	DAMP PROOF COURSE	Material - Hot bitumen and water proofing materials etc. (as given in technical spec).	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings, IS 702	SR/MTC	√	
iii		Acceptance of installation of Joints material & Acceptance of damp proof course.	As agreed / required	B	Acceptance	Each installation randomly	Tech Specs and Const. Drawings		√	
11	**GROUTING**									
i		Material	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR//MTC	√	
ii		Compressive strength of grouting material before its use.	As agreed / required	A	Physical	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/LB/ TR	√	
iii		Compressive strength of cubes after grouting.	As agreed / required	A	Physical	Random	Tech Specs and Const. Drawings	SR/LB/ TR	√	
iv		Acceptance of the grouts : Mixing, placement, application and grout pressure (as applicable)	As agreed / required	B	Physical	Each grout section	Tech Specs and Const. Drawings	SR	√	
12	**MASONARY WORKS**									
12.1	**Test on Bricks**									
i		Compressive strength, water absorption, efflorescence.	As agreed / required	A	Measurement / Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings	SR/LB/ TR	√	
ii		Dimensions , shape, warpage.	As agreed / required	B	Measurement / Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings	SR/LB	√	Warpage test is applicable for facing bricks only as per IS:2691.
12.2	**Modular aerated panel**									
i	**Material**	As required	As agreed / required	A	Review of test report	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/LR	√	
12.3	**Autoclaved Aerated Concrete (AAC) block**									
i		Material	As agreed / required	B	Review of MTC	Each batch/lot of delivery	Tech Specs /IS 2185 Part III and Const. Drawings	SR/MTC	√	
ii		Compressive Strength and Density	As agreed / required	A	Physical	As per relevant IS Code/ One Sample for 10,000 nos. or part thereof	Tech Specs /IS 2185 Part III	TR	√	
iii		Dimensions, shape	As agreed / required	B	Physical	As per relevant IS Code/ One	Tech Specs /IS 2185 Part III	TR/SR	√	
12.4	**Test on Mortar**									
i	Sand	Grading	As agreed / required	B	Test	once per 100 Cum or part thereof	IS:2116	SR/LB	√	
ii		Compressive strength	As agreed / required	B	Test	At random	IS 2250-1981, Tech Specs and Const. Drawings	SR/TR	√	
12.5	**Masonry construction**	Workmanship, verticality and alignment	As agreed / required	B	Visual/ Physical	100%	IS 2212, IS 1905 , Tech Specs and Const. Drawings	SR/LB		
13	**PLASTERING- MATERIAL AND WORKMANSHIP**									
i	Sand	Deleterious Material	As agreed / required	B	Physical	Once per source	IS : 2386 (Part-I &II) & IS :2116, Tech Specs and	SR/TR	√	

ii		Grading	As agreed / required	B	Physical	50 Cum./or part thereof	Tech Specs and Const. Drawings	SR/TR	√	
iii		Silt content	As agreed / required	B	Physical	One per 100 cum., or part thereof	CPWD/ Tech Spec/ IS 2386/ IS 456/ IS 383	SR/LB/ TR	√	
iv	Stone grit plaster/ granular textured coat finish (if applicable)	Material	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	
v	**Galvanised wire mesh (if applicable)**	Galvanized hexagonal wire netting for lath plastering	As agreed / required	B	Review of MTC/ test reports	Each batch/lot of delivery at site	Tech Specs and Const. Drawings	SR/MTC	√	
vi		Thickness, Trueness and finishing of plaster, grooves etc.	As agreed / required	B	Visual/ Measurement	Random in each shift	Tech Specs and Const. Drawings	SR/LB	√	
14	**PAINTING SYSTEM - CONCRETE WORKS (including Chimney) AND PLASTERED MASONARY SURFACES**									
i	Materials and accessories- Oil Bound, Acrylic Emulsion, Chemical Resistant, Oil Resistant Paint etc. as applicable (as given in technical spec).	Shade, type from brand and manufacturer as approved by EIC.	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ii	Surface preparation	As required	As agreed / required	B	Physical / visual	Random in each shift	Tech Specs and Const. Drawings	SR		
iii	Acceptance of painted surfaces	Shade, finish, WFT	As agreed / required	B	Physical/visual	Each surface at random	Tech Specs and Const. Drawings	SR	√	
14.2	**PAINTING SYSTEM - STEEL WORKS (OTHER THAN STRUCTURAL STEEL WORKS)**									
i		Painting Materials and accessories	-	A	Review of MTC/ test reports	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ii		Surface preparation	As agreed / required	B	Physical / visual	Each Erection Mark	Tech Specs and Const. Drawings, Relevant code/ standards	SR	√	
iii		Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	√	
v		Acceptance of painted surfaces : DFT, Finish, Shade	Elcometer	B	Visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	√	
15	**SHEETING, INSULATION & ALLIED WORK**									
i		Material : Profiled Colour coated Metal Deck & Cladding sheets	As agreed / required	A	Review of MTC / Test reports	Each lot received at site	Tech Specs and/ Const. Drawings/ profiled drawing	MTC/TR	√	Co-relation with MTC/TR (Video-jet printing or coil no. or any other means) may be verified with the lot received at site.
ii		Insulation material (other than Chimney insulation), galvanized wire net, aluminium foil, fasteners	As agreed / required	A	Review of MTC/ test reports	Each lot received at site	Tech Specs and/ Const. Drawings	SR / LB/MTC	√	All tests as per specification
iii		Insulation material (for Chimney insulation)	As agreed / required	A	Review of MTC/CHP/MDCC reports	Each lot received at site	Tech Specs and/ Const. Drawings	MTC/CHP/ MDCC/Inspection report	√	
iv		Installation, lap alignment & workmanship.	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and/ Const. Drawings	SR		No gas cutting of colour coated sheets acceptable .
v		Finishing and acceptance	As agreed / required	B	Visual/ Physical	Each installation	Tech Specs and/ Const. Drawings	SR/LB	√	
16	**DOORS , WINDOWS, VENTILATORS & GRILLS**									
i	Steel doors	Materials & Check for shape tolerances thickness, welding & finishing of sections as per TS	As agreed / required	B	Visual/ Physical / test report	For each lot received at site	Tech Specs and Const. Drawings	SR / LB/TR	√	Review of test report
ii	Wood/Timber	Moisture content & anatomy	As agreed / required	A	Physical	For each lot received at site	Tech Specs and Const. Drawings/ IS 287	SR/LB	√	Tests to be carried out from Employer acceptable third party lab. like Forest Research Institute Dehradun. Frequency of check may be decided by EIC based on quantity and requirement.
iii	Wood work in frames	Check for dimensions, surface finish	As agreed/ required	B	Physical	Random for each installation	Tech Specs and Const. Drawings	SR	√	
iv	Flush Door shutter	End emersion test, knife test, adhesion test	As agreed/ required	A	Review of MTC/test reports	For each lot received at site	IS 2202, Tech Specs and Const. Drawings	SR/MTC	√	The required tests to be carried out from Employer acceptable third party lab. like Forest Research Institute Dehradun in addition to review of MTC/TR. Frequency of check may be decided by EIC based on quantity, requirement and IS 2202.

v	Particle Door		As agreed / required	A	Review of MTC/ test reports	For each lot received at site	IS:12823, Tech Specs and Const. Drawings	SR/MTC	√	The required tests to be carried out from Employer acceptable third party lab. like Forest Research Institute Dehradun in addition to review of MTC/TR. Frequency of check may be decided by EIC based on quantity, requirement and IS 12823.
vi	Anodised aluminium works (Door & Window)	Materials- Aluminium sections, Coating	As agreed / required	A	Visual/ Physical / test report	For each lot received at site	IS: 1948, IS: 1949, IS:733, IS1285, IS:1868, IS:11857/ Tech Specs and Const. Drawings	SR / LB	√	Randomly one sample of each type may be send to Employer acceptable third party testing lab. for testing requirements as per TS and IS codes. Anodization shall be as per Tech. Spec. Frequency of check may be decided by EIC based on quantity, requirement and relevant IS code.
vii	Fire proof doors	Material & Receipt inspection	As agreed / required	A	Review of MTC/ purchase order (unpriced copy) / drawings of suppliers / certificate of CBRI/CPRI/GOV. LAB. &	For each source & For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	The door drawing proposed for supply should have been tested and approved by CBRI Roorkee/CPRI/GOV. LAB. for the similar dimensions for minimum fire rating as required in Tech. spec.
viii	Rolling shutters	Surface finish and thickness of plate of approved make and DFT	As agreed / required	B	Physical / visual / review of MTC	Random for each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ix	Steel windows / Grills/ Louvre	Material fabrication and fixtures	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	IS: 1038 / IS:1361, IS: 7452 and Tech Specs and Const. Drawings	SR/MTC	√	
x	Doors / Windows Sections	Material - Rolled Steel, Z Sections,T-iron frames sections, Plates etc.	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
xi	Glass and glazing, Reflective toughened glass as per TS.	Material	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Const. Drawings	SR/MTC	√	
xii	Curved dome on roof/ Poly Carbonate Sheet	Materials - As per tech spec.	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	Randomly one sample of each type may be send to Employer acceptable third party testing lab. for testing requirements as per TS and IS codes. Frequency of check may be decided by EIC based on quantity, requirement and Relevant IS code.
xiii	False Ceiling	Materials - As per tech spec.	As agreed / required	A	Review of MTC/ test reports	For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	Randomly one sample of each type may be send to Employer acceptable third party testing lab. for testing requirements as per TS and IS codes. Frequency of check may be decided by EIC based on quantity, requirement and Relevant IS code.
xiv		Installation finishing and acceptance	As agreed / required	B	Visual / physical	Random	Tech Specs and Const. Drawings	SR		
17	**WATER PROOFING (Roof / Basement Treatment)**									
i		Methodology for the application of water proofing system	As required	B	Review	for each type of treatment	Tech Specs and Const. Drawings	SR	√	
ii	Graded under bed	Levels / slopes	As required	C	Physical	100%	Tech Specs and Const. Drawings			
iii	Elastomeric coatings	Material- Primer coat, finishing coat	As required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
iv	Wearing course	Materials - As per tech spec.	As required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
v		Acceptance of water proofing work	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings			
18	**Fencing and Gates**									
i	PVC coated chain link fencing (IS 2720), Welded wire mesh (IS 1566), Reinforced barbed tape galvanised (IS 2629) etc.	Materials	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications

ii	Structural steel, painting system, caster wheel, ball and bearing, fixtures and fasteners	Materials	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
iii		Alignments, erection painting, DFT etc. and acceptance of the installation and working	As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings	SR	√	
19	**FLOOR FINISHES AND ALIED WORKS**									
i	Cement Concrete Flooring	Glass/ PVC strips in joints	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings	SR		
ii	Ceramic tiles, vitrified tiles, glass mosaic, acid alkali resistant tiles, heavy duty cement concrete tiles (Materials as per TS)	Materials	As agreed / required	B	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications. In case non-availability of MTC, sample to be tested as per relevant IS code.
iii	Interlocking Blocks	Materials	As agreed / required	A	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
iv	Kota Stone, Granite and Marble	Materials: Quality, texture, thickness, colour for each lot of delivery	As agreed / required	B	Physical	Each lot of delivery	Tech Specs/ BOQ and Const. Drawings	SR/TR	√	
v	Metallic / non-metallic hardener	Material	As agreed / required	B	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
vii	Acid / alkali and oil resistant high built seamless epoxy based resin and treatment	Material	As agreed / required	A	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	TR/MTC	√	work to be done by skilled manpower
		Surface preparation (as applicable)	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings, IS 2395			
viii	Rubber Flooring	Material	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings / IS 809	TR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
ix		Finishing and acceptance of all above BOI	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings	SR		
20	**WATER SUPPLY / SANITORY INSTALLATIONS**									
i	Material	Sanitary items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes (GI/ MS/ SCI/ CI / RCC), manhole cover and frames, Over head / loft type etc. as per TS	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
ii		leakage of pipes	As agreed / required	B	Physical	Each installation	Tech specs and const drawings	SR	√	
iii		Acceptance of installations of all sanitary items and fixtures	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings	SR		
20.2	**RCC Pipes**									
i	Material (As per TS)	RCC pipes	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	To be procured from BIS Approved Sources having valid BIS License.
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		
20.3	**Water Storage Tanks**									
i	Material (As per TS)	Over head / loft type	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	To be procured from BIS Approved Sources having valid BIS License.
ii		Acceptance and leakage	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings	SR		
21.0	**SPECIAL ITEMS**									
21.1	**Earthing Mat (Grounding System)**									
i	Material (As per TS)	Earthing mat	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/TR/MTC	√	
ii		Weld sizes & length	Visual/Tape	B	Visual/ Measurement	100%	Tech Specs and Const. Drawings			Employer approved electrodes shall be used
iii		D P test	DP test Kit	A	Physical	10% at random of the offered lot	Tech Specs and Const. Drawings	TR	√	
iv		Earth test	Earthing test kit	A	Physical	100%	Tech Specs and Const. Drawings,	SR/TR	√	
21.2	**Bitumen layer for tank foundation**									
i	Material (As per TS)	Grade of bitumen	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	As per relevant IS and Tech. Specs /MTC	SR/MTC	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii	Acceptance and workmanship	Application / workmanship	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		

21.3	**Composite Aluminium Panels and structural glazing**									
i	Material (As per TS)	Type of aluminium panels / structural glazing / fasteners and fixtures / silicon sealant	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Technical specifications / drawings	SR/TR/MTC	√	MTC shall cover all the properties / parameters as per technical specifications
ii	Acceptance and workmanship	Installation / workmanship	As agreed / required	B	Physical	Random	Technical specifications / drawings	SR		
21.4	**Pressure Release Valves**									
i	Material (As per TS)		As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Technical specifications / drawings	SR/TR/MTC	√	
ii	Acceptance and workmanship	Acceptance / Installation / workmanship	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR	√	
21.5	**ANTI WEED TREATMENT**									
i	Material (As per TS)	Anti-weed treatment materials	As agreed / required	B	Review of MTC/ test reports	Each batch of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
ii		Execution of treatment	As agreed / required	B	Physical	Random check for each treatment	Tech Specs and Const. Drawings	SR		
23	**PILING WORK (If Applicable)**									
23.1	**Execution**									
i		Borehole diameter	As required	B	Physical	100%	As per appd. Drawings and technical specification	SR/LB	√	
ii		Pile layout	Total station	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
iii		Recording ground level and pile termination level	As required	B	Measurement	Random	As per appd. Drawings and technical specification	SR/LB	√	
iv		Cleaning/Flushing of pile bore	As required	B	Measurement	Each pile	IS 2911/ Tech. Specs.	SR/LB	√	
v		Size of bore and During boring of pile record commencement of SPT/ core recovery to ensure socketing length equivalent in terms of the Diameter of the pile below the socketing horizon.(if applicable)	As required	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
vi		Pouring of concrete to project above cut off level.	As required	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
23.2	**Testing**									
i		Bentonite	IS:2720	A	Physical / Test report	Once per lot	As per IS:2720, IS 2911/ tech. Specs.	SR/TR	√	One sample from each source (brand/manufacturer) to be tested at Employer acceptable third party lab.
ii		Density check on sample of mud collected from pile bore bottom	IS 2911	B/A	Physical	Each pile/ Randomly 1 in 10 piles	IS 2911/ Tech. Specs./approved PILING METHODOLOGY	SR/LB	√	Tests to be done before placing of concrete.
ii		Slump test of concrete	IS:1199	B	Physical	Every 2 hrs at pouring point of concrete	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
iii		Concrete Cube strength Test	IS:456	A	Physical	One set of 6 cubes per 50 Cum or part thereof for each grade of concrete per shift whichever is earlier.	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
iv		Initial pile load test, Vertical (Compression), Lateral (horizontal) and pull-out (tension).	IS:2911 / as required	A	Testing	As per Technical Specification/IS standard	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
v		Routine pile tests (VERTICAL LOAD TEST (COMPRESSION) and LATERAL LOAD TEST (horizontal))	IS:2911 / as required	A	Testing	As per Technical Specification/IS standard	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
vi		Pile Integrity Tests (PIT)	PEM / as required	A	Testing	100%	IS:2911, As per appd. Drawings and technical specification and suppliers manual	Test Report	√	
22.0	**GEOTECHNICAL INVESTIGATION WORK**									
i		Deployment of Employer approved Geotechnical Investigation Agency - Equipment, Manpower etc.	As required / agreed	B	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	

ii		Execution of Geotechnical Investigation - locations, type etc. as per scheme	As required / agreed	B	Physical	Each Location	As per technical specifications , approved drawing and relevant IS Codes	SR	√	
iii		Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	B	Physical	each sampling	As per technical specifications , approved drawing and relevant IS Codes	SR		
iv		Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc. if applicable	As required / agreed	B	Physical	each field test	As per technical specifications , approved drawing and relevant IS Codes	SR	√	
v		Submission of Employer approved Final Geotechnical investigation report along with recommendations.	As required / agreed	B	Physical	After completion of investigation work	As per technical specifications and relevant IS Codes	-	√	
23	**ROAD WORKS**									
23.1	**Tests on Embankment, Subgrade Construction and Cut Formation**									
A)	**Suitability of Borrow Fill material**									
i		Sand Content	As per IS 2720	A	Physical	Once per each type of source or change of source subject to a min. of 2 samples	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part IV)	SR/TR	√	
ii		Plasticity Test	As per IS 2720	A	Physical	Once per each type of source or change of source subject to a min. of 2 samples	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part V)	SR/TR	√	
iii		Density Test	As per IS 2720	A	Physical	Each soil type to be tested, 2 tests	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part VIII)	SR/TR	√	
iv		Deleterious Content Test	As per IS 2720	B	Physical	As and when required by Engineer in charge	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XXVII)	SR/TR	√	
v		Moisture Content Test	As per IS 2720	A	Physical	Two Tests	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part II)	SR/TR	√	
vi		CBR Test	As per IS 2720	A	Physical	One CBR test (Avg. of three specimens) or closer as and when required by EIC	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XVI)	SR/TR	√	
vii		Free swell Index	Measuring Cylinder	A	Physical	Once per each type of source or change of source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XI)	SR/TR	√	
B	**Compaction**									
i		Standard proctor Test	As per IS: 2720	A	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt.VII)	SR/TR	√	
ii		Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt.II)	SR/TR	√	
iii		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	A	Physical	One in every 2000 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII),	SR/TR	√	
iv		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.2	**Granular Sub-Base (GSB) (if applicable)**									
i		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Atterberg limits	Atterberg limits determination	A	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iii		Moisture Content prior to compaction	As required / agreed	B	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Density of compacted Layer	As required / agreed	B	Physical	one test per 1000 sqm.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
v		Deleterious Constituents	As required / agreed	B	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
vi		CBR	As required / agreed	B	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	

		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.3	**Water Bound Macadam (WBM)**									
i		Aggregate Impact Value	Aggregate Impact value Test Apparatus	A	Physical	One test per 1000 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 250 cum	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
iii		combined Flakiness and Elongation Indices	Flakiness & Elongation test gauge	B	Physical	One test per 500 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iv		Atterberg limits of binding material	Atterberg limits determination	A	Physical	One test per 50 cum of binding material	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
v		Atterberg limits of screenings	Atterberg limits determination	A	Physical	One test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
23.4	**Wet Mix Macadam (WMM) for base course and sub-base course**									
i		Aggregate Impact value	Aggregate Impact value Test Apparatus	A	Physical	One test per 1000 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 200 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iii		Combined Flakiness index and elongation index	Flakiness & Elongation test gauge	B	Physical	One test per 500 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iv		Atterberg Limits of portion of aggregate passing 425 micron sieve	Atterberg limits determination	A	Physical	One test per 200 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
v		Density of compacted Layer	As required / agreed	B	Physical	one set of three tests per 1000 sqm.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	Template, straight edge
23.5	**Premix Bituminous Macadam (BM)**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 350 cum for each source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Water sensitivity of mix	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Percentage of fractured faces	As required / agreed	B	Physical	one test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Binder content	Bitumen extractor	A	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xi		Control of Temperature of binder and aggregate for mix and of the mix at the time of laying and rolling	Thermometer	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xii		Rate of spread of mixed materials	As required / agreed	B	Physical	At Regular Interval	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.6	**Bituminous Concrete**									

i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Aggregate Impact Value / Los angels abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Soundness Test (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Sand equivalent test	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Plasticity Index	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Polished stone value	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Percentage of fractured faces	As required / agreed	B	Physical	One test per 350 cum of aggregate when crushed gravel is used	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Mix Grading	Set of Sieves	B	Physical	One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xi		Stability and voids analysis of mix including theoretical maximum specific of loose mix	As required / agreed	B	Physical	Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xii		Moisture Susceptibility of mix (AASHTO T283)	As required / agreed	A	Physical	One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xiii		Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Thermometer	B	Physical	At regular intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xiv		Binder content	Bitumen extractor	A	Physical	One set for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xv		Rate of spread of mixed materials	As required / agreed	B	Physical	After every 5th truck load	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xvi		Density of compacted Layer	As required / agreed	A	Physical	One test per 700 Sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.7	**Premix surfacing and Seal coat**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES

ii		Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 100 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Polished stone value	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Temperature of binder at application	Thermometer	B	Physical	At regular interval	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Binder Content	Bitumen extractor	A	Physical	Two tests per day per plant	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
xi		Percentage of fractured faces	As required / agreed	B	Physical	One test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
23.8	**Tack Coat/ Prime coat**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Binder temperature for application	Thermometer	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Rate of spread of binder	As required / agreed	B	Physical	Three tests per day	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
23.9	**RCC Pavements**									
	Quality checks for Materials used for Pavement concrete		As per Table 900-6 of MORTH Spec.							
	Quality checks for concrete used for Pavement concrete		As per Table 900-6 of MORTH Spec.							
23.10	**Alignment, Level, Surface regularity and rectification**									
i		Horizontal alignment, Surface levels and Surface regularity	As required / agreed	B	Physical	As per section 900 of MOSRTH specification	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR		
ii		Rectification	As required / agreed	B	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
24	**Raw Water Reservoir**									
A	**Preparation of foundation surface**									
i		For embankment foundations	Visual	B	Physical	100%	IS:2720 & Tech. Spec.	SR/TR		The foundation shall be free from all organic material, vegetables and weak layers of compressive materials as per Technical spec.
B	**Compaction of Filling / Embankment Works**									
i	Suitability of fill material (if applicable)	Grain size analysis, Organic Matter, Liquid Limit, plastic limit, Shrinkage limit & Free Swell Index and chemical analysis(like Organic Matter, Calcium carbonate, pH value, Total soluble sulphate etc.) as required in TS	As per IS: 2720	B	Physical	Once per each type of source or change of source subject to a min. of 2 samples	IS:2720 (Pt.IV), IS:2720 Pt.XXII, IS:2720 (Pt.XI)/relevant part, Tech Specs and Const. Drawings	SR/TR	√	Test report along with the recommendations regarding suitability of the fill material from NTPC acceptable laboratories to be submitted to EIC for review and acceptance. Geo technical investigation report may also be considered as basis for suitability of fill material if available as per the discretion of EIC.
ii	**Standard proctor Test**	Optimum moisture content (OMC) and max. dry density (MDD) of filling/backfilling materials	As per IS: 2720	A	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings	SR/TR	√	Frequency may be modified by EIC as per the requirement.
iii	Moisture content	Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	IS 2720 (Pt.II), Tech Specs and Const. Drawings	SR/TR	√	
iv	**In-situ Dry Density**									

a	For foundation surface compaction			A	Physical	Once for every 250 metre length	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
b	For cut off trench and core shell			A	Physical	Once for every 250 metre length in each layer separately	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
c	for Embankment filling & compaction works			A	Physical	i) Once for every 250 metre length of Embankment in each layer (layer of compacted thickness as given in Technical spec./BOQ.) ii) Once for every 50 metre width of Embankment or part thereof in each layer separately	IS: 2720 , Technical Specification/BOQ and Construction Drawing	SR/TR	√	
d	For trimmed slope (both side)			A	Physical	Once for every 250 metre length of Embankment	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
C	**Permeability**		As per Relevant IS	A	Physical	Once for every 5000 cum for cut off trench , core and/or as per requirement of Technical spec./BOQ	IS: 2720 , Technical Specification/BOQ and Construction Drawing	SR/TR	√	
D	**Embankment Geometry**									
i		Top width	As per Tech. Spec.	B	Physical	Once for every 100 metre length of trimmed completed Embankment.	Technical Specification and Construction Drawing	SR/TR	√	
ii		Outer Slope	As per Tech. Spec.	B	Physical	--do--	Technical Specification and Construction Drawing	SR/TR	√	
iii		Inner Slope	As per Tech. Spec.	B	Physical	--do--	Technical Specification and Construction Drawing	SR/TR	√	
E	**Coarse Aggregate for aggregate filters**									
i		check for gradation	IS: sieves	B	Physical	Once for each stack and each change of source	for aggregate filter gradation meeting the filter criteria as per Technical Specification.	SR/TR	√	
ii		specific gravity	pycnometer	B	Physical	Once for each stack and each change of source	IS:2386 Part I, and IS:1122 and Technical Specification	SR/TR	√	
iii		crushing value	as required	B	Physical	Once for each source	IS:2386 Part IV Technical Specification	SR/TR	√	
iv		soundness	Chemicals, balances etc.	B	Physical	Once for each source	IS:2386 Part V , IS:1126 Technical Specification	SR/TR	√	
v		impact value	as required	B	Physical	Once for each source	IS:2386 Technical Specification	SR/TR	√	
vi		water absorption	weight balance etc.	B	Physical	Once for each source	IS:2386 Technical Specification	SR/TR	√	
F	**Sand for filters blanket and chimney**									
i		gradation- grain size analysis	sieve set	A	Physical	once for every 10000 cum or change of source whichever is earlier	for sand filter gradation meeting the filter criteria as per Technical Specification.	SR/TR	√	
ii		specific gravity	pycnometer	A	Physical	Once for each source	IS:2386 part I and Technical Specification	SR/TR	√	
iii		Filter criteria	relevant IS Codes	A	Physical & Lab Test	once for every 10000 cum or change of source whichever is earlier	IS:9429 and Technical Specification	Lab. TR	√	
iv		Silt Content	as required	B	Physical	once for every 1000 cum	CPWD/IS 2386/IS 456/IS 383 & Tech. Spec.	SR/TR	√	
v		**All other tests as required in Technical Spec. need to be tested before use.**								
G	**Rock Material for Rip Rap, Rock Toe and Random Rubble Masonry**									
i		Specific gravity	as required	B	Physical	Once for each source	IS:1122 and Technical Specification	SR/TR	√	
ii		soundness	Chemicals, oven balance etc.	B	Physical	Once for each source	IS:1126and Technical Specification	SR/TR	√	
iii		Impact Value	Impact Value testing apparatus	B	Physical	Once for each source	IS:2386 and Technical Specification	SR/TR	√	
iv		Water absorption	Balance, oven	B	Physical	Once for each source	IS:2386 and Technical Specification	SR/TR	√	
v		slake Durability	as required	B	Physical	Once for each source	IS:10050 and Technical Specification	SR/TR	√	
vi		placement profile thickness	as required	B	Physical	Random in each shift	IS:8237 and Technical Specification	SR/TR	√	
25	**HDPE LINING**									
i	Material		As agreed / required	A	Review of MTC / Test reports/ CHP	Each lot received at site	Tech Specs and/ Const. Drawings	MTC/TR/CHP	√	Co-relation of material with CHP or Roll no. or any other means may be verified with the lot received at site.
ii	Material Thickness		As agreed / required	A	Physical	Each Roll	Tech Specs and Const. Drawings	SR	√	Lowest individual of 10 values shall not be less than Nominal -10%.
iii	Installation & Laying of HDPE Lining System		As agreed / required	B	Physical	100%	Technical Specification, const. Drawings and Installation procedure	SR	√	HDPE manufacture shall submit the HDPE Liner Installation procedure to EIC.

iv	NDT Test for HDPE Liner (Air Pressure testing or vacuum Box testing)		As agreed / required	A	Physical	All field seams	Technical Specification, const. Drawings and Manufacturer Recommendation	SR/TR	√	
v	Destructive Seam Testing for HDPE Liner		As agreed / required	A	Physical	One test for every 150m length of seam or as directed by EIC as per TS.	Technical Specification, const. Drawings and Manufacturer Recommendation	SR/TR	√	
26	**GEOTEXTILE**									
i	Material		As agreed / required	A	Review of	Each lot of delivery	Tech Specs and/ Const. Drawings	MTC/TR	√	
ii	Identification of Material		As agreed / required	B	Visual	Each lot of delivery	Technical Specification, const. Drawings and Manufacturer Recommendation	SR		All rolls of the geo-textile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number and roll dimensions.
iii	Acceptance of Installation		As agreed / required	A	Physical	Random	Technical Specification, const. Drawings and Manufacturer Recommendation	SR	√	
27	**INSTRUMENTATION**									
i		Instruments (piezometer, Water Level Sounder, surface settlement etc. as required in TS)	As agreed / required	A	Review of MTC	Each delivery at site	Tech Spec and drawings	TR/MTC	√	
ii		Installation of the instruments at required location	As agreed / required	B	Physical	100%	Tech Spec and drawings/ IS 7356 Part I	SR		
iii		check for functioning of instruments after installation.	As agreed / required	A	Physical	100%	Tech Spec and drawings	SR	√	The instruments shall be accepted by the Engineer only after all the instruments have been demonstrated to be in working condition and initial set of measurement of piezometer shall be taken.
		LEGENDS : * Records identified with tick (√) shall be essentially included by supplier in QA documentation. # Class A : Critical, Class B : Major, Class C : Minor. Class 'A' checks shall be witnessed by Employer FQA and Execution Engineer, Class 'B' checks shall be witnessed by Employer Execution Engineer, Class 'C' checks shall be witnessed by Main contractor engineer. CLASS 'A' &' B' CHECKS SHALL BE NTPC CHP STAGE. SR - Site Register, TR- Test Report, LB-Log Book, IR - Inspection Report, MTC - Manufacturer's Test Certificate. Surveillance of Class 'A' checks shall be perform By Employer Head (FQA), Class 'B' by Employer FQA Engineer and for class 'C' Another Executing Engineer authorised by Head (Executing Deptt)					For Employer Use	Employer DOC NO. :			
Main-supplier							REVIEWED BY	APPROVED BY		APPROVAL SEAL

VOLUME: II B

SECTION - D
(PART I)

SUB-SECTION – D 17

FABRICATION OF STRUCTURAL STEEL WORK

Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

C 0 N T E N T

CLAUSE NO.	DESCRIPTION	SHEET NO.
1.00.00	SCOPE	3
2.00.00	GENERAL	3
3.00.00	WORKMANSHIP	19
4.00.00	INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY	29
5.00.00	INFORMATION TO BE SUBMITTED	33
6.00.00	RATES AND MEASUREMENTS	34

SUB-SECTION – D XVII

FABRICATION OF STRUCTURAL STEEL WORK

1.00.00 SCOPE

This specification covers supply, fabrication, testing, painting and delivery to site of structural steelwork including supply of all consumable stores and rivets, bolts, nuts, washers, electrodes and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the contract.

2.00.00 GENERAL

2.01.00 Work to be provided for by the Contractor

The work to be provided for by the Contractor, unless otherwise specified elsewhere in the contract, shall include, but not be limited to the following

a) Preparation of complete detailed fabrication drawings and erection marking drawings required for all the structures covered under the scope of the contract based on the approved design drawings. As decided by the Engineer, some or all of these detailed drawings will have to be submitted for approval.

b) To submit revised design with calculations and detailed fabrication drawings in case any substitution of the designed sections are to be made.

c) To submit design calculations for joints and. connections developed by the contractor along with detailed fabrication drawings.

d) Furnish all materials, labour, tools and plant and all consumables required for fabrication and supply, all necessary rivets, bolts, nuts, washers, tie rods and welding electrodes for field connections,

e) Furnish shop painting of all fabricated steelwork as per requirements of this Specification.

f) Suitably mark, bundle, and pack for transport all fabricated materials.

g) Prepare and furnish detailed Bill of Materials, Drawing Office Dispatch lists, Rivet and Bolt List and any other list of bought out items required in connection with the fabrication and erection of the structural steelwork.

h) Insure, load and transport all fabricated steelwork field connection materials to site.

i) Maintain a fully equipped workshop at site for fabrication, modification and repairs of steelwork at site as may be required to complete the works in accordance with the Contract.

2.02.00 Work by others

No work under this specification will be provided for by any agency other than the contractor, unless specifically mentioned otherwise elsewhere in the contract.

2.03.00 Codes and standards

All work under this specification shall, unless otherwise specified in the contract, conform to the requirements of the latest revision and/or replacements of the following or any other relevant Indian Standard specifications and codes of practice. In case any particular aspect of the work is not specifically covered by any Indian Standard specification, any other standard practice, as may be specified by the Engineer shall be followed:

IS : 226 - Structural steel (Standard Quality)

IS : 800 - Code of Practice for general construction in steel.

IS : 806 - Code of practice for use of steel tubes in general building construction.

IS : 808 - Rolled steel beams, channels, and angle sections

IS : 813 - Scheme of symbols for welding

IS : 814 - Covered electrodes for metal arc welding of structural steel

IS : 815 - Classification and coding of covered electrodes for metal arc welding of structural steels.

IS : 816 - Code of practice for use of metal arc welding for general construction in mild steel

IS : 817 - Code of practice for training and testing metal arc welders

IS : 818 - Code of practice for safety and health requirements in electric and gas welding and cutting operations

IS : 822 - Code of practice for inspection of welds

IS : 919 - Recommendations for limits and fits for Engineering

IS : 961 - Structural Steel (High Tensile)

IS : 1148 - Rivet bars for structural purposes

IS : 1149 - High tensile rivet bars for structural purposes

IS : 1161 - Steel Tubes for structural purposes

IS : 1200 - Method of measurement of steelwork and ironwork (Part 8)

IS : 1239 - Mild Steel Tubes

IS : 1363 - Black hexagon bolts, nuts and lock nuts (dia. 6 to 30 mm) and black hexagon screws (dia 6 to 24 mm)

IS : 1364 - Precision and semi-precision hexagon bolts, screws, nuts and l locknuts (dia, range 6 to 39 mm)

IS : 1367 - Technical supply conditions for threaded fasteners

IS : 1442 - Covered electrodes for the metal are welding of high tensile structural steel

IS : 1608 - Method for tensile testing of steel products other than sheet strip, wire and tube

IS : 1730 - Dimensions for steel plate, sheet, and strip for structural and general engineering purposes.

IS : 1731 - Dimensions for steel flats for structural and general engineering purposes

IS : 1852 - Rolling and cutting tolerances for hot-rolled steel products

IS : 1977 - Structural steel (ordinary quality) St-42-0

IS : 2062 - Steel for General Structural Purposes

IS : 2074 - Ready mixed paint, red oxide Zinc chromate priming

IS : 2595 - Code of Practice for Radiographic Testing

IS : 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and Steel

IS : 2633 - Method for testing uniformity of coating on Zinc Coated Articles

IS : 3757 - High strength structural bolts

IS : 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel and other allied products

IS : 7205 - Safety Code for Erection of Structural Steelwork

IS : 7215 - Tolerances for fabrication of steel structures

IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels.

IS : 9595 - Recommendations for metal arc welding of carbon and carbon manganese steels.

2.04.00 Conformity with Designs

The contractor shall design all connections, supply and fabricate all steelwork and furnish all connection materials in accordance with the approved drawings and/or as instructed by the Engineer keeping in view the maximum Utilization of the available sizes and sections of steel materials. The methods of painting, marking, packing and delivery of all fabricated materials shall be in accordance with the provisions of the contract and/or as approved by the Engineer. Provision of all relevant Indian Standard Specifications and Codes of Practice shall be followed unless otherwise specified in the contract.

2.05.00 Materials to be used

2.05.01 General

All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section.

The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes,

the manufacturer shall furnish instructions giving recommended voltage and amperage (Polarity in case of D.C. supply) for which the electrodes are suitable.

2.05.02 Steel

All steel materials to be used in construction within the purview of this specification shall comply with any of the following Indian Standard Specifications as may be applicable:

a) IS : 2062 - Steel for general structural purposes

b) IS : 961 - Structural steel High Tensile

c) IS : 1977 - Structural steel (Ordinary quality) St-42-0

In case of imported steel materials being used, these shall conform to specifications equivalent to any of the above as may be applicable.

2.05.03 Rivet Steel

All rivet steel used in construction within the purview of this Specification shall comply with one of the following Indian Standard Specifications as may be applicable:

a) IS : 1148 - Rivet Bars for structural purpose

b) IS : 1149 - High tensile rivet bars for structural purposes. Where high tensile steel is specified for rivets, steps shall be taken to ensure that the rivets are so manufactured that they can be driven and heads formed satisfactorily without the physical properties of steel being impaired.

2.05.04 Electrodes

All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable

a) IS : 814 - Covered electrodes for metal arc welding of structural steel

b) IS : 815 - Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel

c) IS : 1442 - Covered electrodes for the metal arc welding of high tensile structural steel

d) IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels

2.05.05 Bolts and Nuts

All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners.

Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable.

a) Mild Steel

All mild steel for bolts and nuts when tested in accordance with the following Indian Standard Specification shall have a tensile strength of not less than 44 Kg/mm² and a minimum elongation of 23 per cent on a gauge length of 5.6 _/A, where "A" is the cross sectional area of the test specimen

i) IS: 1367: Technical supply conditions for threaded fasteners

ii) IS: 1608: Method for tensile testing of steel products other than sheet, strip, wire and tube

b) High Tensile Steel

The material used for the manufacture of high tensile steel bolts and nuts shall have the mechanical properties appropriate to the particular class of steel as set out in IS: 1367 or as approved by the Engineer.

2.05.06 Washers

Washers shall be made of steel conforming to any of the following Indian Standard Specifications as may be applicable under the provisions of the Contract:

a) IS : 2062 - Steel for general structural purposes

b) IS : 961 - Structural Steel (High Tensile Quality)

c) IS : 1977 - Structural steel (Ordinary Quality) St-42-0

d) IS : 6649 - Hardened washers

2.05.07 Paints

Paints to be used for shop coat of fabricated steel under the purview of this contract shall conform to the Indian Standard Specification IS: 2074 - Ready mixed Paint, Red oxide Zinc Chromate Priming.

2.06.00 Coal Bin

2.06.01 Shape of bins shall be circular, polygonal, square, or rectangular in plan. Bottom hopper portion may have be conical-cum-hyperbolic or any other profile shape as shown in the drawing. Bin shall be termed as bunkers or silos according to their shape and plane of rupture of coal.

2.06.02 For general requirements, fabrication and construction details IS: 9178 (Pt.l & 11) shall be followed as general guidance. The bins shall be fabricated and erected in segments.

2.06.03 The Coal bins shall be made of mild steel plates joined together with full strength butt weld and provided with stiffeners at regular interval. Stiffeners shall be provided on the external face and it may be welded with external face.

2.06.04 Bending of plates and rolled sections to the required shape for fabrication shall be done by plate bending machine or cold bending process Without resorting to heating, hammering, angle smithy and black smithy process.

2.06.05 Poking hole (manual or pneumatic) and striking plate shall be provided to facilitate coal flow. Poking holes shall have circular MS pipe and cover cap as detailed in the drawing.

2.07.00 New Erection Marks

2.07.01 Additional structures involving new erection marks may be required to be added at any stage of work.

2.07.02 All such new erection marks shall be detailed and included in marking schemes and fabrication carded out thereafter.

2.07.03 All such new erection marks shall be considered under item of original fabrication work. As a result of additional structures becoming necessary if the work is delayed beyond the time schedule stipulated, the Engineer shall give suitable extension of time provided he is satisfied about the reasonableness of the delay involved. However, no claim for extra payments or revision of rates due to delay shall be entertained.

2.08.00 ELECTRO FORGED STEEL GRATINGS

2.08.01 Factory made fabricated electro forged gratings unit with steel conforming to IS: 2062 shall be supplied, fabricated, transported, erected and aligned in floorings, platforms, drain and trench covers, walkways, passages, staircases with edge binding strips and anti skid nosing in treads etc.

2.08.02 All grating units shall be rectangular in pattern and electro forged. The size and the spacing of the bearing bars and cross bars shall be as detailed in fabrication drawings. The contractor shall submit the grating design for different spans and load intensities along with fabrication drawings. The depth of the grating unit shall be 40 mm, unless specified otherwise.

2.08.03 The gratings shall be made up in panel units designed to coincide with the span of the structural steel framing or openings as indicated in the design/ scope drawings. Maximum possible standardization of the grating panel sizes shall be tried and designed.

2.08.04 The grating unit shall be accurately fabricated and finished, free from wraps, twists, or any defects that would impair their strength, serviceability, and appearance.

2.08.05 Grating work shall include cut outs and clearance opening for all columns, pipes, ducts, conduits or any other installation penetrating through the grating work. Such cut outs and clearances shall be treated as specified in subsequent clauses.

2.08.06 The gratings shall be notched, trimmed and neatly finished around flanges and webs of the columns, moment connections, cap plates, and such other components of the steel structures encountered during the placement of the gratings. In all such cases, the trimming shall be done to follow the profile of the components encountered. After trimming, the binding strip shall be provided on the grating to suit the profile so obtained.

2.08.07 Opening in gratings for pipes or ducts that are 150mm in size or diameter or larger shall be provided with steel bar toe plates of not less than 5mm thickness and appropriate width, set flush with the bottom of the bearing bars.

2.08.08 Penetrations in gratings that are more than 50mm but less than 150mm in size or diameter shall be welded with plates of size shown in the detailed drawings set flush with the bottom of the grating panel.

2.08.09 Unless otherwise indicated on the drawings, grating units at all penetrations shall be made up in split section, accurately fitted and neatly finished to provide for proper assembly and erection at the job site.

2.08.10 Grating units shall be provided with all necessary clips, bolts, nuts and lock washers required for proper assembly and rigid installation and fastening to abutting units supporting structural steel framing members.

2.08.11 The gratings shall be of reputed make and manufacturer, as approved by Engineer. The unit rate quoted by him for this item shall be inclusive of transport of gratings to the project site, all taxes, duties etc. He shall also provide all facilities and access to the Engineer or his representative to carry out inspection during all stages of manufacturing of gratings.

2.08.12 Maximum deviation in linear dimension from the approved dimension shall not exceed 12mm.

2.08.13 All fabricated grating section and accessories shall be blast cleaned to near white metal surface (Sa 2½) followed by either of the following two:

(a) Two coats of red lead primer and two coats of black enamel finish paint.

(b) Hot dipped galvanization at 610 gm/sq.m.

in the shop prior to erection at site, as the approved drawing.

2.08.14 Prior to finishing all surfaces shall be cleaned, free from rust, mill scale, grease, oil, or any other foreign matter by blast cleaning. BS: 4232 shall be followed for blast cleaning.

2.08.15 Primer can be applied by spray guns or by brushes, however the finish paint shall necessarily be applied by means of spray guns. The applied coatings shall be uniform, free from voids and streaks; drilled or punched holes shall be touched up prior to erection or assembly.

2.09.00 GALVANIZATION OF GRATINGS

2.09.01 Purity of Zinc to be used-for galvanizing shall be 99.5% as per IS: 2 15

2.09.02 After the shop work is complete, the structural material shall be punched with erection mark and be hot double dip galvanized. Before galvanizing the steel section shall be thoroughly blast cleaned to near white metal surface (Sa 2½).

2.09.03 The weight of the zinc coating shall be at least 610 gm/m² - unless noted otherwise.

2.09.04 The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be cleaned and smooth and shall be free from defects like discoloured

patches, bare spots, unevenness of coating, spelter that is loosely attached to the steel, blistered surface, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

2.09.05 There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633.

2.09.06 When the steel section is removed from the galvanizing kettle, excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose.

2.09.07 Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specifications or lack of quality control in any manner in the galvanizing plant, shall render the entire, production in the relevant shift liable to rejection.

2.09.08 All structural steel shall be treated with sodium dichromate or an approved equivalent solution after galvanizing; so as to prevent white storage stains.

2.09.09 If the galvanizing of any member is damaged, the Engineer shall be shown of the extent of damage, if so directed the galvanizing may have to the redone in the similar manner as stated above at no extra cost to the Owner.

2.10.00 STAINLESS STEEL HOPPERS (As per BOQ item)

2.10.01 Material

In case SS Hopper is to be fabricated & erected as per BOQ item with SS415M, following specification shall be followed.
Stainless steel hopper of grade SS 415M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. SS 4 15M having the following chemical composition shall be used.

Material	**%**	**Remarks**
Carbon	10.03%	Max.
Silicon	1.60%	Max.
Manganese	0.80% to 1.50%	
Phosphorous	0.03%	Max.
Sulpher	0.03%	Max.

Chromium	10.80% to 12.50%	
Nickel	1.50%	Max.
Titanium	0.75%	Max.
Nitrogen	0.03%	Max.

The mechanical properties shall be as follows:

Description	**Value**	**Remarks**
Hardness Rock Well B Scale	90	Max.
Tensile Strength	450 MPa	Min.
Yield Strength	300 MPa	Min.
Elongation	25%	Min.

2.10.02 Fabrication

The fabrication, erection, alignment and welding shall be carried out as per the accepted practice and in accordance with relevant I.S. and international specification as well as stipulations contained herein. Fabrication drawings shall be prepared by the contractor on the basis of the design / scope drawings furnished by Engineer. The fabrication and erection works shall be done as per the approved fabrication drawings.

2.10.03 Fabrication Drawings

a) Fabrication drawing shall give the cutting plan for each hopper plate. Such, cutting plan shall be based on the size of the Stainless Steel plate available at store. In order to reduce the wastage and ensure the maximum utilization of stainless steel plate, the cutting plan shall take in the consideration of the reverse curvature and place the various elements of hopper plate in opposite fashion to reduce the end wastage. Similarly the hopper plate element having different radii shall be placed one inside the other, to optimize the stainless steel plate use. Such optimization may also required adjustment in the size of the each element of hopper plate and also additional weld joints.

b) The bill of material of hopper plate shall indicate the inner surface area of the hopper, weight of the hopper based on the inner surface area, weight of each of the cut plate of hopper fabrication, weight of cut and scrap pieces

generated. Contractor shall return to the Owner's store all unutilized (surplus) stainless steel plates and all waste and cut pieces generated. Non return of any part of the surplus/waste steel pieces to the Owner's store will call for the penal recovery at three (03) times the maximum procurement rate for the weight of stainless steel pieces not returned to the store.

c) In case the contractor does the cutting of the stainless steel without approved cutting plan then all the wastage (i.e. the difference between the weight of stainless steel plate cuts and the actual finished weight considered for the measurement for payment) shall be subjected to the penal recovery at the rate mentioned above.

2.10.04 Cuffing

Cutting may be affected by shearing, or by using plasma. The cut edges of all plates shall be perfectly straight and uniform through out. Cutting shall be done as per the cutting plan shown in the fabrication drawing. Should the Engineer find it necessary, the edges shall be ground smooth afterwards by contractor within the unit rates quoted by him. All the edge s shall be ground smooth before they are welded.

2.10.05 Jointing

Welding shall join stainless steel. All weld joints (along the inclined plane) shall be staggered. Any common welding process can weld stainless steel viz. MIG, metal arc or plasma using the covered compatible electrodes as per IS: 5206 or by inert gas arc welding as per IS: 2811. Shielding gas shall be Argon + Hydrogen mixture or Argon + Oxygen mixture. However, Argon + Oxygen mixture shall be preferred. Carbon-di-oxide mixture shall be avoided. 308L and 315L electrodes/fillers shall be used for the welding of Stainless Steel to Stainless Steel and Stainless Steel to Mild Steel respectively. However, the welding process and the type of the electrodes to be used for welding shall be as per welding procedure, as approved by the Engineer. On the basis of the welding procedure, the Contractor shall conduct qualification test.

2.10.06 Bending

The stainless steel plates shall be subjected to cold forming and bending in order to get the desired shape and profile.

2.10.07 Welding sequence

The type of electrodes, welding sequence, preheat and interpass temperature and post weld heat treatment shall be as approved by the Engineer.

2.10.08 Acceptance Criteria of Fabricated Structures

The acceptance of the fabricated structure work shall depend upon correct dimensions and alignment, absence of distortion in the structure, satisfactory results from the inspection and testing of the welded structure joints and the test specimens, general workmanship being good meeting the tolerance requirements given in IS: 7215.

2.11.00 BEARINGS

2.11.01 PTFE (Poly tetra fluorethylene) slide bearing

a) General

The bearings shall consist of upper and lower units. The upper unit shall include a sole plate with mirror finish stainless steel facing bonded to the bottom surface of the sole plate. The lower unit shall consist of a relevant laminated elastomers pad surfaced with PTFE. A rigid confining medium substructure bonds the PTFE to the pad. When the upper and lower units are mated the stainless steel slides on the PTFE surface with an extremely low coefficient of friction. These bearings shall be designed as per the performance requirements. The bearing shall be of reputed make and manufacturer as approved by Engineer, for required vertical loads, as per the construction drawings and for a maximum displacement of ± 50 mm.

b) Material

PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/cm². In order to prevent cold flow in the PTFE surface it shall be rigidly bonded by a special high temperature resistant adhesive to the stainless steel sub-strata. The stainless steel surface, which slides against the PTFE, is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of the stainless steel shall be between 1.0 to 1.5mm.

The resilient bearing pad shall consist of multiple layers of lightweight fabric impregnated with a high quality elastomer compound vulcanized into slabs of uniform standard thickness as per the requirement. This shall withstand vertical (compressive) load not less than 500 kg/cm² and shear loads upto 40 kg/cm².

c) Installation

The seating area for PTFE bearing shall be prepared accurately level and furnished with a thin layer of epoxy resin mortar. The bearing will be

placed on this layer while it is still workable and the bearing is levelled. The bearing should not be displaced as the beam is lowered into position. When the mortar and adhesive are fully set and the beam slightly above the top of the bearing. The upper surface of the bearing shall then be coated with sufficient thickness of epoxy resin mortar so that when the beam is lowered on to the temporary supports it comes into full contact with the mortar and some is squeezed out. The surplus shall be troweled off and after the mortar is fully set the temporary supports removed.

2.12.00 Storage of material

2.12.01 General

All materials shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged, shall be removed from the contractor's yard immediately, failing which, the Engineer shall be at liberty to get the material removed and the cost incurred thereof shall be realised from the Contractor. The Contractor shall maintain upto date accounts in respect of receipt, use, and balance of all sizes and sections of steel and other materials. In case the fabrication is carried out in contractor's fabrication shop outside the plant site where other fabrication works are also carried out, all materials meant for use in this contract shall be stacked separately with easily identifiable marks.

2.12.02 Steel

The steel to be used in fabrication and the resulting cut-pieces shall be stored in separate stacks off the ground section wise and lengthwise so that they can be easily inspected, measured, and accounted for at any time. If required by the Engineer, the materials may have to be stored under cover and suitably painted for protection against weather.

2.12.03 Electrodes

The electrodes for electric arc welding shall be stored in properly designed racks, separating different types of electrodes in distinctly marked compartments. The electrodes shall be kept in a dry and warm condition if necessary by resorting to heating.

2.12.04 Bolts, Nuts and Washers

Bolts, nuts and washers and other fastening materials shall be stored on racks off the ground with a coating of suitable protective oil. These shall be stored in separate gunny bags or compartments according to diameter, length, and quality.

2.12.05 Paints

Paints shall be stored under cover in air tight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened.

2.13.00 Quality Control

The Contractor shall establish and maintain quality control procedures for different items of work and materials to the extent he deems necessary to ensure that all work is performed in accordance with this specification. In addition to the Contractor's quality control procedures, materials and workmanship at all times shall be subjected to inspection by the Engineer or Engineer's representative. As far as possible, all inspection by the Engineer or Engineer's representative shall be made at the Contractor's fabrication shop whether located at Site or elsewhere. The Contractor shall co-operate with the Engineer or Engineer's representative in permitting access for inspection to all places where work is being done and in providing free of cost all necessary help in respect of tools and plants, instrument, labour and materials required to carry out the inspection. The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor.

Materials or workmanship not in reasonable conformance with the provisions of this Specification may be rejected at any time during the progress of the work.

The quality control procedure shall cover but not be limited to the following items of work

a) Steel: Quality manufacturer's test certificates, test reports of representative samples of materials from unidentified stocks if permitted to be used.

b) Rivets, Bolts, Nuts & Washers : Manufacturer's certificate, dimension checks, material testing.

c) Electrodes : Manufacturer's certificate, thickness and quality of flux coating.

d) Welders : Qualifying Tests

e) Welding sets : Performance Tests

f) Welds : Inspection, X-ray, Ultrasonic tests

g) Paints : Manufacturer's certificate, physical inspection

reports

h) Galvanizing : Tests in accordance with IS 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS : 4759 - Specification for Hot-Dip Zinc coatings on Structural Steel and other allied products.

2.14.00 Standard dimensions, forms and weights

The dimensions, forms, weights and tolerances of all rolled shapes rivets, bolts, nuts, studs, washers etc. and other members used in the fabrication of any structure shall, wherever applicable, conform to the requirements of the latest relevant Indian Standards, wherever they exist, or, in the absence of Indian Standards, to other equivalent standards.

2.15.00 Fabrication Drawings

The contractor shall within thirty (30) days after the award of the Contract submit to the Engineer the Schedule of Fabrication and erection of structural Steelworks, for approval. Within one week after receipt of approval on design of any steel structure (part or full) based on the approved design. As decided by the Engineer, six (6) copies each of some or all of the detailed fabrication drawings will have to be submitted for approval.

The sequence of preparation of fabrication drawings shall match with the approved fabrication and erection schedule. The above-mentioned approval for fabrication drawings will be accorded only towards the general conformity with the design requirements as well as specifications. The approval of drawing however shall not relieve the contractor of his sole responsibility in carrying out the work correctly and fulfilling the complete requirements of contract documents.

The fabrication drawings shall include but not limited to the following:

a) Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections.

b) Dimensional drawings of base plates, foundation bolts location etc.

c) Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings.

d) Complete Bill of Materials and detailed drawings of all sections as also their billing weights.

e) Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof.

These drawings shall give all the necessary information for the fabrication, erection, and painting of the steelwork in accordance with the provisions of this Specification. Fabrication drawings shall be made in accordance with the best modern practice and with due regard to sequence, speed and economy in fabrication and erection. Fabrication drawings shall give complete information necessary for fabrication of the various components of the steelwork, including the location, type, size, and extent of welds. These shall also clearly distinguish between shop and field rivets, bolts, and welds and specify the class of bolts and nuts. The drawings shall be drawn to a scale large enough to convey all the necessary information adequately. Notes on the fabrication drawings shall indicate those joints or groups of joints in which it is particularly important that the welding sequence and technique of welding shall be carefully controlled to minimize the locked up stresses and distortion. Welding symbols used shall be in accordance with the requirements of the Indian Standard Specification. IS: 813 - Scheme of symbols for Welding, and shall be consistent throughout. Weld lengths called for on the drawings shall mean the net effective length.

The Contractor shall be responsible for and shall carry out at his cost any alterations of the work due to any discrepancies, errors or omissions on the drawings or other particulars supplied by him, whether such drawings or other particulars have been duly approved or not in accordance with the Contract.

3.00.00 WORKMANSHIP

3.01.00 Fabrication

3.01.01 General

All workmanship shall be equal to the best practice in modern structural shops, and shall conform to the provisions of the Indian Standard IS: 800 - Code of Practice for general construction in steel and other relevant Indian Standards or equivalent.

3.01.02 Straightening Material

Rolled materials before being laid off or worked, must be clean, free from sharp kinks, bends or twists and straight within the tolerances allowed by the Indian Standard Specification on IS: 1552 - Specification for rolling and cutting tolerance for hot-rolled steel products. If straightening is necessary, it may be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 600°C.

3.01.03 Cutting

Shearing, cropping, or sawing shall affect cutting. Use of a mechanically controlled gas-cutting torch may be permitted for mild steel only. Gas cutting of high tensile steel may also be permitted provided special care is taken to leave sufficient metal to be removed by machining, so that all metal that has been hardened by flame is removed. Gas cutting without a mechanically controlled torch may be permitted if special care is taken and done under expert hand, subject to the approval of the Engineer.

To determine the effective size of members cut by gas, 3 mm shall be deducted from each cut edge. Gas cut edges, which will be subjected to substantial stress or which are to have weld metal deposited on them, shall be reasonably free from gouges, occasional notches or gouges not more than 4 mm deep will be permitted. Gouges greater than 4 mm that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch free to a radius of at least 12 mm. Shearing, cropping and gas cutting shall be clean, reasonably square and free from any distortion.

3.01.04 Planning of edges

Planning or finishing of sheared or cropped edges of plates or shapes or of edges gas-cut with a mechanically controlled torch shall not be required, unless specifically required by design and called for on the drawings, included in a stipulation for edge preparation for welding or as may be required after the inspection of the cut surface. Surface cut with hand-flame shall generally be ground, unless specifically instructed otherwise by the Engineer.

3.01.05 Clearances

The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 2 mm at each end. The erection clearance at ends of beams web shall be not more than 3 mm at each end, but where for practical reasons greater clearance is necessary, suitably designed cheatings shall be provided.

3.02.00 Riveted and bolted construction

3.02.01 Holes

Holes through more than one thickness of material for members, such as compound stanchions and girder flanges, shall be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, if the thickness of the material is not greater than the nominal diameter of rivet or bolt plus 3 mm subject to a maximum thickness of 16 mm

provided that the holes are punched 3 mm less in diameter than the required size and reamed after assembly to the full diameter.

Holes for rivets or black bolts shall be not more than 1.5 mm or 2.0 mm (depending on whether the diameter of the rivet or bolt is less or more than or equal to 25 mm) larger in diameter than the nominal diameter of the rivet or black bolt passing through them.

Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to a tolerance grade of BS as specified in IS: 919. Parts to be connected shall be firmly held together by tacking welds or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all thickness in one operation shall be drilled to a smaller size and reamed out after assembly.

Holes for rivets or bolts shall not be formed by gas cutting process.

3.02.02 Assembly

All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting to enlarge unmatching holes shall not generally be permitted. In case drifting is permitted to a slight extent during assembly, it shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the rivets or bolts shall be reamed. Poor matching of holes shall be cause for rejection .The component parts shall be so assembled that they are neither twisted not otherwise damaged, and shall be so prepared that the specified cambers, if any, are maintained.

Rivets shall ordinarily be hot driven, in which case their finished heads shall be approximately hemispherical in shape and shall be of uniform size throughout the work for rivets of the same size full, neatly finished and concentric with he holes. Rivets shall be heated uniformly to a temperature not exceeding 1 125°C they shall not be driven after their temperature has fallen below 540°C.

Rivets shall be driven by power riveters, of either compression or manually operated type, employing pneumatic, hydraulic or electric power. Hand driven rivets shall not be allowed unless in exceptional cases specifically approved by the Engineer. After driving, rivets shall be tight, shall completely fill the holes and their heads shall be in full contact with the surface. In case of countersunk rivets, the countersinking shall be fully filled by the rivet, any proudness of the countersunk head being dressed off flush, if required.

Riveted members shall have all parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single

riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

All loose, burnt, or otherwise defective rivets shall be cut out and replaced and special care shall be taken to inspect all single riveted connections. Special care shall also be taken in heating and driving long rivets. The Contractor shall prove the quality of riveting by cutting some rivets chosen at random by the Engineer. No extra payment will be made to the Contractor for such cutting and replacing. Riveting work, for any particular section or group, will be considered satisfactory when at least 90% of the corresponding cut rivets is found to be sound. If the ratio is below 75%, all the rivets in the particular section or group shall be cut, removed and replaced and tested again at the Contractor's expense. For cases between 75% and 90% the engineer shall have the option to instruct cutting and replacing any number of further rivets at the Contractor's cost as he deems necessary.

Bolted construction shall be permitted only in case of field connections if called for on the Drawings and is subjected to the limitation of particular connections as may be specified. In special cases, however, shop bolt connections may be allowed if shown on drawing or directed by the Engineer.

Washers shall be tapered or otherwise suitably shaped, where necessary, to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project trough the nut at least one thread. In all cases the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. In addition to the normal washer one spring washer or lock nut shall be provided for each bolt for connections subjected to vibrating forces or otherwise as may be specified on the Drawings.

3.03.00 Welded Construction

3.03.01 General

Welding shall be in accordance with relevant Indian Standards and as supplemented in the Specification. Welding shall be done by experienced and good welders who have been qualified by tests in accordance with IS: 817.

3.03.02 Preparation of material

Surface to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material except that mill scale, which withstands vigorous wire brushing, may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch.

3.03.03 Assembling

Parts to be fillet welded shall be brought in, as close contact as practicable and in no event shall be separated by more than 4 mm. If the separation is 1.5 mm or greater, the size of the fillet welds shall be increased by the amount of the separation. The fit of joints at contact surfaces, which are not completely sealed by, welds, shall be close enough to exclude water after painting. Abutting parts to be butt-welded shall be carefully aligned. Misalignments greater than 3 mm shall be corrected and in making the correction the parts shall not be drawn into a sharper slope than two degrees (2°).

The work shall be positioned for flat welding whenever practicable.

3.03.04 Welding Sequence

In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as will avoid needless distortion and minimize shrinkage stresses in the closing welds of a rigid assembly, such closing welds shall be made in compression elements.

In the fabrication of cover-plated beams and built-up members, all shop splices in each component part shall be made before such component part is welded to other parts of the member. Long girders or girder sections may be made by shod splicing not more than three sub-sections, each made in accordance with this paragraph.

When required by the Engineer, welded assemblies shall be stress relieved by heat-treating in accordance with the provisions of the relevant Indian Standard or any other Standard approved by the Engineer.

3.03.05 Welding technique

All complete penetration groove welds made by manual welding, except when produced with the aid of backing material not more than 8 m thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Groove welds made with the use of the backing of the same material, as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips need not be removed. If required, they may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal and the weld metal surface is left flush or slightly convex with full throat thickness.

Groove welds shall be terminated at the ends of a joint in a manner that will

ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract.

To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards.

3.03. 12 Temperature

No welding shall normally be done on parent material at a temperature below (-) 5°C. However, if welding is to undertaken at low temperature, adequate precautions as recommended in relevant Indian Standard shall be taken. When the parent material is less than 40 mm thick and the temperature is between (-) 5°C and 0°C, the surface around the joint to a distance of 100 mm or 4 times the thickness of the material, whichever is greater, shall be preheated till it is hand warm. When the parent material is more than 40 mm thick, the temperature of the area mentioned above shall be in no case be less than 20°C. All requirements regarding preheating of the parent material shall be in accordance with the relevant Indian Standard.

3.03. 13 Peening

Where required, intermediate layers of multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool, peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peening.

3.03. 14 Equipment

These shall be capable of producing proper current so that the operator may produce satisfactory welds. The welding machine shall be of a type and capacity as recommended by the manufacturers of electrodes or as may be approved by the engineer.

3.04.00 Finish

Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-butted over the whole section with a clearance not exceeding 0.1 mm locally at any place. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc; after welding/riveting together, should be accurately machined so that the parts connected butt over the entire surfaces of contact. Care should be taken that those connecting angles of channels are fixed with such accuracy that they are not reduced in thickness by machining by more

than 1.0 mm.

3.05.00 Slab bases and caps

Bases and caps fabricated out of steel slabs, except when cut material with true surface, shall be accurately machined over the bearing surface and shall be in effective contact with the end of the stanchion. A bearing face, which is to be grouted direct to a foundation, need not be machined if such face is true and parallel to the upper face.

To facilitate grouting, holes shall be provided, where necessary, in stanchion bases for the escape of air.

3. 12.00 Lacing bars

The ends of lacing bars shall be neat and free from burns.

3. 13.00 Separators

Rolled section or built-up steel separators or diaphragms shall be required for all double beams except where encased in concrete, in which case, pipe separators shall be used.

3.14.00 Bearing Plates

Provision shall be made for all necessary steel bearing plates to take up reaction of beams and columns and the required stiffeners and gussets whether or not specified in Drawings.

3.15.00 Floor Grating

All grating units shall be rectangular in pattern and of pressure locked assembly. The size and spacing of bearing bars and cross bars shall be as approved in detailed drawings. Alternatively diamond pattern grating if approved may be used.

The grating shall be made in panel units designed to span as indicated in structural steel framing drawing or as directed by the Engineer.

The grating units shall be finished free from warps, twists, or any other defects. Grating work shall include cutouts and clearance openings for all columns, pipes, ducts, conduits etc. The gratings shall be notched, trimmed, and neatly finished around components of the steel structures encountered.

Binding strip shall be provided on the grating to suit the profile. Openings in gratings shall be provided with steel bar toe plates of not less than 5 mm thickness and 100 mm width.

Unless otherwise indicated on drawings, all penetrations of grating units shall be made up in split section, accurately fitted, and neatly finished. Grating units shall be provided with all necessary clips, bolts, lock washers etc. for proper assembly and installation on supporting steel members. Maximum deviation in linear dimension shall not exceed 12 mm.

3.10.00 Chequered Plates

Minimum thickness of chequered plate floorings, covers etc. shall be 6 mm O/P. Chequered plate shall be accurately cut to the required sizes and shapes and the cut edges properly ground. Stiffeners shall be provided wherever required from design consideration.

3.11.00 Architectural Clearances

Bearing plates and stiffener connections shall not be permitted to encroach on the designed architectural clearances.

3.11.00 Shop connections

a) All shop connections shall be otherwise riveted or welded as specified on the Drawings.

b) Heads of rivets on surfaces carrying brick walls shall be flattened to 10 mm thick projection.

c) Certain connections, specified to be shop connections, may be changed to field connections if desired by the Engineer for convenience of erection and the contractor will have to make the desired changes at no extra cost to the exchequer.

3.13.00 Castings

Steel castings shall be annealed.

3.14.00 Shop erection

The steelwork shall be temporarily shop-erected complete or as directed by the Engineer so that accuracy of fit may be checked before dispatch. The parts shall be shop-erected with a sufficient number of parallel drifts to bring and keep the parts in place. In case of parts drilled or punched using steel jigs to make all similar parts interchangeable, the steelwork shall be shop erected in

such a way as will facilitate the check of interchange ability.

3.15.00 Shop painting

3.15.01 General

Unless otherwise specified, steelwork, which will be concealed by interior building finish, need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned, in accordance with the following paragraph, by brush, spray, roller coating, flow-coating or dipping as may be approved by the Engineer.

After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing or by other methods of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by the solvent. Steelwork specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt and other foreign material by trough sweeping with a fibre brush.

3.15.02 Inaccessible parts

Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint, Positively of different colours to prove application of two coats before assembly. This does not apply to the interior of sealed hollow sections.

3.15.03 Contact surfaces

Contact surface shall be cleaned in accordance with sub-clause 3.13.1 before assembly.

3.15.04 Finished surfaces

Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

3.15.05 Surfaces adjacent to field welds

Unless otherwise provided for, surfaces within 50 of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

3.16.00 Galvanizing

3.16.01 General

Structural steelwork for switchyard or other structures as may be specified in the contract shall be hot dip galvanized in accordance with the American Society for Testing and Materials Specification ASTM-A 123 or IS: 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and steel. Where the steel structures are required to be galvanized the field connection materials like bolts, nuts and washers shall also be galvanized.

3.16.02 Surface Preparation

All members to be galvanized shall be cleaned, by the process of pickling of rust, loose scale, oil, grease, slag and spatter of welded areas and other foreign substances prior to galvanizing. Pickling shall be carried out by immersing the steel in an acid bath containing either sulphuric or hydrochloric acid at a suitable concentration and temperature. The concentration of the acid and the temperature of the bath can be varied, provided that the pickling time is adjusted accordingly.

The pickling process shall be completed by thoroughly rinsing with water, which should preferably be warm, so as to remove the residual acid.

3.16.03 Procedure

Galvanizing shall be carried out by hot dip process in a proper and uniformly heated bath. It shall meet all the requirements when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS: 4759 - Specification for Hot-dip zinc coatings on Structural Steel & other allied products.

After finishing the threads of bolts, galvanizing shall be applied over the entire surface uniformly. The threads of bolts shall not be machined after galvanizing and shall not be clogged with zinc. The threads of nuts may be tapped after galvanizing but care shall be taken to use oil in the threads of nuts during erection.

The surface preparation for galvanizing and the process of galvanizing itself, shall not adversely affect the mechanical properties of the materials to be galvanized. Where members are of such lengths as to prevent complete dipping in one operation, great care shall be taken to prevent warping.

Materials on which galvanizing has been damaged shall be acid stripped and re-galvanized unless otherwise directed, but if any member becomes damaged after leaving been dipped twice, it shall be rejected. Special care shall be taken

not to injure the skin on galvanized surfaces during transport, handling, and erection. Damages, if occur, shall be made good in accordance or as directed by the Engineer.

4.00.00 INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY

4.01.00 Inspection

Unless specified otherwise, inspection to all, work shall be made by the or Engineer's representative at the place of manufacture prior to delivery. The Engineer or his representative shall have free access at all reasonable times to those parts of the manufacturer's works which are concerned with the fabrication of the steelwork under this Contract and he shall be afforded all reasonable facilities for satisfying himself that the fabrication is being done in accordance with the provisions of this Specification.

The Contractor shall provide free of charge, such labour, materials, electricity, fuel, water, stores, tools and plant, apparatus and instruments as may be required by the Engineer to carry out inspection and/or tests in accordance with the Contract. The Contractor shall guarantee compliance with the provisions of this Specification.

4.02.00 Testing and Acceptance Criteria

4.02.01 General

The Contractor shall carry out sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own Cost. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test.

4.02.02 Steel

All steel supplied by, the Contractor shall conform, to the relevant Indian Standards. Except otherwise mentioned in the contract, only tested quality steel having mill test reports shall be used. In case unidentified steel materials are permitted to be used by the Engineer, random samples of materials will be taken from each unidentified lot of 50 M.T or less of any particular section for tests to conform to relevant Indian Standards. Cost of all tests shall be born by the contractor.

All material shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance.

4.02.02 Welding

a) The weld surface shall be cleaned with steel wire brush to remove spatter metal, slag etc. and 100% of welds shall be inspected visually for size, length of weldment and external defects. Weld gauges shall be used for checking weld sizes. The surface shall be clean with regular beads and free from slags, cracks, blow-holes etc.

b) Non-destructive examination shall be carried out to determine soundness of weldments as follows:

i) 10% at random on fillet-joints.

ii) 100% on all butt-joints.

c) Should the ND tests indicate defects like improper root penetration, extensive blowholes, slag intrusion etc., such welds shall be back gauged, joints prepared again and rewelded. All defects shall be rectified by the Contractor at no extra costs.

d) All electrodes shall be procured from approved reputed manufacturers with test certificates. The correct grade and size of electrode, which has not deteriorated in storage, shall be used. The inspection and testing of welding shall be performed in accordance with the provisions of the relevant Indian Standards or other equivalents. For every 50 tones of welded fabrication, the Engineer may ask for 1(one) test-destructive or non-destructive including X -ray, ultrasonic test or similar, the cost of which shall be borne by the Contractor.

4.02.04 Rivets, bolts, nuts and washers

All rivets, bolts, nuts, and washers shall be procured from M/s. Guest Keen William Ltd. or equivalent and shall confirm to the relevant Indian Standards. If desired by the Engineer, representative samples of these materials may have to be tested in an approved laboratory and in accordance with the procedures described in relevant Indian Standards. Cost of all such testing shall have to be borne by the Contractor. In addition to testing the rivets by hammer, 2% (two per cent) of the rivets done shall have to be cut off by chisels to ascertain the fit, quality of material and workmanship. The removal of the cut rivets and re-installing new rivets shall be done by the Contractor at his own cost.

4.02.05 Shop painting

All paints and primers shall be of standard quality and procured from approved

manufacturers and shall conform to the provisions of the relevant Indian Standards.

4.02. 12 Galvanizing

All galvanizing shall be uniform and of standard quality when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and 15: 4759 - specification for Hot-Dip Zinc Coatings on Structural Steel & other allied products.

4.03.00 Tolerance

The tolerances on the dimensions of individual rolled steel components shall be as specified in IS: 1852 - specification for rolling and Cutting Tolerances for Hot-rolled Steel Products. The tolerances on straightness, length etc. of various fabricated components (such as beams and girders, columns, crane gantry girder etc.) of the steel structures shall be as specified in IS: 721 - Tolerances for Fabrication of Steel Structures.

4.04.00 Acceptance

Should any structure or part of a structure be found not to comply with any of the provisions of this specification, the same shall be liable to rejection. No Structure or part of the structure once rejected, shall be offered again for test, except in cases where the Engineer considers the defects rectifiable. The Engineer may, at his discretion, check some of the tests at an appropriate laboratory at the contractors cost.

When all tests to be performed in the Contractor's shop under the terms of this contract have been successfully carried out, the steelwork will be accepted forthwith and the Engineer will issue acceptance certificate, upon receipt of which, the items will be shop painted, packed and dispatched. No item to be delivered unless an acceptance certificate for the same has been issued. The satisfactory completion of these tests or the issue of the certificates shall not bind the Owner to accept the work, should it, on further tests before or after erection, be found not in compliance with the Contract.

4.05.00 Delivery of materials

4.05.01 General

The Contractor will deliver the fabricated structural steel materials to site with all necessary field connection materials in such sequence as will permit the most efficient and economical performance of the erection work. The Owner may prescribe or control the sequence of delivery of materials, at his own

discretion.

4.05.02 Marking

Each separate piece of fabricated steelwork shall be distinctly marked on all surfaces before delivery in accordance with the markings shown on approved erection drawings and shall bear such other marks as will further facilitate identification and erection.

4.05.03 Shipping

Shipping shall be strictly in accordance with the sequence stipulated in the agreed Programme. Contractor shall dispatch the materials to the e worksite securely protecting and packing the materials to avoid loss or damage during transport by rail, road or water. All parts shall be adequately braced to prevent damage in transit.

Each bundle, bale or package delivered under this contract shall be marked on as many sides as possible and such distinct marking (all previous irrelevant markings being carefully obliterated) shall show the following:

a) Name and address of the consignee

b) Name and address of the consignor

c) Gross weight of the package in tonnes and its dimensions

d) Identification marks and/or number of the package

e) Custom registration number, if required

All markings shall be carried out with such materials as would ensure quick drying and indelibility.

Each component or part or piece of material when shipped, shall be indelibly marked and/or tagged with reference to assembly drawings and corresponding piece numbers.

Each packing case shall contain in duplicate in English a packing list pasted on to the inside of the cover in a water-proof envelope, quoting especially -

a) Name of the Contractor

b) Number and date of the Contract

c) Name of the office placing the contract

d) Nomenclature of stores

e) A schedule of parts or pieces, giving the parts or piece number with reference to assembly drawings and the quantity of each.

The shipping dimensions of each packing shall not exceed the maximum dimensions permissible for transport over the Indian Railways/Roads.

After delivery of the materials at site, all packing materials shall automatically become the property of the Owner.

Notwithstanding anything stated hereinbefore, any loss or damage resulting from inadequate packing shall be made good by the Contractor at no additional cost to the Owner. When facilities exist, all shipments shall be covered by approved Insurance Policy for transit at the cost of the Contractor.

The contractor shall ship the complete materials or part on board a vessel belonging to an agency approved by the Owner or on rail and/or road transport as directed. The Contractor shall take all reasonable steps to ensure correct appraisal of freight rates, weights and volumes and in no case will the Owner be liable to pay any warehouse, wharfage, demurrage and other charges.

If, however, the Owner has to make payment of any of the above-mentioned charges, the amount paid will be deducted from the bills of the Contractor.

Necessary advise regarding the shipment with relevant details shall reach the Engineer at least a week in advance.

5.00.00 INFORMATION TO BE SUBMITTED

5.01.00 With Tender

The following information is required to be submitted with the Tender:

a) Progress Schedule

The Contractor shall quote in his Tender a detailed schedule of progress of work and total time of completion, itemizing the time required for each of the following aspects of work.

i) Preparation and approval of fabrication drawing

ii) Procurement of Materials

iii) Fabrication and shipping of all anchor bolts

iv) Fabrication and shipping of main steelwork.

v) Fabrication and shipping of steelwork for bunkers, tanks and/or silos as applicable.

vi) Fabrication and shipping of all other remaining steelwork including miscellaneous steelwork.

vii) Final date of completion of all shipments.

b) Shop

Location of the Tenderer's fabrication workshop giving details of equipment, manpower, the total capacity, and the capacity that will be available exclusively for this contract shall be submitted.

5.02.00 After Award

After award of the Contract the successful Tenderer is to submit the following:

a) Complete fabrication drawings, material lists, cutting lists, rive and bolt lists, field welding schedules based on the approved design drawings prepared by him in accordance with the approved schedule.

b) Monthly Progress Report with necessary photographs in six (6) copies to reach the Engineer on or before the 7th day o. each month, giving the up-to-date status of preparation of detailed shop drawings, bill of materials, procurement of materials, actual fabrication done, shipping and all other relevant information.

c) Detailed monthly material reconciliation statements relevant to the Work done and reported in the Progress Report, giving the stock at hand of raw steel, work in progress, finished materials.

d) Results of any test as and when conducted and as require by the engineer.

e) Manufacturer’s mill test report in respect of steel materials, rivets, bolts, nuts, and electrodes as may be applicable.

6.00.00 RATES AND MEASUREMENT

6.01.00 Rates

6.01.01 The items of work in the Schedule of items describe the work in brief. The various items of the Schedule of items shall be read in conjunction with these specifications including amendments and additions, general conditions of

contract, special conditions of contracts, and other tender documents, if any. For each item of Schedule of Items, the bidder's rates shall include the activities covered in the description of the item as well as all necessary operations described in the Specifications.

6.01.02 The bidder's rates shall include cost of all minor details which are obviously and fairly intended and which may not have been included in the description in these documents but are essential for the satisfactory completion of the work. Rates shall also include for taking all safety measures.

6.01.03 The bidder's -rates for all items of schedule of items shall include complete cost towards plant, equipment, erection and dismantling of scaffolding, men, materials and consumables, skilled and unskilled labour, levies, taxes, royalties, duties, transport, storage, repair/rectification/maintenance until handing over, contingencies, overhead and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work.

6.01.04 No claims shall be entertained, if the details shown on the `Released for Construction' drawings differ from those shown on the bid/tender drawings.

6.01.05 Rates shall be inclusive of all leads and lifts/elevation.

6.01.06 The bidder's rates for Structural Steel shall include for fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, erection scheme, alignment, welding, including preheating and post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus/waste steel materials including cut pieces/waste steel, provision of additional butt/weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work.

The rates for fabrication are inclusive of all tests on welds and material and no extra shall be payable for quality tests specified for fabrication of structure in shop or at site.

Separate BOQ items for test on welds like radiography or Ultrasonic, DPT, magnetic particle tests are kept for tests on material/fabrication not covered under regular fabrication item of BOQ.

6.01.07 The bidder's rates for foundation bolts assembly shall include fabrication, threading, heat treatment, erection, installation, and alignment of complete bolt

assembly with nuts, locknuts, anchor plates, stiffener plates, protective tape, etc. This shall also include the cost of all materials not issued by the Owner. Material issued by Owner will be specified in GCC.

6.01.08 The bidders rates for application of inorganic primer shall include surface preparation to near white metal surface by blast cleaning, abrasives, touch up painting, suitable enclosure to avoid contamination and the necessary statutory approval from the factory inspector/pollution control board etc. regarding the method of blast cleaning and abrasives used, and getting approval of the specialized agency supplying the primer specified.

6.01.09 The bidder's rates for application of finish painting system shall include surface preparation, application of intermediate (under) coat, finish coat and final finish coat, and getting approval of the specialized agency supplying the finish paint.

6.01.10 The bidder's rates for electro-forged gratings (if specified) shall include supply, fabrication, transportation to the site, erection and alignment of factory made electro-forged gratings, all taxes, duties thereon etc. The rates shall also include preparation of grating design for different spans and load intensifies, preparation of design and fabrication drawings, edge preparation, blast cleaning followed by finish paint.

6.01.11 The bidder's rates for galvanization of factory made electro-forged gratings (if specified) shall include the application of hot dipped galvanization as finish over the fabricated gratings and the treatment to be given for prevention of white storage stains, as per the technical Aspiration.

6.01.12 The bidder’s rates for permanent mild steel bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types of Structural Steel works, as per the technical specification.

6.01.13 The bidder’s rates for high strength structural bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types, of Structural Steel works, as per the technical specification.

6.01.14 The bidder’s rates for dismantling, additions to, alterations in and/or modifications shall be inclusive of all operations such as lowering of material, carriage etc., as mentioned in the technical specification. Unutilised steel pieces cut/removed shall be returned to the project stores free of charge. Non-return of unublized steel pieces to the Owner's store would be considered as wastage and recovery would be affected as per the provision of contract for structural steel consumption. This shall not include the weight of temporarily dismantled/supported members, connected member.

The bidder should prepare an optimised cutting plan as per fabrication

drawing to utilise the steel material upto maximum extent and minimise the wastage/scrap. Quantity of wastage/scrap of material should be limited to the percentage mentioned elsewhere in the conditions of tender/ contract specifications.

6.01.15 The bidder's rates for re-erection of erection marks after additions to, alterations in and/or modifications shall be inclusive of all operations mentioned in technical specification for the calculated weight of the rectified/modified erection mark rejected at site. This shall not include the weight of temporarily dismantled/supported members, connected member. All the operations mentioned above for restoring such members shall be carried out at no extra cost. The work of erection of any erection mark which has not been dismantled but have been modified/rectified before erection shall not be paid under this item but shall be paid under relevant item of fabrication and erection of steel work of Schedule of items for the modified weight.

6.01.16 The bidder's rates for PTFE shall include design, supply, transportation of the complete assembly with guides and dust protection cover and installation of bearings in position drilling, bolting, erecting aligning etc. along with any taxes, duties thereon etc.

6.01.17 The bidder's rates for Stainless Steel hopper (if specified) shall include fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, all other operations mentioned in the technical specification. The rates shall also include for erection scheme, alignment, making cutting plan, cutting, jointing, bending, rolling, grinding, drilling, bolting, assembly, edge preparation, welding including pre-heating, post-heating, testing of welders, inspection of welds, inspection and testing, protection against damage in transit, stability of structures, installation of temporary structures etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus / waste steel materials including cut pieces/waste steel, provision of additional butt / weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work.

6.01.18 The bidders rates for preformed flexible open ended bellow strap of neoprene (if specified) shall include supply and transportation, installation in position, drilling, bolting, aligning etc. complete along with any taxes, duties thereon etc.

6.01.19 The bidder's rates for Stainless Steel Hand Rail (if specified) shall include complete Hand Rail including, materials, fabrication, grinding & finishing, stainless steel beading, stainless steel cleats, stainless steel fasteners, neoprene gaskets, preparation of shop drawing but excluding the cost of glazing. The Owner shall supply no material for this item of work.

6.02.00 MODE OF MEASUREMENT

6.02.01 The measurement for the item of foundation bolts assembly including that of nuts; locknuts shall be based on the calculated weight of steel installed in Metric Tonne, corrected to second place of decimal. The weight of the foundation bolt shall be calculated in the same way as that done for the item of fabrication, erection, alignment of structural steel. The weight of the nut / locknut shall be taken as per actual weight supplied by the contractor and accepted by the Engineer.

6.02.02 The measurement for the item of fabrication, erection, alignment, welding, etc. of structural steel work shall be based on the approved weight of steel nearest to a Kg, by applying the unit weight as adopted at the time of issue of structural steel on the measurements worked out as given below.

6.02.03 For ISMB, ISMC, ISA, flats, round bars, square bars and pipes, length shall be taken as per distance between planes normal to the axis of the member passing through the extreme points of the section.

6.02.04 Gussets plates in trusses, and bracings, brackets plates, stiffeners, and skew cuts if any in plates for butt welds, the area shall be assumed as the minimum circumscribed rectangle. However deduction for any notch/skew cut shall be made as mentioned in clause no-6.02.06.

6.02.05 For bunker wall plates, the minimum-circumscribing rectangle of the individual plate/pieces out of which these wall plates are assembled by butt-welding, shall be measured. Care shall be taken to ensure maximum utilization of cut-pieces generated by providing extra butt joints (for which no extra payment shall be made).

6.02.06 For all other plates, where the area of any notch/skew cut in the plate is less than 0.05 sq.m. the area of the plate shall be assumed as that of the minimum circumscribing rectangle for the purpose of measurement and calculation of area for the purpose of payment. However, if the area of any notch/skew cuts in a plate is more than 0.05 sq.m, the area of notch/skew cut shall be deducted from assumed minimum circumscribing rectangular area for the purpose of payment.

6.02.07 No deduction shall be made for the hole in the members, if the area of individual hole is less than 0.05 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.05 sq.m.

6.02.08 All cut-pieces and scrap generated due to cutting of holes, skew-cuts of plates, gussets, brackets, stiffeners, etc. shall be stacked separately and handed over to the project stores without being considered for material accounting as the

circumscribing rectangle has been considered for payment.

6.02.09 The splice plate shown in the fabrication drawing or approved by the Engineer shall only be measured for payment.

6.02.10 The weight of permanent bolts, washers and nuts and welds shall not be included in the weights of the members. No extra payment shall be made for welding/bolting.

6.02.11 The bolts and nuts required for erection purpose shall not be paid for and may be taken away by the Contractor after final welding for members. Erection boltholes left after removal of erection bolts shall be suitably plugged with welds.

6.02.12 The measurement for the item of application of inorganic primer including blast cleaning of steel surfaces shall be based on the weight on which the zinc silicate primer is applied, after blast cleaning in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for payment of the item of fabrication and erection of structural steel works.

6.02.13 The measurement for the item of application of finish primer system shall be based on the weight on which the epoxy based finish primer is applied in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for payment of the item of fabrication and erection of structural steel works.

6.02.14 The measurement for the item of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor, and accepted by the Engineer. Nothing extra shall be payable for making cutouts, notches, openings of any profile, trimming profiles etc. in the grating units.

6.02.15 The measurement for the item of hot dipped galvanization of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal of gratings galvanized by the Contractor and accepted by the Engineer.

6.02.16 The measurement for the item of permanent bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.

6.02.17 The measurement for the item of High Strength Structural bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.

6.02.18 The measurement for the item of the work of dismantling, additions, alterations, reerection etc. shall be as given below

6.02.19 For dismantling, the unmodified weight of the actually dismantled erection marks shall only be measured.

6.02.20 For the work of addition to, alteration in and / or modification of 'erection marks' either in erected position or in the fabrication yard, measurement of weight for payment purpose shall be calculated as the arithmetic sum of weight of steel cut and removed from the erection mark, weight of steel reutilised out of such cut and removed pieces and weight of additional new steel pieces added to the erection mark.

6.02.21 For re-erection the weight of the modified erection mark shall only be measured.

6.02.22 The weight shall be measured nearest to kg. and shall be arrived in a manner similar to the measurement for the item of fabrication, erection, alignment and welding of structural steel.

6.02.23 The measurement for the item of PTFE bearings shall be based on the load carrying capacity of PTFE in MT, corrected to third place of decimal, supplied by the contractor and as accepted by the Engineer and as per the approved bearing schedule, for the total vertical load carrying capacity, for all bearings.

6.02.24 The measurement for the item of stainless steel hopper shall be based on the actual finished weight of hopper weight in Kgs, corrected to second place of decimal. The hopper weight shall be arrived by multiplying of the inner surface area of the hopper with the unit weight of the hopper plate.

6.02.25 The measurement for the item of flexible open-ended bellows straps of neoprene shall be based in running meter, corrected to second place of decimal. Bellow Straps shall be supplied as per the requirement of the approved drawings. The measurement shall be done for the inner circumference of the bunker on which neoprene has been fixed and for the length supplied by the Contractor 'and as accepted by the Engineer.

6.02.26 The measurement for the item of Stainless Steel Hand Railing shall be based on finished weight of handrail in Kgs corrected to second place of decimal. The weight shall also include the weight of Stainless Steel fasteners, Stainless Steel beading, Stainless Steel cleats etc. The weight shall be the finished weight of Hand Rail, as accepted by the Engineer.