Project Engineering Management

Bharat Heavy Electricals Limited
(A Govt. of India undertaking)

Enquiry No.: E-6363/2019 dtd. 24/01/2020 **Due Date: 03/02/2020 by 2:00 PM**

Open Tender Enquiry

Subject: Wind Tunnel Study for Air Cooled Condenser.

Dear Madam/ Sir,

Most competitive rates are invited from bidders for Wind tunnel study for air cooled condenser (Refer Technical Terms & Conditions). Quotations are invited in two parts in sealed cover with Enquiry no., Enquiry date, Quotation due date & Time, Name/ Address of the Organisation whom submitting the offer legibly super-scribed on it, for the above-mentioned item so as to reach the undersigned before 2:00 P.M. on or before the above mentioned due date.

Scope of work: Conducting Wind tunnel study of ACC structure including preparation of models, conducting wind tunnel tests, studying variation of force coefficient value, framing methodology for establishing wind load on ACC components, preparation and submission of report etc. all complete as per specification.

Submission of Bid: Inviting offers in two parts through sealed bid, however bidders can submit password protected bid through email on following e-mail id's: ncsharma@bhel.in; nitingupta@bhel.in

Delivery Period: 20 weeks from date of award of work.

Payment Terms & Submission of Invoice: 50% of the total order value as advance payment (interest free and waiver of BG) through NEFT/ RTGS along with work order against invoice submitted by Institutions. Balance 50% of the total order value after submission of final report, and within 15 days of the final report submission. Invoice (GST compliant) shall be submitted in triplicate, to Civil Department of BHEL/ PS-PEM, PPEI Building, Noida.

Validity of Rates: After awarding the work, Prices shall remain firm without any variation till completion of contract.

Evaluation Criteria: Evaluation shall be done on the Total Price excluding tax (i.e. "X") at Column B as mentioned in price bid format Annexure-IX.

Technical Specifications, PQR, Input Drawings are enclosed. Commercial Terms & Conditions & Price Format shall be as per enclosed Annexures - I to IX.

Tender and all correspondence thereof, shall be addressed to the undersigned by name & designation and sent at the following address:

Tender Room,
M/s Bharat Heavy Electricals Ltd.,
Project Engineering Management,
Power Project Engineering Institute,
HRDI & ESI Complex,
Plot No 25, Sector-16 A, Noida-201301 (U.P.)
Mob. No- 9911170053, Phone no. 0120-4213591
Thanking You,

24/01/2020

Yours faithfully,
On behalf of BHEL,
N C Sharma
Dy. Mgr./CMM

नरेश चन्द्र शर्मा / Naresh Chandra Sharma
उप प्रबंधक (सी.एम.एम.) / Dy. Manager (C.M.M.)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड / Bharat Heavy Electricals Ltd.
पावर सेक्टर–परियोजना प्रबंधन
Power Sector-Project Management
पीपीईआई भवन, एच.आर.डी.आई. एवं ई.एस.आई. कॉम्पलेक्स
PPEI Bldg, H.R.D.I. & E.S.I. Complex
प्लाट नं. 25, सेक्टर 16 ए, नोएडा-201301
Plot No. 25, Sec. 16 A, Noida-201301

Annexure- 'I'

COMMERCIAL TERMS AND CONDITIONS

1. **BID SUBMISSION**

Bids shall be submitted latest **by 2:00 PM** on or before the due date i.e. **03/02/2020** in two parts as follows:

PART-1: TECHNO-COMMERCIAL BID

This part shall contain the following:

a) Technical Specification & other scope of work

b) Commercial terms and conditions, General terms and conditions

c) Unpriced copy of the price bid with all amounts/figures/ percentages wherever quoted in the price bid being replaced with the word 'Quoted' or 'Q'.

d) Supporting document/ information to be submitted against each point of 'PQR' and Documents to be enclosed as per NIT.

This part shall be submitted in duplicate in two separate Sealed Covers with bidder's distinctive Seal super scribed with correct Enquiry No., Item of supply, due date of opening and **'part-1: techno-commercial bid'**.

Complete tender in all respects duly signed & stamped on each and every page by the authorized signatory of the bidder as a token of acceptance of all the terms and conditions of tender.

PART -2: PRICE BID

This part shall contain Prices only and should not contain any technical details and/or Commercial Terms & Conditions. Any technical details and/or Commercial Terms & Conditions, if found in this part shall be ignored as the same are supposed to be contained in PART-I only as indicated above.

This part shall be submitted in a separate Sealed Cover with bidder's distinctive Seal super scribed with correct Enquiry No., Item of supply, due date of opening and **'part -2: price bid'.**

Tenders and all correspondence thereof, shall be addressed to the undersigned by name & designation and sent at the following address:

Kind Attn: Sh N C Sharma / Dy. Mgr. (CMM) & Sh I P Singh/ DGM (CMM)
Tender Room,
M/s Bharat Heavy Electricals Ltd.,
Project Engineering Management,
Power Project Engineering Institute,
HRD & ESI Complex,
Plot No 25, Sector-16 A, Noida-201301 (U.P.)
Mob. No- 9911170053, 9818989654 Phone no. 0120-4213591, 4368749

However bidders can also submit password protected bid submitted through email on following e-mail id's: ncsharma@bhel.in; nitingupta@bhel.in

2. **BID OPENING**

PART- I (Techno-Commercial Bids) will be opened at **3:00 PM** on the due date **03/02/2020** in the presence of bidders who may like to be present. Date and time of opening of Part - II (Price Bids) shall be communicated separately.

3. The bid shall remain valid for a period of 90 days from the date of opening of offers. No revision of prices shall be entertained after bids have been opened. Bidder shall not be entitled during this period to revoke or vary the content of

(Signature and seal of the bidder)

bid or any terms thereof. In case of any unsolicited variation subsequent to bid opening, the bid shall be treated as "Rejected".

4. No revision of prices shall be entertained after bids have been opened.

5. Prices shall remain firm without any variation till completion of contract.

6. Illustrative leaflets giving technical details of items offered should be enclosed, wherever necessary.

7. BHEL shall be under no obligation to accept the lowest or any other bid and shall have the right to accept or reject any bid in part or in full without assigning any reason whatsoever.

8. Late tenders will be rejected.

9. **PAYMENT TERMS:**
50% of the total order value as advance payment (interest free and waiver of BG) through NEFT/ RTGS along with work order against invoice submitted by Institutions. Balance 50% of the total order value after submission of final report, and within 15 days of the final report submission. Invoice (GST compliant) shall be submitted in triplicate, to Civil Department of BHEL/ PS-PEM, PPEI Building, Noida.

In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following order of precedence:

i. Amendments to Purchase Order/ Work Order/ Framework Agreement
ii. Purchase Order/ Work Order/ Framework Agreement
iii. Letter of intent (LOI)/ Letter of Award (LOA)
iv. Clarifications agreed between Buyer and Seller as regards to the tender or the bidding conditions
v. Corrigenda to NIT, with those of later date having precedence over those of earlier date
vi. Enquiry letter and annexures except documents listed in point no (vii) to (viii) below
vii. Technical specifications

10. **PRICE DISCREPRENCY:**
Following shall be considered for evaluation and ordering for non-conformities/ errors/ discrepancies in price bid:
i. Bidders should quote total price in "figures" with corresponding words in price bid format.
ii. If, in the price structure quoted for the required goods/ services/ works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly., unless in the opinion of the Purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.
iii. If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.
iv. If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject of (ii) and (iii) above.
v. If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date up to which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the Purchaser, the bid is liable to be ignored.

11. **LANGUAGE & CORRECTIONS:**
i. The Bid shall be in English language. All correspondence and documents relating to the bid exchanged between the bidder and the purchaser shall also be in ENGLISH language. However, any technical document/ literature etc. printed in a language other than English shall be accompanied by its true English translation duly signed for its correctness. Any document submitted with the bid but not in English language shall not be treated as part of the bid document. The responsibility for the correctness of the translations if any solely rests on the bidder and purchaser shall not be responsible for any loss/likely loss arising out of error in translation whatsoever. In such cases, for the purpose of interpretation of the bid, the English translation shall prevail.

(Signature and seal of the bidder)

ii. Tenderer shall quote the rates in English language and Indo-Arabic numerals only. Total Price shall be entered in figures as well as in words. For the purpose of tender, metric system of units shall be used.

iii. All entries in the tender shall either be typed or written legibly in ink. Cancellations, corrections, insertions, erasements, over-writing (if unavoidable) shall be authenticated with signature and seal by the bidder.

12. ETHICS IN BUSINESS DEALINGS/ SUSPENSION OF BUSINESS DEALINGS:

In order to protect the commercial interests of BHEL, it becomes necessary to take action against bidders/ sellers/ suppliers / contractors by way of suspension of business dealings, who either fail to perform or are in default without any reasonable cause, cause loss of business/ money/ reputation, indulge in malpractices, cheating, bribery, fraud or any other misconduct or formation of cartels so as to influence the bidding process or influence the price etc. Suspension of Business Dealings could be in the form of "Hold" or "Banning" a bidders/ sellers/ suppliers / contractors. Detailed guidelines are available at www.bhel.com/www.bhelpem.com. Bidders should get themselves acquainted with these guidelines.

13. DEALING WITH BIDDERS UNDER SUSPENSION

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firm is available on BHEL web site www.bhel.in

14. BHEL shall be under no obligation to accept the lowest or any other bid and shall have the right to accept or reject any bid in part or in full without assigning any reason whatsoever. BHEL also reserves the right to reject any or all quotations without assigning any reason whatsoever. Quotation of the parties which have been black-listed / debarred / banned by PSUs / kept on hold by any office of Delhi-based Divisions of BHEL during the last three years will be rejected. Late tenders will be rejected.

15. TAX DEDUCTION AT SOURCE:

Tax shall be deducted at source from the running bills as per applicable Income Tax Rules and other statutory requirements.

16. TERMINATION OF CONTRACT:

If at any time during the currency of contract, the Caterer defaults in performance of the work with due diligence and continues to do so or commit any default in complying any of the tender terms and conditions even after the notice (in writing) is given to him, BHEL may, without prejudice to any other, has right to remedy which shall have accrued or shall accrue thereafter to BHEL, to terminate the contract.

17. SHORT CLOSURE OF CONTRACT:

BHEL reserves the right to short close the contract with one-month notice without assigning any reason.

18. NO DEVIATION CERTIFICATE: Institutions must comply with the tender specification and all terms and conditions of contract. No deviation shall be entertained.

19. EVALUATION CRITERIA:

L1 shall be decided based on Total Price excluding tax at Column B in Price Format (Annexure-IX). In the event of more than one bidder having identical Total Evaluated Cost and there is a tie amongst the bidders, the respective bidders would be asked to submit their revised price bids. If distinct Ll rate isn't arrived at after submission of revised bids and the tie prevails between more than one bidders for Total Evaluated Cost, then the L1 'will be decided based on lottery which will be carried out in the presence of all the L1 bidders or their representatives who choose to be present. Based on the above outcome, the bidders would be ranked from L-l position in ascending order.

20. In case of any act of default/ omission/ pilferage/ prejudice to any interest of BHEL, BHEL may take action against Institution as per company guidelines in addition to the penalty & action explicitly mentioned in this tender document.

(Signature and seal of the bidder)

Annexure- 'II'

GENERAL TERMS AND CONDITIONS

21. ARBITRATION & CONCILIATION:

21.1 CONCILIATION:

If at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract), which the Parties are unable to settle mutually, arise inter-se the Parties, the same may, be referred by either party to Conciliation to be conducted through Independent Experts Committee (IEC) to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators under BHEL Conciliation Scheme.

Notes:

i. No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.
ii. Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.
iii. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in Procedure (Annexure-X) to this GCC. The Procedure (Annexure-X) together with its Formats will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in this GCC.
iv. The Contractor/ supplier hereby agrees that BHEL may make any amendments or modifications to the provisions stipulated in the Procedure (Annexure-X) to this GCC from time to time and confirms that it shall be bound by such amended or modified provisions of the Procedure (Annexure-X) with effect from the date as intimated by BHEL to it.
v. The venue of conciliation shall be Delhi/ New Delhi/ PO issuing agency city where PO is issued by BHEL Power Sector Regional HQ

21.2 ARBITRATION:

Except as provided elsewhere in this Contract, in case amicable settlement is not reached between the Parties, in respect of any dispute or difference; arising out of the formation, breach, termination, validity of execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the contract, then, either Party may, by a notice in terms of Section 21 of Arbitration & Conciliation Act in writing to the other Party commence arbitration. The notice shall as far as possible contain the particulars of all claims to be referred to arbitration.

The arbitration shall be conducted by Sole Arbitrator to be appointed mutually by the Competent Authority of BHEL (purchaser) & Seller within the statutory period as applicable. As far as practicable, names of 2 or more persons shall be forwarded to the Seller for seeking consent of the Seller to one of the names proposed for appointment as arbitrator in the case. If the parties fail to agree on the name of Sole Arbitrator, then appointment shall be made as per the provisions of section 11 of the Arbitration & Conciliation Act.

The Arbitrator shall pass a reasoned award and the award of the Arbitrator shall be final and binding upon the Parties. The language of Arbitration shall be English.

(Signature and seal of the bidder)

Subject as aforesaid, the provisions of Arbitration of Conciliation Act 1996 (India) or statutory modification/ Amendments or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat and venue of arbitration shall be Delhi/ New Delhi/ PO issuing agency city where PO is issued by BHEL Power Sector Regional HQ

The cost of arbitration shall be borne equally by the parties' subject to the final apportionment of the cost of the arbitration as per the award/order of the arbitrator.

Subject to the arbitration in terms of Clause above, the Courts at Delhi-NCR/ (PO issuing agency city- where PO has been issued by BHEL Power Sector Regional HQ) shall have exclusive jurisdiction over any matter arising out of or in connection with this contract.

Notwithstanding the existence or any dispute or difference and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

22. LAWS GOVERNING THE CONTRACT:

Contract, including all matters connected with contract, shall be governed by the Indian Law, both substantive and procedural, for the time being in force including modification thereto, and shall be subject to the exclusive jurisdiction of the Indian courts at Delhi-NCR/ (PO issuing agency city- where PO has been issued by BHEL Power Sector Regional HQ).

It shall be responsibility of the vendor to ensure compliance of Labor laws, safety regulations, workmen compensation, insurance, BOCW act or other relevant acts.

23. JURISDICTION OF COURT:

Courts at Delhi-NCR/ (PO issuing agency city- where PO has been issued by BHEL Power Sector Regional HQ) shall have exclusive jurisdiction to decide the dispute, if any, arising out of or in respect of the contract(s) to which these conditions are applicable.

24. SETTLEMENT OF DISPUTES:

24.1 Except as otherwise specifically provided in the Order/ Contract, all disputes concerning questions of the facts arising under the Order/ Contract, shall be decided by Purchaser, subject to written appeal by the Seller/ Contractor to the Purchaser, whose decision shall be final.

24.2 Any dispute or difference shall be, to the extent possible, settled amicably between the parties hereto, failing which the disputed issues shall be settled through arbitration.

24.3 Seller/ Contractor shall continue to perform the order/ contract, pending settlement of dispute(s).

25. BHEL FRAUD PREVENTION POLICY:

The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice. BHEL Fraud prevention policy is also uploaded on www.bhelpem.com & www.bhel.com

26. FORCE MAJEURE:

26.1 Notwithstanding anything contained in the contract, neither the Seller nor the Buyer shall be held responsible for total or partial non execution/non- performance of any of the contractual obligations,

(Signature and seal of the bidder)

in case such execution/performance is impeded/prevented due to occurrence of a 'Force Majeure' event not within the reasonable control of the party affected, which materially interferes or directly affects the performance of the obligations or duties under the contract.

Force Majeure event means an event beyond the control of the parties to the contract including but not limited to war, Military operations of any nature, Act of God, earthquakes, floods, fire, quarantine restrictions, acts of public enemy, blockades, civil war, explosion, epidemics, insurgency, change in law or government policy etc.

26.2 The party claiming to be affected by such Force Majeure event shall notify/inform the other party in writing without delay within a reasonable period of the occurrence and cessation of such event specifying the Force Majeure event and its effect on performance of contractual obligations. In the event of the parties hereto not agreeing that a force majeure event has occurred, the parties shall submit the dispute(s) for resolution pursuant to the provisions hereunder, provided that the burden of proof as to whether a force majeure event has occurred shall be upon the party claiming such an event.

26.3 If it is agreed between the parties that a Force Majeure event has occurred and its effect continues for a period of 36 months, then either party shall be free to cancel the contract. However, if the effect of such event ceases within this period of 36 months, the performance of the obligations put on hold shall be resumed immediately.

26.4 Not-withstanding the above provisions, Purchaser shall reserve the right to cancel the Order/ Contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of delivery and other schedules.

26.5 If a war like situation has developed in a country where Sellers's works (of this PO) is located or there is political instability or civil war and Indian Embassy located in that country/Indian Government forbids or advises for not having any business dealings in that country/ region/zone, then BHEL reserves the right to cancel the order/Contract without incurring any liability for any kind of payment or compensation to the Seller on that account.

27. STATUTORY VARIATION:

27.1 In general, Statutory variation for GST is payable to the Seller during currency of the contract between Buyer and Seller. Further, for period beyond the currency of the contract, BHEL will reimburse the actual applicable tax even if the same is higher than the amount applicable within the contractual period in case BHEL is able to take the input tax credit. However, the decision of BHEL in this regard will be final and binding on the seller/contractor otherwise vendor/contractor has to bear the differential upward increase in tax and ex- works price is to be adjusted accordingly

27.2 No other variations such as on Custom Duty, exchange rate, minimum wages, prices of controlled commodities, any other input etc. shall be payable by the purchaser unless specifically agreed upon.

28. The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendor/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL web site http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud as soon as it comes to their notice.

NOTE:

It is presumed that the bidder has accepted all the instructions, Terms and conditions and Technical Specifications covered in this Tender Enquiry.

----------X----------

(Signature and seal of the bidder)

Annexure- 'III'

Acceptance Letter / No Deviation Certificate

Notwithstanding anything mentioned in our bid, we hereby accept all terms and conditions of the above tender.

Or

We hereby accept all terms and conditions of the above tender except the following:

(Give reference to Clause Nos. of Terms & Conditions which are not acceptable)

1.

2.

3.

4.

5.

Note: Any deviation specified elsewhere in the tender shall not be considered. Deviations may or may not be accepted by BHEL.

(Signature & seal of the contractor)

(Signature and seal of the bidder)

Annexure – 'IV'

DETAILS OF BUSINESS

The vendor shall furnish the following information along with Part-1 bid.

1.0	Name of the firm		
2.0	Address for communication		
3.0	Registered Office, if any :		
	Telephone No. (Office) (Res) (Mobile) (Fax)		
4.0	Name of proprietor / partner / Director(s)		
5.0	Name of Bankers		
6.0	Enclose Experience Certificates with Govt. /Public Sector Undertaking / Private of repute.		
7.0	Copy of PAN Card/GSTIN to be enclosed		
8.0	Any other information		

(Signature and seal of the bidder)

Annexure- 'V'

DECLARATION

I/ We hereby declare that I / we have not been banned or de-listed by any PSU / Government Department / Financial Institute / Court and no case is pending with the police / court against our firm/ partner or the company.

(Signature & seal of the Bidder)

(Signature and seal of the bidder)

Annexure- 'VI'

TECHNICAL DETAILS

For Technical bid

Work Experience fulfilling, submitted in Part-I Bid)

EXPERIENCE	No. of Work	Value	Customer's Name
1.			
2.			
3.			

(Signature and seal of the bidder)

Annexure-VII

NEFT Application Form

Name of the firm/Authorized Distributor/Authorized:

Name of the Bank:

Address Of the Bank:

Company's A/c no:

Type of A/c:

IFSC CODE:

RTGS CODE:

Company's E-MAIL ADDRESS:

Company PAN No.:

Authorized Signature

Company Seal

THE ABOVE DETAILS ARE TO BE SUBMITTED EITHER ATTESTED BY YOUR BANKERS OR CHEQUE LEAF DULY CANCELLED WITH IFSC CODE & A/C NO. PRINTED ON IT MAY BE ENCLOSED.

Accompanying documents :

Cancelled cheque leaf for A/C no. & IFSC confirmation

(Signature and seal of the bidder)

Annexure-VIII

CHECK-LIST (Part-I Bid)

SUMMARY OF COMPLIANCE TO REQUIREMENT OF TENDER

Sl. No.	Description of requirement	Yes/ No / NA	Page No(s)
1	Commercial Terms and Conditions (Annexure-"I").		
2	General Terms & Conditions (Annexure-"II").		
3	Acceptance Letter/ No Deviation Certificate (Annexure-"III")		
4	Details Of Business (Annexure –"IV")		
5	Declaration (Annexure-"V")		
6	Technical Details (Annexure-"VI")		
7	NEFT Format Duly Certified by Bank OR Cancelled Cheque with sign & seal of bidder (Annexure-"VII")		
8	Check List (Annexure-"VIII")		
9	Unpriced Bid Format (Annexure-"IX")		

(Signature and seal of the bidder)

Price Format for Wind tunnel study for air cooled condenser

ANNEXURE-IX

Sl. No.	Scope of Work	HSN Code/ Service Activity No.	Total Price excluding taxes (INR)	GST Rate @ __%	GST Amount on Total Price (INR)	Total Price (INR) (All inclusive)
		A	B	C	D = B x C/100	F = B + D
1	Conducting Wind tunnel study of ACC structure including preparation of models, conducting wind tunnel tests, studying variation of force coefficient value, framing methodology for establishing wind load on ACC components, preparation and submission of report etc. all complete as per specification.				Derived	Derived
			Grand Total: X =			Derived

Quoted price i.e. "X" (In words) = ...

Notes:

1. **Evaluation Criteria:** L1 shall be decided based on Total Price excluding tax (i.e. "**X**") at Column B.

(Sign & Seal)

TECHNICAL PREQUALIFYING REQUIREMENT OF BIDDERS FOR WIND TUNNEL STUDY OF ACC STRUCTURE

SPECIFICATION NO. PE-TS-ACC-600-002

BHARAT HEAVY ELECTRICALS LIMITED
Project Engineering Management
PPEI BUILDING, HRD & ESI COMPLEX
Plot No. 25, Sector 16A
NOIDA, U.P. – 201301

TECHNICAL PREQUALIFYING REQUIREMENT FOR WIND TUNNEL STUDY OF ACC STRUCTURE

1. Bidder should have successfully executed Wind Tunnel model and testing along with determination of wind load parameters for industrial structures/ other structures for a height of at least 30m for any one of the following in the last seven years from latest date of bid submission

   a) One work of value not less than 33 lakhs (excluding taxes).

   OR

   b) Two works each of value not less than 21 lakhs (excluding taxes).

   OR

   c) Three works each of value not less than 17 lakhs (excluding taxes).

2. Bidder should have their own Wind tunnel testing facility.

TECHNICAL SPECIFICATION
FOR
WIND TUNNEL STUDY OF ACC STRUCTURE

SPECIFICATION NO. PE-TS-ACC-600-001

VOLUME-II

BHARAT HEAVY ELECTRICALS LIMITED
Project Engineering Management
PPEI BUILDING, HRD & ESI COMPLEX
Plot No. 25, Sector 16A
NOIDA, U.P. – 201301

CONTENTS

SECTION 'A'

SCOPE OF WORK

SCOPE OF WORK

Introduction

Air Cooled Condenser is a system for cooling the main steam generated in the power cycle of a thermal power plant. Conventionally this was done with water cooled condenser along with Cooling Tower. Scarcity of water resources in the country resulted into increasing use of Air Cooled Condensers (ACC).

BHEL is in the process of in-house development of ACC design. ACC structural arrangement consists of a truss supported on RCC hollow columns which in turn supports number of cooling fans arranged in a rectangular pattern for cooling the main steam. There are two planes (under plane level and fan deck level) of structural steel truss arrangement. The truss arrangement of ACC structure rests on RCC circular hollow columns at a height varying from 40-60 m above ground level. Steam is condensed through fan induced air flow at a height of about 50-70 m above ground level. The top of ACC structure shall have saw tooth like shape (delta shape called A-frame). The plan dimensions of ACC structure vary depending upon requirement.

For structural design of ACC, evaluation of wind load is necessary. The scope of this project is to develop a methodology for evaluation of wind load for such type of structure and verification of same with experimental test study. The scope of Bidder shall include but not be limited to the following:

1. Preparation of experimental models of ACC truss arrangement, supporting members along with wind wall, A-frame along with duct and tube bundles resting on structural truss arrangement, ACC supporting columns etc. including surrounding structures as required.
2. Conducting wind tunnel tests and establishing forces coefficient value (Cf) for
   (a) standalone case and
   (b) for interference conditions considering the effect of surrounding structures on force coefficient value.
3. Studying the variation of force coefficient value with respect to plan dimension, height, geometry of A frame and wind wall height.
4. Framing a methodology for evaluation of wind load on various components of ACC structure in general. Methodology shall cover arriving at empirical formulae (compatible with experimental study) as a function of structure geometry and other parameters as required.
5. Preparation and submission of report.

SECTION 'B'

PROJECT INFORMATION

PROJECT INFORMATION

Brief Description of Air Cooled Condenser

Air Cooled Condensers are located just outside the Main Power House. ACC structural arrangement consists of a truss supported on RCC hollow columns which in turn supports number of cooling fans arranged in a rectangular pattern for cooling the main steam. There are two planes (under plane level and fan deck level) of structural steel truss arrangement. In general, the structural design of ACC comprises 3 parts --- Fans supporting truss arrangement, truss supporting RCC Columns, Foundation. BHEL is aiming to determine the forces acting on the structure due to wind load to carry out analysis and design of each of the three components.

Project details of Air Cooled Condenser

The truss arrangement of ACC structure rests on RCC circular hollow columns at a height of 55m above ground level. The structure above the truss consists of 10 sections, each section having 9 modules. Each module has 14 bundles arranged in A shape and are called A frames. Steam in the tube bundles is to be condensed through fan induced air flow at a height of 63m above ground level. Tube bundles are supported at top and bottom by means of delta-shaped structures (A-frames) directly above cooling fans at fan deck level. The main exhaust steam duct manifold which directs steam to the tube bundles is located on top of A-frame. This main exhaust steam duct is supported by cantilever truss towards Power House. The tube bundles supported by A-frame are surrounded by a peripheral wind wall. Fan deck structure also carries the fan/gearbox/motor unit for each module. The steel truss height is about 7m with continuous length over four spans of 25m each supported on concrete columns with a special arrangement of moment free support and lateral restraint with all bolted connections. Structures like valve platform, exit platforms, etc. have to be suitably modelled. The general schematic arrangement of ACC is shown in Figure-1.

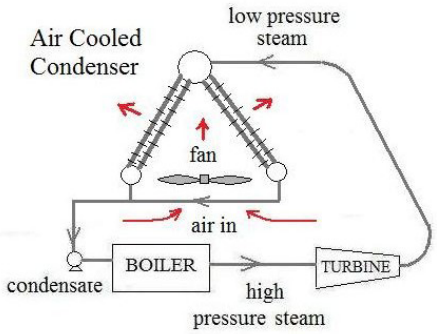

Figure-1: Schematic arrangement of ACC System

A typical general arrangement of ACC is attached in Annexure-A.

Project Site Conditions

Climatic Conditions: Temperature: Monthly Basis	
Mean of Daily Max Mean of Daily Min	37.8 ^{0} C (In the month of May) 9.3 ^{0} C (In the month of Dec & Jan)
Temperature : Annual Basis	
Mean of Daily Max Mean of Daily Min	29.3 ^{0} C 18.1 ^{0} C
Highest Temp Recorded	46.6 ^{0} C
Lowest Temp Recorded	0.5 ^{0} C
Relative Humidity	Varies between 26% AND 88%
Annual Average Rainfall	1277.9mm
Wind Load : Calculations for wind effect shall be in accordance with IS 875 (Part-3) taking into account the following:	Basic Wind Speed =39m/sec

SECTION 'C'

SPECIFIC TECHNICAL REQUIREMENTS

1. **General:**

1.01. Bidder shall conduct Wind Tunnel study on mutually agreed date with BHEL. The test will be witnessed by authorised representatives from BHEL.

1.02. Dimensional analysis of ACC structure vis-a-vis the model, shall be conducted to find the various dimensional parameters. The dimensional analysis shall be furnished in the detailed experiment report.

1.03. Wind loading will be in accordance with Indian Standard Code IS:875 (Part 3) for all basic wind speeds.

1.04. Bidder shall simulate the terrain and surrounding structures as required in the wind tunnel, as given in IS 875 Part (III).

2. **Material of Construction**

Material for preparation of rigid model shall be any suitable material reflecting dynamic properties of ACC to complete the study. Bidder will finalise the material in consultation with BHEL prior to initiating model preparation. The scaled down model of complete ACC structure should consist of columns, structural truss arrangement, A-frames along with tube bundles and wind shielding wall. However, fans are not required to be modelled.

3. **Process/ Methodology to be adopted for the Study**

3.01. Multiple rigid models of ACC unit, at suitable model scale shall be designed, fabricated and instrumented, so that wind loads (force and pressure measurements) could be obtained.

3.02. Tests shall be carried out under simulated atmospheric boundary layer conditions for both standalone as well as for interference situations.

3.03. The **force measurements** shall be done for various components of the model namely,

(a) on the entire structure.
(b) on the all supporting columns.
(c) on the superstructure supported on the columns.

The superstructure shall also be tested for situations with and without the wind shielding walls.

3.04. The **force measurements** shall be carried out for the following cases:

Case-1: ACC structure plan area A1, column height H1 & wind shielding wall height h1.
Case-2: ACC structure plan area A1, column height H1 & wind shielding wall height h2.
Case-3: ACC structure plan area A1, column height H1 & wind shielding wall height h3.
Case-4: ACC structure plan area A2, column height H2 & wind shielding wall height h4.
Case-5: ACC structure plan area A2, column height H2 & wind shielding wall height h5.
Case-6: ACC structure plan area A2, column height H2 & wind shielding wall height h6.
Case-7: ACC structure plan area A3, column height H3 & wind shielding wall height h7.
Case-8: ACC structure plan area A3, column height H3 & wind shielding wall height h8.
Case-9: ACC structure plan area A3, column height H3 & wind shielding wall height h9.

3.05. The **pressure measurement** shall be carried out on various components of the model namely,

(a) On a column placed at three different plan locations. The pressure ports shall be provided at three cross sectional locations of the column, along the height.

(b) The pressure measurement shall also be carried out on the surfaces of A type structures at three different heights along the apex of the A type structure on both the sides, along its length by providing pressure ports to obtain the internal, external and net pressure coefficients.

(c) The instrumented “A type structure” shall be placed at three different plan locations, and the pressure data shall be obtained as mentioned in point “b” above.

(d) The pressure measurements as mentioned in points (b) and (c) above shall be carried out with as well as without the wind wall cases (for one typical height as specified by BHEL).

4. **The report shall contain the following:**

i) Scope of work

ii) Detailed procedure and methodology of ACC model preparation for each model.

iii) Detailed procedure for wind tunnel testing of ACC structure for all cases.

iv) Test data of wind tunnel testing for all cases.

v) Step by step procedure for evaluation of wind load on various components of a prototype ACC structure as per general arrangement furnished by BHEL.

vi) A parametric study report indicating variation in coefficient value with respect to change in wind speed, column height, column diameter, column spacing, plan dimension of ACC structure and A frame height.

vii) Interference effect of surrounding structures on ACC model.

viii) For every case of wind tunnel study natural frequency of structure, bending moment, shear force and deflection of the structure.

This report will form the basis of design philosophy to be adopted by BHEL in future projects for Air Cooled Condensers.

5. A soft copy along with a hard copy of draft report shall be submitted for BHEL's review. On finalisation, five hard copies of final report along with a soft copy shall be submitted at the end.

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Annexure-A

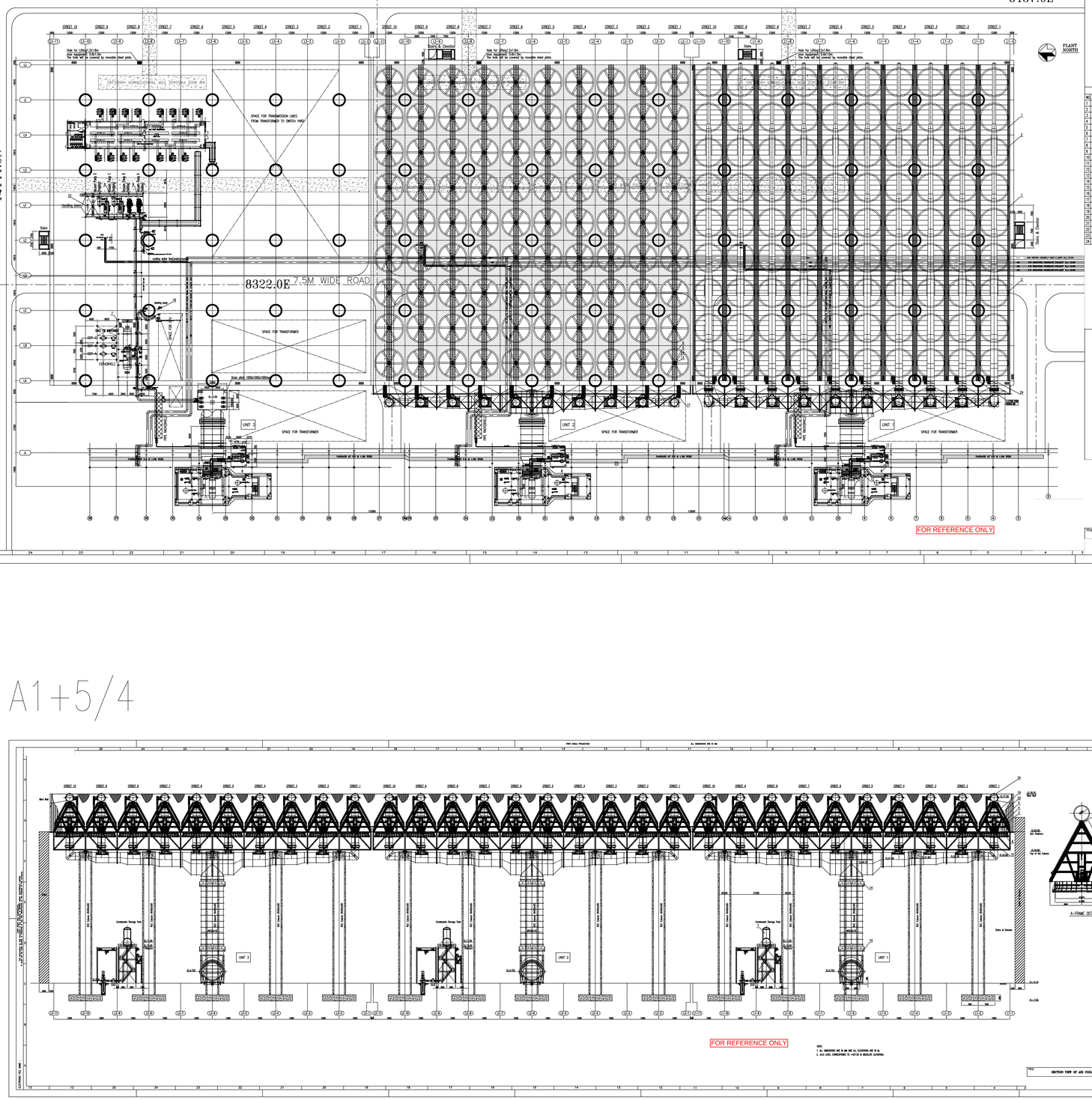
List of Drawings provided by BHEL as reference for Wind Tunnel study of ACC structure

A.1 List of drawings attached

S. No.	Title
1	GENERAL ARRANGEMENT OF ACC (INCLUDES L1 TO L11 GRIDS IN ONE DIRECTION & LA', LA TO LJ GRIDS IN OTHER DIRECTION)
2	LAYOUT OF A-FRAME
3	LAYOUT OF FAN BRIDGE
4	LAYOUT OF WINDWALL
5	PLAN AT EL 55.5M
6	PLAN AT EL 63M
7	LAYOUT OF FAN DECK
8	TRUSS (UNDERSTRUCTURE) SECTION AXIS L1, L2, L3 & L4
9	TRUSS (UNDERSTRUCTURE) SECTION AXIS L5, L6, L7 & L8
10	TRUSS (UNDERSTRUCTURE) SECTION AXIS L9, L10 & L11
11	TRUSS (UNDERSTRUCTURE) SECTION AXIS LA', LA, LB & LC
12	TRUSS (UNDERSTRUCTURE) SECTION AXIS LD, LE, LF & LG
13	TRUSS (UNDERSTRUCTURE) SECTION AXIS LH, LI & LJ
14	LAYOUT OF WALKWAY AT EL 63M
15	LAYOUT OF WALKWAY BETWEEN STREETS
16	WINDWALL DETAILS

A1+5/4

A1+1/4



TECHNICAL DATA

1.Design Ambient Air Temperature : 38 deg C
2.Design Condenser Back Pressure : 106.6 mm Hg
3.No. of Modules per ACC : 90
4.Tube Size : 22OD/20I/1.5 mm x mm x mm
Type : Single Row
Material : Aluminum Cladded CS EN 10139OC 01+C290
5.Fin Size : 0.25 mm
Material : Aluminum (Spec and grade to be mentioned)
6.Design Steam Flow : 1275.293 tons/hr
7.Design Pressure : 0.5 bar (g) and Full Vacuum
8.Design Temperature : 121 deg C
9.Surface Area provided (sq. m) :

EQUIPMENTS LIST

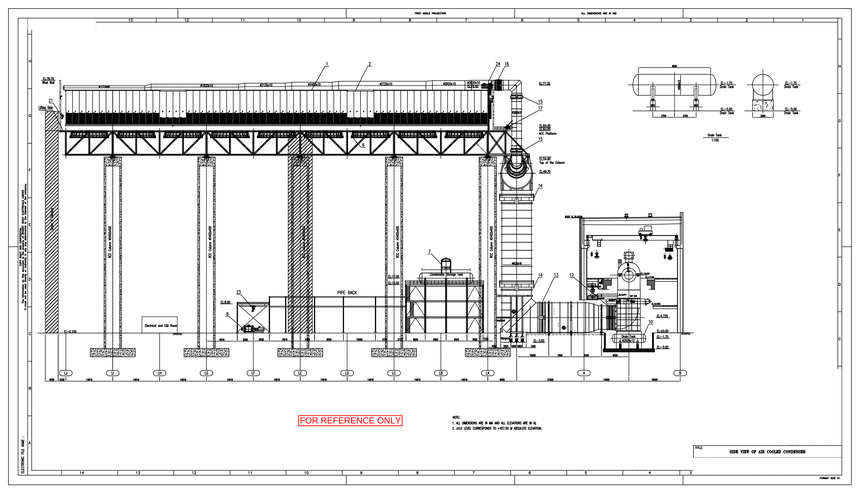
NO.	NAME	TYPE AND MATERIAL	UNIT	QTY/UNIT	REMARK
1	Fin tube bundle-Condenser	Single row 11.6×2.0585m	Set	1100	
2	Fin tube bundle-Dephlegmator	Single row 11.4×2.0585m	Set	180	
3	Axial fan	Blade Material: FRP; Hub Material: CS	Set	90	
4	Gear box	Parallel shaft, helical gear	Set	90	
5	Fan motor	Vertical, Dual speed, Rated power: 200KW	Set	90	
6	Fan shaft and cable guard	Type: belt, Mat: FRP	Set	90	
7	Condensate tank	Material: CS	Set	1	
8	Vacuum pump(hogging)	Liquid ring	Set	2	
9	Vacuum pump(holding)	Liquid ring	Set	2	
10	Drain tank	Material: CS	Set	1	
11	Drain pump	Vertical Centrifugal Canister Type	Set	2	
12	Lateral expansion joint	DN7300, SS304	Set	1	
13	Hinged expansion joint	DN6200, SS304	Set	1	
14	Gimbal expansion joint	DN6200, SS304	Set	2	
15	Gimbal expansion joint	DN3000, SS304	Set	20	
16	Hinged expansion joint	DN3000, SS304	Set	10	
17	Rupture disc	DN800, Release pressure:0.45barg, SS316L	Set	10	
18	Cleaning pump	Q:150L/h, H:15MPa	Set	1	
19	Cleaning ladder	Semi-automatic	Set	20	
20	Chain hoist	Location :Fan Deck	Set	10	
21	Electrical hoist	Location :Fan Deck	Set	1	
22	Electrical hoist	For Drain Pump	Set	1	
23	Electrical crane	For Vacuum Pump	Set	1	
24	Isolation valve	DN3000	Set	10	

NOTE:
1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN M.
2. ±0.0 LEVEL CORRESPONDS TO +457.50 M ABSOLUTE ELEVATION.
3. EQUIPMENTS LAYOUT IS SAME FOR THREE UNITS.

TITLE: PLAN VIEW OF AIR COOLED CONDENSER

NOTE:
1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN M.
2. ±0.0 LEVEL CORRESPONDS TO +457.50 M ABSOLUTE ELEVATION.

TITLE: SECTION VIEW OF AIR COOLED CONDENSER



NOTE:
1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN M.
2. ±0.0 LEVEL CORRESPONDS TO +457.50 M ABSOLUTE ELEVATION.

TITLE: SIDE VIEW OF AIR COOLED CONDENSER

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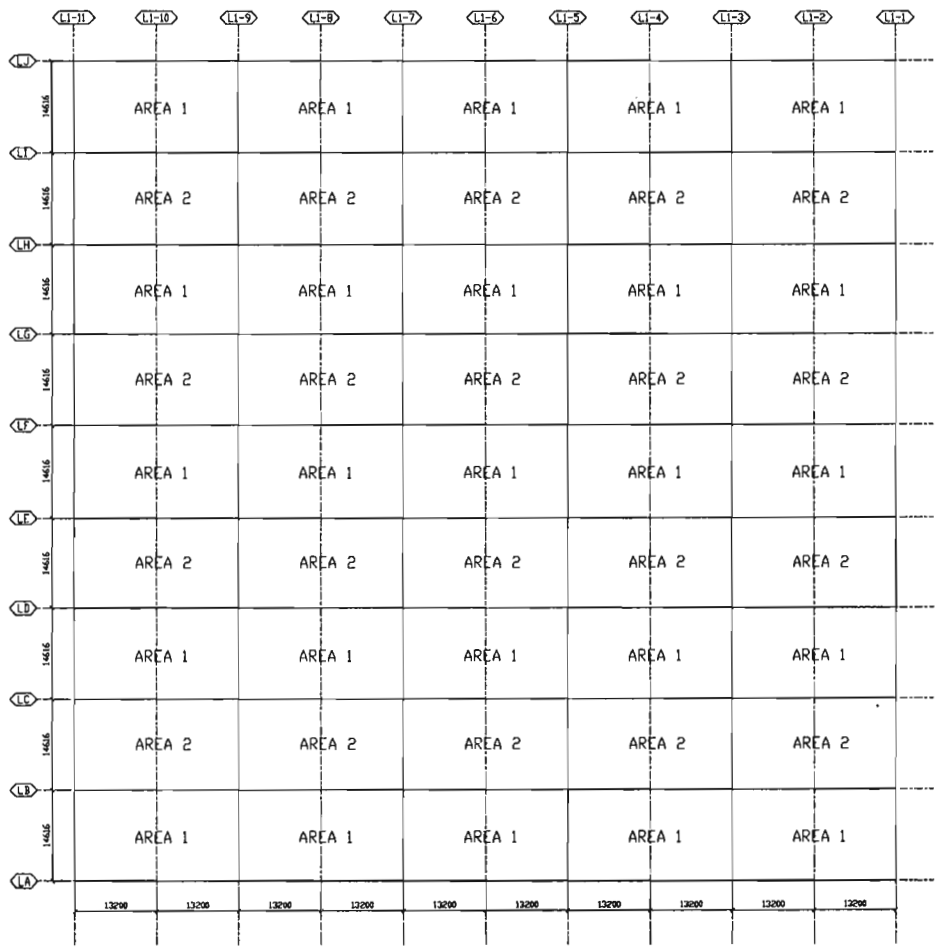
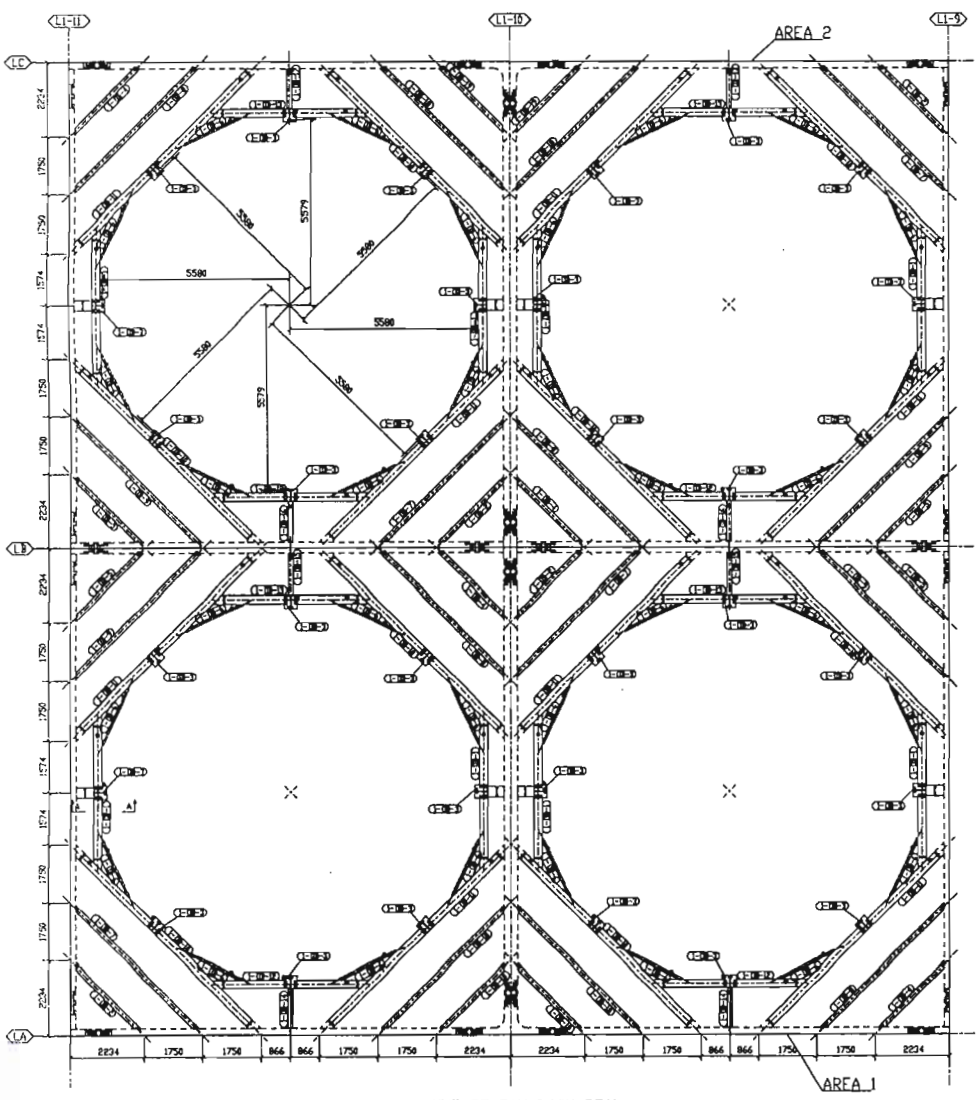
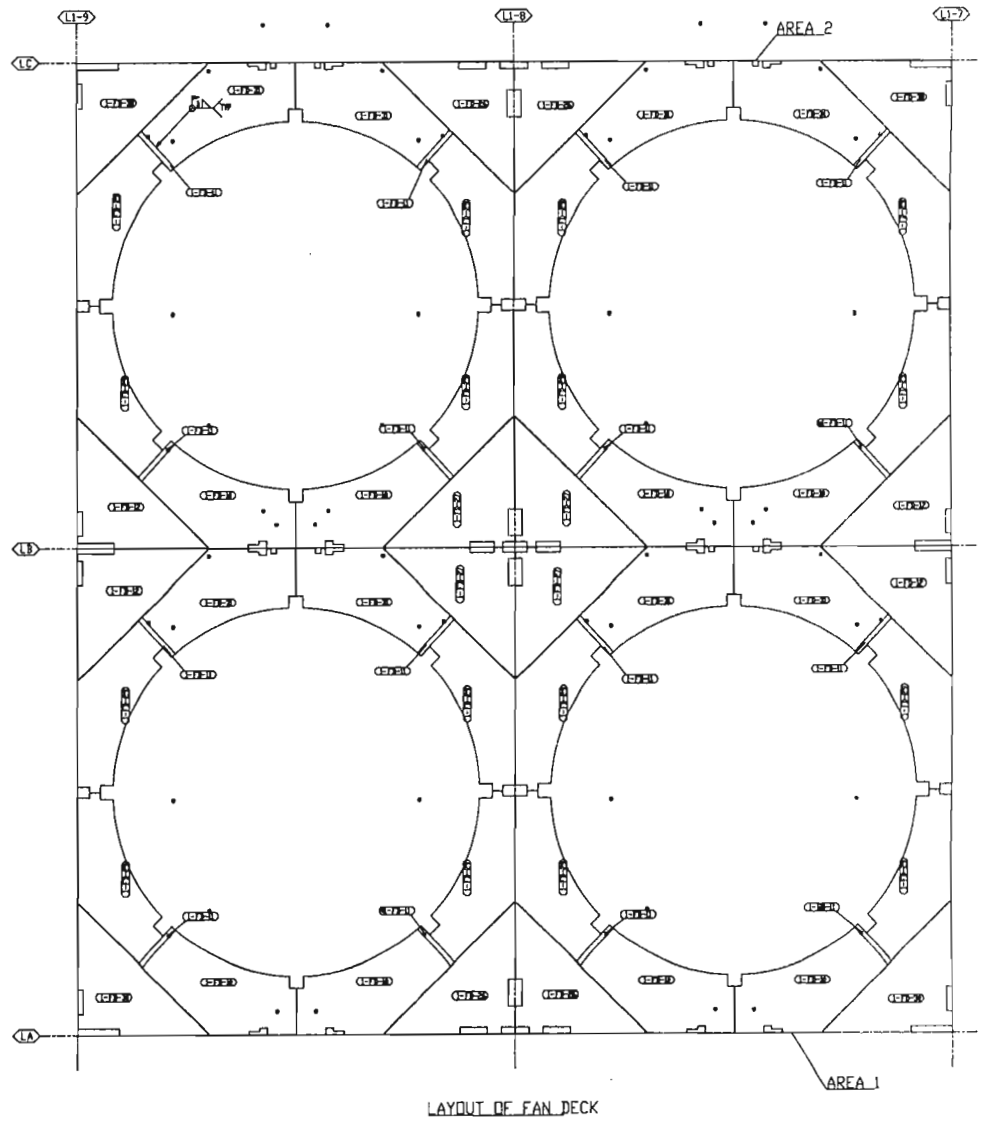


LAYOUT OF FAN DECK SYSTEM

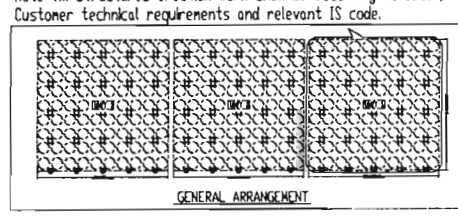


LAYOUT OF FAN DECK BEAM

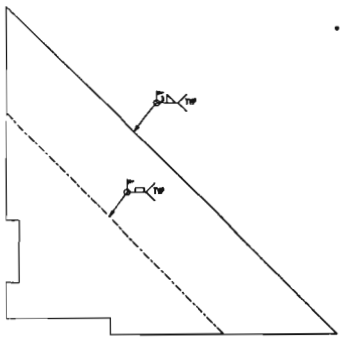


LAYOUT OF FAN DECK

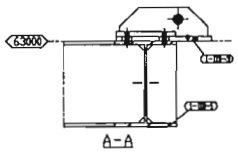
Note: All structures erection work shall be according to IS:800, IS:2843, Customer technical requirements and relevant IS code.



GENERAL ARRANGEMENT



TYPICAL WELDING OF FAN DECK



A-A

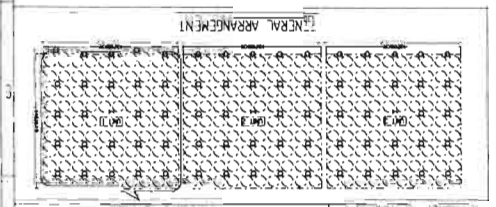
FOR REFERENCE ONLY

TITLE

LAYOUT OF FAN DECK SYSTEM OF UNIT1

Note: All structures erection work shall be according to IS:800, IS:2843, Customer technical requirements and relevant IS code.

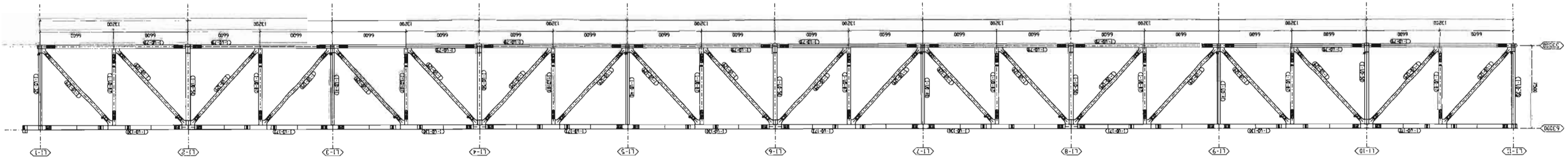
GENERAL ARRANGEMENT



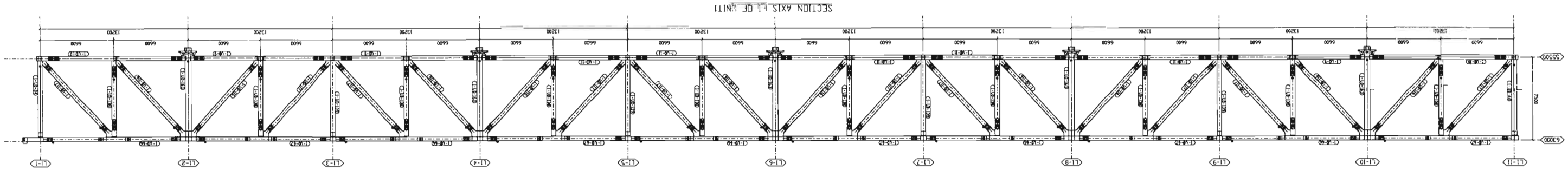
FOR REFERENCE ONLY

LASER STRUCTURE SECTION AXIS L.H. OF UNIT1

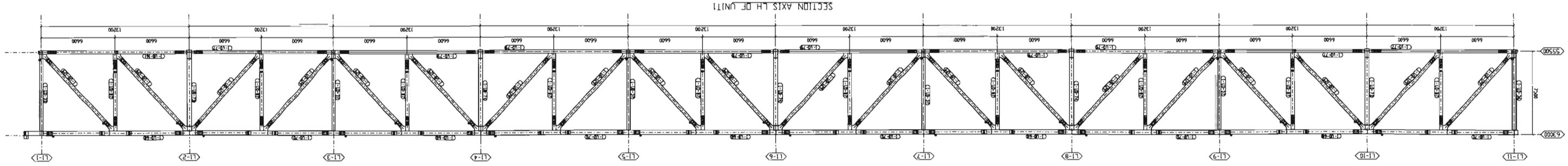
SECTION AXIS L.L OF UNIT1



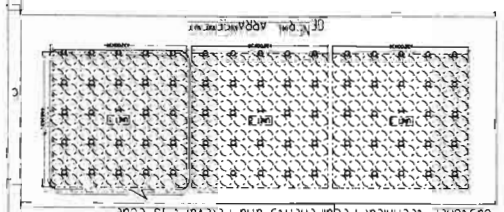
SECTION AXIS L.L OF UNIT1



SECTION AXIS LH OF UNIT1



FOR REFERENCE ONLY



Note: All structures erection work shall be according to IS:800, IS:2062, Customer technical requirements and relevant IS code

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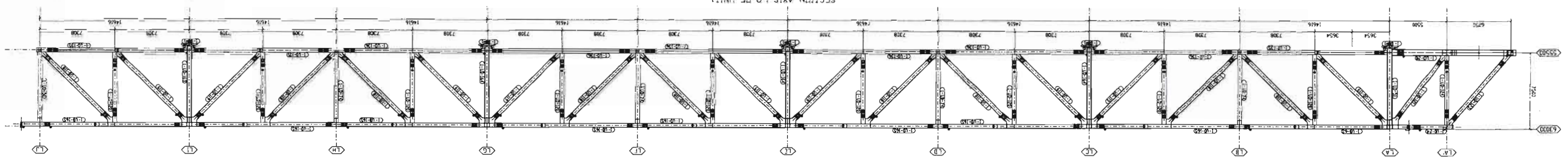
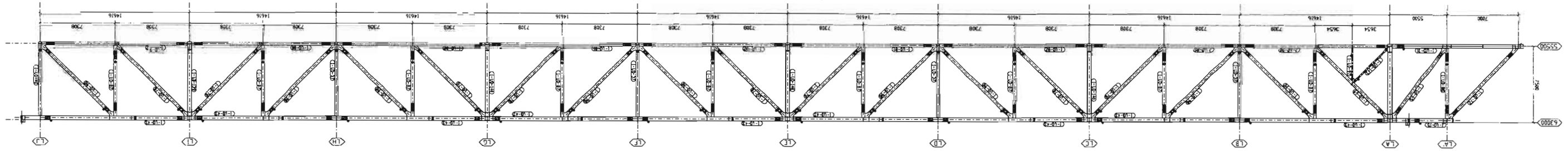


SECTION AXIS L7 OF UNIT1



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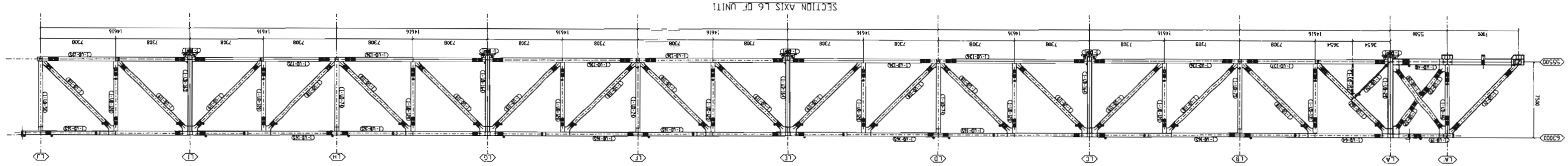
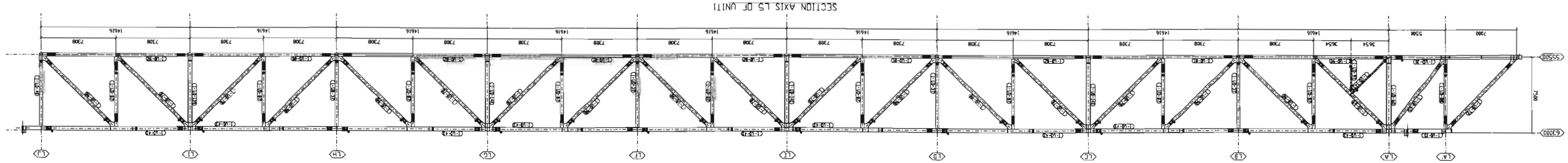
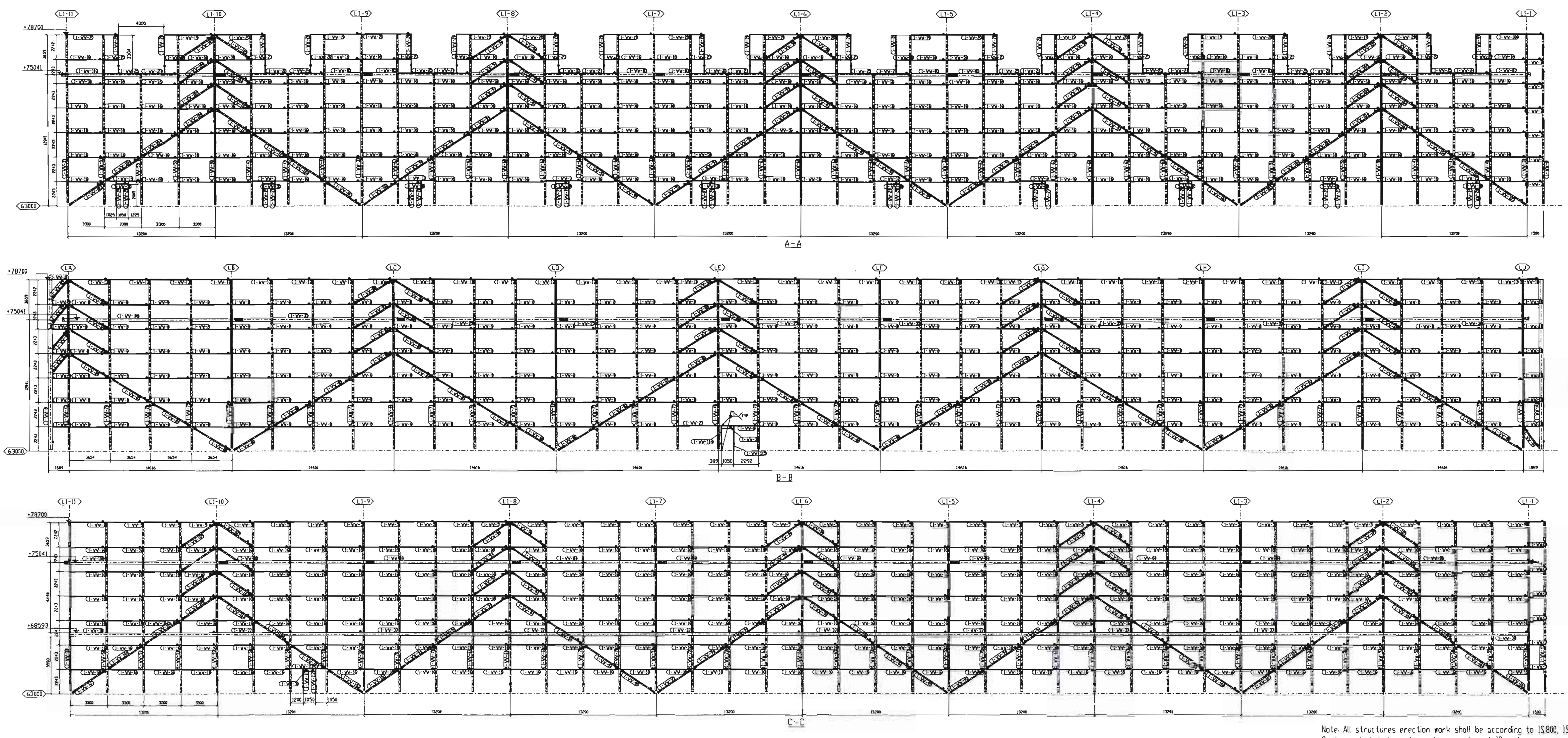


SECTION AXIS L5 OF UNIT1

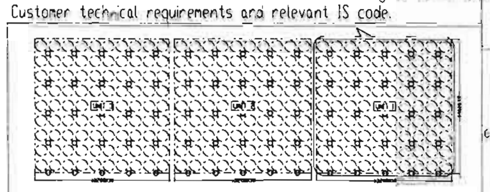


FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



Note: All structures erection work shall be according to IS:800, IS:12843, Customer technical requirements and relevant IS code.



GENERAL ARRANGEMENT

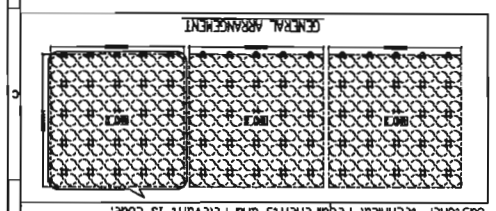
FOR REFERENCE ONLY

TITLE: LAYOUT OF WINDWALL FOR UNIT(2)

UNDER STRUCTURE SECTION AXIS LD/LE/LF/LG OF UNIT1

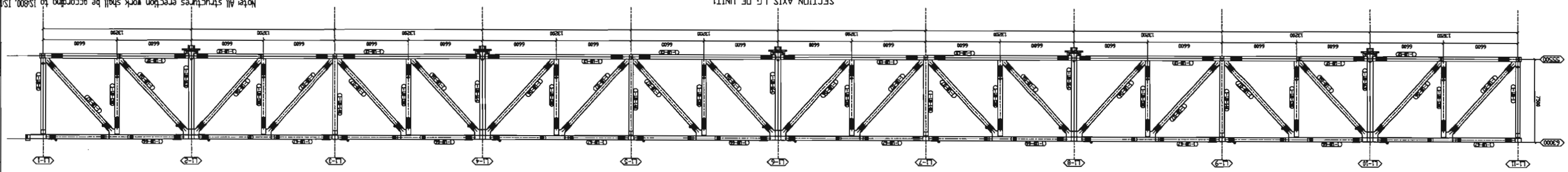
FOR REFERENCE ONLY

GENERAL ARRANGEMENT

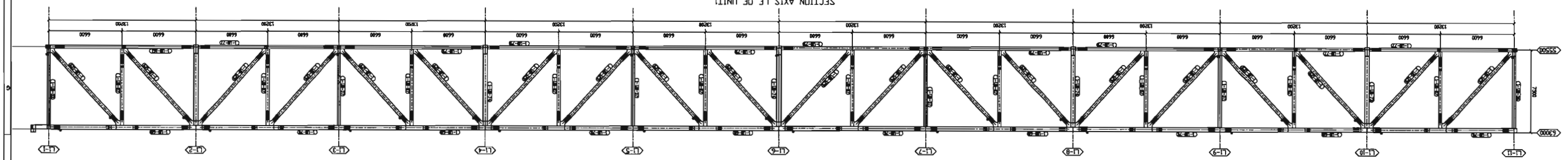


Note: All structures erection work shall be according to IS800, IS12843, Customer technical requirements and relevant IS code.

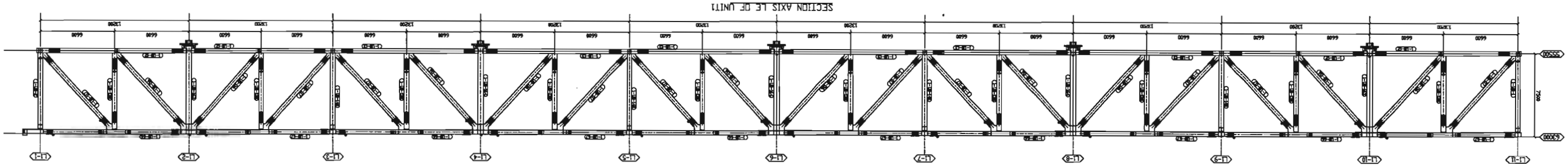
SECTION AXIS LG OF UNIT1



SECTION AXIS LF OF UNIT1



SECTION AXIS LE OF UNIT1



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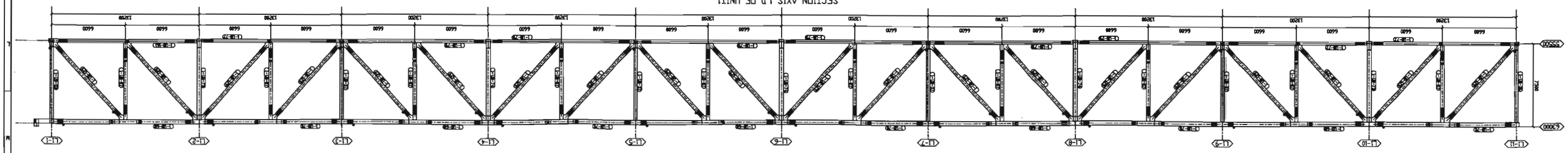
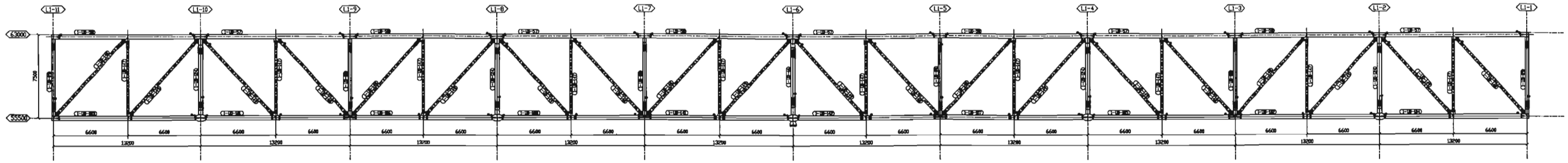


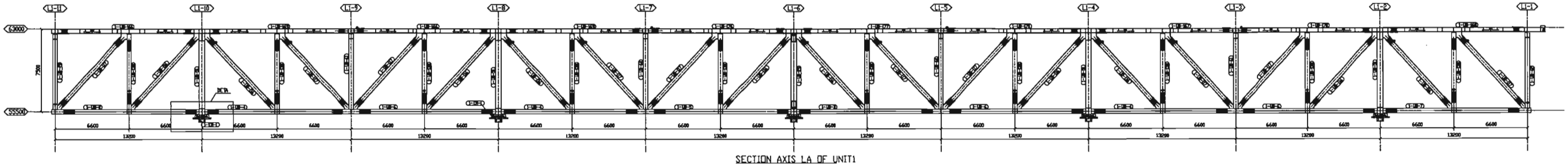
ELECTRONIC FILE NAME :

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION



SECTION AXIS LA' OF UNIT1



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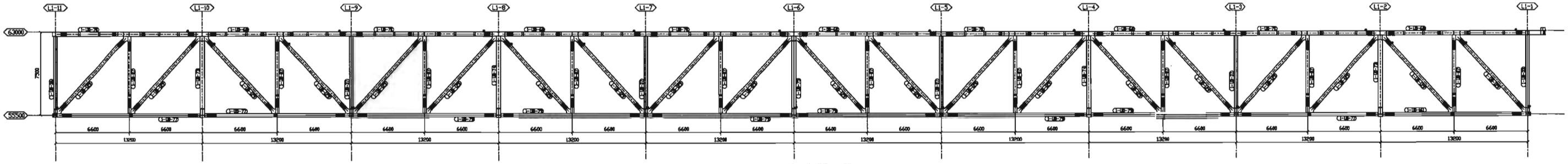

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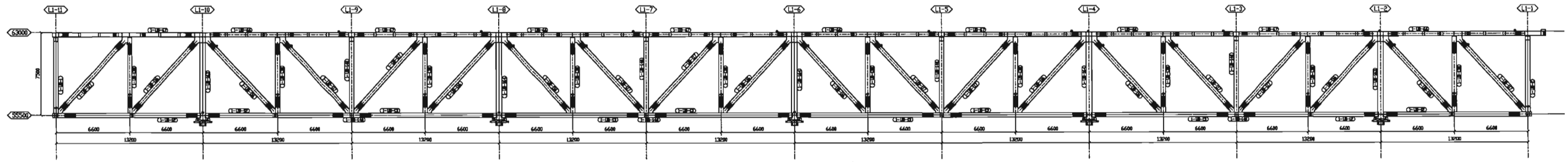

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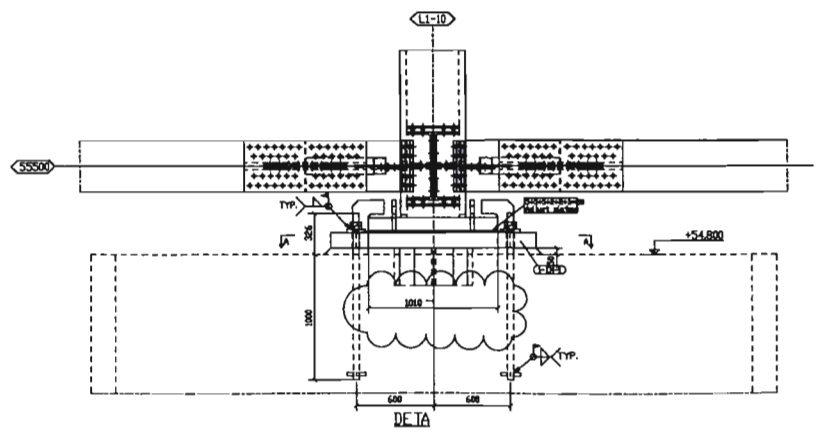
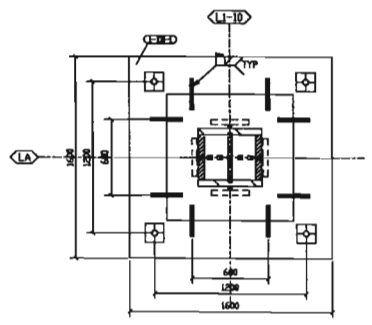


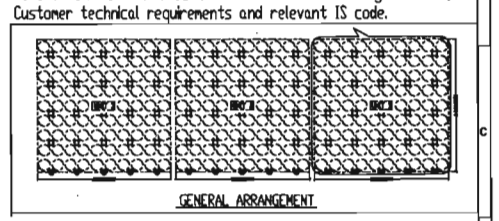
DETA



A-A

FOR REFERENCE ONLY

Note: All structures erection work shall be according to IS:800, IS:12843, Customer technical requirements and relevant IS code.



GENERAL ARRANGEMENT

TITLE

UNDER STRUCTURE SECTION AXIS LA'/LA/LB LC OF UNIT1

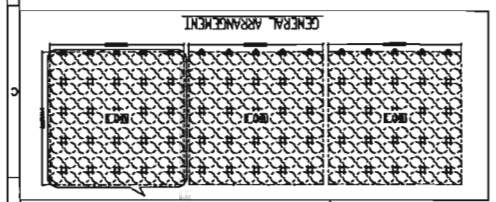
ELECTRONIC FILE MADE :

ELECTRONIC FILE NAME :

UNDER STRUCTURE SECTION AXIS L9/L10/L11 OF UNIT1

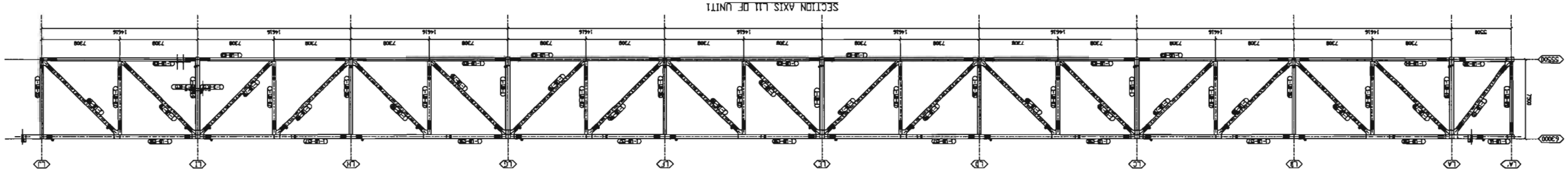
FOR REFERENCE ONLY

GENERAL ARRANGEMENT



Note: All structures erection work shall be according to IS800, IS2062, IS2713, Customer technical requirements and relevant IS code.

SECTION AXIS L11 OF UNIT1



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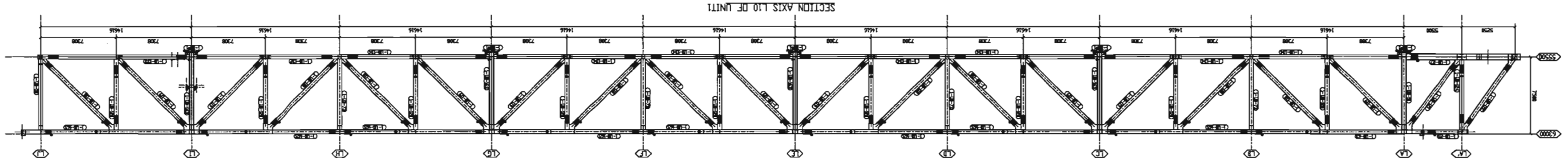
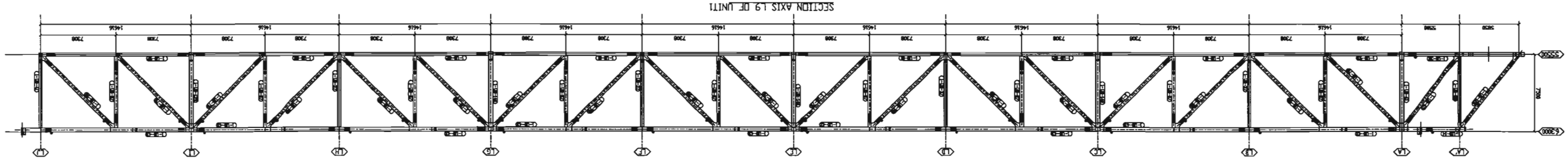


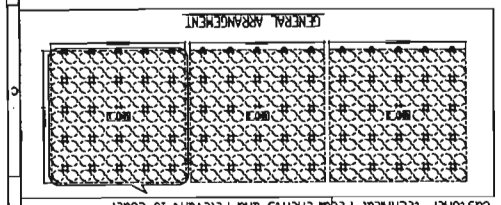
SECTION AXIS L9 OF UNIT1



TITLE: UNDER STRUCTURE SECTION AXIS L1/L2/L3/L4 OF UNIT1

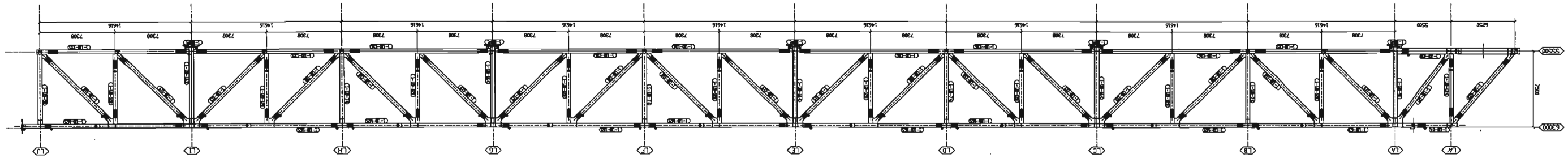
FOR REFERENCE ONLY

GENERAL ARRANGEMENT

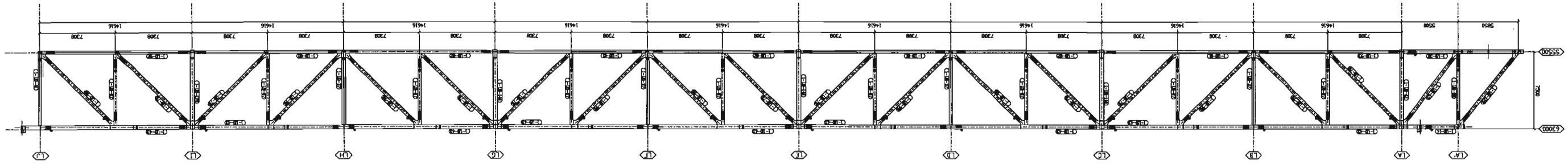


Note: All structures erection work shall be according to IS:800, IS:2062, Customer technical requirements and relevant IS code.

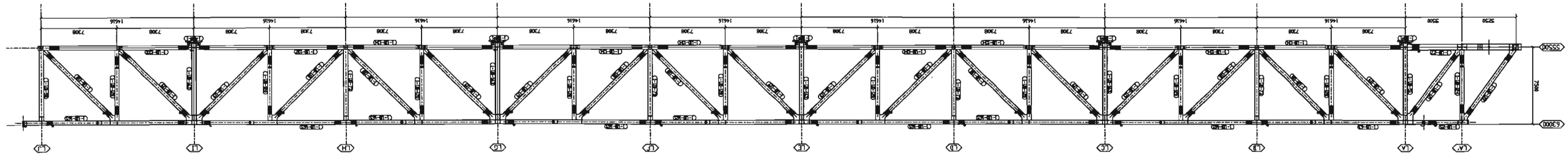
SECTION AXIS L4 OF UNIT1



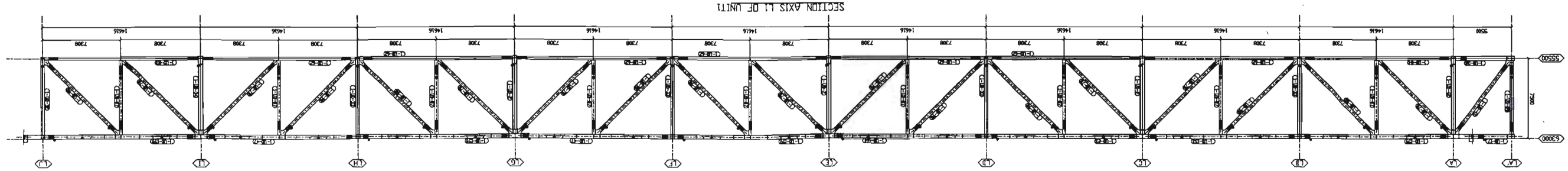
SECTION AXIS L3 OF UNIT1



SECTION AXIS L2 OF UNIT1



SECTION AXIS L1 OF UNIT1



ELECTRONIC FILE NAME :

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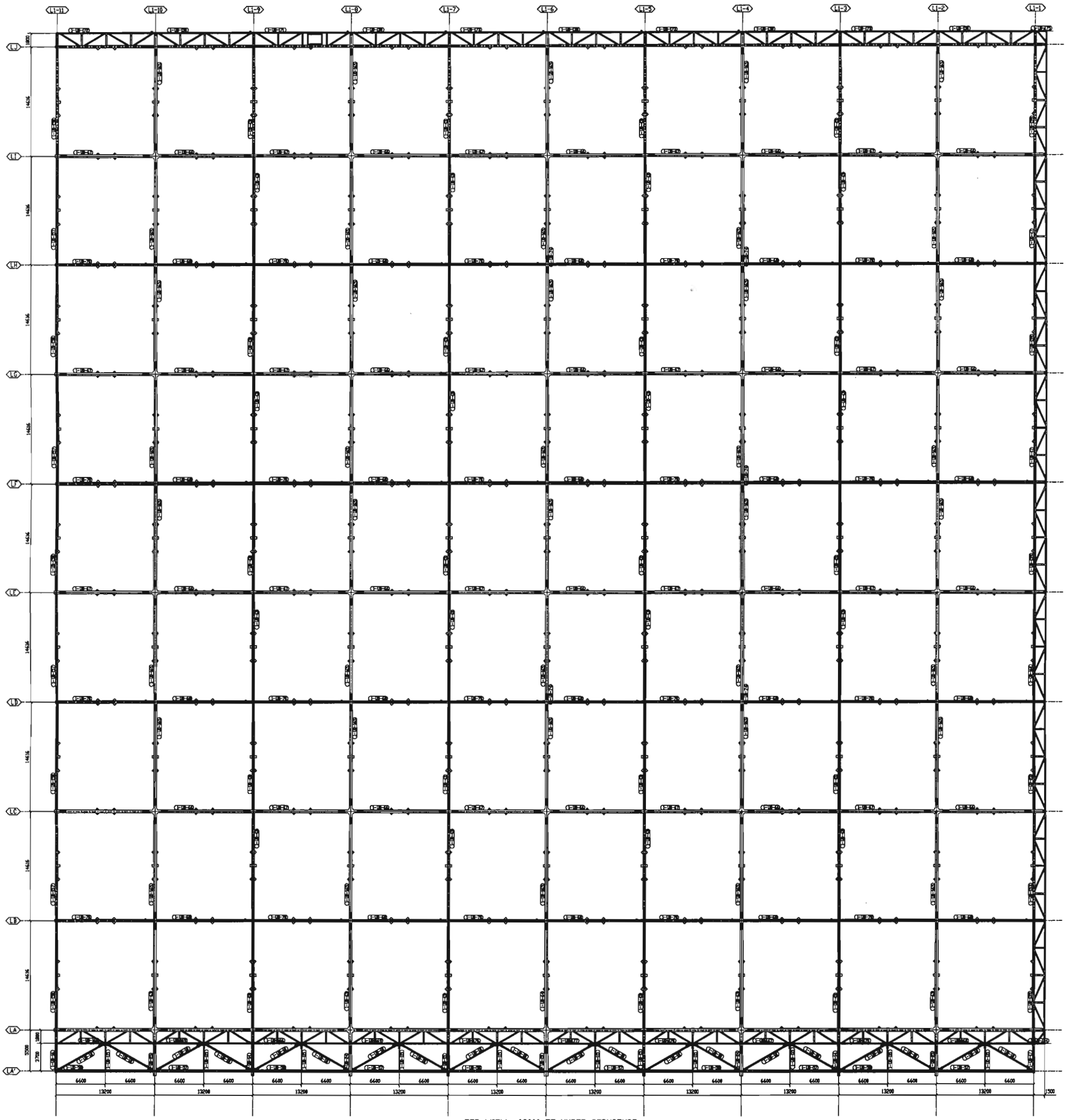
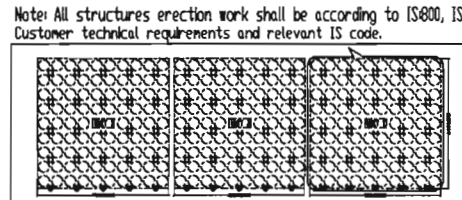


TOP VIEW +63000 OF UNDER STRUCTURE

Note: All structures erection work shall be according to IS:800, IS:12843, Customer technical requirements and relevant IS code.



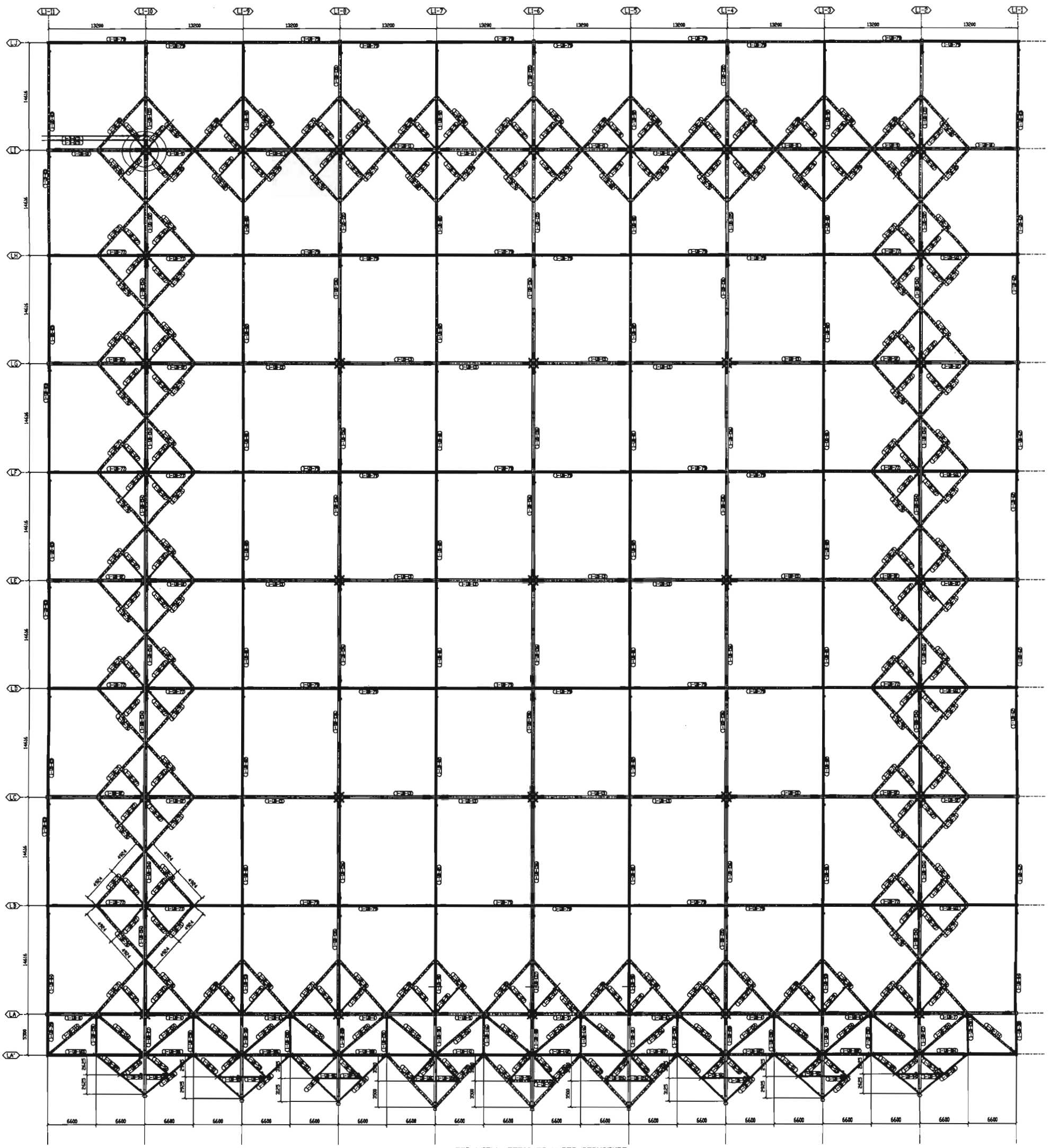
GENERAL ARRANGEMENT

FOR REFERENCE ONLY

TITLE

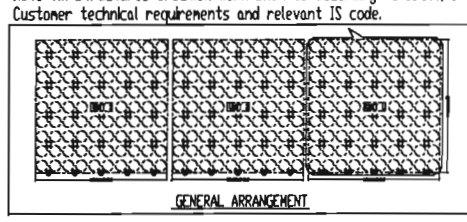
TOP VIEW +63000 OF UNDER STRUCTURE FOR UNIT1

ELECTRONIC FILE NAME :



TOP VIEW +55500 OF UNDER STRUCTURE

Note: All structures erection work shall be according to IS:800, IS:12843, Customer technical requirements and relevant IS code.



GENERAL ARRANGEMENT

FOR REFERENCE ONLY

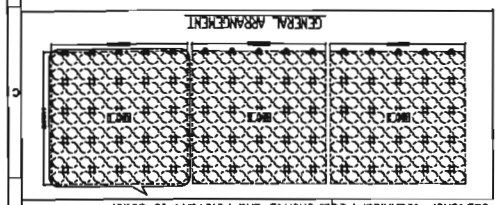
TITLE

TOP VIEW +55500 OF UNDER STRUCTURE FOR UNIT1

TITLE

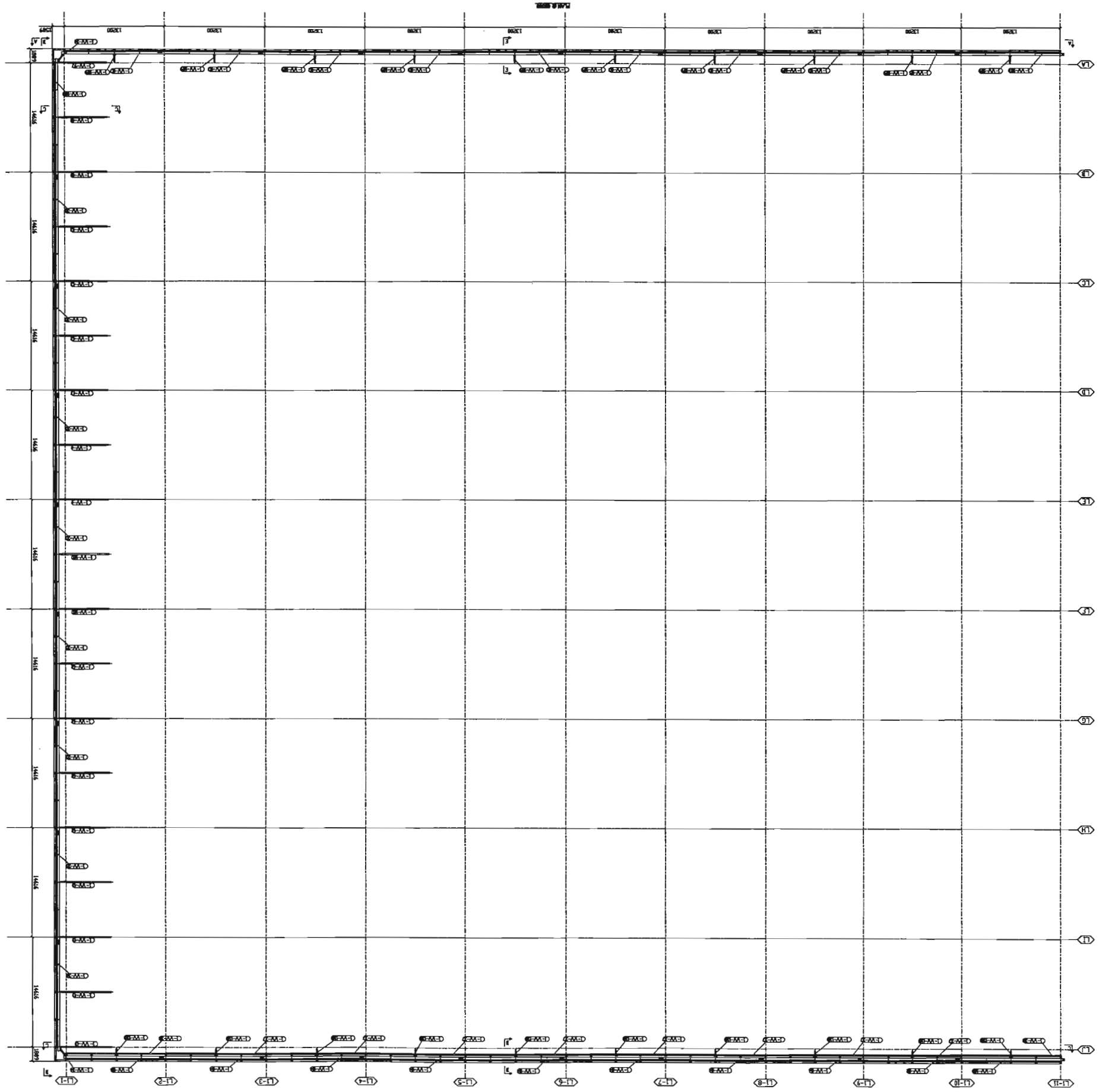
LAYOUT OF WINDWALL FOR UNIT1(2)

GENERAL ARRANGEMENT

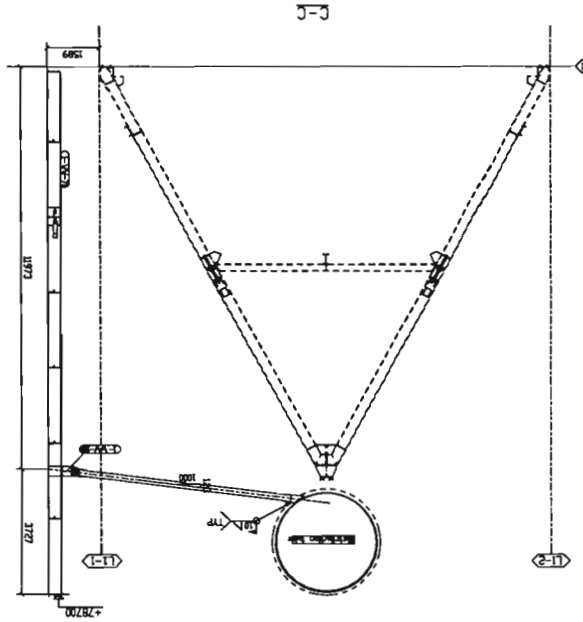


Note: All structures erection work shall be according to IS:800, IS:2062,
Customer technical requirements and relevant IS code.

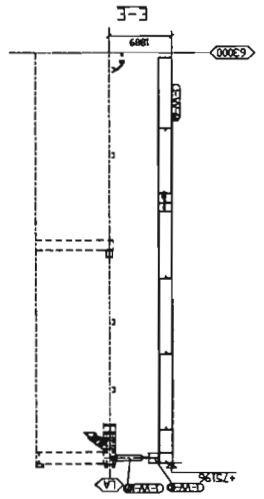
FOR REFERENCE ONLY



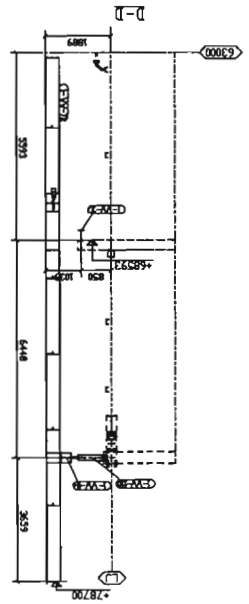
C-C



E-E



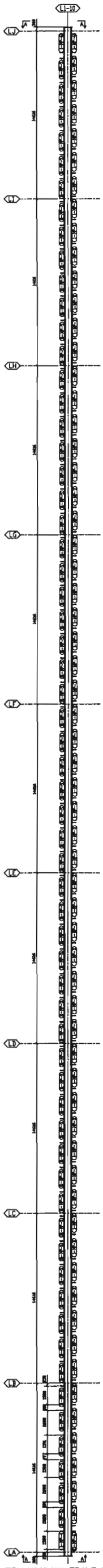
D-D



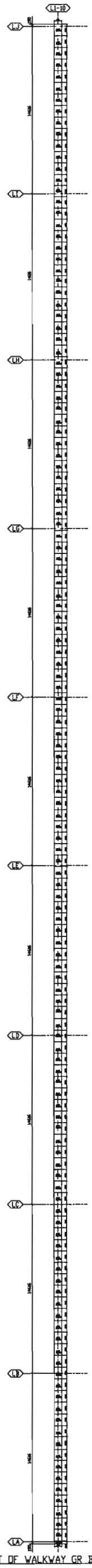
ELECTRONIC FILE NAME :

ALL DIMENSIONS ARE IN MM

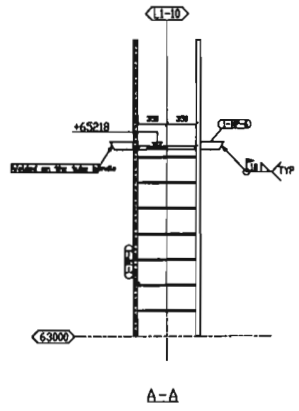
PRINT MODEL PROJECTION



LAYOUT OF WALKWAY FRAME BETWEEN STREETS



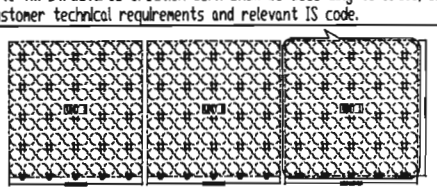
LAYOUT OF WALKWAY GR BETWEEN STREETS



A-A

SCHEDULE OF GRATINGS							
Grating Mark	CLAMP & NUT BOLT	Qty	SPAN	WIDTH	Area in Sqm		REMARK
					UNIT Area	Total Area	
15GR1	524	131	664	1000	0.66	86.98	
12GR2	4	1	2020	710	1.43	1.43	
	528	132		TOTAL		88.42	
Total Grating Area = 796.76 Sq.Mtr.							

Note: All structures erection work shall be according to IS:800, IS:2843, Customer technical requirements and relevant IS code.



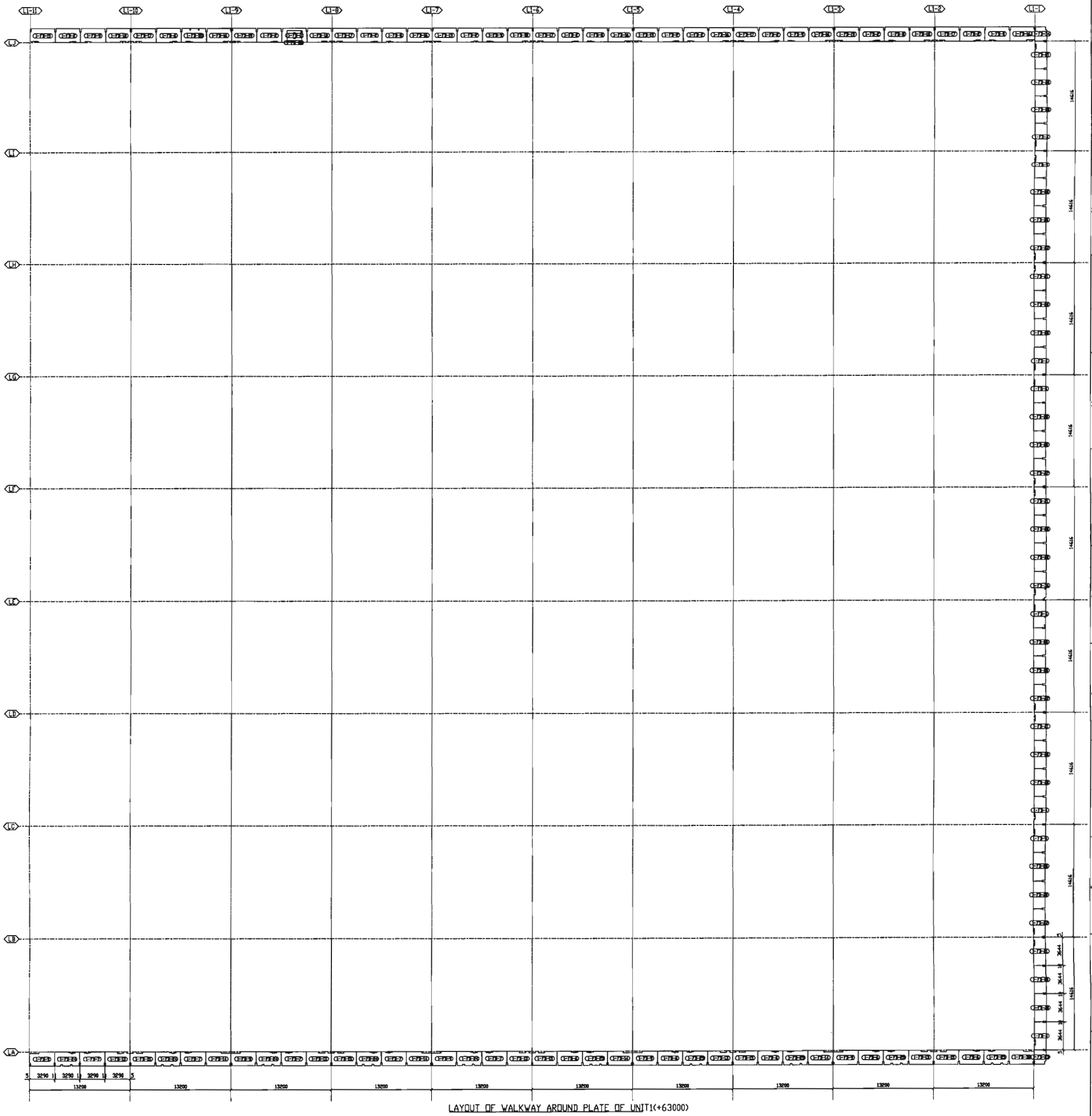
GENERAL ARRANGEMENT

FOR REFERENCE ONLY

Note?
Total 9 same rows,only 1 row shown

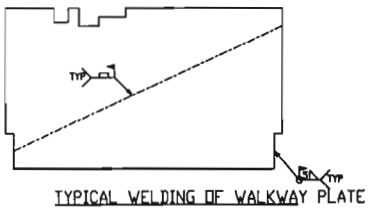
TITLE
LAYOUT OF WALKWAY BETWEEN STREETS FOR UNIT1

ELECTRONIC FILE NAME :



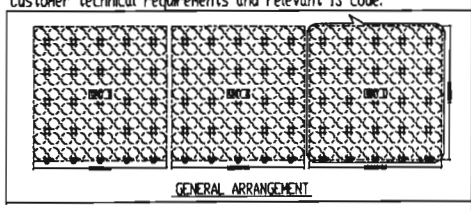
LAYOUT OF WALKWAY AROUND PLATE OF UNIT1(+63000)

Note: All structures erection work shall be according to IS:800, IS:2843, Customer technical requirements and relevant IS code.



TYPICAL WELDING OF WALKWAY PLATE

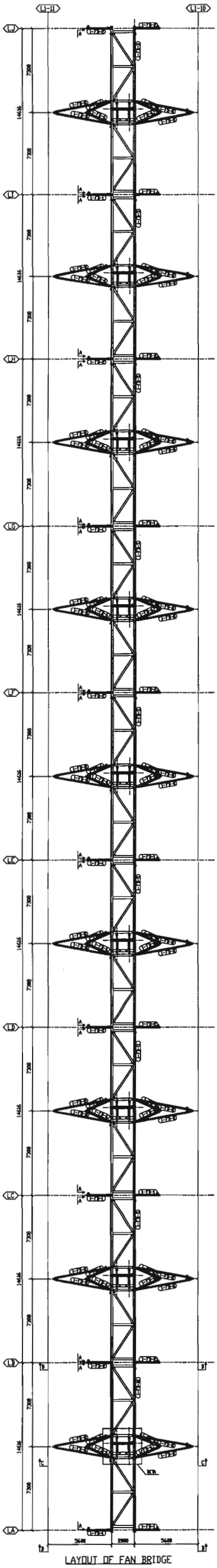
FOR REFERENCE ONLY



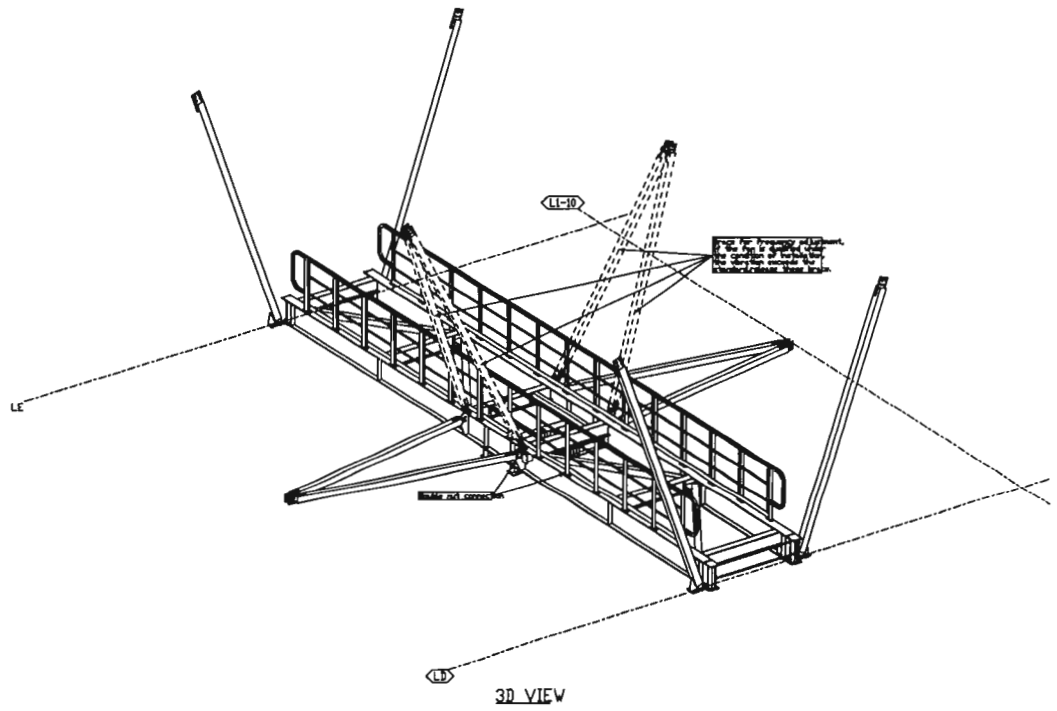
GENERAL ARRANGEMENT

TITLE
LAYOUT OF WALKWAY AROUND PLATE OF UNIT1(+63000)

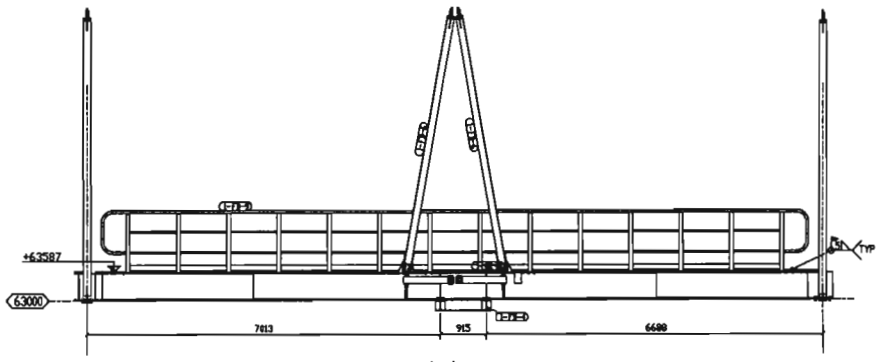
ELECTRONIC FILE NAME :



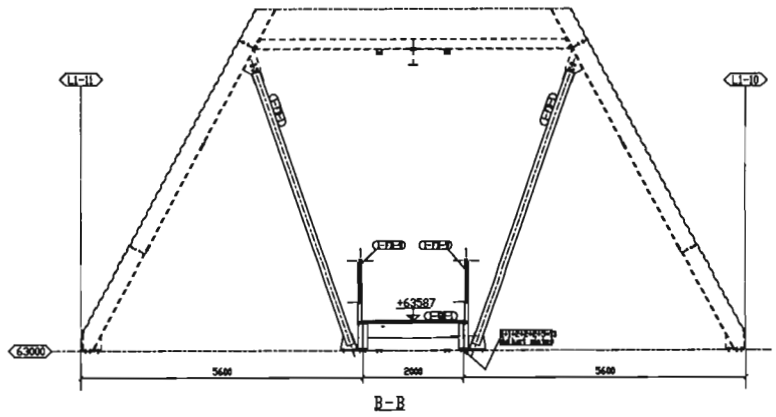
LAYOUT OF FAN BRIDGE



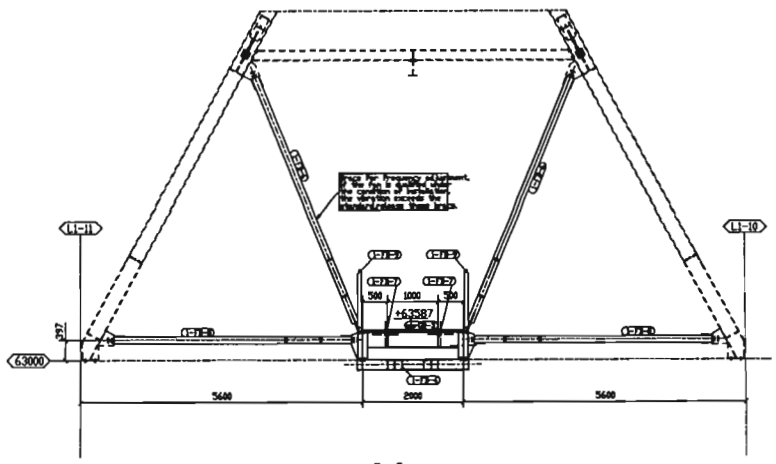
3D VIEW



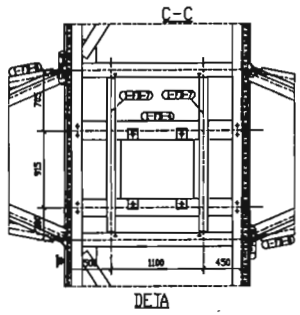
A-A



B-B

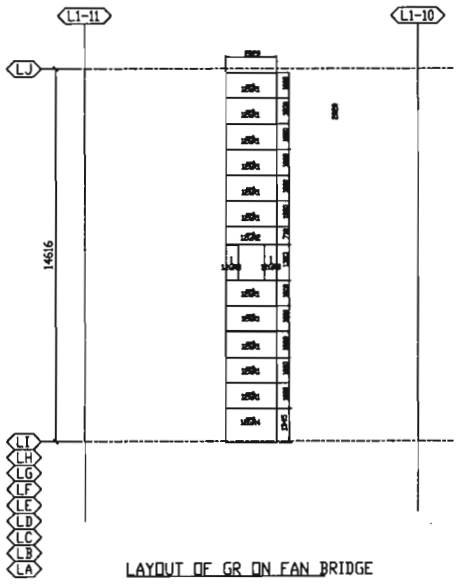


C-C



DETA

FOR REFERENCE ONLY



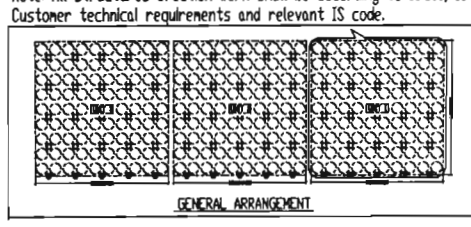
LAYOUT OF GR ON FAN BRIDGE

Note?
Total 10 same rows,only 1 row shown

SCHEDULE OF GRATINGS

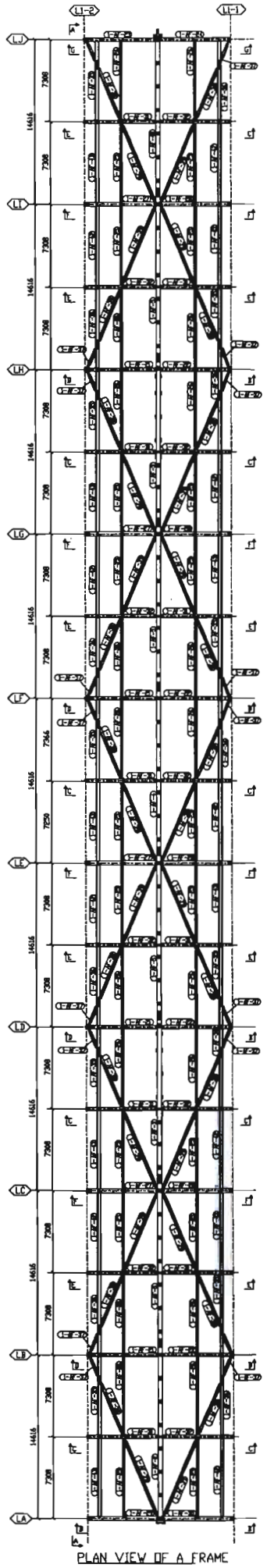
Grating Mark	CLAMP & NUT BOLT	Qty	GAP		TOTAL QTY	SPAN	WIDTH	Area in Sqm		REMARK
			LA TO LI					UNIT Area	Total Area	
12GR1	44	11	9		99	2020	1000	2.02	199.98	
12GR2	4	1	9		9	2020	710	1.43	12.91	
12GR3	8	2	9		18	1383	500	0.69	12.45	
12GR4	4	1	9		9	2020	1345	2.72	24.45	
	60	16					TOTAL		249.79	
Total Grating Area							=	2497.87	Sq.Mtr.	

Note: All structures erection work shall be according to IS:800, IS:2043, Customer technical requirements and relevant IS code.

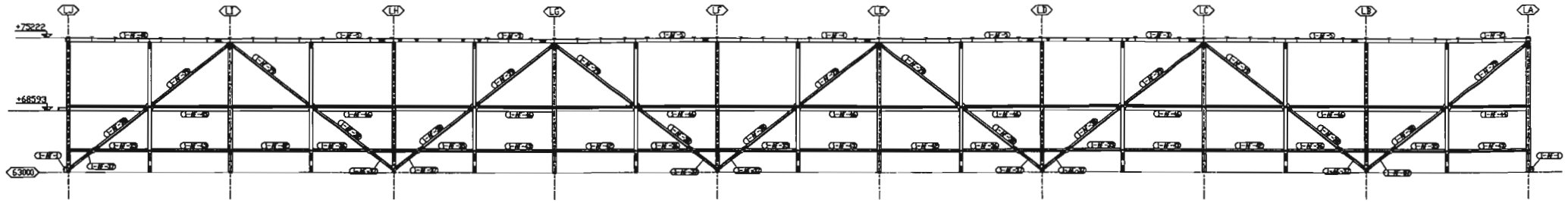


GENERAL ARRANGEMENT

TITLE
LAYOUT OF FAN BRIDGE FOR UNIT1



PLAN VIEW OF A FRAME



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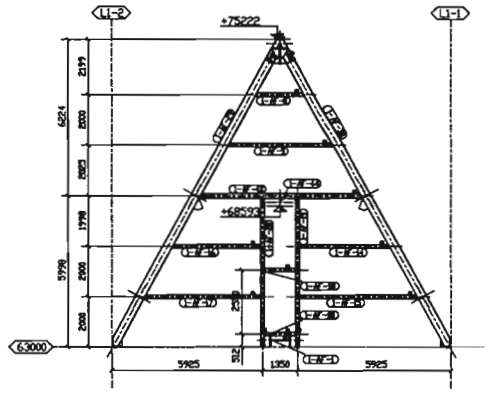

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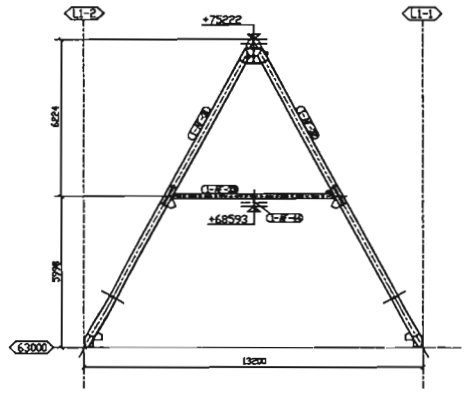

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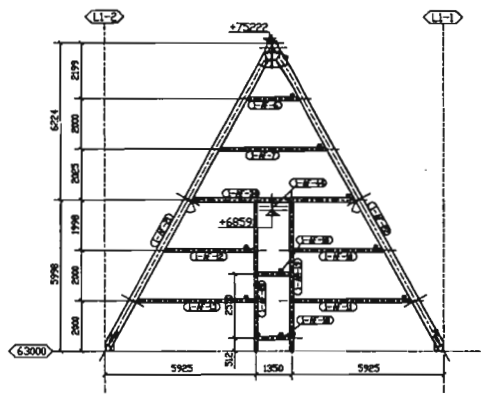

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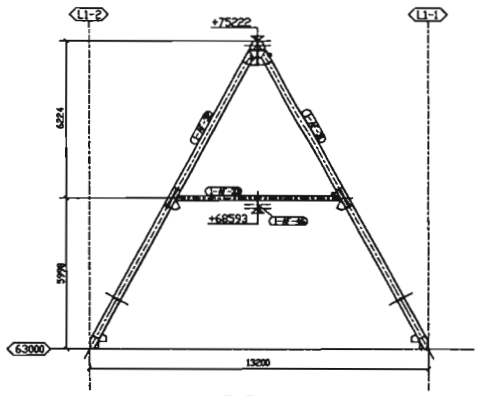
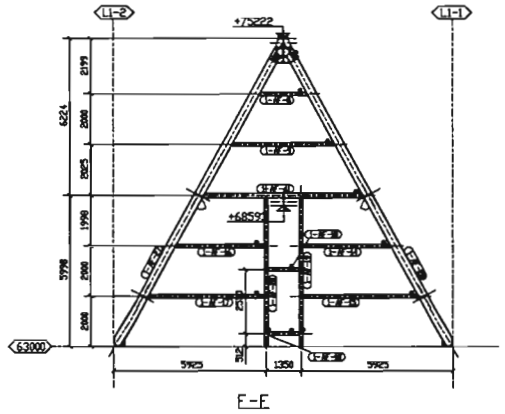
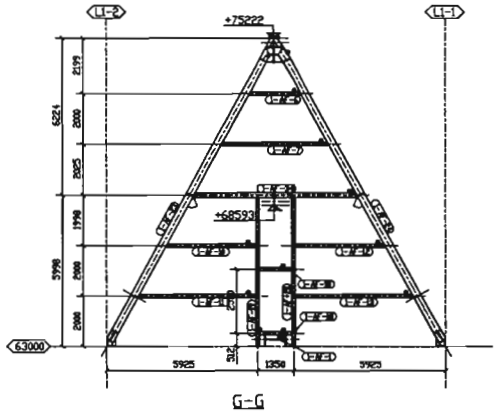


E-E

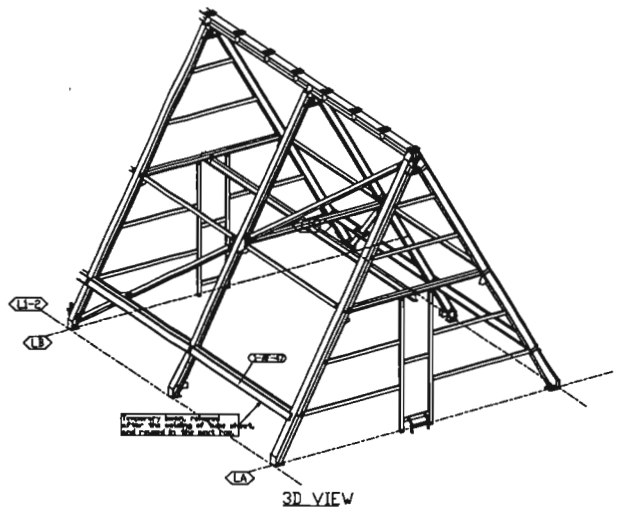


F-F



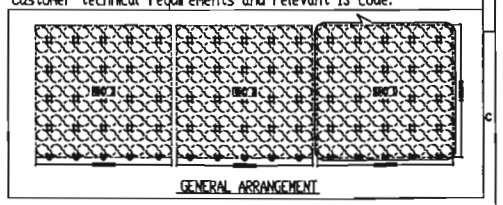
G-G

FOR REFERENCE ONLY



3D VIEW

Note: All structures erection work shall be according to IS:800, IS:2943, Customer technical requirements and relevant IS code.



GENERAL ARRANGEMENT

Note:
Total 10 same rows,only 1 row shown

TITLE: LAYOUT OF A FRAME FOR UNIT1

FORMAT SIZE A0

TECHNICAL SPECIFICATION
FOR
WIND TUNNEL STUDY OF ACC STRUCTURE

SPECIFICATION NO. PE-TS-ACC-600-001

VOLUME-III

SCHEDULE OF QUANTITIES

BHARAT HEAVY ELECTRICALS LIMITED
Project Engineering Management
PPEI BUILDING, HRD & ESI COMPLEX
Plot No. 25, Sector 16A
NOIDA, U.P. – 201301

SCHEDULE OF QUANTITIES

S. No.	Scope of Work	UNIT	QUANTITY	RATE (INR)	AMOUNT (INR)
1	Conducting Wind tunnel study of ACC structure including preparation of models, conducting wind tunnel tests, studying variation of force coefficient value, framing methodology for establishing wind load on ACC components, preparation and submission of report etc. all complete as per specification.	LUMPSUM	1		