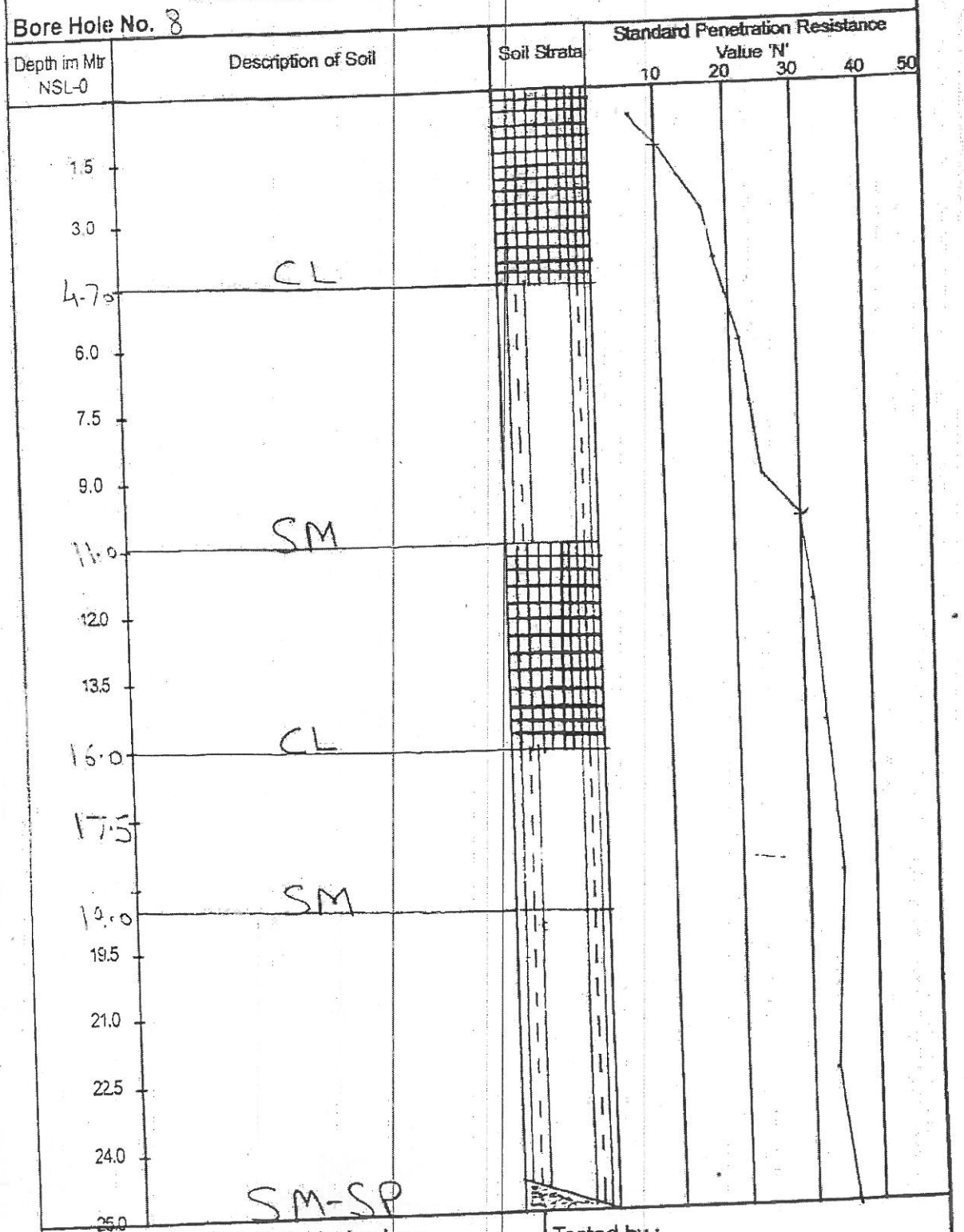
Bore Hole Chart

Bore Hole No. 8



Deptt. of Soil Mechanices

National Laboratories
(Test House)

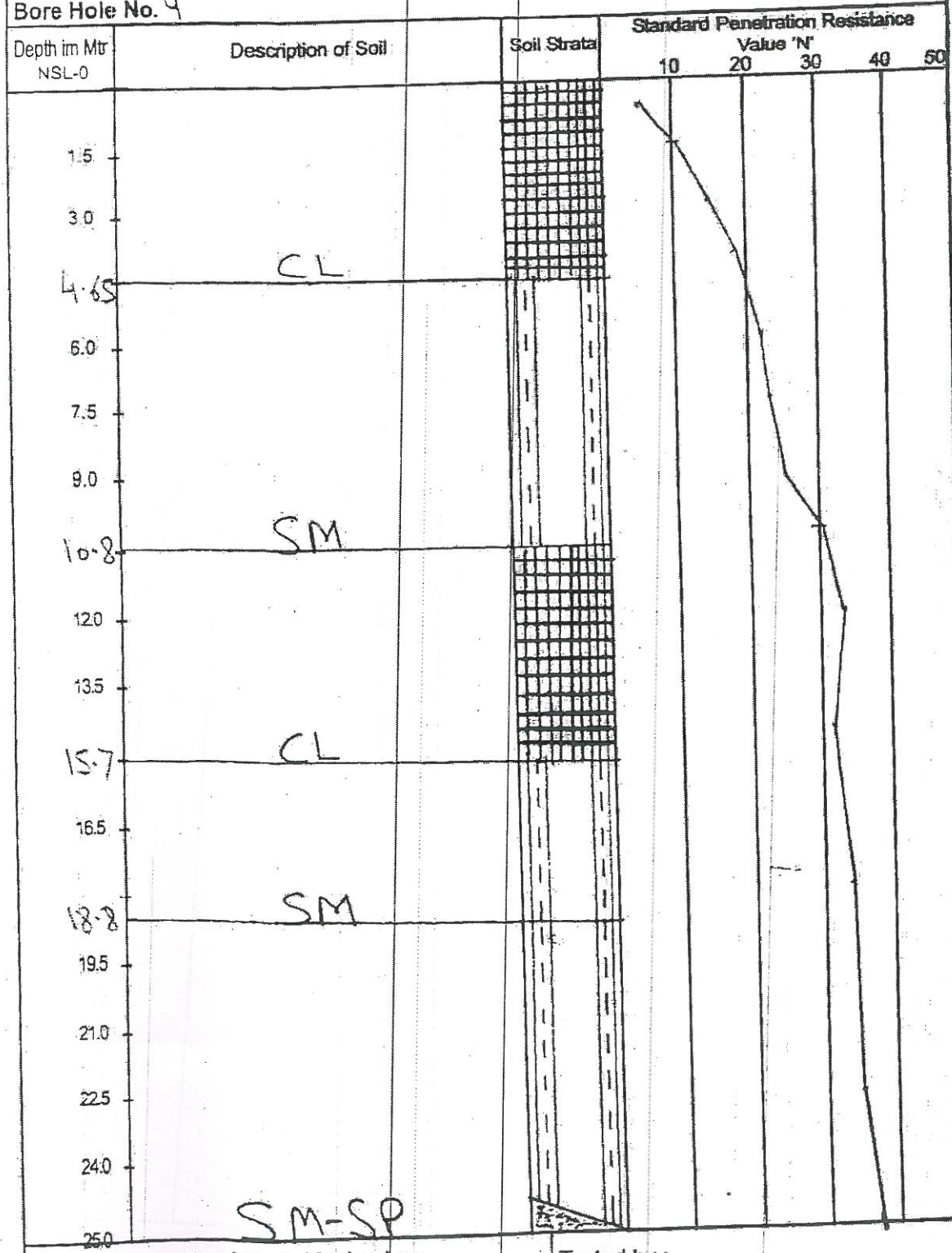
Tested by :

Date _____ Drawn by _____

Not to be Scale

Bore Hole Chart

Bore Hole No. 9



Deptt. of Soil Mechanics

National Laboratories

(Test House)

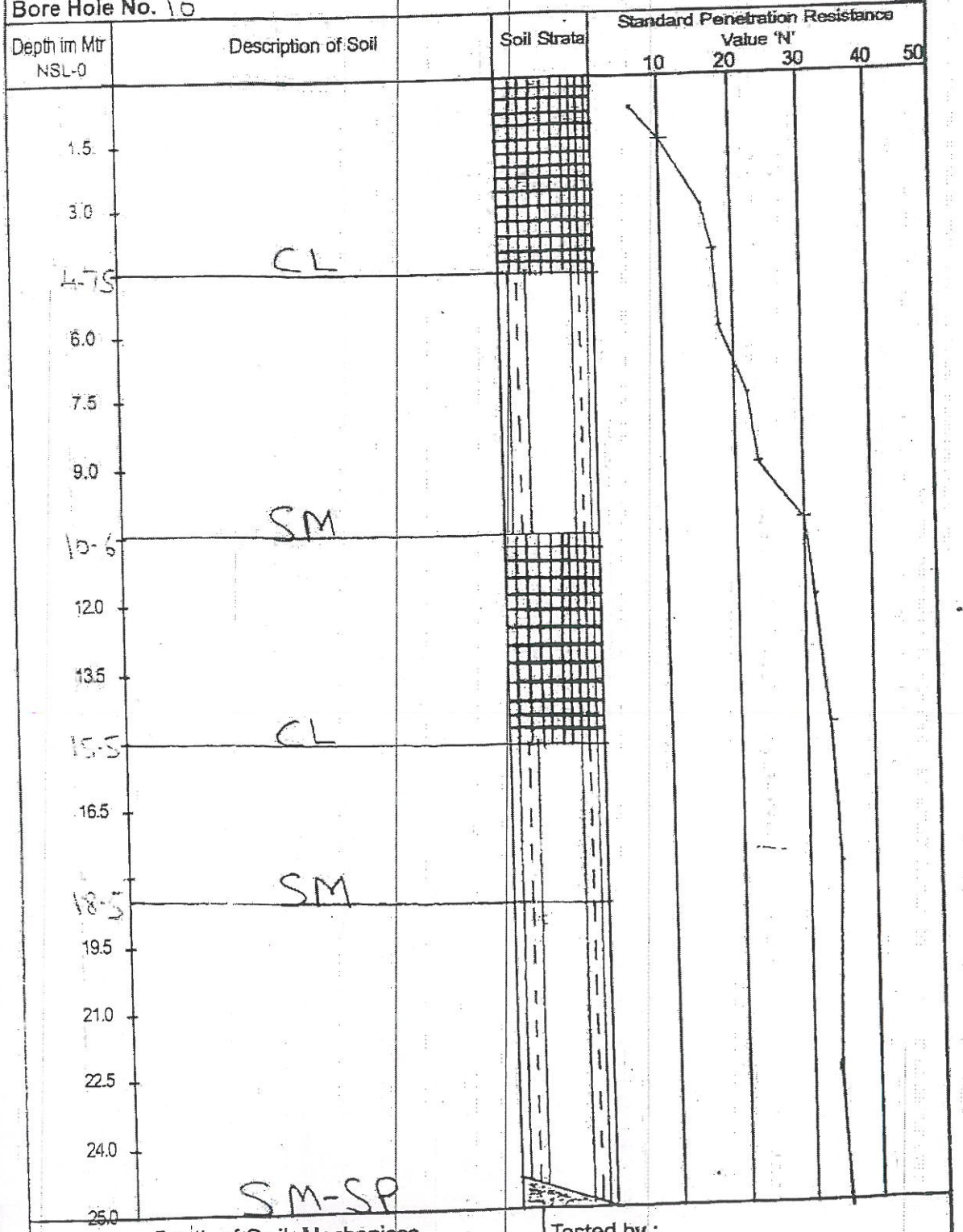
Tested by :

Date _____ Drawn by _____

Not to be Scale

Bore Hole Chart

Bore Hole No. 10



Deptt. of Soil Mechanices

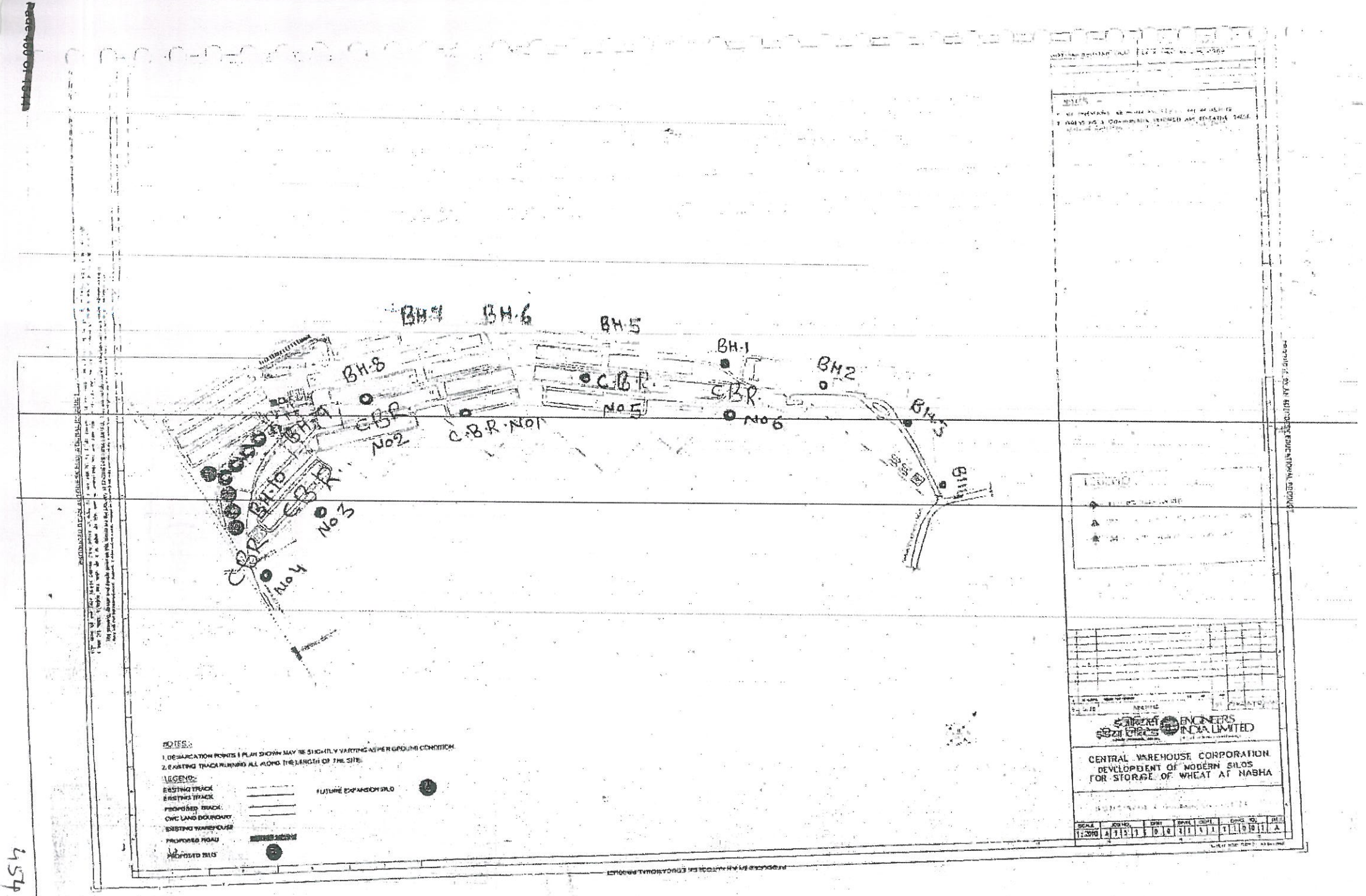
National Laboratories

(Test House)

Tested by :

Date _____ Drawn by _____

Not to be Scale


BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
BH-9
BH-10
C.B.R. No1
C.B.R. No2
C.B.R. No3
C.B.R. No4
C.B.R. No5
C.B.R. No6
NOTES:
1. DESIGNATION POINTS & PLAN SHOWN MAY BE SLIGHTLY VARYING AS PER GROUND CONDITION.
2. EXISTING TRACK RUNNING ALL ALONG THE LENGTH OF THE SITE.
LEGEND:
EXISTING TRACK
EXISTING TRACK
PROPOSED TRACK
CWC LAND BOUNDARY
EXISTING WAREHOUSE
PROPOSED ROAD
PROPOSED SILO
FUTURE EXPANSION SILO
ENGINEERS INDIA LIMITED
CENTRAL WAREHOUSE CORPORATION
DEVELOPMENT OF MODERN SILOS
FOR STORAGE OF WHEAT AT NASHA

"Notations"

N	Observed SPT Value
Nn	Normalized SPT Value
Y	Bulk unit weight
ẙ	Submerged unit weight
Yd	Dry unit weight
Ysat	Saturated Unit weight`
G	Specific gravity of soil
Wl	Liquid limit
Wp	Plastic limit
Lp	Plasticity index
Qu	Unconfined compressive strength
Cu	Undrained shear strength
C	Effective cohesion parameter
Ø	Effective angle of shearing resistance
Øm	Mobilized angle of shearing resistance
NØ	Flow value ($Tan^2 \sqrt{}45 + \sqrt{}ø/2$)
GSF	General shear failure
LSF	Local shear failure.
Cc	Compression index
B	Width of foundation
L	Length of foundation
D	Depth of foundation
q	Effective surcharge
Ny,Nq & Nc	Bearing capacity factors
Sy,Sq & Sc	Shape factors
dy,dq & dc	Depth factors
SSWL	Sub soil water level
W	W.T.correction factor
H	Thickness of clayey layer
σ'o	Original effective overburden pressure.
σ	Vertical stress increment .
eo	Original void ratio
W	Water content
Ht	Thickness of sandy layer
Bt	Top width of sandy layer
	Stress increment at the top of a sandy layer
Df	Depth factor

"Notations"

Lyf	:	Lateral yield factor
Rf	:	Rigidity factor
qnf	:	Net ultimate bearing capacity
qns	:	Net safe bearing capacity against shear failure
qn	:	Allowable bearing capacity
So	:	Settlement due to a net unit foundation loading intensity (1 Kg/cm^2)
Soh	:	Settlement due to net unit foundation loading intensity under submerged conditions (1 Kg/cm^2)
WT	:	Water table
St	:	Total Settlement
Sa	:	Maximum allowable settlement
Gw	:	Well graded gravels
GP	:	Poorly graded gravels
GM	:	Silty gravels
GC	:	Clayey gravels
SW	:	Well graded gravels
SP	:	Poorly graded gravels
SM	:	Silty sands
SC	:	Clayey sands
ML	:	Silt of low compressibility
CL	:	Clay of low plasticity
MI	:	Silt of medium compressibility
CI	:	Clay of medium plasticity
MH	:	Silt of high compressibility
CH	:	Clay of high plasticity
M(NP)	:	Non plastic silt
ML-CL	:	Mixture of ML and CL

1.0 GENERAL

1.1 The design considerations given hereunder establish the minimum basic requirements for civil-structural works for LSTK contracts.

This standard specification shall be read in conjunction with the Engineering Design Basis document (EDB) issued for the Job and Standard Specification No. 6-68-0022 for Material & Construction requirements.

All structures shall be designed for satisfactory performance and functions for which the same are to be constructed.

a) Whenever any reference to BIS/ other code is made, the same shall be taken as the latest revision (with all amendments issued there to) on the notified date of submission of tender.

b) Apart from the codes mentioned in particular in the EDB document, all other relevant codes related to the specific job under consideration and/ or referred to in the above-mentioned codes, shall be followed wherever applicable. Reference to some of the codes does not limit or restrict the scope of applicability of other relevant codes.

c) In case of any variation/ contradiction between the provisions of BIS codes and the requirements given in EDB document, the provisions given in EDB document shall have precedence over all others. In absence of relevant BIS codes, reference to corresponding British or American codes may be made (in that order of preference).

All designs, detailing and construction shall strictly conform to the standards, specifications and 'specific requirements' enclosed with the tender. Only if relevant information is not available in these documents, reference to relevant BIS code shall be made.

1.2 A Document Control Index [DCI, i.e. detailed list of drawings/ documents, including specifications, standards, design philosophy (foundation & superstructure), general notes, design calculations, design drawings, Bulk Material Take-off (Bulk MTO), bar bending schedules (for RCC works) and fabrication drawings (for structural steel works)] indicating the document/ drawing category (review or record as applicable) together with the scheduled and actual date of submission of the documents, shall be submitted by the Contractor through the Document Control Index Module (DCIM) and kept updated at all times in the DCIM for review by Owner/ owner's representative.

1.3 The Bulk MTO document containing Cement, Re-bars (*diameter-wise*) and Structural Steel (*section-wise*) shall be submitted within 45 days from the date of receipt of LOI. The same shall be updated at 50% & 90% stages of engineering.

1.4 Structure-wise quantity statements (showing anticipated, released and balance quantities of concrete, structural steel and piles) shall be submitted by the Contractor and kept updated at all times in the Document Control Index Module (DCIM) for review by Owner/ owner's representative. The DCI shall also indicate the document/ drawing category (review or record as applicable) together with the scheduled and actual date of submission of the documents.

1.5 Document Control Index Module (DCIM) is a web application that lets suppliers/ contractors manage their Document Control Index (DCI) through an interface, submit their documents for review/ record and get the reviewed/ approved documents/ drawings.

2.0 DESIGN & DOCUMENT REVIEW

2.1 Before proceeding with design and drawing preparation, the Contractor shall submit detailed philosophy of design of various parts of (all) the structures and foundations (including equipment foundations) along with explanatory sketches for review by Owner/ owner's representative. Only after the approval (including review and incorporation of comments as offered during the review) of the design philosophy, the Contractor shall submit any design document and/ or drawing for review or record or issue the same for construction.

2.2 The Contractor shall carry out the structural design of all structures and prepare complete set of civil and structural approved for construction (AFC) drawings needed for correct and accurate construction. The design/ drawing shall be strictly in accordance with the approved design philosophy prepared for the structure (including "Design Criteria" given in the EDB) and architectural/ structural general arrangement and shall incorporate all the comments/ suggestions given by Owner/ owner's representative without any extra cost to the Owner and without any implication on the time-schedule for completion of works.

2.3 Design and detailing of the structures and foundations shall fulfill all functional requirements for which the same is intended and it shall be ensured that adequate accesses, clearances, clearing of interferences, provision of cutouts, etc. have been provided to make the structure/ foundation fully operational.

2.4 Construction of units/ structures identified for design/ drawing review (as referred in Vendor Document Requirement (VDR) attached in the bid document or DCI) by Owner/ owner's representative shall not be taken up at the site till these documents are reviewed by Owner/ owner's representative and comments/ suggestions given by Owner/ owner's representative are incorporated along with submission of compliance sheet indicating incorporation of all comments. For all other foundations and structures the Contractor shall directly submit the AFC drawings to Engineer-in-Charge and construction of such works shall be taken up immediately. Design and drawings for such foundations/ structures shall also be simultaneously submitted in DCIM for Owner/ owner's representative's record. In the event Owner/ owner's representative offers any comment on documents/ drawings of record category, it shall be ensured by the Contractor that these comments are duly incorporated in the documents/ drawings and revised set of document/ drawing is issued to site for construction and simultaneously submitted in DCIM for Owner/ owner's representative's record.

2.5 Submission of typical review category documents shall be taken up prior to corresponding record category documents. Owner/ Owner's representative comments on typical review category documents shall be duly taken care in all relevant record category documents as well before issuing them for construction and simultaneously submitted in DCIM for Owner/ owner's representative's record.

Wherever review is carried out the same shall be restricted to following:

a) Conformance of general arrangement of the structure to approved design philosophy and design basis.
b) Overall framing of the building/ conceptual foundation system.
c) Detailed design and drawings including input/ output of computer analysis and design vis-a-vis actual drawing.

Irrespective of the identified structures requiring review, the Contractor shall submit complete set of design and drawings of all structure/ foundation systems.

2.6 To facilitate an overall systematic review, the Contractor shall ensure the following:

a) Structural design/ drawings for any structure/ foundation are submitted for review only if referenced input (e.g. architectural drawing, equipment layout, piping general arrangement drawing (GAD), equipment data sheet, vendor drawing, etc.) have been reviewed by the concerned Owner's specialist in approval/ review Code-2 or Code-1 and are available in the DCIM on or before the date of submission of structural design/ drawings.

b) Design and drawings of each independent building/ structure are submitted simultaneously

c) Relevant checklist(s) duly filled-up, signed (by the approver of civil-structural design/ drawing) & stamped, shall accompany each deliverable of civil-structural document/ drawing submitted by the contractor. The checklist(s) are to be used as a guide while performing the related activities. The same are attached as annexure. All points listed therein are mandatory check point. Other points/ observations/ comments may be added based on need and judicious discretion depending on the importance of activity/ deliverables.

d) Soft copy of files created as input for computer analysis/ design are also part of the respective design documents.

e) All re-submissions are accompanied with a compliance statement (a document stating point-wise compliance to all comments by Owner/ owner's representative on previous submission)

2.7 In case the referenced input (e.g. geotechnical recommendations, architectural drawing, equipment layout, piping general arrangement drawing (GAD), equipment data sheet, vendor drawing, etc.) as applicable, reviewed by the concerned Owner's specialist in approval/ review Code-2 or Code-1 are not available in the DCIM on or before the date of submission of structural design/ drawings for any structure/ foundation, the date of submission of structural design/ drawings shall deemed to be considered as the date of submission of approved reference drawing.

2.8 To ensure accuracy, correctness and completeness of documents before submission to Owner/ owner's representative, the Contractor shall ensure that all such submitted designs and drawings are complete in all respects, thoroughly checked, stamped APPROVED FOR CONSTRUCTION, and signed APPROVED by the Contractor's own responsible civil/ structural graduate (minimum) engineer (irrespective of the fact that the same are prepared in the Contractor's own design office or by an approved agency/ sub-contractor).

Incomplete, unchecked, unsigned and unstamped design documents/ drawings shall not be reviewed/ accepted for construction and shall be deemed to be considered as void/ withdrawn.

2.9 The accuracy/ correctness of all designs and drawings shall be the sole responsibility of the Contractor and any delay/ loss/ damage to the Owner in respect of any mistake/ discrepancy/ anomaly in such designs and drawings shall be entirely borne by the Contractor.

2.10 Owner/ owner's representative reserves the right to review any/ all or none of the designs and drawings. Review by Owner/ owner's representative shall not relieve the Contractor of his responsibility for correct design and execution of the works.

2.11 Revision of any design/ drawing/ detailing shall not be permitted unless the same is necessitated due to comments on review of such documents by Owner/ owner's representative. Such revisions shall be restricted to incorporation of these comments only and no new details shall be added in the drawings unless called for by comments during review. All revised portion shall be clearly marked and clouded on the respective drawing for easy

identification. Subsequent review of such revised documents, if required shall be limited to revision as clouded.

2.12 All fabrication/ erection drawings and bar bending schedules shall be prepared by the Contractor and shall be directly issued through DCIM for construction to the work. Such drawings together with design calculations for all splices, joints and gusset plates shall simultaneously be reviewed by Owner/ owner's representative at site (Resident Construction Manager). The Owner/ owner's representative at site at his discretion may review all or some or none of these designs & drawings.

Wherever such review is carried out the same shall be restricted to the following:

a) Structural layouts, orientation, elevation of structural members.
b) Section/ size of members.
c) Adequacy of few critical connections and joints for their required strength.

2.13 For analysis and design of structures, latest version of internationally accepted commercial software viz. STAAD.PRO or equivalent are permitted.

In case software packages (commercially available or in-house developed) other than above are intended to be used for analysis and design, the same shall be informed in writing to Owner/ owner's representative. A validation report consisting of calculations and relevant computer files containing input and detailed output (also refer clause 2.14) shall be submitted by the Contractor through DCIM. Only after getting written approval from Owner/ owner's representative, to this effect, such intended software be put to use for detailed analysis and design.

2.14 The following minimum documentation shall be submitted through DCIM for computer aided analysis and design as a part of structural analysis & design document:

a) Complete input and output files in native format.
b) Relevant sketches of structure geometry with node and member numbering, loading, bending moment, shear force, deflected shape diagrams, etc.
c) Summary of member end forces, support reactions, stress ratio, deflections, etc.

2.15 Contractor shall depute the concerned Civil-Structural design engineer to the review office of Owner/ owner's representative as and when required for review of contractor's documents. During such reviews involving computer aided analysis/ design/ drafting of structures, the contractor shall make his own arrangement of Personal Computer (PC) in the form of Lap-top in the premises of review office of Owner/ owner's representative. This is required to expeditiously resolve all the comments including those involving the use of PC by contractor in his submission. The contractor shall ensure that these PC's are fully operational along with necessary software already loaded including the input/ output/ drawing files of the structures being reviewed. The contractor shall revise and re-submit the analysis/ design and drawings as required during review, through DCIM.

Reviewing of designs/ drawings is not obligatory on the part of Owner/ owner's representative and complete correctness/ soundness of the designs/ drawings and their execution at the site shall be the sole responsibility of the Contractor irrespective of the fact whether the same has been reviewed by Owner/ owner's representative or not. Any defect observed during construction or till the defect liability period of works' shall be rectified and removed by the Contractor. The Contractor shall carry out whatever modification or reconstruction is needed for the purpose, to the entire satisfaction of the Engineer-in-Charge/ Owner without any extra cost and/ or time implication to the Owner.

Filled-up, signed (by the approver of civil-structural design/ drawing) & stamped checklist shall accompany each submission of civil-structural document/ drawing by the contractor:

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

Sl. No.	PMC Requirement	Contractor's Response	Remarks
1.	The submission is as per submission schedule as per approved DCI.	□ Yes	
2.	The submission is as per submission sequence as per approved DCI.	□ Yes	
3.	Basic documents prepared by the contractor (e.g. design philosophy, specifications, standards, general notes, etc.) are already approved.	□ Yes	
4.	Bulk MTO has been submitted.	□ Yes	
5.	All the referenced input (e.g. geotechnical recommendations, architectural drawing, equipment layout, piping general arrangement drawing (GAD), equipment data sheet, vendor drawing, etc.) as applicable have been reviewed by the concerned Owner's specialist in approval/ review Code-2 or Code-1 and are available in the DCIM on or before the date of submission of structural design/ drawings.	□ Yes	
6.	The design calculations being submitted herewith are complete in all respects, thoroughly checked and confirm to approved engineering design basis, relevant approved input documents and applicable codes & standards, stamped APPROVED FOR CONSTRUCTION, and signed APPROVED by the Contractor's own responsible civil/ structural graduate (minimum) engineer (irrespective of the fact that the same are prepared in the Contractor's own design office or by an approved agency/ sub-contractor).	□ Yes	
7.	The drawings being submitted herewith are complete in all respects, thoroughly checked and confirm to approved design calculations, approved general arrangement, stamped APPROVED FOR CONSTRUCTION, and signed APPROVED by the Contractor's own responsible civil/ structural graduate (minimum) engineer (irrespective of the fact that the same are prepared in the Contractor's own design office or by an approved agency/ sub-contractor).	□ Yes	
8.	The documents/ drawing being submitted are complete with respect to the whole structure.	□ Yes	
9.	In case this submission is for drawings only, the related analysis & design have already been submitted.	□ Yes	
10.	Structure-wise quantity statements (showing anticipated, released and balance quantities of concrete, structural steel and piles) are updated & submitted.	□ Yes	
11.	In case this submission is of record category document/ drawing, similar review category documents/ drawings have already been submitted.	□ Yes	

Sl. No.	PMC Requirement	Contractor's Response	Remarks
13.	In case this submission is of record category document/ drawing, the submitted document/ drawing incorporates comments on the similar review category document/ drawing.	□ Yes	
14.	The accuracy/ correctness of all designs and drawings shall be the sole responsibility of the Contractor and any delay/ loss/ damage to the Owner in respect of any mistake/ discrepancy/ anomaly in such designs and drawings shall be entirely borne by the Contractor. Review by Owner/ owner's representative shall not relieve the Contractor of his responsibility for correct design and execution of the works	□ Yes	

Date: Name & Signature

Note:

Contractor to check & confirm that the submission meets the above requirements of PMC and categorically tick ☑ mark in the "☐ Yes" response.

Filled-up, signed & stamped compliance sheet shall accompany each re-submission of civil-structural document/ drawing by the contractor:

Document No. :

Rev. No.:

Date of Submission:

Date of Review:

Review Code: □ 1 □ 2 □ 3 □ R □ V

Sl. No.	Reference Clause	PMC Comments	Contractor's Response
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

Review Code Legend:

Code 1	:	No comments.
Code 2	:	Proceed with manufacture/ fabrication as per commented document. Revised document required.
Code 3	:	Document does not confirm to basic requirement as marked. Resubmit for review.
R	:	Retained for Records.
V	:	Void.

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
1	Founding level/ depth of foundation with respect to HPP/ FGL/ NGL/ EGL/ FFL (strike out whichever is not applicable).	
2	Requirement & Level of plinth/ tie beams.	
3	Type, Shape & Dimensions of footing.	
4	Adequacy of loading for foundation.	
5	Correctness of the design forces as per analysis.	
6	Selection of critical loading cases/ combinations.	
7	Long/ short column effect for pedestal.	
8	Size of pedestal: a) type of anchor bolts b) bolt spacing (with respect to clearance between the bolts) c) edge distance of anchor bolts d) depth of embedment of anchor bolts	
9	Location co-ordinates & Orientation with respect to North direction.	
10	Conformance to Geotechnical recommendations: a) check for SBC at founding depth (w.r.t. settlement/ shear) b) consideration of ground water table. c) check for FOS against overturning, sliding d) increase in SBC (limited to 25% for wind or seismic/ 100% for blast) e) spacing of piles (within group & inter-group) f) pile cut-off level g) load check conforming to pile capacity h) increase in pile capacities (limited to 50% for vertical & 25% for lateral for wind/ seismic/ 50% for blast)	
11	Projection of foundation outside battery limit is co-ordinated with Civil Department for under-ground piping, etc.	
12	Ductile detailing requirements for reinforcement, wherever applicable.	
13	Internal co-ordination with all concerned departments.	

Date:

Name & Signature

Legend :

✓ : Check carried out and found OK

✓ NA : Check carried out and found not applicable

CHECK LIST FOR ANALYSIS & DESIGN OF FOUNDATION FOR ROTATING EQUIPMENTS

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
1	Approved (at least review code 2) inputs available.	
2	Complete loading data: a) reference line of machine, base frame dimensions and suction side & discharge side (for pumps) b) size of block/ deck, pedestal above HPP c) static/dynamic loads (or dynamic load factor) & their location of application (as per vendor) d) permissible limiting values of vibration parameters e) pocket dimensions, locations f) grout type & thickness g) whether anti-vibration pads are provided	✓
3	Founding level/ depth of foundation w.r.t. HPP/ FGL/ NGL/ EGL/ FFL	
4	Value of C_u & net SBC from soil recommendations. For pile foundations, the pile stiffness value.	
5	Amplitude of vibration and resonance check in required modes.	
6	No fouling with adjacent foundation as per equipment layout.	
7	Check for limiting size of element(s).	
8	Check for critical speed, whether the machine is variable speed or fixed speed? If variable speed motor is used, whether amplitude has been checked considering the machine speed same as the natural frequency of the foundation system.	
9	Minimum reinforcement requirement as per IS:2974.	
10	Specified number of construction joints & their details.	
11	Note for single pour.	
12	Internal co-ordination with all concerned departments.	

Date:

Name & Signature

Legend :

✓ : Check carried out and found OK
✓ NA : Check carried out and found not applicable

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
1.0	**Availability of Inputs**	
1.1	Approved Architecture drawings of building	
1.2	Approved Plot Plan	
1.3	Approved related Area Drawings	
1.4	Contour plan	
1.5	Approved Geotechnical Recommendation	
1.6	Approved Electrical Drawings for Substation Building	
1.7	Approved Instrumentation Drawings for Control Room Building	
1.8	Vendor Inputs for: a) Air Conditioning Equipments b) Transformers etc. c) Lift	
2.0	**Correctness of Inputs**	
2.1	With respect to Architecture Drawings: a) Framing arrangement. b) Level & Location: i) Co-ordinate of building ii) Finished Ground Level iii) Finished Floor Level iv) Approach Road Level c) Brickwork arrangement i) Length/ height of brickwork. ii) Stability check for brickwork with Steel frame. iii) Flushing of Brickwork with frame structure. iv) Brick supporting arrangement for Rain water Pipe encasing. d) Requirement of expansion joints as per codal provisions. e) Arrangement & levels of false flooring & false ceiling. f) Clear height of floors. g) Cross-checking of elevations at FFLs of Ground Floor, Upper Floors, Roof etc., w.r.t. FGL, Approach Road Level. h) Monorail location & extent of monorail beam for Substation building.	
2.2	With respect to Mechanical Drawings: a) Lift Pit Size and loading available in Approved Mechanical/ Vendor Drawing. b) Machine Room Details available in Approved Mechanical/ Vendor Drawing. c) Cut-out details for duct in AC Plant room/ AHU rooms in Approved Mechanical/ Vendor Drawing. d) Details of pedestals for AC Plant/ AHU in Approved Mechanical/ Vendor drawing. e) Monorail location & Capacity as per Approved Mechanical drawing.	

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
2.3	With respect to Electrical Drawings: a) Transformer details. b) LT-HT Switch gear panel location. c) Cable trench layout.	
2.4	With respect to Instrumentation Drawings: a) Panel resting arrangements. b) Cable tray details. c) Pipe sleeves details. d) MCT location. e) Cable tray in superstructure. f) Cable trench layout.	
2.5	With respect to General Civil Area Drawings: a) Co-ordinates of building b) Orientation of building with respect to North direction. c) Approach Road level/ Finished Ground Level. d) Contour for NGL from Plot Plan. e) Fouling with existing/ proposed facilities from Area/ Foundation drawing. f) Underground facilities from Area Drawing.	
2.6	With respect to Geotechnical Recommendation: a) Type of foundation (Shallow or Pile). b) Depth of foundation. c) Net Allowable SBC for foundation from Geotechnical Report. d) Pile Capacity from Geotechnical Report. e) Diameter of Pile & Spacing of Piles from Geotechnical Report. f) Specification of Piling. g) Drawing of Pile.	
3.0	**Design Aspects**	
3.1	Structure is analysed as 3D Framed Structure.	
3.2	Uses of Codes as per approved EDB: a) For Concrete (IS:456/ IS:13920) b) For Steel (IS:800)	
3.3	Grade of Material as per approved EDB: a) Concrete b) Reinforcement c) Structural Steel	
3.4	Covers as per approved EDB: a) Foundation b) Column c) Beam d) Slab e) Wall	
3.5	Checking of Minimum thickness as per approved EDB: a) Foundation b) Column c) Beam d) Slab e) Wall	
3.6	**Loadings**	

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
3.6.1	Dead Load: a) Self weight b) Slab load c) Brick load d) Gutter/ Parapet load	
3.6.2	Live/ Imposed load as per approved EDB for panels, ducts, cables etc. on floor, roof canopy, passage, lobby & stair case: a) Office Building b) Administrative building c) Substation building d) Control room	
3.6.3	Seismic Load as per approved EDB: a) Method of Seismic Analysis (Seismic Coefficient/ Response Spectra). b) Importance factor (Mention Value). c) Response reduction factor accordingly consideration of ductile detailing (Mention Value). d) Damping factor (Mention Value). e) Type of soil. f) Type of structure. g) Time period for frame structure as per IS:1893.	
3.6.4	Wind load for Shed type Building a) Basic Wind Speed (Mention Value). b) Probability Factor (k_1) (Mention Value). c) Terrain, Height, Structure Size Factor (k_2) (Mention Value). d) Topography Factor (k_3) (Mention Value).	
3.6.5	Blast load for Control Room shall be as per RRA report (Mention Blast Pressure).	
3.6.6	Load combination shall be as per approved EDB:	
3.7	Design of concrete member of building shall be as per IS:456/ IS:13920.	
3.8	Ductile detailing requirements for Reinforcement, wherever applicable.	
3.9	Slenderness check for design of columns.	
3.10	Crack width of beam/ slab.	
3.11	Deflection of slab/ staircase.	
3.12	**Foundation design.**	
3.12.1	Fouling of under-ground cable trench with foundations/ plinth beams etc.	
3.12.2	Alignment of plinth beams with brick walls.	
3.12.3	Factor of safety against overturning & Sliding as per approved EDB.	
3.12.4	Checking of SBC/ pile capacity as per approved Geotechnical Recommendation.	
3.12.5	Maximum allowable settlement of soil as per approved EDB	
3.12.6	Checking of modified pressure calculation in case of tension occurred.	
3.12.7	Increase in stress shall be as per Geotechnical Recommendation.	
3.12.8	Minimum percentage of reinforcement as per approved EDB	
3.12.9	Minimum spacing of reinforcement bar as per approved EDB.	
4.0	Internal coordination with other departments.	

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
5.0	MTO for super structure & Substructure a) Area of building b) Concrete in foundation c) Concrete in superstructure d) Reinforcement in foundation e) Reinforcement in superstructure f) Reinforcement per Cu. M. of Concrete for foundation g) Reinforcement per Cu. M. of Concrete for superstructure	

Date:

Name & Signature

Legend :

✓ : Check carried out and found OK

✓ NA : Check carried out and found not applicable

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
A	**SUB-STRUCTURE**	
1	Refer separate checklist for foundation.	
B	**SUPER-STRUCTURE**	
1	Check wind & seismic parameters considered.	
2	Check estimation of wind forces.	
3	Check estimation of seismic loads.	
4	Check structural configuration and bracing system (vertical & horizontal).	
5	Check analysis corresponding to critical wind/ seismic direction.	
6	Check whether correct limiting values of slenderness ratios for structural elements (columns, beams, bracings, etc.) used in design.	
7	Check whether correct effective lengths of structural elements (columns, beams, bracings, etc.) used in design.	
8	Check whether critical maximum design forces have been considered from various load combinations for the design of respective elements.	
9	Check for permissible horizontal (transverse & longitudinal) deflections.	
10	Internal co-ordination with all concerned departments.	

Date: Name & Signature

Legend :

✓ : Check carried out and found OK

✓ NA : Check carried out and found not applicable

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
A	**SUB-STRUCTURE**	
1	Refer separate checklist for foundation.	
B	**SUPER-STRUCTURE**	
1	Check the system stability & dynamic analysis as per design basis/Job specification.	
2	Check the correctness in estimation of wind pressure corresponding to right shape factor for exposed members.	
3	Check the lateral load transfer from gallery to top of trestle.	
4	Check the supporting arrangement of gallery for keeping proper provision for expansion, check limiting vertical deflection.	
5	The analysis & design shall conform to the erection scheme being adopted.	
6	Internal co-ordination with all concerned departments.	

Date:

Name & Signature

Legend :

✓ : Check carried out and found OK
✓ NA : Check carried out and found not applicable

Project:		Job No.:	
Document No.:		Rev. No.:	
Document Title:			

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
1	**GENERAL**	
a	Drawing number is as per approved DCI	
b	Electronic file number is as per approved DCI	
c	Draughting is as per design requirements	
d	North line/ orientation as per input data	
e	Notes comply with Job Specifications and General Notes	
f	Field notes for specific instructions/ scope of work defined	
g	Layout of grids and spacing/ dimensions/ equipment location, support, orientation etc. as per input data	
h	Referenced Drawings specified	
i	Referenced Standards specified	
j	If not adequately clear in General Notes, grade of concrete and grade of reinforcement bars specified	
k	Bill of materials furnished (for the detailed portion)	
l	Necessary internal co-ordination done with relevant departments as per requirements	
m	Resolution/ incorporation of comments received	
2	**FOUNDATIONS**	
a	Coordinates/ location is as per input data, suction side & discharge side (for pump foundations) as per layout drawing	
b	Referenced level and elevations specified are as per approved General Civil/ Architectural drawings/ Piping GAD (viz. NGL/ FGL/ HPP)	
c	Elevation/ depth of foundation bottom furnished	
d	Fouling with surrounding foundations/ services cleared	
e	Any extra cover for rebar required and specified	
f	Any extra minimum cement content required and specified	
g	Thickness, projection and grade of lean concrete specified	
h	Anchor bolt location and orientation specified	
i	Adequacy of foundation depth checked to accommodate anchor bolt assemblies	
j	Anchor bolt description (as per standard) specified	
k	Depth of pockets specified	
l	Minimum cover on anchor bolts/ pockets checked	
m	Fouling between anchor bolt assembly and pedestal rebar checked	
n	Grout thickness specified	
o	Reinforcement provided as per design/ codal requirements	

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
p	Links and ties detailed	
q	Dowel lengths for column rebars staggered and specified	
r	Depth of machine foundations with respect to building foundations checked	
s	Separation detail for machine foundations and pouring sequence given	
t	Requirement of water bars at construction joints for liquid retaining structures furnished	
u	Requirement of protective painting	
v	Field note for sequence of construction, if adjoining foundations are at different level	
w	For pump foundations, following field note shall compulsorily be added in foundation drawings: "The pump discharge nozzle is facing towards North/East/West/South". (appropriate direction shall be selected as per layout drawing, in case discharge is upwards, direction of suction nozzle shall be specified)	
3	**SUPER STRUCTURE Reinforced Cement Concrete**	
a	Layout is as per approved Piping GAD/ Architectural drawings	
b	Requirement of expansion/ separation joints checked	
c	Anchor bolt location and orientation specified	
d	Anchor bolt description (as per standard) specified	
e	Pockets for bolts located/oriented and specified	
f	Depth of pockets/ length of bolts in RCC members checked	
g	Minimum cover on anchor bolts/ pockets checked	
h	Fouling between anchor bolt assembly and rebar checked	
i	Grout thickness specified	
j	Reinforcement provided as per design/ codal requirements	
k	Cut-outs as per requirement provided with edge protection	
l	Slope has been provided over RCC roof	
m	Curb around all openings	
n	Insert plates & pipe sleeves provided wherever required	
o	Extra reinforcement around cut-outs & openings	
p	Dowel bars for lap length & anchorage length	
q	Nominal links in column, stirrups for beams & their arrangement	
4	**SUPER STRUCTURE Structural steel**	
a	Layout is as per approved Piping GAD/ input drawings	
b	Requirement of expansion/ separation joints checked	
c	Bolting details for equipments specified	
d	Member sizing and connection details furnished	
e	Grating/ chequered plate requirements with supporting members furnished	
f	Welding requirements furnished	
g	Fire-proofing requirements furnished	

SR. NO.	CHECK/ CONTROL POINTS	Tick Mark as per Legend
h	Requirement of removable floor/ handrails checked	
i	Requirement of grouting holes in base plates specified	
j	Vertical & Horizontal bracings provided as per piping clearance	
k	Splicing location has been proposed/ suggested	
l	Approach staircase/ ladder provided with proper landing at entry point	
m	Toe plate around openings	
n	Stiffness/ diaphragm plates have been suitably provided	
o	Vertical clearance below monorail beam checked	
p	Capacity of monorail specified & structurally stable cantilever projection given	
5	Drawing issued through DCIM (Document Control Index Module)	

Date:

Name & Signature

Legend :

✓ : Check carried out and found OK
✓ NA : Check carried out and found not applicable

STANDARD SPECIFICATION CIVIL-STRUCTURAL

LUMP-SUM TURN KEY WORKS (L.S.T.K)

MATERIAL & CONSTRUCTION

1. Specifications to be followed for all Civil works would be the latest CPWD specification, 2009 with latest amendments/correction slips and latest relevant BIS Codes.
2. In the event of any ambiguity in CPWD specifications and BIS Codes for any item of the works, CPWD specifications will prevail.
3. In the event of non-availability of any specifications for any of the item either indigenous or imported then the specification of the manufacturing company would be followed.

Scope of Work (Electrical)

1.0 The scope of work under this package covers design and engineering, system design, detailed engineering, preparation of drawings and documents as specified, sizing, selection, procurement, transportation to site, supply of all materials/ equipment, all tools and tackles, installation, testing, commissioning and handing over of all electrical work complete in all respects as per data sheets, drawings, specifications, standards, CPWD specifications etc., specified in the bid package for the Development of Silos for Storage of Wheat of M/s CWC at Nabha, Punjab

1.1 **Works Included**

Works as listed below, but not limited to it, are included in the scope of this contract. It shall be on the basis of single point contractor's responsibility, completely covering all the equipment defined in this document and required for completion of the system.

1.1.1 Basic design and detailed Engineering

a) Basic engineering calculations i.e. load analysis, short circuit, voltage drop during motor start-up etc.

b) Sizing and selection of electrical equipment.

c) Single line diagram and single line diagrams for individual switchboards, UPS, DC systems, Aux power supply system.

d) Electrical Equipment list and Motor List.

e) Preparation of Electrical and Instrumentation interlock and interface requirements as per process/ operational requirements.

f) Relay & metering diagrams, Control, protection and Annunciation schemes.

g) Substation Sizing including construction of new substation for complete system, substation SS-01.

h) Preparation of substation equipment layout, providing RCC cable trenches for complete substation.

i) Sizing calculations for cables, cable trays/ cable trenches including providing cable trays and RCC trenches.

j) Procurement engineering activities including preparation of enquiry specifications, bid evaluation, preparation of purchase specifications, expediting and approval of vendor drawings.

k) Area-wise illumination level calculation and preparation of power supply distribution scheme for normal, emergency and critical lighting.

l) Calculations for complete earthing and lightning protection. Carryout soil resistivity test to ascertain the soil resistivity value for earthing system design.

m) Preparation of electrical layouts such as equipment layouts, lighting layouts, cabling layouts, earthing layouts, lightning protection layout, plant Communication layouts, fire alarm layouts, telephone layouts.

n) Block diagram for public address system, Block Diagram for Fire detection & alarm

system, Block diagram for telephone system.

o) Schematic and wiring diagrams.

p) Cable termination and equipment Installation details.

q) Cable schedule, interface drawings, interconnection diagrams, etc. for public address system, fire detection & alarm system and telephone system

r) Equipment specifications and data sheets.

s) Preparation of bill of materials for cabling, lighting, earthing, communication, fire alarm, telephone system and miscellaneous items.

t) Cable Schedules, drum schedules.

u) Collection of data from site/Owner as required for carrying out detailed engineering.

v) Lighting/ Power panel schedules.

w) Interconnection drawings.

x) Relay Co-ordination drawings, Protection coordination drawings, relay setting calculations; relay parameterization for complete power system.

y) Shop inspection and testing procedures and QA schedule.

z) Field testing and commissioning procedures.

aa) Preparation of as-built drawings on completion of the project for final records.

bb) Preparation of operation and maintenance schedule/manuals.

cc) Type, routine and acceptance test certificates.

dd) Vendor and sub vendor drawings.

ee) Any other work/ activity, which are not listed above, however are necessary for completeness of electrical system

The CONTRACTOR while performing design and engineering activities shall adhere to following guidelines:

- CONTRACTOR, if not covered but required shall prepare any additional specifications for equipment or bulk material. CONTRACTOR shall follow current national & international standards/specifications for the equipment that are not covered by OWNER/ PMC's specifications.
- The drawings supplied by OWNER/ PMC/ define the basic system design and distribution philosophy for the package. This is based on preliminary electric load data and for guidance purpose only. CONTRACTOR shall develop detailed drawings and submit for PMC review.
- Contractor to note that equipment ratings and quantity, wherever specified in the bid package shall be considered as minimum rating & quantity. Contractor shall be responsible to verify the same and provide equipment with higher rating & quantity

subject to minimum rating as per bid package requirements. Compliance shall be without any extra cost and time implications to owner.

- Contractor shall provide substation SS-01 for feeding all electrical loads of the project of development of Silos for Storage of Wheat. Contractor shall prepare detailed SLD during detail engineering and show electrical equipment for Storage Silos and other loads in SS-01.

1.1.2 Complete design, sizing, selection, engineering, manufacture/ procurement, shop testing, supply, transportation to site, installation, testing, commissioning and handing over of the electrical system including but not limited to the following:

~~a) Two / Four pole outdoor structure for receiving 11 KV power supply complete with insulators, lightning arrestor, ACSR conductors, isolator/ LB switch with handle, drop out fuses, cable box, structural members and CT/ PT, energy meter for tariff metering as required.~~ 2

~~b) Modifications including new equipment, components in existing SEB power supply receiving station for tapping 11 KV power supply to new two/four pole structure, 11 KV overhead ACSR line/ cable from existing receiving station to new two/four pole structure.~~ 2

c) 11 kV, 630 A, 40 kA for 1 second, indoor type, isolating breaker panel complete with VCB type circuit breaker for incoming 11 kV power supply with numerical relay, PT, CT etc.

d) Supply and termination of Heat shrinkable end termination kits and straight through jointing kits, cable glands and lugs required for terminating Incoming 11 kV cable to 11kV Isolator breaker panel inside the substation. 2

e) 11 kV (UE) Aluminum conductor, XLPE insulated, armoured cables with heat shrinkable end termination kits and straight through jointing kits, cable glands and lugs for all cabling.

f) 11kV / 0.433 kV, 1000 KVA (min.), ONAN distribution transformer with OLTC, RTCC with range -15% to +5% and steps of 2.5%.

g) 415 V, 1600 A (min.), 3-phase TPN, 50 kA for 1 sec Bus duct for interconnection between distribution transformer and power cum motor control center

h) 415 V, 1600 A (min.), 3-phase TPN, 50 kA for 1 sec draw-out type Power cum motor Control Center (PMCC).

i) 415 V, 800 A (min.), 3-phase TPN, 50 kA for 1 sec draw-out type Emergency Power cum motor Control Center (EPMCC) and cables for interconnection between PMCC and EPMCC.

j) 415/415 V, 3-phase, dry type, 200 KVA (min.) lighting transformers for normal lighting and 50 KVA (min.) for emergency lighting system.

k) 415V, 400 A (min.), 3-phase TPN, 20 kA for 1 sec. draw-out type, Lighting Distribution Board (LDB)/ Emergency lighting distribution board (ELDB).

l) 110V DC supply system comprising parallel redundant battery chargers, Lead Acid battery, DCDB, for switchgear protection & control and critical lighting.

m) 110V AC Single UPS with bypass UPS system with panel mounted Lead Acid battery, ACDB, for DCS/PLC/Instrumentation loads, Data communication LAN system, Public address system. ACDB shall have 110/240V AC transformer for feeding 240V AC LAN power supply sockets.

n) Electricals for the DG set including generator, control panel, line cubicle with power isolating ACB, engine starting batteries as required.

o) Variable frequency drives systems with by pass as required for variable speed motors as required.

p) 415V Capacitor bank, dry type with Automatic power factor correction system.

q) Control Cables from switchboards to PLC/SCADA, telephone system and Fire alarm system, jelly filled telephone cables for outdoor areas

r) Serial link /LAN cables for numerical relays other electrical equipment for serial connectivity

s) All MV cables for power, control, lighting, armoured type required for the complete system.

t) Cables for public address system, telephone system and Fire alarm system, armoured type, jelly filled telephone cables.

u) Flameproof and Industrial type MV motors as required.

v) Soft Starter for starting of Large motor on DG set as required.

w) Electrical heaters, Heater control panels, Thyristorised and contactor controlled if required.

x) Flameproof and Industrial type control stations with push buttons, selector switches, ammeters, lamps as required.

y) Flameproof and Industrial type 415V AC welding receptacles and 240V AC, 1-phase Convenience receptacles.

z) Canopies complete with fixing arrangement and hardware for all outdoor equipment

aa) Complete lighting for the system comprising lighting of buildings, substation, control room, Package areas, roads, storage silos, loading areas, weigh bridges & cabins, container storage yard etc., high mast for general lighting, ground lighting poles, platform lighting poles, flameproof & industrial lighting panels, flameproof & industrial power panels, flameproof & industrial lighting fixtures, decorative lighting fixtures, lamps and accessories, flameproof & industrial power sockets etc., exhaust fans, ceiling fans, complete wiring, cabling, normal & emergency lighting, critical DC lighting.

bb) Complete cable tray work, GI cable trays, tray covers, supports, racks, RCC cable trenches with removable covers, culvert and sleeves for road crossings as required from substation to loads, within the package, within substation & other buildings including for incoming 11kV & 415V cables and associated control cables.

cc) Complete cable tray work, GI cable trays, tray covers, supports, racks, cable trenches ~~for public address system, telephone~~ and Fire alarm system cables.

dd) Complete earthing including earth pits, earthing grid and loops, equipment earthing, static and lightning protection using grounding cables, strips, wires associated connectors and accessories and connection to existing earth grid. Contractor scope also includes measurement of soil resistivity at site and design of earthing system.

ee) Complete cabling for Power, Control, lighting, plant communication, telephone and Fire alarm system, including various packages, GI pipes for cable protection above ground, floor sleeves, supports, cable markers, identification tags, G.I. saddles and all other associated accessories.

ff) Package MCCs for various packages if required. All electrical equipment and related items required for various package equipment not mentioned herein, but necessary for commissioning of the Package systems.

gg) Safety equipment such as, shock hazard charts, first aid boxes, caution boards, apron, eye shields, discharge rods, DCP portable CO_2 fire extinguishers, insulating mats, sand buckets, 11 kV grade hand gloves and other equipment for safety of all electrical equipment and personnel as per statutory regulations.

~~hh) Providing 3 nos. UPS power supply points along with each LAN node/point including wires, conduits, switch sockets etc.~~

ii) ~~Complete Public address system for the entire project including Central Exchange with amplifiers, Desktop type master call stations, required quantity of outdoor type loudspeakers along with ground mounted poles, mounting brackets & accessories, decorative box type speakers wall mounted with mounting bracket, all hardware and accessories and twisted pair communication cables with cable glands & lugs and steel conduit for cable laying.~~

jj) Complete Analogue addressable Fire Detection and Alarm System for buildings & outdoor areas for the entire project including all devices & components such as CFAP, DGFAP, Sirens, addressable Electronic hooters, Hooter Acknowledgment Box, addressable intelligent multi sensor detectors, addressable manual call points, response indicators for rooms & concealed areas, addressable exit signs, self powered exit signs, fault isolator modules, control relay modules and fire alarm cabling/wiring for the signal loops & power supply loops to DGFAP from devices, cabling between CFAP & DGFAP.

kk) ~~Complete Telephone System (EPABX) for the entire project complete with material such as EPABX exchange, Main Distribution Frame (MDF) & Intermediate Distribution Frame (IDF) with Krone tag blocks, Telephone Junction Boxes (TJBs), operating stations, analogue and digital telephone instruments, jelly filled armoured twisted pair telephone cables etc.~~

ll) ~~Telephone wiring for telephones including telephone~~ junction box with ~~Krone tag blocks, cable glands, conduits, wires, cables, socket outlets, RJ-11 type plug in jacks. All rooms in buildings shall be provided with 2 nos. telephone sockets on opposite walls.~~

mm) Tools and tackles for maintenance of all electrical equipment and systems. This shall include following tools & tackles as minimum but not limited to these:

- Analogue & Digital multi meters
- Clip-on meters of different ranges
- Tong testers
- Allen Keys
- Hammers
- Complete tool kit for the Electrician comprising of screw drivers, testers, pliers, spanners, cable cutter / stripper, adhesive tapes etc.
- Portable battery and mains operated HV and MV megger
- Breaker withdrawal trolley – for HV and MV switchboard
- Breaker handling trolley MV – 1 no.
- Earthing trolley for 11 kV switchboard for line & bus- 1 no.
- Illuminated SLD

nn) All Commissioning Spares.

1.1.3 All Civil works required for installation of electrical equipment, supports for cables/ cable trays/ concrete lined trenches for completion of electrical works.

1.1.4 CONTRACTOR shall include painting and marking of all buses, individual incomers, all outgoing feeders etc. with details such as tag no., feeder rating, sending end source reference etc. for all switchboards.

1.1.5 Painting of all structural steel supports provided for installation of all electrical equipment, associated components, cables, earthing etc.

1.1.6 Pressurized electrical substation building for electrical equipment. The substation building shall comprise of as a minimum, switchgear room, battery room, pressurization blower room, maintenance room/store, Toilet, and air conditioned operator room, besides outdoor transformer bay. Pressurization of switchgear room, ventilation of battery room, air-conditioning of AC rooms including supply of all related electricals is in contractor scope.

1.1.7 Air-conditioned rooms/space in the substation building for installation of VFD and other electronic equipment etc. if required shall be provided by the contractor including supply of all electrics for air-conditioning.

1.1.8 Inspection and Factory Acceptance Tests including type tests for electrical equipment (type tests as per job specification, data sheets and as defined in bid document).

1.1.9 Electrical requirements for EOT cranes, MOVs, electric heater, fire suppression system, deluge system clean agent system etc. as required.

1.1.10 Statutory Approvals

The contractor shall obtain approvals from the concerned electrical inspectorate / CEA for installation drawings and engineering of the electrical system and equipment covered under the contractor's scope. Any modification or additional requirements of the electrical inspectorate shall have to be carried out by the contractor at his own cost without affecting time schedule. Arranging for any other approvals required for the complex, from agencies such as TAC etc. are included in the Contractor's scope.

1.1.11 Construction Power

a) Construction power supply for the Package shall be arranged by contractor as required for feeding loads to carry out construction activities. Construction power

supply shall not be provided by owner/ other contractor.

b) To ensure uninterrupted construction activities and keep pace with overall construction/ project schedule, power availability shall be ensured by contractor through portable DG sets, which are to be supplied, operated and maintained by the contractor.

c) Contractor shall provide necessary lighting during construction phase at places/areas of work (such as silos, substation, fabrication storage yard etc.) including all equipment/items required and maintenance of same during the project execution phase.

1.1.12 Any other electrical equipment, material and work not explicitly mentioned but, nevertheless required to fulfill the following minimum requirements meet the operational requirements shall be deemed to be included in the scope of the contractor with no additional cost/ time implication to the Owner.

- Achieving the plant operational requirements as indicated bid documents.
- To ensure equipment and personnel safety.
- To suit site facilities and environmental conditions.
- To meet the requirement of statutory approving authority.

1.1.13 All the works to be performed and supplies to be affected as part of the contract shall require specific approval/ review of owner or his authorized representative. Major activities requiring approval/ review shall include but not be limited to those identified in the list of documents for Approval/ review/ records.
Before proceeding with procurement and/ or order placement, the contractor shall furnish technical data and particulars of his final selected vendor as per vendor data form to EIL/Owner for approval. In case vendor, as proposed by contractor, is found unacceptable, the contractor shall furnish technical data and particulars of other vendors from EIL approved list of vendors for EIL/ Owner approval.

1.1.14 All drawings/ documents to be submitted for approval/ review/ records shall accompany design calculations as per approved schedule of documentation.

1.1.15 For the following equipment, contractor shall ensure that testing and commissioning of the equipment at site shall be done by the respective equipment manufacturer:

- HT Isolator
- Numerical Relays
- ~~Public address system~~
- Fire alarm & detection system
- ~~EPABX Telephone system~~
- UPS
- VFD
- ~~DG set~~

1.1.16 However for other equipments, contractor shall ensure services of manufacturer's representative as required during testing and commissioning.

1.1.17 ~~Contractor shall coordinate with SEB for checking the adequacy of the existing 11 KV line to the Site for the additional load of the project and changes if any in the existing tariff metering arrangement. All liaising & interface activities with SEB for augmentation of existing 11KV incoming power supply line and existing tariff metering arrangement to suit new load requirements is in contractor scope.~~

2

483

1.1.18 Contractor shall also furnish factory acceptance and site acceptance testing procedures from manufacturers for OWNER/PMC approval. Site acceptance testing shall be included for equipments such as Public address system, Fire alarm & detection system, EPABX, Numerical relay, DC system, UPS, VFD, DG set etc. The equipment manufacturer shall carry out these tests at site only. Site testing procedures shall be got approved from OWNER/PMC before performing these tests at Site.

1.0 GENERAL

This specification shall be read in conjunction with Electrical system described in the tender documents.

Intent of this job specification is to define the electrical system and the specific requirement applicable to the scope covered under this contract in addition to the equipment specifications, design philosophy, drawings etc. as enclosed with the bid document and shall be complied for engineering, supply, installation, testing and commissioning. The designed system shall also comply with the requirement of applicable Indian/ international standards and must comply with the Indian statutory regulations. Wherever EIL specification is not available, specification prepared by contractor subject to EIL approval shall be followed. Critical job specific requirement are also covered in this document as conflict avoidance.

Codes and standards as prevailing in the country of origin may be followed for equipment purchased abroad provided that the equivalent standards are more stringent than Indian / International standards and meet the statutory regulations of the approving Indian statutory authorities.

It is responsibility of the Contractor to highlight any contradiction amongst various documents at the bid stage itself. The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. Owner's concurrence shall, however, be obtained before taking a decision in such matters.

- Statutory Regulations

  In particular, the latest version of the following statutory regulations shall be followed for design of electrical system:
  - Indian Electricity Act
  - Indian Electricity Rules/ CEA Regulations
  - The Factory Act
  - Requirements of other statutory bodies as applicable, e.g. CEA, LPCB.

- Engineering design basis (SLD shall be considered a part of Engineering Design Basis)
- Data sheets & drawings
- Job specifications for electrical facilities
- Design Philosophy
- Equipment Specifications
- Codes & standards

CONTRACTOR shall furnish list of conflicts, if any, along with their offer and also furnish the basis that is considered for submitting offer. Owner/EIL will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform owner/EIL of their interpretation. In case bidder fails to convey the same prior to award, the Owner's decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ambiguities shall be admissible.

2.0 POWER SYSTEM DESCRIPTION

CONTRACTOR shall refer the enclosed Single Line Diagram; Drawing no. A951-00-16-50-1001 for electrical power distribution system of the project for Development of Silos for Storage of Wheat at CWC, Nabha, Punjab

The loads of the project shall be fed from the ~~existing~~ SEB 11kV power supply available in the complex. The adequacy of the 11KV power supply shall be checked and additional equipment's for feeding existing and new loads shall be provided. ~~11 KV power supply for the project loads shall be tapped using cable/ overhead conductor from existing 11 kV supply receiving station and by providing a new Two pole /Four pole structure with equipment's. Further~~ 1 no. new 11 kV cable shall be provided from Two pole /Four pole structure for supplying 11 KV power to new Substation SS-01 located within the complex. 11 kV indoor isolation breaker panel shall be provided in Substation SS-01 for further feeding the distribution transformer. This feeder, rated for 100% distribution transformer rating will feed downstream substation.

At SS-01, power will be received at the 11 kV isolation breaker panel via 11 kV cable from Two pole/Four pole structure and will be stepped down to 415 V utilization level through 1 no. of 11/0.433 kV Distribution transformer for feeding the 415 V loads of Package through 415 V PMCC switchboard. All these facilities shall be located in SS-01.

Emergency power from 1 no. DG set will be received at 415V EPMCC and 1 no. feeder from PMCC shall also be provided to EPMCC. Emergency loads i.e. motors, lighting, UPS system, DC system, FA, PA etc. shall be fed through EPMCC provided by contractor.

CONTRACTOR shall follow Electrical Design basis attached for the power feeding of various MV loads through MV switchboards in SS-01. For various MV loads, normal PMCC fed from normal power supply and Emergency PMCC fed from emergency supply feeders have been envisaged. Lighting distribution board LDB/ Emergency Lighting distribution board (ELDB) fed through normal & emergency lighting transformers shall be provided to distribute normal and emergency lighting loads. UPS systems and DC systems shall be provided to supply respective loads.

415 V system neutral shall be solidly earthed.

3.0 ENGINEERING AND JOB SPECIFIC REQUIREMENTS

3.1 GENERAL

Various equipment's covered in the bid package to be supplied by the contractor shall in general be, in accordance with the requirements defined in design basis document, respective equipment datasheet and hardware datasheet. Besides these, the following requirements as detailed out in respective clauses for the equipment's shall also be considered:

Contractor shall ensure that all electrical equipment comply to site and system conditions, rating and other technical requirement as specified in the engineering design basis and shown in the single line diagram.

CONTRACTOR shall use CPWD General Specifications for Electrical works (Part-I internal 2013, part-IV substations, part- II external 1994 as amended upto date wherever relevant and applicable), and design basis document attached with bid package for various equipment's. However for equipment where CPWD's standard specifications are not available, the CONTRACTOR shall use EIL specifications attached with bid package. In case neither EIL or CPWD specification is available then CONTRACTOR shall use their own specification developed based on project specific requirement and good engineering practices prevalent in similar industry so as to ensure satisfactory operational and maintenance requirements subject to approval by owner/EIL.

CONTRACTOR shall note that data sheets for some of the equipment are not enclosed separately. Equipment data sheets for all equipment shall be prepared by the CONTRACTOR based on relevant codes and data sheet shall contain all technical data and information which are essential for review and technical acceptability, detailed engineering, installation, testing, repair and maintenance, replacement etc.

All equipment shall be subjected to routine and acceptance tests as per applicable codes. In addition, equipment shall be subjected to type tests if specified elsewhere.

CONTRACTOR shall clearly specify in their purchase specifications, the requirement of conducting other special tests/ type tests, which are envisaged for various electrical equipment, which shall have no impact on cost and time.

3.2 FAULT LEVEL SELECTION

Single Line diagram indicate the fault levels at different voltage levels. CONTRACTOR shall however verify and select parameter such that to limit the maximum fault level as per the following:

(i) 40 kA for 1 sec. on 11 kV bus
(ii) 50 kA for 1 sec. on 415 V bus

3.3 EQUIPMENT SIZING AND SINGLE LINE DIAGRAM

a) Single line diagram attached shows the philosophy of distribution of electrical power and is indicative only. Quantity of equipment shown in SLD are minimum and shall have no bearing on the actual quantity and rating of equipment required during detail engineering. CONTRACTOR shall detail out the single line diagram based on loads finalized during engineering and size all electrical equipment and shall furnish same for the review of Owner/PMC.

b) Sizing of various equipment's in contractor's scope of supply i.e.11 kV isolation breaker panel, equipment's on Two pole/ Four Pole structure, 11/0.433kV distribution transformer, MV Bus duct, Capacitor Bank with APFC, PMCC, EPMCC, LDB/ELDB, normal & emergency lighting transformers, DC system, UPS system, VFD systems (if any), LP/PP/ELP, 11 KV cable, MV power and control cables etc. is included in Contractor's scope of work. All equipment's shall be sized subject to load analysis to be carried out by the Contractor.

3.4 ELECTRICAL EQUIPMENT FOR DUST LADEN AREAS

CONTRACTOR shall follow clause no. 4.11.2 of IS-5503-II:1969 for selection of electrical equipment located in dust-laden atmosphere. As mentioned in clause no. 4.11.2 "All Electrical wirings, fittings, fixtures and electric drive motors installed in dust-laden atmosphere, except in the open and in offices and similar locations so occupied and segregated as to be reasonably free from dust, shall be flame-proof."

In addition, CONTRACTOR shall check whether any combustible dust is being handled in the project and accordingly decide if any area to be classified as hazardous area for combustible dust hazard. Combustible dust area classification and electrical equipment selection in dust hazard area shall be finalized by contractor during detail engineering in line with IS/IEC-61241. However irrespective of whether area is classified for hazardous dust or not, equipment's complying to clause no. 4.11.2 of IS-5503-II:1969 shall be provided in dust laden indoor locations.

4.0 EQUIPMENT PARTICULAR SPECIFICATION

4.1 MV MOTORS

All MV motors shall be energy efficient IE2 type as per IS-12615:2011. Motor and junction box shall have ingress protection class of IP-65. Indoor motors for dust laden atmosphere shall be flameproof type in line with IS-5503-II:1969.

4.2 LOCAL CONTROL STATION

Local push button control station shall be provided for all motors. In addition to Local Control stations for motors, weatherproof emergency push button station near distribution transformer shall be considered to trip the transformer feeder in case of emergency. The switch shall be with pad lock feature. Local control stations for indoor motors in dust laden atmosphere shall be flameproof type in line with IS-5503-II:1969

4.3 FIRE ALARM AND COMMUNICATION CABLES

Fire alarm cables shall be, copper conductor, twisted pair, overall shielded type with min. conductor size of 1.5 sq. mm and outer sheath of RED color as per the specifications attached with bid package. Communication cables shall be copper conductor, twisted pair overall shielded type with min. cross section area as 0.9 mm dia. Fire alarm & communication cables shall be as per enclosed data sheet A951-000-16-50-DS-0010 and EIL standard specification no. 6-51-0052.

~~Wiring for telephone sets shall be concealed wiring inside buildings, control room, switch gear room and above false ceiling/ flooring. Telephone wiring for all building in the project limit shall be provided. Jelly filled telephone cables shall be provided in outdoor areas.~~

~~Wiring for FA detectors/power supply loops shall be concealed~~ wiring inside buildings and ~~in surface conduit above false ceiling/ below false flooring~~.

All fire alarm cables, plant communication cables and telephone cables as required shall be supplied & installed by contractor.

4.4 FIRE DETECTION AND ALARM SYSTEM

(i) Fire alarm system shall be engineered as per the specifications attached with the bid document.

(ii) Fire Alarm system shall be engineered and procured for the entire project. The fire alarm system shall be analogue addressable type consisting of central fire alarm panel (CFAP) work station, Data gathering and fire alarm panel (DGFAP), intelligent addressable multi sensor detector, manual call points, hooters, sirens, exit signs, control relay modules and integrating hardware.

(iii) Fire alarm equipment installation and cabling shall be as per specification attached, approved sizing calculations and block diagram.

(iv) Interface cabling with air-conditioning system, pressurization system, clean agent system and other systems shall be provided as applicable.

~~4.5 PUBLIC ADDRESS SYSTEM~~

(i) ~~Public Address System shall be engineered in line with the specifications attached with the bid document for all areas of the project including buildings.~~

(ii) ~~All equipment and cabling including supply of all material as per approved layouts and block diagram for Public address system equipment shall be done by contractor.~~

4.6 PRESSURIZATION AND AIR CONDITIONING SYSTEM

Pressurization and air conditioning system as provided as a part of this bid document shall have necessary interface with fire alarm system.

4.7 CABLES AND WIRES

Heat shrinkable type HV cable end termination kits and straight through jointing kits shall be provided as required.

4.8 SUBSTATION BUILDING

The Substation SS-01 shall be adequately sized with proper equipment layout & clearances and this shall be subject to Owner/ EIL's approval. Contractor shall increase the size of the building, if required at any stage, to accommodate electrical equipment required for the project.

Substation shall be raised with internal trenches by compacting the soil so that bottom of the cable trench within substation is minimum 150 mm above the surrounding Grade Level. The substation building shall have switchgear room, battery room, pressurization room, HVAC room, maintenance room/store, Toilet as minimum. Outdoor type transformer bay shall be provided. Further Air conditioned operator room, VFD room (if any), shall be provided. The switchgear room shall be pressurized.

The air-conditioning/ pressurization ducts in substation shall be so mounted that they do not obstruct illumination.

Fire fighting system like portable type CO_2 extinguishers, sand buckets, Fire paint etc shall be provided for substation, transformer bay etc. as per statutory regulations and as defined elsewhere.

All civil works required for completion of substation building is included in contractor's scope of work.

4.9 RCC LINED TRENCHES/ CABLE TRAYS

(i) RCC Electrical trenches shall be provided in substation and in outdoor area.
(ii) Cables for different voltage grades shall be laid in independent cable trays. Separate cable trays shall be provided for control cables.
(iii) All HV & MV power cables in racks/trays shall be laid in single layer only.
(iv) 10% spare space shall be provided in cable trays/trenches.
(v) Cable trays covers shall be provided for top most cable trays and vertical trays.

~~4.10 TELEPHONE SYSTEM~~

~~For complete scope with regard to telephone system please refer elsewhere in bid package.~~

5.0 MISCELLANEOUS REQUIREMENTS

(a) All outdoor electrical equipment's i.e. motors, LCS, switch sockets, LP/PP, MCP, etc. shall be provided with canopy.
(b) Lighting fixtures shall be provided with external reflectors.
(c) ~~Adequate nos. of 30 mtr Telescopic Tubular type High Mast system shall be provided by CONTRACTOR for general area lighting. Each high mast shall have minimum 12 nos. of lighting fixtures with fixture having 2 x 400 W HPSV SON-T type lamps as per datasheet A951-000-16-50-DS-15.~~
(d) LED lamp shall be provided in all type of AC & DC lighting fixtures ~~except for lighting fixtures on Flood Light High Masts.~~

6.0 INSPECTION AND TESTING AT MANUFACTURER'S WORKS

(i) All major electrical equipment and material shall be subject to inspection by owner/ PMC or authorized representative at manufacturers' works. Contractor/Vendor/ Sub-Vendor shall furnish all necessary information concerning the supply to owner/PMC.

(ii) Contractor shall ensure that the electrical equipment procured have type test certificates. Type test certificates for HV and MV switchboards shall not be more than five years old. In those cases where type test certificates are more than five years old, contractor/manufacturer shall carry out the type tests at CPRI or any authorized testing lab prior to dispatch of equipment with no commercial implication.

(iii) During fabrication, all the equipment shall be subject to inspection by owner/PMC or by an agency authorized by the owner to assess the progress of work as well as to ascertain that only quality raw material is used.

(iv) Routine and acceptance tests as listed in relevant Indian standard and equipment specifications shall be conducted. Type test if listed in ITPs and in the relevant data sheet shall be conducted. Type test, if specified, shall be conducted only on one of equipment of each type and rating. These tests shall be carried out by the Contractor/vendor/sub-vendor and shall be witnessed by owner/PMC or an agency authorized by owner/PMC.

(v) All flameproof equipment and equipment for dust hazardous area shall have necessary type certificates from the testing agency (CMIFR etc.) along with statutory authorities approval.

7.0 FIELD TESTING & COMMISSIONING

(i) Contractor shall carry out the installation, field testing and commissioning of all items of electrical equipment including installation, commissioning fire detection and alarm system, plant communication public address system etc. Further appropriate test and commissioning reports and as-built documentation as necessary for all electrical equipment shall be provided.

(ii) Field testing and commissioning of FA system, PA system, VFD, UPS system, DG set shall be done by OEM (Original Equipment supplier). For other equipment, contractor shall ensure services of manufacturers' representatives for supervision of installation, testing and commissioning.

(iii) Contractor shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.

(iv) All electrical equipment shall be said to be installed and mechanically complete after circuit testing, primary and secondary injection testing and loop simulation is complete. Due care and consideration shall be given to the installation of all equipment, materials and facilities.

(v) Obtaining clearance for energizing the complete electrical facilities covered under this tender and approval of installation / drawings from central electrical inspector

and any other concerned approving authority e.g. CEA, TAC, CCE, DGFASLI etc. is in contractor scope.

8.0 TWO YEARS SPARES

Bidder shall furnish the required spares for two years of normal operation and maintenance for all electrical equipment with itemized quantity and unit rate. However owner will decide ordering as per their requirement.

9.0 MAKES OF EQUIPMENT/COMPONENTS

(i) Refer elsewhere in the bid document for acceptable makes of major electrical equipment and electrical components.

(ii) Contractor/ vendor while ordering shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Contractor/ vendor shall give a notice of at least one year to the Owner and PMC before phasing out the products/spares to enable the owner for placement of order for spares and services.

(iii) Contractor/ Vendor may procure material from any of owner/ PMC-approved vendors. However current validity and range of approval as per PMC enlistment letter, workload, stability and solvency need to be verified by the vendor/contractor before placement of order.

(iv) Contractor/ Vendor can offer equipment/components of makes other than specified in the tender during order execution. The alternate make of equipment/components will be evaluated post order, based on the satisfactory track record and test certificates to be furnished by the Vendor/ Contractor. In case the alternate makes are not found acceptable, equipment/components shall be strictly as per vendor list enclosed with the tender.

10.0 LIST OF ATTACHMENT

10.1 EQUIPMENT DATASHEETS:

SL. NO.	DATA SHEET TITLE	DATA SHEET NO.	REV. NO.	NO. OF SHEETS
1.	HV Switchboard	A951-000-16-50-DS-01	0	5
2.	MV Switchboard	A951-000-16-50-DS-02	0	4
3.	Distribution Transformer	A951-000-16-50-DS-03	1	4
4.	MV Bus Duct	A951-000-16-50-DS-04	0	2
5.	Battery & Battery Charger	A951-000-16-50-DS-05	0	7
~~6.~~	~~MV Squirrel Cage Induction Motor~~	~~A951-000-16-50-DS-06~~	~~1~~	~~2~~
~~7.~~	~~AC VFD System~~	~~A951-000-16-50-DS-07~~	~~0~~	~~9~~
8.	HV/MV Cables	A951-000-16-50-DS-08	0	3

SL. NO.	DATA SHEET TITLE	DATA SHEET NO.	REV. NO.	NO. OF SHEETS
9.	Numerical Relay	A951-000-16-50-DS-09	0	4
10.	FA/Communication Cables	A951-000-16-50-DS-10	0	2
11.	Electrical load data	A951-000-16-50-DS-11	0	2
12.	Lighting Fixtures schedule	A951-000-16-50-DS-12	0	7
13.	UPS System	A951-000-16-50-DS-13	0	6
14.	Dry type Lighting Transformer	A951-000-16-50-DS-14	1	3
15.	High Mast Lighting System	A951-000-16-50-DS-15	0	4
16.	Fire Alarm System	A951-000-16-50-DS-16	0	2

10.2 HARDWARE DATASHEETS:

SL. NO.	DATA SHEET TITLE	DATA SHEET NO.	REV. NO.	NO. OF SHEETS
1.	11 kV Isolation breaker panel	A951-000-16-50-DS-21	1	1
2.	415V Feeder Component List	A951-000-16-50-DS-22	1	1
3.	415V Feeder Hardware Data sheets	A951-000-16-50-DS-23	1	10

10.3 ELECTRICAL DRAWINGS

SL. NO.	DATA SHEET TITLE	DATA SHEET NO.	REV. NO.	NO. OF SHEETS
1.	Single Line Diagram	A951-00-16-50-1001	1	1

10.4 EIL ELECTRICAL SPECIFICATIONS:

SL. NO.	EIL SPECIFICATION	SPECIFICATION NO.	REV. NO.	NO. OF SHEETS
1.	Specification for flameproof control stations	6-51-0006	5	7
2.	Specification for flameproof lighting and power panels	6-51-0008	5	7
3.	Specification for industrial type control stations	6-51-0014	5	6
4.	Specification for UPS system	6-51-0017	6	23
5.	Specification for battery charger.	6-51-0019	4	15

SL. NO.	EIL SPECIFICATION	SPECIFICATION NO.	REV. NO.	NO. OF SHEETS
6.	Specification for flameproof plugs, sockets & hand lamps.	6-51-0021	5	7
7.	Specification for soft starters for motors	6-51-0036	0	13
8.	Specification for MV variable frequency drive system	6-51-0038	2	15
9.	Specification for high mast lighting system	6-51-0039	3	11
10.	Specification for stationary lead acid batteries	6-51-0046	3	6
11.	Specification for stationary valve regulated lead acid batteries.	6-51-0048	2	7
12.	Specification for medium and high voltage cables & accessories.	6-51-0051	7	10
13.	Specification for communication and fire alarm cables.	6-51-0052	6	10
14.	Specification for MV and HV bus duct	6-51-0054	4	7
15.	Specification for numerical relays & substation automation system	6-51-0055	2	15
16.	Specification for hazardous area light fixtures and junctions boxes	6-51-0061	5	7
17.	Specification for energy efficient medium voltage induction motors	6-51-0064	1	12
18.	Specification for fire detection and alarm system.	6-51-0076	5	26
19.	Specification for electrical motor operated valve actuators.	6-51-0091	4	10
20.	Design philosophy for electrical facilities.	6-51-0099	6	26

EXISTING SEB 11KV SUPPLY RECEIVING STATION

11 KV OVERHEAD LINE / CABLE

TWO--POLE/FOUR--POLE MOUNTED OUTDOOR GRID EQUIPMENT FOR RECEIVING 11KV SUPPLY

TO SEB/PSU RECEIVING

K.V. ISOLATOR

DROP OUT FUSE

11 KV CABLE

BY OTHERS

BY CONTRACTOR

(SEE NOTE-2)

SS-01

11 KV ISOLATOR BREAKER

11 KV CABLE

TR-0111
11/0.433 KV
1000 KVA (MIN.)
Z=0.25%
Dyn11 , OLTC
+ 5% -15%, 2.5 % STEPS

(BUS DUCT MIN. 1600A)

PMCC-0131

SS-01

NC

415 V, 1600A (min.), 50Hz., 50KA for 1 sec., TPN

MOTOR FEEDERS (RATING >55KW UPTO160 KW TYP.)

RATING UPTO 55 KW (METERING CT FOR MOTORS >4.5KW; CBCT & ELR FOR MOTORS >22KW) (TYP)

SPARE FEEDER (TYP.)

SPARE FEEDER(TYP.)

ELCB

TYPICAL OUTGOING FDRS FOR MCV's, SPACE HEATER, WELDING RECEPTACLES, POWER PANELS

APFC

CAPACITOR FEEDER

PP (TYP.)

SPARE MOTOR FEEDER (TYP.)

SPARE MOTOR FEEDER (TYP.)

SPARE FEEDER(TYP.)

SPARE FEEDER(TYP.)

SPARE FEEDER(TYP.)

SPARE FEEDER(TYP.)

(FOR LAB SOCKETS TYP.)

US-0171
110V UPS SYSTEM FOR DATA COMMUNICATION
FROM EPMCC-0132

CONTROL ROOM / SS-01

SS-01

ACDB 110V, 1PH, 2WIRE

UPS LOADS LAN, POWER SOCKETS

UPS LOADS FOR PA SYSTEM/ INST. LOADS

DC-0171
FROM EPMCC

BAT & BAT CHARGER

SS-01

110V DCDB

DC LOADS FOR HVAC CONTROL AND DC CRITICAL LIGHTING INCLUDING SPARE FEEDERS

DG-001
1 X 400 kVA (MIN.)
0.8P.F, 415 V

DG

AMF-001

415V PVC CABLE

415V PVC CABLE

EMERGENCY BOARD

EPMCC-0132

SS-01

NC

I/L

NO

415 V, 800A (min.) 50Hz, 50KA (1 sec.) TPN

800 A

800 A

UPS DC SYYSTEM FA, PA, LAN ETC.

SPARE FEEDERS (TYP.)

RATING UPTO 55 KW (METERING CT FOR MOTORS >4.5KW; CBCT FOR MOTORS >22KW)

MOTOR FEEDERS (RATING >55KW UPTO160 KW TYP.)

SPARE FEEDER (TYP.)

SPARE FEEDERS (TYP.)

SPARE FEEDER (TYP.)

SPARE FEEDERS

UPS DC SYYSTEM FA, PA, LAN ETC.

NORMAL LTG. TRAFO.
415/415V
200 KVA (min.)
Z=4%(min), Dyn1

EMERGENCY LTG. TRAFO.
415/415V
80 KVA (min.)
Z=4%(min), Dyn1

LB/ELB-0152

SS-01

NC

I/L

NC

415V, 400A, 50Hz, TPN

NO

ELCB ELCB ELCB ELCB ELCB ELCB ELCB

FLOOD LIGHT MAST (TYP.)

TYPICAL OUTGOING FEEDERS FOR INDOOR & OUTDOOR LPs/ELPs

OUTDOOR

LP (TYP.)

INDOOR

LP (TYP.)

INDOOR

ELP (TYP.)

OUTDOOR

ELP (TYP.)

REF. DWG. NO.	REFERENCE DRAWING TITLE

NOTES :-

1. ELECTRICAL DISTRIBUTION IS CONCEPTUAL. CONTRACTOR SHALL DEVELOP DETAILED SLD WITH RELAY AND METERING FOR POWER DISTRIBUTION SHOWING COMPLETE ELECTRICS. THE ELECTRICAL EQUIPMENT SHOWN IN THE SLD ARE INDICATIVE CONTRACTOR TO PROVIDE ALL ELECTRICAL EQUIPMENTS AS REQUIRED
2. SUPPLY AND TERMINATION OF HEAT SHRINKABLE END TERMINATION KITS AND STRAIGHT THROUGH JOINTING KITS, CABLE GLANDS AND LUGS REQUIRED FOR TERMINATING INCOMING 11KV CABLE TO 11KV ISOLATOR BREAKER PANEL INSIDE THE SUBSTATION IS IN CONTRACTORS SCOPE OF WORK
3. QUANTITIES AND RATING SPECIFIED ARE INDICATIVE & MINIMUM. CONTRACTOR SHALL SELECT RATING & QUANTITY MEETING BID DOCUMENT REQUIREMENT.
4. TYPICAL OUTGOING FEEDERS ARE SHOWN IN THE SLD FOR ALL SWITCHBOARDS. REQUIRED NUMBER OF OUTGOING FEEDERS INCLUDING SPARE FEEDERS SHALL BE PROVIDED BY THE CONTRACTOR IN LINE WITH BID DOCUMENT.
5. RELAYS AND METERS SHALL BE PROVIDED FOR FEEDERS AS PER DATASHEET & ENGINEERING DESIGN BASIS ENCLOSED WITH THE BID DOCUMENT.
6. ANY OTHER EQUIPMENT AS REQUIRED FOR MEETING OPERATIONAL & STATUTORY REQUIREMENT SHALL BE PROVIDED BY CONTRACTOR.
7. ALL EMERGENCY LOADS SHALL BE CONNECTED TO EMERGENCY BOARD EPMCC-0132
8. THE QUANTITY OF ELECTRICAL EQUIPMENT I.E. DISTRIBUTION TRANSFORMER, PMCC, EPMCC, LDB, UPS, DC SYSTEM ETC. SHOWN IN THE SLD ARE CONCEPTUAL ONLY.THE QUANTITIES OF THESE SHALL BE DECIDED & FINALISED DURING DETAIL ENGINEERING MEETING BID PACKAGE REQUIREMENT WITH NO COST AND TIME IMPLICATION.

LEGENDS

- HV CIRCUIT BREAKER
- AIR CIRCUIT BREAKER
- TRANSFORMER WITH OLTC
- BUSBAR
- FUSE
- ON LOAD ISOLATOR
- MINIATURE CIRCUIT BREAKER
- EARTH LEAKAGE CIRCUIT BREAKER
- MOTOR
- RECTIFIER/CHARGER
- INVERTER
- BATTERIES
- CONTACTOR
- THERMAL OVERLOAD RELAY
- DRAWOUT FEATURE
- I/L INTERLOCK
- PUSH BUTTON STATION WITH AMMETER
- PUSH BUTTON STATION
- BUSDUCT
- CABLE GLAND TERMINATION
- MPR MOTOR PROTECTION RELAY
- CAPACITOR BANK
- MOULDED CASE CIRCUIT BREAKER (MCCB)
- VOLTAGE TRANSFORMER

REV.	DATE	REVISIONS	DRN BY	CHKD	APPD	PEM/PC
2	01.02.2017	REVISED AND REISSUED FOR TENDER	GK	PG	BRB	
1	14.12.2016	REVISED AND REISSUED FOR TENDER	GK	PG	BRB	
0	21.11.2016	ISSUED FOR TENDER	GK	PG	BRB	
A	04.11.2016	ISSUED FOR CLIENT COMMENTS	GK	PG	BRB	

ENGINEERS INDIA LIMITED
(A Govt. of India Undertaking)

CENTRAL WAREHOUSE CORPORATION
DEVELOPMENT OF MODERN SILOS
FOR STORAGE OF WHEAT AT NABHA

SINGLE LINE DIAGRAM

SCALE	JOB NO.	UNIT	DEPT.	SECT.	DWG. NO.	REV.
NIL	A 9 5 1	0 0	1 6 5	0	1 0 0 1	2

1-1641-0501 REV.0 A1-841x594