REPUBLIC OF IRAQ
MINISTRY OF ELECTRICITY
GENERAL DIRECTORATE OF ELECTRICAL TRANSMISSION PROJECTS

TENDER DOCUMENTS :T.L 164/ NT/ 2015

VOLUME 3/3
TECHNICAL SPECIFICATION

MANUFACTURE, TEST ,SUPPLY AND SHIPMENT OF TOWERS FOR 400 K.V AND 132 K.V OVERHEAD TRANSMISSION LINES.

Issued in JUN 2015

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TECHNICAL SPECIFICATION

1. GENERAL

1.1 Definitions

In addition to the terms referred to in General and Particular Conditions of Contract, the following, where used in this Specification, shall have the meanings listed below:

a. The word “specified” shall mean specified herein or in the attached Schedules.
b. The expression “Commencement Date” hereafter used in connection with the time from which the various periods are to run shall mean the date specified in the Schedules.

1.2 Scope of work

The work covered by this Specification **MANUFACTURE**, **TEST ,SUPPLY, SHIPMENT unloading, transit insurance and delivery at Mussaib warehouse OF TOWERS FOR 400 K.V AND 132 K.V OVERHEAD TRANSMISSION LINES**.
The overhead Transmission lines will form part of the Ministry of Electricity’s transmission system.

1.3 Extent of work

The Contract Works to be supplied shall include all work incidental thereto whether specified in detail or not and shall be carried out by the Contractor in accordance with the Specification and Conditions of Contract and shall comprise the following:.

a. Manufacture test supply and shipment of 400 and 132 k.v steel self support lattice tower according to workshop drawing provided by clinet

b. Work at Time and Material rates:

If and when required to do so by the written instructions of the Engineer any work not covered by the Price Schedules, at prices stated in Volume 1/1 , Labour and Equipment Rates for Extra Field Work.

1.4 Standards and codes

Except where otherwise specified or implied, the works shall comply with the latest applicable Standards or Recommendations of the International Electrotechnical Commission (IEC) and ISO (International Standards Organisation). If relevant IEC and ISO standards and recommendations are not available in any case or cases then relevant British Standards or National Standards shall apply if available.

When IEC, ISO, BSI or National Standards are referred to the edition used shall be that current at the Date of Tender, together with any amendments issued to that date.

Further to that above, the standard order of preference is listed below,

IEC International Electrotechnical Commission
ISO International Standards Organisation BSI British Standards Institution
NS National Standards (where available)
ANSI American National Standards Institute
IEEE Institute of Electrical and Electronic Engineers
ASCE American Society of Civil Engineers
NEMA National Electrical Manufacturers Association
ASTM American Society for Testing and Materials
UL Standards of the Underwriters Laboratories of USA
IPCEA Insulated Power Cable Engineers Association of USA
ASME American Society of Mechanical Engineers
AWS American Welding Society

Where the use of a standard other than IEC, ISO or BS is agreed then this standard shall be used, where applicable, throughout the work. Where other standards are proposed in place of IEC, ISO or BS standards, confirmation shall be provided that the provisions of the standards are equivalent to or exceed those of equivalent IEC, ISO or BS standards.

Copies of any standards proposed in substitution for IEC, ISO or BS standards must be submitted with the Tender accompanied where necessary by English translations of the appropriate sections.

Notwithstanding any descriptions, drawings or illustrations which may have been submitted with the Tender, all details other than those shown in Schedule F, 'Deviations from the Technical Specification' and approved by the Engineer shall be deemed to be in accordance with the Specification and the standard specifications and codes referred to therein.

No departures from the Specification except those shown in the Schedule F, 'Deviations from the Technical Specification' and approved by the Engineer, are to be made without the written approval of the Engineer

1.5 Abbreviations

The following abbreviations have been used in addition to those listed in Clause 2.5, Standards and Codes.

m	Metre
nm	nanometre
mm	millimetre
km	kilometre
m3	cubic metre
º	degree
g	gram
kg	kilogram
kg/km	kilogram per kilometre
kg/m3	kilogram per cubic metre
N	Newton
kN	kiloNewton
N/mm2	Newton per square millimetre
KNm	kiloNewton x metre
s	second
µs	micro second
m/s	metre per second
kph	kilometre per hour
m3/s	cubic metres per second
dc	direct current
A	ampere
kA	kilo ampere
V	volt
kV	kilovolt
kA2s	kilo ampere squared x seconds
mW	milliwatt
kW	kilowatt
MW	megawatt
Mb/s	megabits per second
ºC	degrees centigrade
rh	relative humidity
Hz	hertz (cycles per second)
MHz	megahertz
rms	root mean square
ps/nm.km	pico second per nanometre x kilometre
dB	decibel
µV	micro volt
%	per cent
ACSR	aluminium conductor steel reinforced

Alum	aluminium
ATOL	air traffic obstruction lights
AWM	aircraft warning markers
BER	bit error rate
D	depth
DFB	distributed feedback
H	height
HF	high frequency
ICAO	International Civil Aviation Organization
LED	light emitting diode
LH	left hand
MFL	mechanical failure load
MOE	Ministry of Energy
MTBF	mean time between failures
MTTR	mean time to repair
No	number
NDT	non destructive testing
OPGW	optical fibre conductor
OTDR	optical time domain reflectometer
PDH	Plesiochronous digital hierarchy
RTS	rated tensile strength
RH	right hand
SI	International System of Units
SML	specified mechanical load
SMWT	specified maximum working tension
UTS	ultimate tensile strength
W	width

1.6 Transport

The Contractor shall inform himself fully as to all available transport facilities, road width, and axle load limitations, loading gauges and any other requirements and shall ensure that equipment as packed for transport shall conform to the relevant limitations. Any cost arising from the use of roads or tracks, including tolls, shall be borne by the Contractor.

The Contractor shall ensure by his own inquiries that the facilities available for unloading and bearing capacity of wharfs at the port of entry are adequate for his proposed plant and equipment.

The Contractor shall take reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute load so that the risk of damage shall be limited as far as is reasonably possible.

The Contractor shall immediately report to the Engineer any claims made against him arising out of alleged damage to a highway or bridge.

The Contractor shall be responsible for all costs including those incurred by the Engineer, arising from repair or replacement due to damage to equipment or materials during transport, off.loading or erection on site, until take.over.

The Contractor shall be responsible for obtaining from the relevant authorities all permissions necessary to use docking, off.loading, highway, and bridge facilities required for the transportation of contract materials and plant.

1.7 Safety of personnel

The maximum safety, consistent with good erection practice, must be afforded to personnel directly engaged on this Contract, or who in the normal course of their occupation find it necessary to utilize temporary works erected by the Contractor or frequent the working area. Reasonable measures shall be taken to afford adequate protection against material falling from a higher level onto personnel below.

Particular care shall be taken during work at places where the line runs parallel to other lines which may be energized.

The Contractor and his representatives shall in all ways comply with the Ministry of Electricity's Safety Rules regarding electrical apparatus and the safety of men working thereon.

No testing or other work on apparatus which has been delivered to Store and which is liable to be electrically charged from any source shall be permitted except under a "Permit to Work" which will be issued for the purpose by the Ministry of Electricity's Operating Engineer.

1.8 Compliance with regulations

All apparatus and materials supplied shall comply in all respects with such of the requirements of the Regulations and Acts in force in Iraq as are applicable to the Contract Supply and with other applicable Regulations to which the Ministry of Electricity is subject.

1.9 General particulars and guarantees

The work shall comply with the general particulars and guarantees stated in the Schedules. The Contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees, whether such particulars and guarantees have been approved by the Engineer or not.

1.10 Variations from Conditions of Contract

In the event of there being any inconsistency between the provisions of this Specification and the Conditions of Contract, the provisions of the Conditions of Contract shall prevail.

1.11 Places of manufacture

The manufacturers and the places of manufacture, testing and inspection of the various portions of the Tower shall be as stated in Schedule B.

1.12 Dates for completion

The dates of Supply, delivery and completion of the various sections of the Tower shall be as stated in Schedule B which also states the dates by which the Contractor will require access to the Site.

1.13 Access to manufacturers' works

Access to the Contractor's works shall be granted to the representative of the Engineer for the purpose of inspection, testing and ascertaining progress.

1.14 Planning and progress reports

The Contractor shall submit for review, within 4 weeks of the starting date of the Contract, an outline, material procurement, manufacture, test and delivery to store progress report. Within a further period of 4 weeks the Contractor shall provide a detailed programme in a format to be agreed by the Engineer; this programme shall also include details of drawing submissions.
Reporting requirements shall be as specified from time to time by the party that has entered into the Contract with the Contractor or shall be otherwise, as follows.

The Contractor shall submit to the Engineer at monthly intervals, not later than the seventh day of the following month, and in such formats as may be required by the Engineer, detailed progress reports of the status of material procurement, manufacture, works tests, delivery to store, with regard to the agreed contract programme.

Reports shall include a chart detailing plant manufacture, test and delivery. The chart shall indicate all phases of the work with provision for modification if found necessary during execution of the Works.

The design aspect of the progress report shall include a comprehensive statement on drawings and calculations submitted for review.

The details on material procurement shall give the dates and details of orders placed, indicating delivery dates and expected inspection dates quoted by the manufacturer. If any delivery date has an adverse affect on the contract programme the Contractor shall state the remedial action taken to ensure that delays do not occur.

The section on manufacture shall indicate dates of arrival of material, the progress of manufacture and testing and shall state the date on which the material will be ready for transport. Any events which may adversely affect completion in the manufacturer's works shall also be reported.

All works tests and the test results shall be listed and a commentary provided. Any test failures shall be explained and the Contractor shall state his proposed actions to prevent delay to the project completion.

The shipping or transport of each order shall be monitored in the progress report and shall give the date when equipment is available for transport, the expected time of delivery to site and the dates actually achieved.

Any delays which may affect any milestone or completion date shall be detailed by the Contractor who shall state the action taken to effect contract completion in accordance with the contract programme.

The Contractor shall forward two copies of each progress report to the Engineer. If during the execution of the Contract the Engineer considers the progress position of any section of the work to be unsatisfactory the Engineer shall be at liberty to call progress meetings at site or in his office with a responsible representative of the Contractor.

1.15 Quality assurance

To ensure that the supply and services under the Scope of this Contract, The quality assurance arrangements shall conform to the relevant requirements of ISO 9001.
The systems and procedures which the Contractor will use to ensure that the Works comply with the Contract requirements shall be defined in the Contractor's Quality Plan for the Works.
The Contractor shall operate systems which implement the following:
Hold point . "A stage in material procurement or workmanship process beyond which work shall not proceed without the documented agreement of designated individuals or organizations."
The Engineer's written agreement is required to authorize work to progress beyond the hold points indicated in reviewed quality plans.
Notification point – "A stage in material procurement or workmanship process for which advance notice of the activity is required to facilitate witness".
If the Engineer does not attend after receiving documented notification in accordance with the agreed procedures and with the correct period of notice then work may proceed.

1.15.1 Quality assurance requirements

The Contractor shall, for all phases of work to be performed under the Contract, establish and implement quality assurance arrangements which, as a minimum, meet the requirements of ISO 9001, "Model for quality assurance in design, development, production, installation and servicing".
The Contractor shall ensure that all work carried out under the Contract is performed by suitably qualified and skilled personnel and that good quality materials, which meet relevant international standard specifications, where such exist, are used.

1.15.2 Quality assurance arrangements – quality plan

The Contractor shall submit a comprehensive contract specific Quality Plan for review and comment, within two weeks of award of contract.
The Quality Plan shall identify as a minimum:

a. the Contractor's organization and responsibilities of key management including quality
b. assurance personnel;
c. the duties and responsibilities assigned to staff ensuring quality of work for the Contract;
d. the prime project documents, specifications, codes of practice, standards;
e. the correspondence and reporting interfaces, and liaison between the Engineer and the Contractor;
a. the procedures the Contractor intends to use to manage and control the Contract, including:

i. the duties and responsibilities assigned to staff ensuring quality of work for the Contract;
ii. hold and notification points;
iii. submission of engineering documents required by the Specification;
iv. the inspection of materials and components on receipt;
v. reference to the Contractor's work procedures appropriate to each activity;
vi. inspection during fabrication/construction;
vii. final inspection and test.

It is recommended that separate Quality Plans be submitted for the design/manufacture and construction/installation phases.
The Contractor shall review, amend and re.submit quality plans as necessary during the Contract.

1.15.3 Contractor quality audits

The Contractor shall carry out a formal programme of project quality audits. These shall include audits of the manufacture and test and of the Contractor's organization. The Engineer reserves the right to accompany the Contractor on such audits.

1.15.4 Inspection and tests

Inspection and test plans shall be prepared for all major items of equipment/plant, defining the quality control and inspection activities to be performed to ensure that the manufacture and completion of the plant complies with the specified requirements. Inspection and test plans shall be submitted for review.

The Contractor shall submit for review, within 30 days of the Contract Award, a schedule defining the plant/equipment/systems.

The Contractor shall review all inspection and test plans and associated control documents, to ensure their adequacy prior to submission.

The Contractor shall be responsible for identifying and arranging any statutory verification activities in the country of manufacture.

Inspection and test plans may be of any form to suit the Contractor's system, but shall as a minimum:

a. indicate each inspection and test
b. identify the characteristics to be inspected, examined, and tested and specify procedures, acceptance criteria to be used and the applicable verifying document
c. indicate mandatory hold points established by the Engineer which require verification of selected characteristics of an item of process before this work can proceed,
b. define or refer to sampling plans if proposed and where they will be used,
c. where applicable, specify where lots or batches will be used.

A note advising that all materials and equipment may be subject to inspection by the Engineer as determined by the inspection and test plan. Copies of such purchase orders shall be forwarded to the Engineer.

In order to verify compliance with engineering, procurement, manufacturing requirements and programmes, the Engineer shall have access, at all times, to all places where materials or equipment are being prepared or manufactured, including the works of the Contractor

The Contractor shall advise the Engineer of the readiness of inspection at least 3 weeks prior to a notification point or hold point. Work shall not proceed beyond a hold point without the written agreement of the Engineer or his nominated representative.

Inspection of the plant/equipment may be made by the Engineer and could include the following activities:

i. Periodic monitoring to confirm the effectiveness of, and the Contractor's compliance with, the established quality plan, system procedures and inspection and test plan.

ii. Witnessing of inspections and tests and/or verification of inspection records to be carried out at the Engineer's discretion covering:

a. compliance of raw material with specified requirements
b. compliance of manufactured parts, and final items with specifications, drawings, standards and good engineering practice
c. witnessing of inspection and tests
d. packing for shipment including check for completeness, handling requirements, and case markings and identification.

Raw materials, components, shall be subject to inspection and test by the Engineer as required by the Specification and to the extent practicable at all times and places, during the period of manufacture.

The Contractor shall keep the Engineer informed in advance of the time of starting and of the progress of the Supply in its various stages so that arrangements can be made for inspection and for test. The Contractor shall also provide, without additional charge, all reasonable facilities and assistance for the safety and convenience of the Engineer in the performance of his duties. All of the required tests shall be made at the Contractor's expense, including the cost of all samples used.

The Contractor shall not offer, unless otherwise agreed, any item of equipment or system for inspection to the Engineer until all planned inspections and tests to date have been completed to the satisfaction of the Contractor.

The Engineer shall Endeavour to schedule the performance of inspection and tests so as to avoid undue risk of delaying the Supply. In the event of postponement, by the Contractor, of tests previously scheduled, or the necessity to make additional tests due to unsatisfactory results of the original tests, or other reasons attributable to the Contactor, the Contractor shall bear all costs for new tests and the costs incurred by the Engineer or his nominated representative in re.inspecting the non.conforming item or its replacement.

The inspection and tests by the Engineer of any equipment/component or lots thereof does not relieve the Contractor of any responsibility whatever regarding defects or other failures which may be found before the end of the defects liability period.

The Contractor shall provide a quality release certificate confirming compliance with the Contract requirements and a data book, comprising the inspection, test, qualification and material records required by the pertaining specifications.

No material shall be shipped to the Store until all tests, analysis and inspections have been made and certified copies of reports of test and analysis or Contractor's certificates have been accepted and released by the Engineer or by a waiver in writing.

1.15.5 Non.conformances

All items or services not in accordance with the Contract Specification, or deviating from a previously reviewed document, shall be considered non.conforming.
All such items shall be clearly identified and isolated where practical, and reported to the Engineer via a non.conformance report. Information to be provided with non.conformance notifications shall include:

a. identification of the item(s),
b. reference to relevant specification/drawings, including applicable revisions,
c. reference to the application inspection and test plan stage,
d. description of the non.conformance, with sketch where appropriate,
e. method by which the non.conformance was detected,
f. cause,
g. proposed corrective action, with technical justification, where necessary,
h. for significant non.conformances, proposed action to prevent recurrence,
i. applicable procedures.

The Engineer shall have complete authority to accept or reject any equipment or part thereof considered not to be in accordance with the specified requirements.
Approval of any concession applications is the prerogative of the Engineer, and approval of a particular case shall not set a precedent.
Any non.conformances identified by the Engineer shall be notified by issue of the Engineer's nonconformance report to the Contractor. Notification of re.inspection shall not be made until the completed non.conformance report, together with any applicable concession applications have been accepted by the Engineer.
Acceptance or rejection of the equipment and/or components will be made as promptly as practicable following any inspection or test involvement by the Engineer. However, failure to inspect and accept or reject equipment and/or components shall neither relieve the Contractor from responsibility for such items, which may not be in accordance with the specified requirements, nor impose liability for them on the Engineer.

1.15.6 Records

Records packages to be delivered shall be agreed with the Engineer prior to setting.to.Store of each phase, i.e. design, test, manufacture,

1.15.7 Method statements

Prior to commencing work, the Contractor shall submit method statements setting out full details of his methods of working. This is a hold point.

1.16 Design and standardization

All the tower parts shall be manufactured according to workshop drawing which will be provided to contractor after signing the contract , the standards shall according to item 1.4

1.17 Quality of material

All material used under this Contract shall be new and of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion or deterioration or the setting up of undue stresses in any part and without affecting the strength and suitability of the various parts for the work which they have to perform. No repair of defective parts including welding, filling and plugging will be permitted without the sanction in writing of the Engineer.

1.18 Language, weights and measures

The English language shall be used in all written communications between the Engineer and the Contractor with respect to the services to be rendered and with respect to all documents and drawings procured or prepared by the Contractor pertaining to the work.
Whenever anything is required under the terms of the Contract to be marked, printed or engraved, the English language shall be used except where otherwise provided in the Specification.
The design features of all equipment, all quantities and values which are required to be stated in the Technical Schedules and all dimensions on drawings whether prepared by the Contractor or not shall be stated in the International System of Units (SI).

1.19 Testing and inspection

All materials used in the Contract Works shall be made available for inspection and test by the Engineer during manufacture and it is the Contractor's responsibility to advise the Engineer when equipment and materials are available for inspection.

The Contractor shall carry out the tests stated in Clause **1.4** in accordance with the conditions thereof and the latest applicable Standards or Recommendations and such additional tests as in the opinion of the Engineer are necessary to determine that the Works comply with the conditions of this Specification either under test conditions (in the Manufacturer's Works, or elsewhere). Type tests may be omitted at the discretion of the Engineer if satisfactory evidence is given of such tests already made on identical equipment.

All materials used shall also be subjected to and shall withstand satisfactorily such routine tests as are customary in the manufacture of the types of plant or material included in the Works.

All tests shall be carried out to the satisfaction of the Engineer and in his presence, at such reasonable times as he may require, unless agreed otherwise.

Not less than 3 weeks notice of all tests shall be given to the Engineer in order that he may be represented if he so desires. As many tests as in the opinion of the Engineer are possible shall be arranged together.

The original and 5 copies of test records whether or not they have been witnessed by the Engineer shall be supplied to the Engineer.

Measuring apparatus shall be approved by the Engineer and if required shall be calibrated at the expense of the Contractor at an approved laboratory.

The Contractor shall be responsible for the proper testing of work completed or plant or materials supplied by a sub.Contractor to the same extent as if the work, plant or materials were completed or supplied by the Contractor himself.

The Contractor shall supply suitable test pieces of all materials as required by the Engineer. If required by the Engineer test specimens shall be prepared for check testing and forwarded at the expense of the Contractor to an independent testing authority selected by the Engineer.

1.20 Drawings, models and samples

A list of the drawings attached to the Specification is given in Schedule E – 'Drawings, Documentation and Samples'.
A list of the drawings which are to be submitted by the Contractor with his Tender and a list of drawings to be submitted after the Commencement Date are also given in Schedule E.
The Contractor shall provide free of charge any additional drawings and/or copies of any reviewed drawings required by the Engineer.
The Contractor shall submit samples of materials as required from time to time by the Engineer.
The Contractor shall submit all drawings or samples of materials for review in sufficient time to permit modifications to be made and the drawings or samples resubmitted without delaying the initial deliveries or the completion of the Contract Works. The time allowed for the Engineer to review and comment on drawings, samples and models shall be agreed.
If the Contractor requires early review of any drawing in order to avoid delay in the completion of the Contract Works, he shall advise the Engineer to such effect when submitting the drawing.
Four copies of each drawing and four copies of any subsequent revision shall be submitted to the Engineer for review. Following final review, four further copies of the reviewed drawing shall be marked "Issued for Construction" and shall be supplied to the Engineer for distribution and to Site.
Drawings for review shall be submitted as paper prints or electronic copies as shall be agreed and shall bear the authorized Contract reference.
All drawings shall be drawn to one of the preferred scales quoted in Table 7 of BS Publication PD6031 and on paper of the appropriate size from the International Series of A sizes.

All detail drawings submitted for review shall be to scale and of a size not less than 1/25 full size. All important dimensions shall be given and the material of which each part is to be constructed shall be indicated.
Except as otherwise specifically approved, all drawings shall be of size not greater than A0 (normally) 841 mm x 1189 mm) nor smaller than A4 (normally 210 mm x 297 mm).
All dimensions marked on the drawings shall be considered correct although measurement by scale may differ therefrom. Detailed drawings shall be acted on where they differ from general arrangement drawings.
The Engineer reserves the right to request any further additional information that may be considered necessary in order fully to review the Contractor's drawings.

Any drawing modified from a previously submitted drawing shall bear a new version number. Revised drawings reissued for review shall have at least one copy clearly marked indicating the amendments to the drawing. Revision boxes must be provided giving the date, revision letter and brief description of each drawing.
Any drawing or document submitted for information only shall be indicated as such by the Contractor.
Drawings submitted for information only will not be returned to the Contractor unless the Engineer considers that such drawings do need to be reviewed, in which case they will be returned suitably stamped with comments.
All drawings submitted by the Contractor shall have the following particulars in the lower right hand corner in addition to the Contractor's name, date, scale, number and title of the drawing, contract number, overhead line title and equipment description.

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The Contractor shall when submitting drawings provide an indexing system for all the drawings divided for each type of equipment.
The drawing format and the indexing system, as detailed in Schedule E, will be agreed at the first Contract meeting between the Contractor and the Engineer.
All prints shall be folded to A4 size and the title, drawing number and revision suffix shall remain visible.
Drawings, samples and models already submitted by the Contractor and reviewed by the Engineer (and such drawings, samples and models as shall be thereafter submitted by the Contractor and reviewed by the Engineer) shall not be departed from without the instruction in writing of the Engineer.
All drawings, samples and models shall be submitted in accordance with the provisions in the Schedules and shall become the property of the Ministry of Electricity.
The requirements for Final Record drawings are given in Clause 2.29 of this Specification.

1.21 Packing and shipment

All materials shall be carefully packed for transport by sea, rail and road and in such a manner that the packing provides adequate protection against corrosion, physical damage, contamination or damage from water or dust or from any other source in all climatic conditions experienced in transit and during storage on site during the construction period.
The whole of the materials shall be packed where necessary in non.returnable cases or on nonreturnable drums or otherwise prepared for overseas shipment in a manner suitable to withstand rough handling without sustaining damage.
The Contractor shall prepare a method statement covering all aspects of packaging, marking, colour coding, documentation, lifting, transporting and stacking of etc., that will be used by all manufacturers, suppliers and shippers and will be applicable for all stages from manufacture/supply via transport and storage to use. This method statement shall be subject to the approval of the Engineer and it is a requirement that this approval is received before any materials are packed.
Bundles of steel angle sections shall be properly tied together by an approved method and care taken to ensure that they are robust and not of excessive length for handling during shipment. The weight limit for the bundles should be approximately 500 kg. . Strap bundles of steelwork with extra heavy duty galvanized steel straps, ensuring that all members in a bundle are alike, that they are packed in an interlocking fashion and that the strapping pressure is sufficient to prevent slippage of members within the bundle. The members within each bundle shall be secured with wire passing through member holes at each end of the bundle
The Contractor's attention is drawn to the provision of the Specification wherein the Contractor is required to suitably protect all steelwork before shipment to prevent damage to galvanized surfaces by wet storage stain. Full details of the proposed method of protection, (for instance, dipping in Sodium Dichromate solution) shall be submitted to the Engineer for approval prior to fabrication of the steel.
For short members (1 m long or less), the size of each bundle shall be limited to approximately 300mm in width and 300mm in height. Extra straps shall be used as necessary to prevent slippage between members within bundles. It is preferable if the bundles are secured to pallets, which are then double strapped in both directions.
Small members such as gusset plates, clip angles, etc., shall be wired together in small bundles and shall be packed in heavy gauge drums or strong boxes with totally closed–in sides, bottom and top.
Bolts and nuts shall be crated for shipment. Together with washers and similar accessories they shall be packed in boxes or in small steel pails. Where pails are used, the lids shall be securely wired to the pails, which shall be placed on a pallet, with a second pallet placed on

top of the pails so that it touches and secures all the pail lids. The pallets shall be double strapped in both directions.

Bundles of steelwork shall be handled and stored horizontally; they shall not be placed ‘on end’.

Metallic lifting lugs and chains shall only be used if adequate rubber sheathing is provided to the steel.

The preferred method for lifting bundles of steel is to use manilla rope slings. The lifting surfaces shall be protected with strips of wood or rubber. All steelwork shall be held above ground, truck beds, warehouse floors, wharfs, etc., by the use of suitable blocks, which shall also be used between layers and bundles when these are stored or piled. Sufficient blocking shall be provided to ensure that members are not subject to bending and to provide easy access for slings and fork lifts.

Suppliers’ standard cardboard boxes shall be left intact and shall be over.packed using wooden boxes designed to suit.

Packing crates where used shall be strongly constructed and the contents shall be securely bolted or fastened in position with struts or cross battens. Cross battens supporting weight in any direction are not to rely for their support on nails or screws driven lengthwise into the grain of the wood, but are to be supported by cleats secured from the inside. Drain holes shall be provided in crate bottoms where necessary.

Crating together of components of dissimilar metals is not acceptable.

All parts shall be clearly marked to facilitate easy sorting and erection.

Particular attention shall be given to strutting before packing crates are fastened down. Cases shall be upended after packing to prove that there is no movement of the contents.

Timber wedges or chocks shall be firmly fastened in place to prevent their displacement when the timber shrinks.

Where bolts are used, large washers shall be fitted under the head and nut to distribute the pressure and the timber shall be strengthened by means of a pad.

Woodwool shall be avoided as far as possible.

Waterproof paper and felt linings are to overlap at seams by at least 12 mm and seams shall be secured together in an approved manner but the enclosure is to be provided with screened openings to provide ventilation.

Each crate or package shall contain a packing list in a waterproof envelope. All cases, packages, etc should be clearly marked on the outside to indicate the total weight, show where the weight is bearing, the correct position of the slings and shall be marked with the contract number and port of destination.

They shall also bear an identification mark relating to the appropriate shipping documents. Material intended for different locations in Iraq shall be packed separately and packages shall clearly identify the destination.

The Engineer may require to inspect and review the packing before items are despatched but the Contractor is to be entirely responsible for ensuring that the packing is suitable for transit and such inspection will not exonerate the Contractor from any loss or damage due to faulty packing.

All arrangements shall be made for all forms of transport used, to ensure that all items are transported safely and on time to their destination.

Only reputable carriers, which have regular schedules to the required destination shall be used. All the facilities, reliability and record of carriers, ports and other depots shall be investigated and arrangements shall be made to supplement any deficiencies in handling equipment and other facilities. The number of carriers shall be kept to a minimum and double handling at ports and depots shall be avoided as far as possible. The contractor shall ensure that all warehouses used en route, are suitable and that all items can be stored without any deterioration or damage from water, sunlight dust or any other cause. When possible the sending of partial consignments is to be avoided. If such
are required, items such as steel Towers shall be shipped in complete units.

The Contractor shall make all the necessary arrangements for customs clearance in Iraq, the country of origin, and any countries through which goods pass.

The Contractor shall obtain all the necessary export and import permits and any other documents required for the transport of goods. Copies of all forms and documents relating to customs, permits, packing lists, bills of lading and insurance, etc. shall be forwarded to the Engineer Packing cases and packing material shall remain the property of the Contractor.

All labels, markings and colour codings on crates, packages, etc., shall be legible, waterproof, not affected by sunlight and are securely fixed or painted on the item.

The standard project shipping mark shall be applied to all items and shall be visible at a distance from different viewpoints. In addition to a packing list included in a waterproof envelope, each item shall be marked on the outside providing details of contents, order number, shipper, shipping contract numbers case numbers, etc.

Packages contained within a larger crate shall be marked with full details of their contents and any other relevant information. Oil, paint and other hazardous or inflammable materials are to be marked accordingly, including the wording “Flash Point °C” and the recommended storage temperature

2 Design and Engineering

2.1 Towers and Structures (Types and Duties)

For 400 k.v

Towers for the 400-KV transmission lines are rigid self-supported type. The towers have been given code letters. Tower type letters are as given in table below:

TOWER TYPES	EXTENSIONS (meter)	
	Rigid Body	Rigid Leg
Tangent Tower Type (XA)	6	0,1.5, 3.0, 4.5, 6.0
0 - 10 deg. Angle & Long Span Tangent Tower Type (XB)	6, 12, 18, 24, 30, 36	0,1.5, 3.0, 4.5, 6.0
0 - 45 deg Angle & Semi dead end Tower Type (XC)	6	0,1.5, 3.0, 4.5, 6.0
0 -90 deg Angle & dead end Tower Type (XD)	6	0,1.5, 3.0, 4.5, 6.0
Transposition Tower Type XE	____	0,1.5, 3.0, 4.5, 6.0

For 132k.v

Towers for the 132-KV transmission lines are rigid self-supported type. The towers have been given code letters. Tower type letters are as given in table below:

Tower Type	Angle of deviation	Leg Extension
Tangent tower type 2S2	0-2 deg.	0,3,6
Medium angle and sectionalized tower type 2T2	0-45 deg.	0,3,6
Large angle and full dead end tower type 2E2	0-90 deg.	0,3,6
Special tower type 2SP2	0-5 deg angle tower in L dir., and 0-30 deg. angle or 0-15 deg. entry or 0-15 deg. opposite entry tower in H dir.	0,3,6
Under crossing tower type 2K2	0-60 deg. tension tower , 0-30 deg. dead end tower	0,3,6
Crossing tower type 2R2	0 deg.	0,3,6,9,12,15

Manufacture and supply towers according to workshop drawing (Primary drawing attached with tender & the detail workshop drawing will supplied after award), tower include steel members, plates, bolts and all attachment.

2.2 Tower Fabrication

2.2.1 General

Supply materials, fabricate ,trial assembles and deliver galvanized steel work for 400 k.v & 132 k.v transmission lines according workshop drawings(given by the Employer) and last issue of the following standards:

Steel quality: BSEN 10025 S355 JR and S355 J0, denoted by "H"

Bolts:

- Quality class: 5.8
- Bolts will be according to DIN 7990 each bolt will be supplied with:
  - (1) one plain washer , (DIN 126)
  - (1) one spring washer , (DIN 127)
  - (1) one standard nut , (DIN 555)
- Step bolts will be according to DIN 931 with (2) two nuts and (2) two plain washer

2.2.2 Galvanizing

All steel items, bolts, nuts &washers to be hot – dip galvanized. As per (ASTM - A- 123). Equivalent standards are accepted subjected to approve of engineer.

2.2.3 Fabrication

Minimum spacing of bolts and edge distances are as given in table below:

Diameter	Minimum Bolt Spacing	Minimum Edge Distance		
		Rolled Edge	Sheared Edge	Flame Cut Edge
mm	mm	Mm	mm	mm
16	40	19	22	25
20	48	27	31	34
22	57	32	35	38

2.2.4 Marking

Carry out marking before galvanizing with letters at least 16mm high and which are clearly legible after galvanizing. Ensure that the marking in no way impairs the mechanical strength of the member.

2.2.5 Bending

Use cold formed bending whenever possible. Submit bending procedure for approval and ensure that it is in accordance with recognized standards. Any material showing signs of cracking will be rejected .Do not carry out hot bending without prior approval.

Cold bend tower members in a hydraulic press with a suitable die to prevent buckling of the legs. Do not perform this procedure under quick impact but in slow moving press. Use this technique of bending to bend members through angles up to approximately 45 deg.

Whenever hot bending is required, do not heat with a torch but in an oven so that the member is uniformly heated to a distance of approximately 150mm on either side of the bend point. Depending on the material to be bent, use proper heat treatment procedures to preserve the original characteristics of the metal. Do not permit notching or welding.

2.2.6 Punching

Ensure that the center of any hole does vary more that 1.5mm from its position as shown on the drawing. Ensure that the center-to-center distance of end holes in a group of holes does not vary more than 1.5mm from the dimension shown on the drawing.

Do not plug or weld incorrectly punched holes .Ensure that punches and dies are sharp and true and all punched holes round, true to size and free from ragged edges and burrs. Ensure that diameters of the finished holes are equal to the nominal diameters of the bolts plus 1.5mm.

Do not punch material above 12.5mm thick.

2.2.7 Other

1. Defects and Cuts

Ensure that materials used for fabrication are free from mill and shop defects. Make cuts cleanly and without drawn or ragged edges. Submit all flame cut procedures for prior approval.

2. Bolts, Nuts and Washers

-Secure all connections by bolts, nuts and one 3mm minimum thick flat washer.
-Supply 10% more than of the bolts required in drawing quantity.

3. Galvanizing

Galvanize tower steel and fasteners to ASTM-A-123.

4. Assembly of Prototype

Completely assemble each prototype tower with matching units including extensions footing after galvanizing.

5. Mill Order and Test Report

Furnish copies of all mill orders and all certified mill test reports covering the physical and chemical properties of the steel to be used.

2.3 Tower Attachments

3.3.1 Step Bolts

Provide each tower with step bolts of an approved type on one of the legs spaced not more than 0.4meters apart, on alternate faces of the leg starting immediately above the anticlimbing device and continuing to within one(1) meter of the earthwire peak attachment point (s).

Provide step bolt holes between the ground line and the anti-climbing device. Ensure that each step bolt withstands a vertical load of at least 1330 N.

3.3.2 Grounding

Provide the holes necessary for accommodating the specified counterpoise and grounding connections each leg of every tower and extension. Also provide holes on each earthwire peak for the connection of a metallic bond from the earthwire.

3.3.3 Anti-Climbing Guard (Protection)

Each tower is to be equipped with a guard to prevent unauthorized persons from climbing the tower. This guard is to be composed of steel rods not less than 12mm in diameter and not less than 30cm in length sharpened at the ends and bent towards the ground. The rods are to be fastened to the tower structure by screws at the height between 3 to 4 meter above the ground level and to run around trunk of the tower or around each leg-in case of longer legs extension.

3.3.4 Bird Guards

Equip the towers with approved devices immediately above each conductor suspension assembly attachment point to prevent the perching and nesting of birds at these points, as shown on the drawings, or as agreed by the Engineer.

3.3.5 Warning and Identification Plates

Provide conspicuous danger plates, circuit plates, phase plates, and line and tower number plates of approved types which are resistant to fading under the climatic conditions at Site, and fix them in the positions as shown in the Drawings.

Manufacture danger plates from sheet iron to show white characters on a vitreous enameled red background. Ensure the plate is not less than 1.5 mm thick, and not less than 300 mm by 300 mm in area.

Ensure that characters are the maximum possible size to accommodate the following text, in Arabic and English, together with a centrally disposed "lightning"- type flash extending the full width of the plate:

"DANGER"

"Do not touch these wires even those fallen on the ground"

Submit Arabic text, which must appear above the English text, for approval by the Engineer before manufacture commences.

Ensure that the tower number plate is attached immediately below the danger plate.

Provide phase identification plates marked R, S and T respectively, to indicate the line conductor phases. Fit in approved positions on terminal and other strain type towers.

Provide circuit number plates marked in Roman numeral one (I) on one circuit and Roman numeral two (II) for the other circuit.

2.4 Grounding Materials

Supply the following materials for grounding:

a) Ground rods: minimum 16mm diameter by 3 meter long , copper or copper clad steel with provisions for coupling rods together and provided with suitable clamp for connection of copper ground wire .
b) Connection wire: stranded copper, minimum size 3 strands, each 3.7mm diameter hard drawn copper.
c) Clamps to tower steel to be bronze or copper as recommended by the manufacture, such that galvanic corrosion is eliminated.

3 Testing

3.1 Material Tests

1. Raw materials, parts, and assemblies used shall be tested in accordance with the ASTM standards listing in clause (1.4) for testing steel.
2. furnish three(3) copies of all mill orders and all certified mill test reports covering the physical and chemical properties of the steel to be used as follows:.

For steel

- Chemical Analysis.
- Tensile Tests.
- Bend Tests.
- Impact Test.

For nuts, bolts, and washers

- Tensile Strength Test
- Bend Test.

The manufacturer shall maintain a record of tests carried out by him for examination by ETP/Engineer. While work is being carried on, ETP/Engineer shall have free entry at all times to all parts of the Tower Manufacturer's plant to inspect any part of the production of the Towers covered by this specification.

3.2 Acceptance Tests

The following acceptance tests shall be carried out

For Tower:

1. Visual examination.
2. Verification of dimensions and weights
3. Tower assemply

For nuts, bolts, and washers*:*

1. Verification of dimensions.
2. Visual inspection.
3. Proof load test
4. Ultimate tensile strength test.
5. Galvanizing test.
6. Bend test.

4 Packing and Shipping

4.1 Packing

With ref. to item1.21, included in this section are the minimum requirements to ensure that all materials pertaining to the works are packed and transported to their destination without sustaining any damage or deterioration. Also included are details of documents to be provided and requirements for labeling and marking of containers.

Write and submit to the engineer a comprehensive specification covering packing, marking, colour coding of tower member, documentation…etc, include, but not being limited to, any methods or procedure described herein.

Ensure that all materials are adequately packed to provide protection against corrosion, physical damage, contamination or damage from water, dust, or any other source during handling and all necessary transport.

Handle all crates ,boxes, bundles ,…etc carefully at all time and do not drop ,dump, throw or push items from, onto or into any form of transport ,during storage or at any other time.

Small parts and fasteners shall be carefully boxed, crated, bagged or otherwise containerized and protected for shipment.

Steel Tower shall be crated and placed in an open top container van and secured in a manner to prevent damage, including damage to galvanized and coating .Blocks and straps shall be rust proof and properly padded to minimize abrasion.

There shall be handling instruction to minimize damage to painted or galvanized surfaces.

The packing shall be each tower consist of many bundles for members and boxes for bolts and small member.

4.2 Shipping

With ref. to item 1.21 , all steel Tower and its components shall be shipped from the factory to the specified location.

Each shipment shall be accompanied by a detailed packing list of all parts, identifiable by structure type and number. Arms and bolts will be identified by the list for matchup with the respective Tower shaft. All parts required for any one structure shall be in one shipment, if possible.

The ETP shall be notified prior to each shipment that is to take place and reserves the right to inspect the components prior to shipment. The notification shall give quantities, weight, name of carrier used, and expected time of arrival.

After delivery, the Towers will be inspected and shall be free of dirt, oil blisters, flux, black spots, dross, teardrop edges, flaking zinc, and in general shall be smooth, attractive, and unscarred. Towers not meeting this requirement shall be repaired or replaced by the Contractor at no additional cost to ETP.

SCHEDULE OF TECHNICAL INFORMATIONS FOR 400 K.V TOWERS

SCHEDULE A

DATES FOR MANUFACTURE, INSPECTION, COMPLETION AND TESTING

The Schedule to be completed by the Tenderer and the times entered are to be binding on the Contractor and signed by him. All periods are to be in weeks and shall show the commencement and completion for each item The Contractor shall refer to the construction programe noting key dates and periods.

Commencement Date:

Completion Date:

Total period of Contract: 420 calendar days

Description	Month	
	Start	Complete
Submit of all technical documentation for approval	**0**	**21**
Test of tower steelwork	**21**	**45**
Shipment of Towers: 50% of tension towers	**45**	**245**
Shipment of Towers: 50% of suspensions towers	**45**	**245**
Shipment of Towers: 50% of tension towers	**245**	**420**
Shipment of Towers: 50% of suspension tower	**245**	**420**

SCHEDULE B
MANUFACTURERS AND PLACES OF MANUFACTURE, TESTING AND INSPECTION

Item	Manufacturer	Place of Manufacturer	Place of testing and inspection
Steel Towers: a. Steel billets, etc b. Steel sections c. Fabrication d. Galvanizing e. Check assembly f. Tower tests Aircraft warning markers Bolts and nuts Grounding materials	ASIA, AFRICA, EUROPE, SOUTH & NORTH AMERICA		

SCHEDULE OF TECHNICAL INFORMATIONS FOR 132 K.V TOWERS

SCHEDULE A

DATES FOR MANUFACTURE, INSPECTION, COMPLETION AND TESTING

The Schedule to be completed by the Tenderer and the times entered are to be binding on the Contractor and signed by him. All periods are to be in weeks and shall show the commencement and completion for each item The Contractor shall refer to the construction programe noting key dates and periods.

Commencement Date:

Completion Date:

Total period of Contract 420 calendar dats

Description	DAYS	
	Start	Complete
Submit of all technical documentation for approval	**0**	**21**
Test of tower steelwork	**21**	**45**
Shipment of Towers: 50% of tension towers	**45**	**245**
Shipment of Towers: 50% of suspensions towers	**45**	**245**
Shipment of Towers: 50% of tension towers	**245**	**420**
Shipment of Towers: 50% of suspension tower	**245**	**420**

SCHEDULE B
MANUFACTURERS AND PLACES OF MANUFACTURE, TESTING AND INSPECTION

Item	Manufacturer	Place of Manufacturer	Place of testing and inspection
Steel Towers: a. Steel billets, etc b. Steel sections c. Fabrication d. Galvanizing e. Check assembly f. Tower tests Aircraft warning markers Bolts and nuts Grounding materials	ASIA, AFRICA, EUROPE, SOUTH & NORTH AMERICA		

Weights of Tower

Approximate Towers Weight For 400 k.v

1. Total Weight for Tower Type XA

Item	Description	Weight (Section + Bolts + Galvanize) kg
1	Basic Body with Stub	7,112
2	Basic Body for +6 B.E with Stub	5,598
3	+6 Mt BODY EXT.	3,309
4	+ 0,0 Mt LEGS (FOR 4 LEGS)	313
5	+1,5 Mt LEGS (FOR 4 LEGS)	639
6	+3,0 Mt LEGS (FOR 4 LEGS)	926
7	+4,5 Mt LEGS (FOR 4 LEGS)	1,257
8	+6,0 Mt LEGS (FOR 4 LEGS)	1,634
9	TEMPLATE	1,569

2. Total Weight for Tower Type XB

Item	Description	Weight (Section + Bolts + Galvanize) kg
1	Basic Body with Stub	11,500
2	+6 Mt BODY EXT.	3,920
3	+12 Mt BODY EXT.	6,300
4	+18 Mt BODY EXT.	9,281
5	+24 Mt BODY EXT.	12,954
6	+30 Mt BODY EXT.	17,281
7	+36 Mt BODY EXT.	23,518
8	± 0,0 Mt LEGS (FOR 4 LEGS)	570
9	+1,5 Mt LEGS (FOR 4 LEGS)	1,037
10	+3,0 Mt LEGS (FOR 4 LEGS)	1,530
11	+4,5 Mt LEGS (FOR 4 LEGS)	2,099
12	+6,0 Mt LEGS (FOR 4 LEGS)	2,895
13	TEMPLATE(BASIC BODY & +6 BODY+6 Mt Leg Ext.)	1,540
14	TEMPLATE(+12 ,+18,+24,+30 & +36 BODY+6 Mt Leg Ext.)	4,015

3. Total Weight for Tower Type XC

Item	Description	Weight (Section + Bolts + Galvanize) kg
1	Basic Body with Stub	15,286
2	Basic Body for +6 B.E with Stub	14,586
3	+6 Mt BODY EXT.	3,827
4	± 0,0 Mt LEGS (FOR 4 LEGS)	768
5	+1,5 Mt LEGS (FOR 4 LEGS)	1,287
6	+3,0 Mt LEGS (FOR 4 LEGS)	1,814
7	+4,5 Mt LEGS (FOR 4 LEGS)	2,431
8	'+6,0 Mt LEGS (FOR 4 LEGS)	3,020
9	TEMPLATE	2,245

4. Total Weight for Tower Type XD

Item	Description	Weight (Section + Bolts + Galvanize) kg
1	Basic Body with Stub	20,080
2	Basic Body for +6 B.E with Stub	19,364
3	+6 Mt BODY EXT.	4,230
4	± 0,0 Mt LEGS (FOR 4 LEGS)	875
5	+1,5 Mt LEGS (FOR 4 LEGS)	1,527
6	+3,0 Mt LEGS (FOR 4 LEGS)	2,042
7	+4,5 Mt LEGS (FOR 4 LEGS)	2,838
8	'+6,0 Mt LEGS (FOR 4 LEGS)	3,575
9	TEMPLATE	2,050

5. Total Weight for Tower Type XE

Item	Description	Weight (Section + Bolts + Galvanize) kg
1	Basic Body with Stub	19,473
2	± 0,0 Mt LEGS (FOR 4 LEGS)	639
3	+1,5 Mt LEGS (FOR 4 LEGS)	1,186
4	+3,0 Mt LEGS (FOR 4 LEGS)	1,558
5	+4,5 Mt LEGS (FOR 4 LEGS)	2,116
6	'+6,0 Mt LEGS (FOR 4 LEGS)	2,764
7	TEMPLATE	3,194

Approximate Towers Weight

1- Total Weight for Tower Type 2S2

Item	Description	FINAL AGREED WEIGHT 1QTY (KG)
1	Basic Body with Stub +A.C.D	4,861
2	+0 Leg Ext	747
3	+ 3 Leg Ext	1,541
4	+ 6 Leg Ext	2,421
5	Template	682

2- Total Weight for Tower Type 2T2

Item	Description	Weight (Sections +Bolts+ Galvanized) kg
1	Basic Body with Stub +A.C.D	10,854
2	+0 Leg Ext	1,629
3	+ 3 Leg Ext	3,546
4	+ 6 Leg Ext	5,647
5	Template	1,018

3- Total Weight for Tower Type 2E2

Item	Description	Weight (Sections +Bolts+ Galvanized) Kg
1	Basic Body with Stub +A.C.D	12,296
2	+0 Leg Ext	2,204
3	+ 3 Leg Ext	4,481
4	+ 6 Leg Ext	6,197
5	Template	1,268

4- Total Weight for Tower Type 2R2

Item	Description	Weight (Sections +Bolts+ Galvanized) Kg
1	Basic Body with Stub +A.C.D	10,816
2	+0 Leg Ext	2,504
3	+ 3 Leg Ext	4,316
4	+ 6 Leg Ext	5,400
5	+ 9 Leg Ext	7,464
6	+ 12 Leg Ext	8,594
7	+ 15 Leg Ext	9,811
8	Template	1,482

5- Total Weight for Tower Type 2K2

Item	Description	Weight (Sections +Bolts+ Galvanized) Kg
1	Basic Body with Stub +A.C.D	10,452
2	+0 Leg Ext	1,608
3	+ 3 Leg Ext	3,737
4	+ 6 Leg Ext	6,159
5	Template	1,030

6- Total Weight for Tower Type 2SP2

Description	Weight (Sections +Bolts+ Galvanized) Kg
Basic Body with Stub +A.C.D	20,153
+0 Leg Ext	2,911
+ 3 Leg Ext	6,077
+ 6 Leg Ext	8,505
Template	1,444

Notes:-

1-132 v towers (2S2,2T2,2E2,2R2,2K2,2SP2) are double circuit with conductor Type (ACSR TEAL)

2- The materials of the towers are:

- Steel quality: BSEN 10025 S355 JR and S355 J0, denoted by "H"

- Bolts:

- Quality class: 5.8

- Bolts will be according to DIN 7990 each bolt will be supplied with:

One plain washer, (DIN 126)

One spring washer, (DIN 127)

One standard nut, (DIN 555)

Step bolts will be according to DIN 931 with (2) two nuts and (2) two plain washer

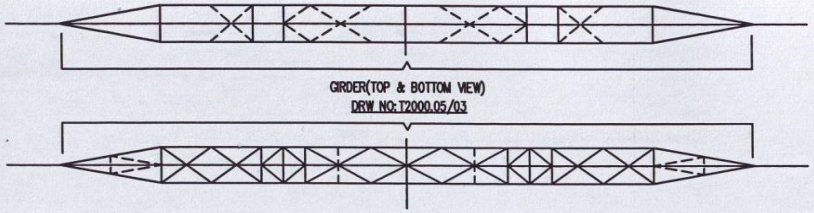
- Equivalent standards are accepted subjected to approve of engineer.

3-The tower members section varied from 45 ×45 ×5mm to 200×200×16mm and the hexagonal bolts are M16,M20,M22 and M24 with variable length.

4- All towers workshop drawings will be given to the Contractor by ETP immediately after the contract becomes effective & opening letter of credit.

DRAWINGS

DRAWINGS FOR 400 K.V



GIRDER(TOP & BOTTOM VIEW)
DRW NO: T2000.05/03

GIRDER
DRW NO: T2000.05/02

GROUND WIRE PEAK
DRW NO: T2000.05/01

CROSS ARM
DRW NO: T2000.05/04

K-FRAME
DRW NO: T2000.05/05

1600

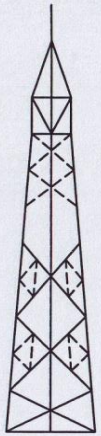
COMMON BODY-I
DRW NO: T2000.05/07

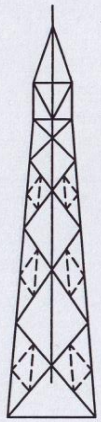
BODY FOR +6 BODY EXT.
DRW NO: T2000.05/09

+6.0 BODY EXT.
DRW NO: T2000.05/10

±0,0 LEG EXT.	DRW NO: T2000.05/12
+1,5 LEG EXT.	DRW NO: T2000.05/12
+3 LEG EXT.	DRW NO: T2000.05/13
+4,5 LEG EXT.	DRW NO: T2000.05/14
+6 LEG EXT.	DRW NO: T2000.05/15
STUB	DRW NO: T2000.05/16

300
GROUND LEVEL
9524

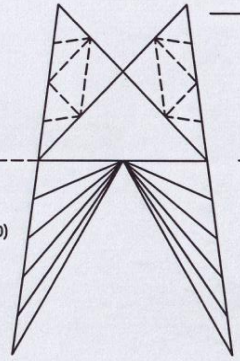




GROUND WIRE PEAK
DRW NO: T2000.05/01

K-FRAME (VIEW-G & VIEW -E)
DRW NO: T2000.05/06

FOR TENDERING
PURPOSE ONLY



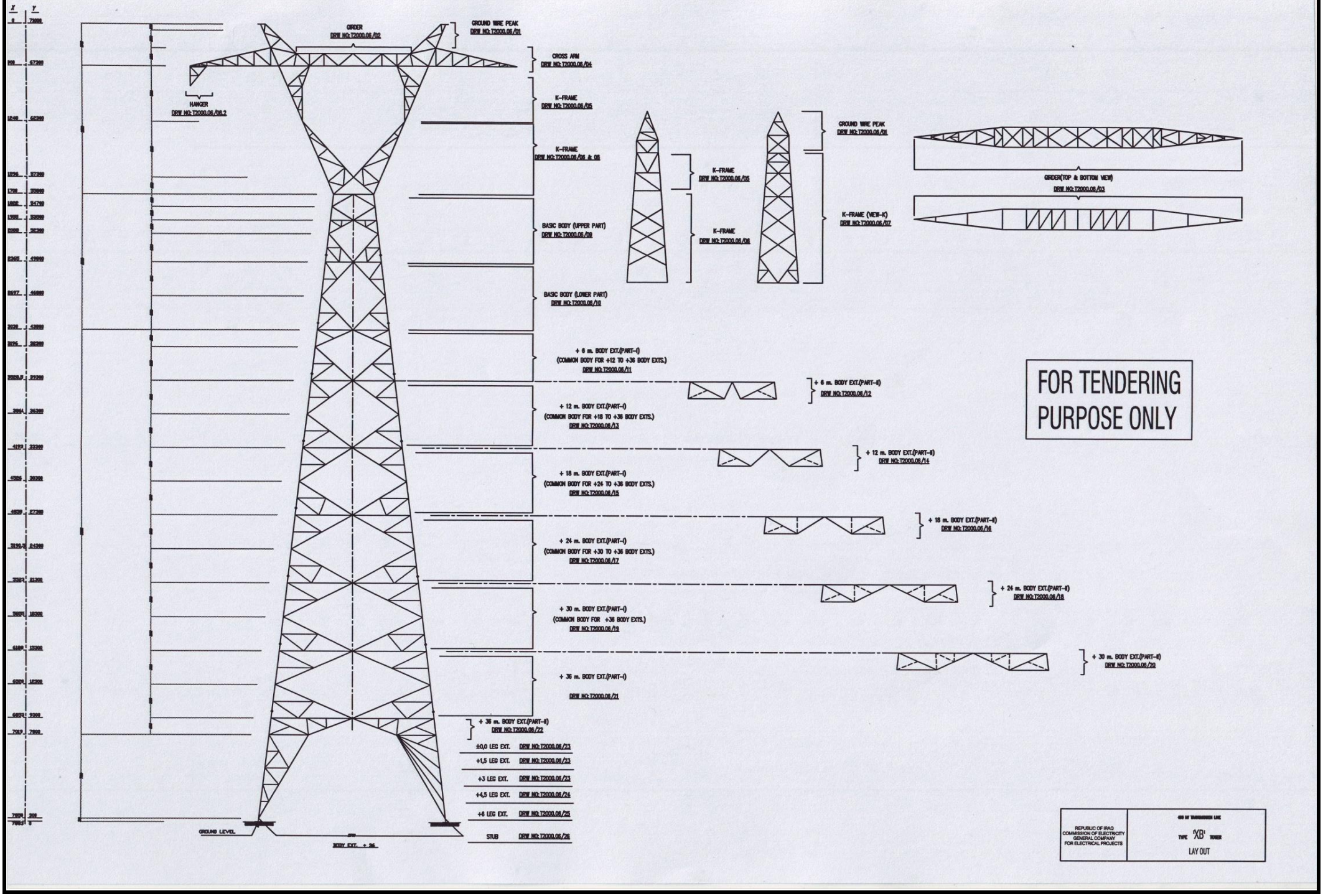
+6.0 BODY EXT.(SECTION L-L VIEW-0)
DRW NO: T2000.05/11

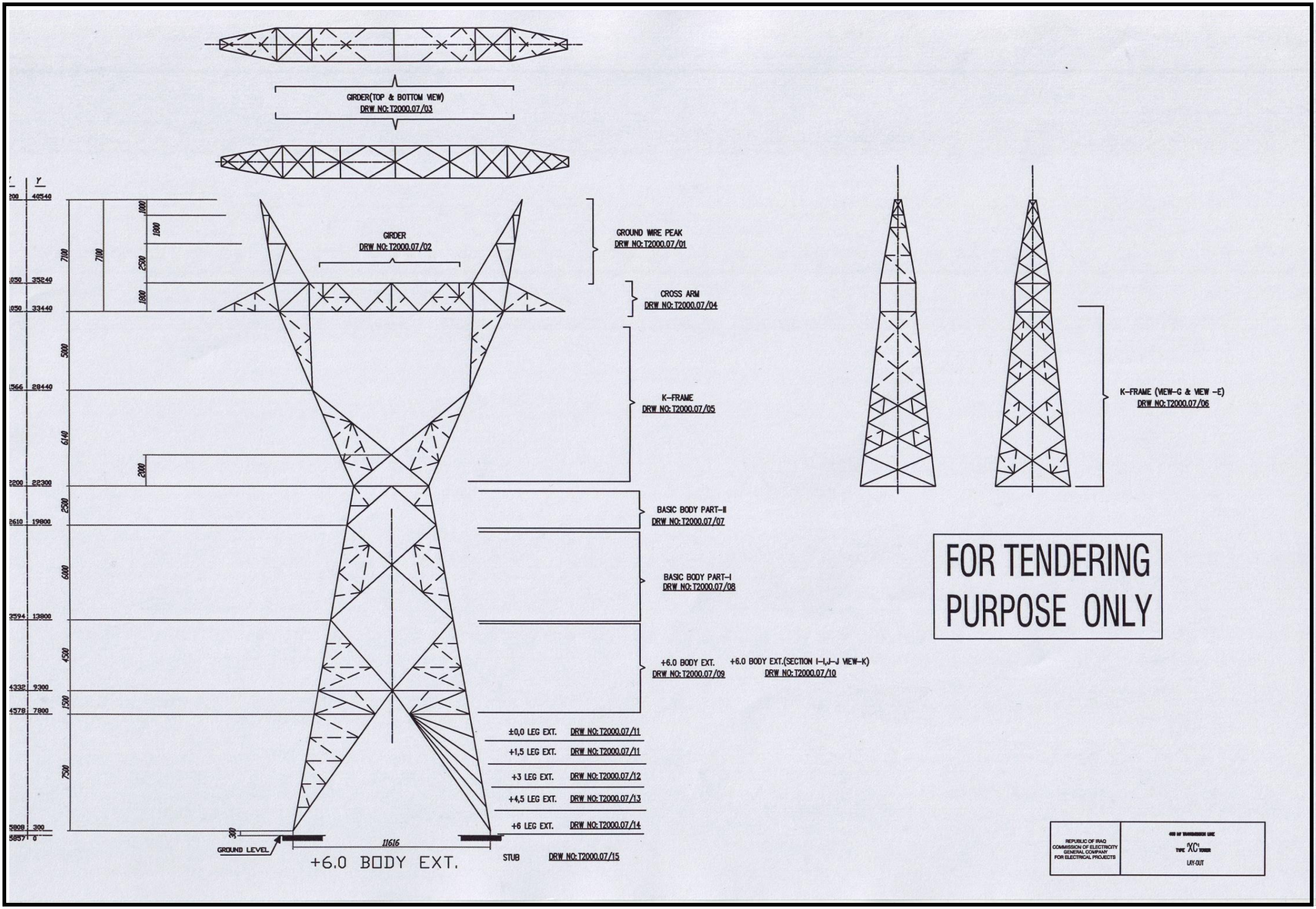
BASIC BODY (COMMON BODY -II)
DRW NO: T2000.05/08

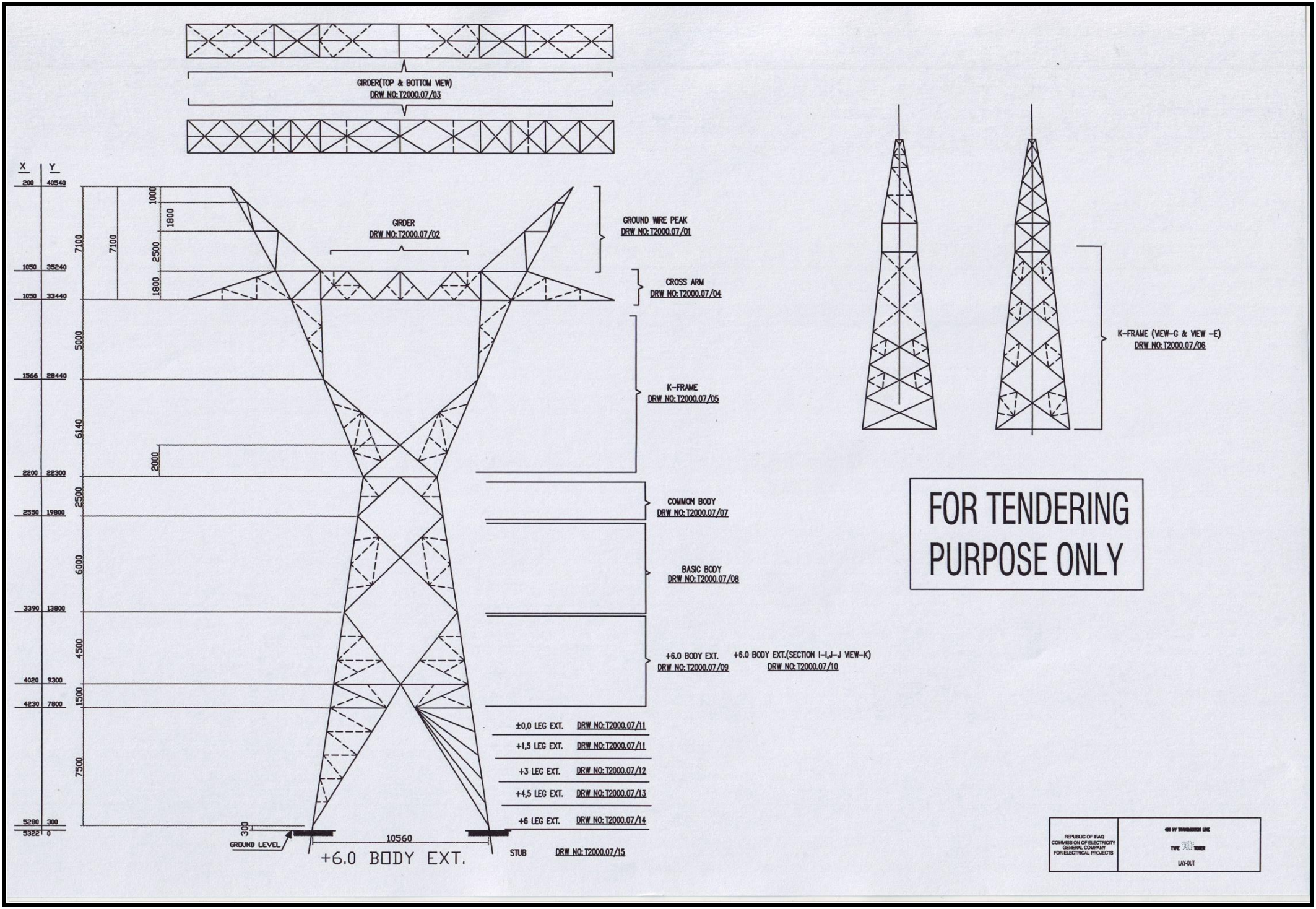
±0,0 LEG EXT.
+1,5 LEG EXT.
+3 LEG EXT.
+4,5 LEG EXT.
+6 LEG EXT.

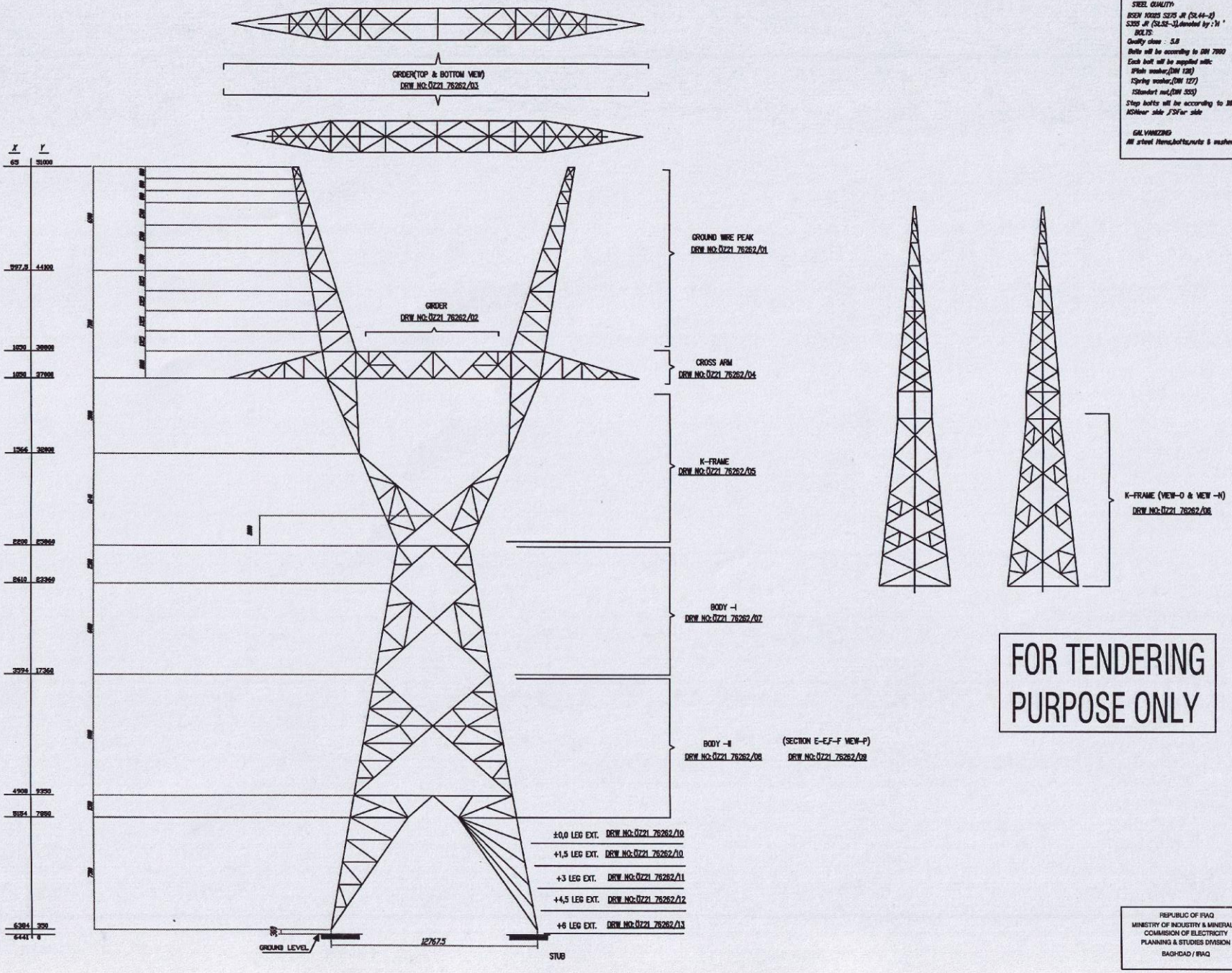
REPUBLIC OF IRAQ
COMMISSION OF ELECTRICITY
GENERAL COMPANY
FOR ELECTRICAL PROJECTS

400 kV TRANSMISSION LINE
TYPE 'XA' TOWER


X
Y
GIRDER
DRW NO:T2000.06/02
GROUND WIRE PEAK
DRW NO:T2000.06/01
CROSS ARM
DRW NO:T2000.06/04
HANGER
DRW NO:T2000.06/06.2
K-FRAME
DRW NO:T2000.06/05
K-FRAME
DRW NO:T2000.06/06 & 08
BASIC BODY (UPPER PART)
DRW NO:T2000.06/09
BASIC BODY (LOWER PART)
DRW NO:T2000.06/10
+ 6 m. BODY EXT.(PART-I)
(COMMON BODY FOR +12 TO +36 BODY EXTS.)
DRW NO:T2000.06/11
+ 6 m. BODY EXT.(PART-II)
DRW NO:T2000.06/12
+ 12 m. BODY EXT.(PART-I)
(COMMON BODY FOR +18 TO +36 BODY EXTS.)
DRW NO:T2000.06/13
+ 12 m. BODY EXT.(PART-II)
DRW NO:T2000.06/14
+ 18 m. BODY EXT.(PART-I)
(COMMON BODY FOR +24 TO +36 BODY EXTS.)
DRW NO:T2000.06/15
+ 18 m. BODY EXT.(PART-II)
DRW NO:T2000.06/16
+ 24 m. BODY EXT.(PART-I)
(COMMON BODY FOR +30 TO +36 BODY EXTS.)
DRW NO:T2000.06/17
+ 24 m. BODY EXT.(PART-II)
DRW NO:T2000.06/18
+ 30 m. BODY EXT.(PART-I)
(COMMON BODY FOR +36 BODY EXTS.)
DRW NO:T2000.06/19
+ 30 m. BODY EXT.(PART-II)
DRW NO:T2000.06/20
+ 36 m. BODY EXT.(PART-I)
DRW NO:T2000.06/21
+ 36 m. BODY EXT.(PART-II)
DRW NO:T2000.06/22
±0,0 LEG EXT. DRW NO:T2000.06/23
+1,5 LEG EXT. DRW NO:T2000.06/23
+3 LEG EXT. DRW NO:T2000.06/23
+4,5 LEG EXT. DRW NO:T2000.06/24
+6 LEG EXT. DRW NO:T2000.06/25
STUB DRW NO:T2000.06/26
GROUND LEVEL
BODY EXT. + 36
K-FRAME
DRW NO:T2000.06/05
K-FRAME
DRW NO:T2000.06/08
GROUND WIRE PEAK
DRW NO:T2000.06/01
K-FRAME (VIEW-K)
DRW NO:T2000.06/07
GIRDER(TOP & BOTTOM VIEW)
DRW NO:T2000.06/03
FOR TENDERING
PURPOSE ONLY
REPUBLIC OF IRAQ
COMMISSION OF ELECTRICITY
GENERAL COMPANY
FOR ELECTRICAL PROJECTS
400 kV TRANSMISSION LINE
TYPE 'XB' TOWER
LAY OUT


GIRDER(TOP & BOTTOM VIEW)
DRW NO: T2000.07/03
GIRDER
DRW NO: T2000.07/02
GROUND WIRE PEAK
DRW NO: T2000.07/01
CROSS ARM
DRW NO: T2000.07/04
K-FRAME
DRW NO: T2000.07/05
BASIC BODY PART-II
DRW NO: T2000.07/07
BASIC BODY PART-I
DRW NO: T2000.07/08
+6.0 BODY EXT.
DRW NO: T2000.07/09
+6.0 BODY EXT.(SECTION I-I,J-J VIEW-K)
DRW NO: T2000.07/10
±0,0 LEG EXT. DRW NO: T2000.07/11
+1,5 LEG EXT. DRW NO: T2000.07/11
+3 LEG EXT. DRW NO: T2000.07/12
+4,5 LEG EXT. DRW NO: T2000.07/13
+6 LEG EXT. DRW NO: T2000.07/14
STUB DRW NO: T2000.07/15
K-FRAME (VIEW-G & VIEW -E)
DRW NO: T2000.07/06
FOR TENDERING PURPOSE ONLY
GROUND LEVEL
11616
+6.0 BODY EXT.
REPUBLIC OF IRAQ
COMMISSION OF ELECTRICITY
GENERAL COMPANY
FOR ELECTRICAL PROJECTS
TYPE 'XC' TOWER
LAY-OUT


GIRDER(TOP & BOTTOM VIEW)
DRW NO: T2000.07/03
X
Y
200
40540
1050
35240
1050
33440
1566
28440
2200
22300
2550
19800
3390
13800
4020
9300
4230
7800
5280
300
5321
0
7100
7100
5000
6140
2500
6000
4500
1500
7500
1000
1800
2500
1800
2000
300
GROUND LEVEL
10560
+6.0 BODY EXT.
GIRDER
DRW NO: T2000.07/02
GROUND WIRE PEAK
DRW NO: T2000.07/01
CROSS ARM
DRW NO: T2000.07/04
K-FRAME
DRW NO: T2000.07/05
COMMON BODY
DRW NO: T2000.07/07
BASIC BODY
DRW NO: T2000.07/08
+6.0 BODY EXT.
DRW NO: T2000.07/09
+6.0 BODY EXT.(SECTION I-I,J-J VIEW-K)
DRW NO: T2000.07/10
±0,0 LEG EXT. DRW NO: T2000.07/11
+1,5 LEG EXT. DRW NO: T2000.07/11
+3 LEG EXT. DRW NO: T2000.07/12
+4,5 LEG EXT. DRW NO: T2000.07/13
+6 LEG EXT. DRW NO: T2000.07/14
STUB DRW NO: T2000.07/15
K-FRAME (VIEW-G & VIEW -E)
DRW NO: T2000.07/06
FOR TENDERING
PURPOSE ONLY
REPUBLIC OF IRAQ
COMMISSION OF ELECTRICITY
GENERAL COMPANY
FOR ELECTRICAL PROJECTS
400 kV TRANSMISSION LINE
TYPE 10 TOWER
LAY-OUT

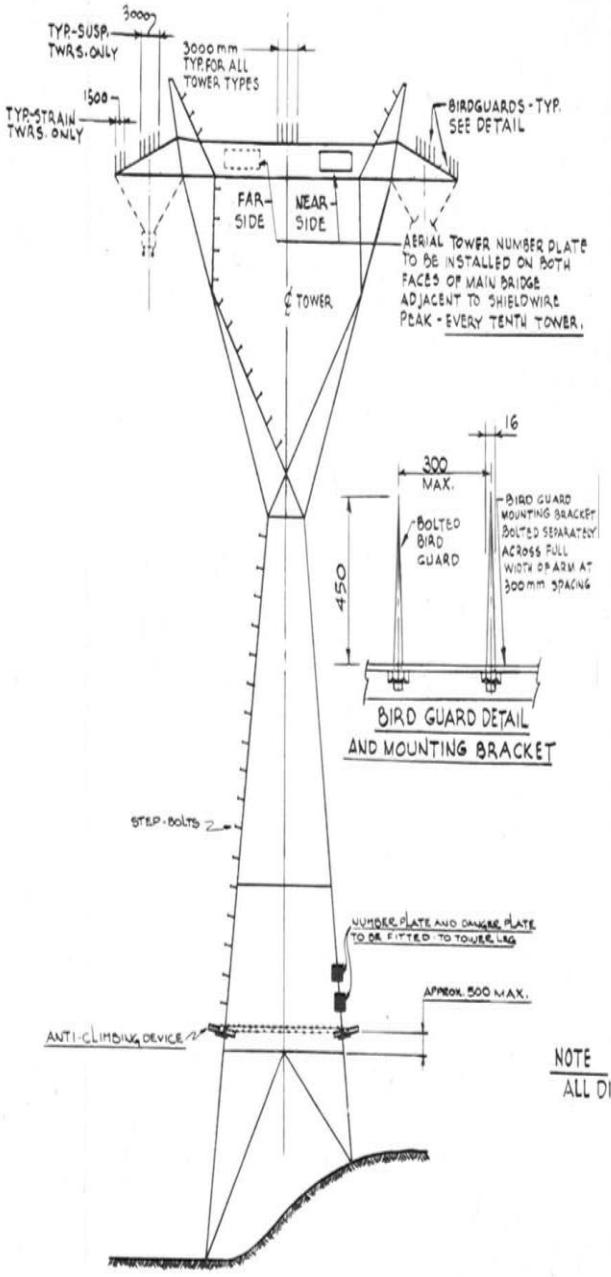


STEEL QUALITY:
BSEN 10025 S275 JR (St.44-2)
S355 JR (St.52-3),denoted by : N '
BOLTS:
Quality class : 5.8
Bolts will be according to DIN 7990
Each bolt will be supplied with:
1Plain washer,(DIN 126)
1Spring washer,(DIN 127)
1Standart nut,(DIN 555)
Step bolts will be according to DIN 931 with 2 nuts and 1 spring washer
NSNear side /FSFar side

GALVANIZING
All steel items,bolts,nuts & washers to be ho-dip galvanized as per
(ASTM-A-123)

FOR TENDERING PURPOSE ONLY

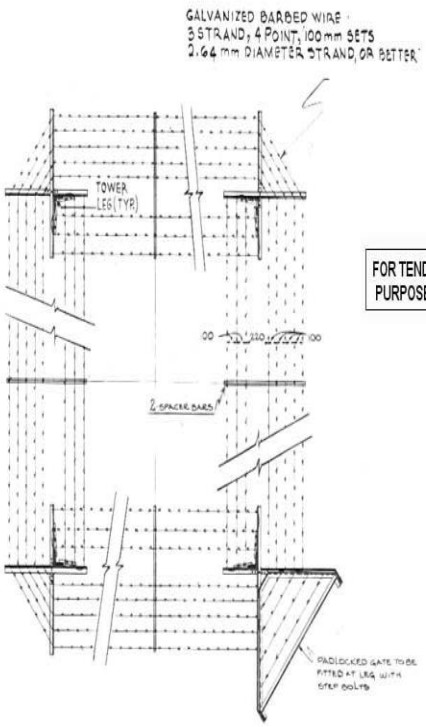
REPUBLIC OF IRAQ MINISTRY OF INDUSTRY & MINERALS COMMISION OF ELECTRICITY PLANNING & STUDIES DIVISION BAGHDAD / IRAQ	LAY-OUT TYPE XE



BIRD GUARD DETAIL AND MOUNTING BRACKET

MOUNTING LOCATION

TOWER SIGNS, ANTI-CLIMBING DEVICE, BIRD GUARDS & STEP-BOLTS



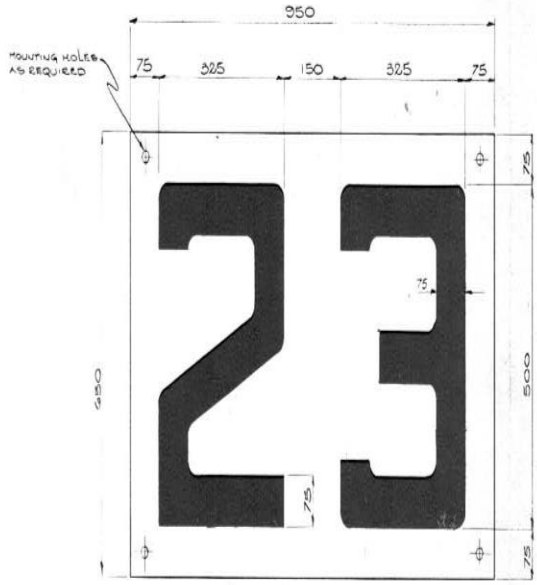
FOR TENDERING PURPOSE ONLY

ADJUSTABLE ANTI-CLIMBING DEVICE

(FOR ALL SELF-SUPPORTING TOWERS)

NOTE

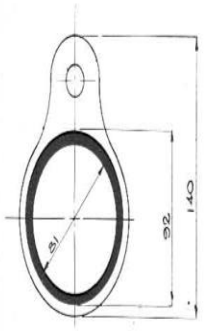
ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE NOTED.



COLOURS: BLACK NUMBERS ON YELLOW BACKGROUND

NOTES: 1 - SINGLE DIGIT NUMBER TO BE CENTERED
2. 0 OMITTED IE: 23 MEANS TOWER Nº 230

AERIAL TOWER NUMBER PLATE



COLOURS: YELLOW WITH BLACK CIRCLE
RED WITH WHITE CIRCLE
BLUE WITH WHITE CIRCLE

PHASE PLATE

FOR TENDERING PURPOSE ONLY

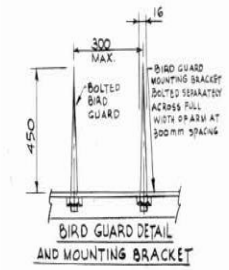
COLOURS: BLACK NUMBERS ON YELLOW BACKGROUND

NOTE: TOP NUMBER DESIGNATES LINE NUMBER
LOWER NUMBER DESIGNATES TOWER NUMBER

LINE AND TOWER NUMBER PLATE

COLOURS: RED BACKGROUND
WHITE CHARACTERS

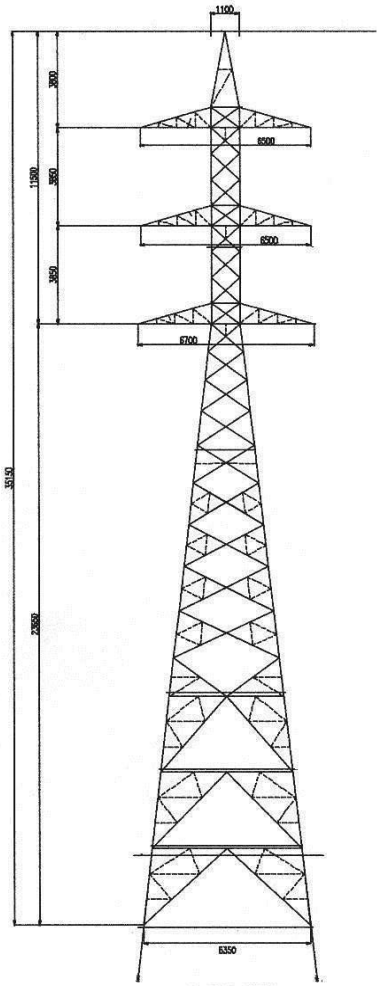
DANGER PLATE



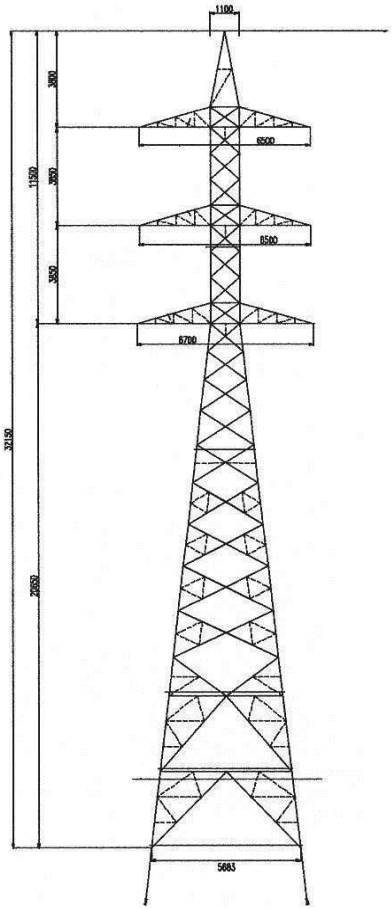
BIRD GUARD DETAIL
AND MOUNTING BRACKET

NOTES
1. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SIGN PLATES TO BE 16 GAUGE M.S. ENAMEL FINISH.
3. FIBER WASHER TO BE SUPPLIED FOR EACH PLATE (2 PER BOLT HOLE).
4. ALL SIGNS TO BE BOLTED TO TOWER OR ON MOUNTING BRACKETS.

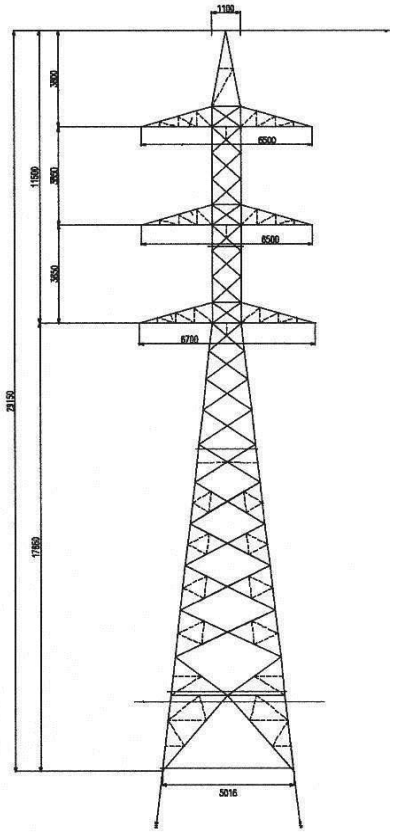
DRAWINGS FOR 132 K.V



+6 LEG EXT.



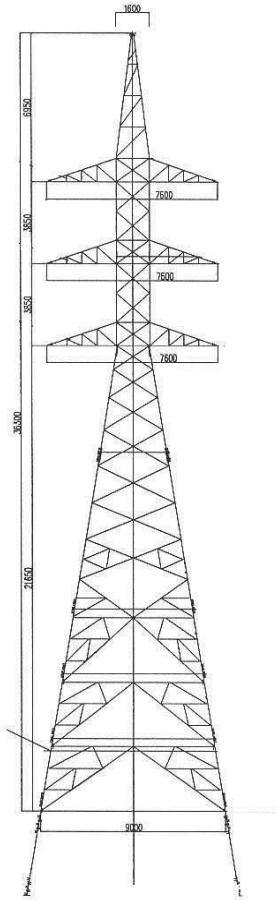
+3 LEG EXT.



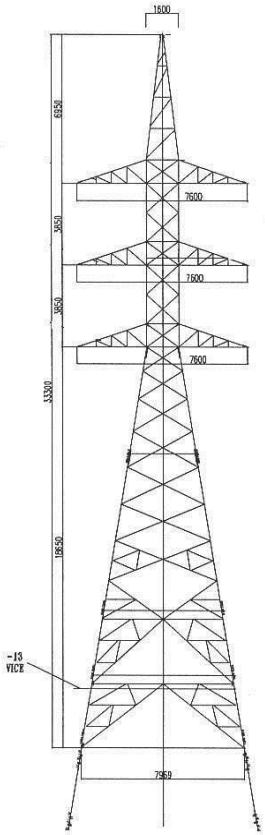
+±0 LEG EXT.

FOR TENDERING PURPOSE ONLY

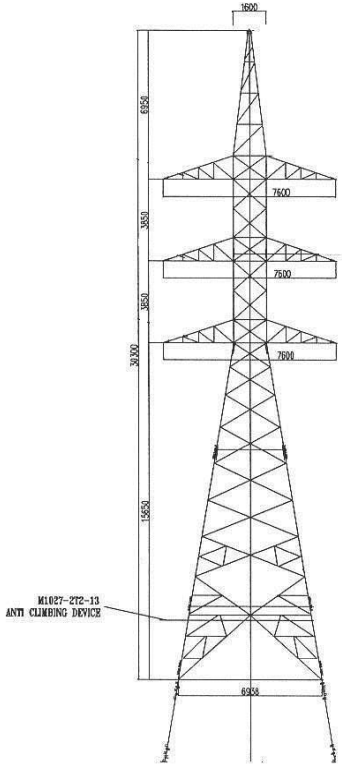
LAYOUT OF TOWER 2S



2T2 +6 LEG EXT.



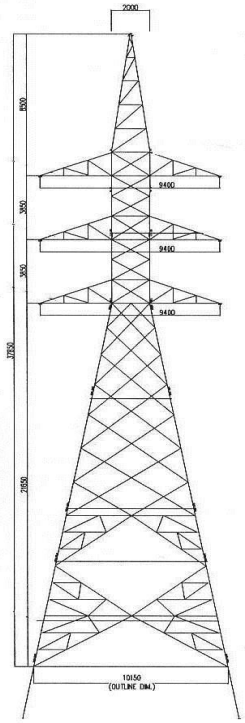
2T2 +3 LEG EXT.



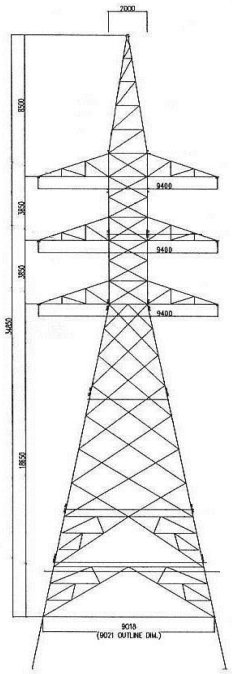
2T2 +0 LEG EXT.

FOR TENDERING PURPOSE ONLY

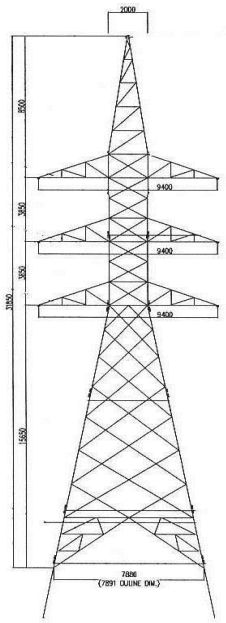
LAYOUT OF TOWER 2T2



2E2 +6 LEG EXT.



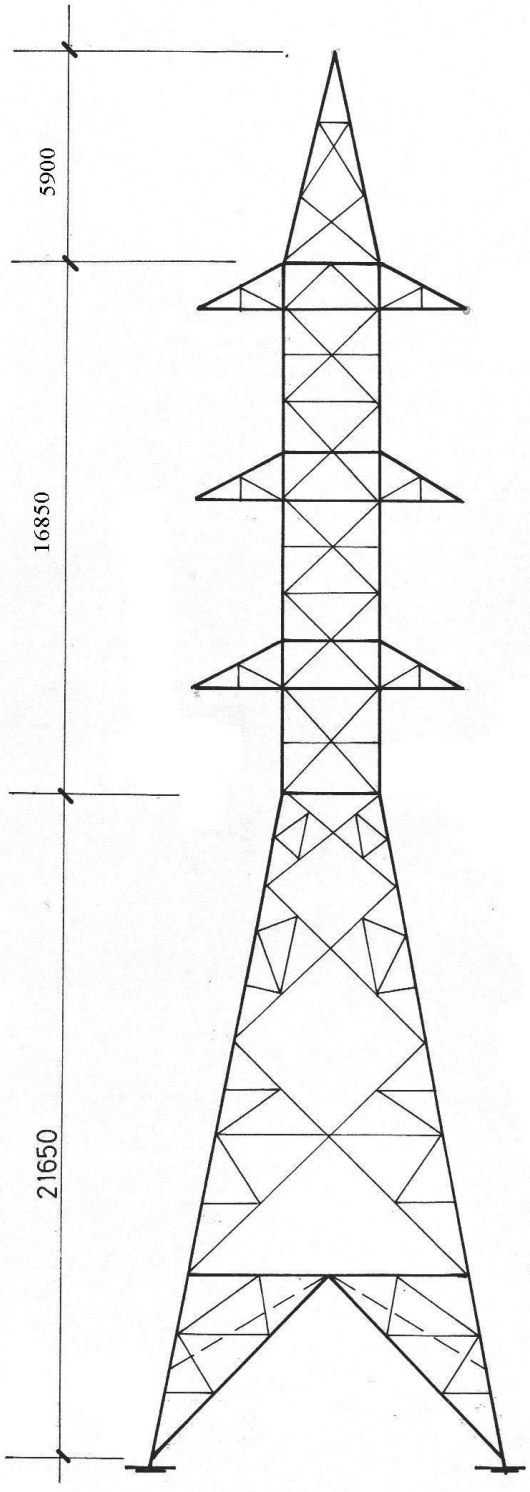
2E2 +3 LEG EXT.

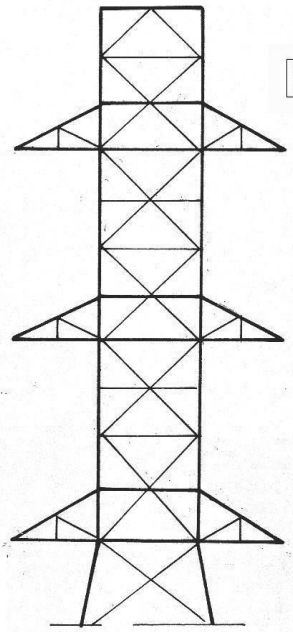


2E2 ±0 LEG EXT.

FOR TENDERING PURPOSE ONLY

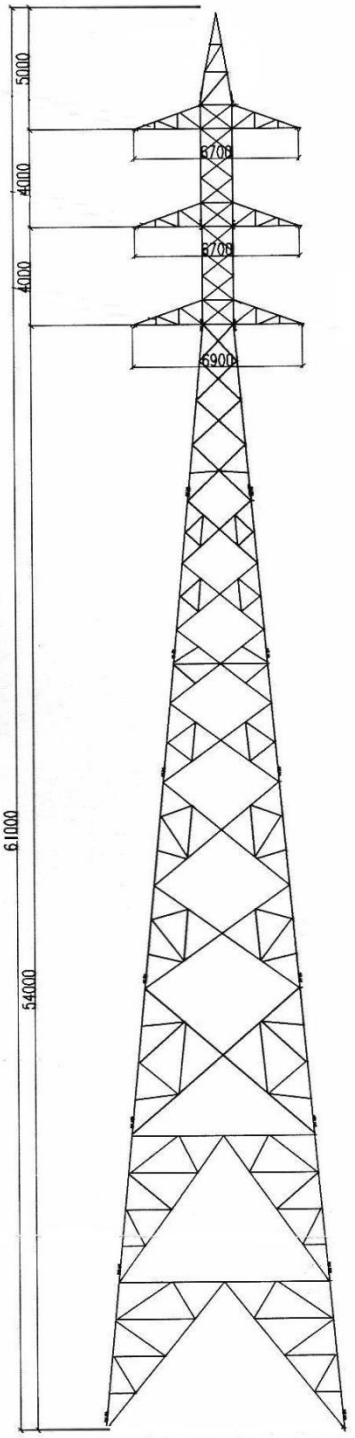
LAYOUT OF TOWER 2E2





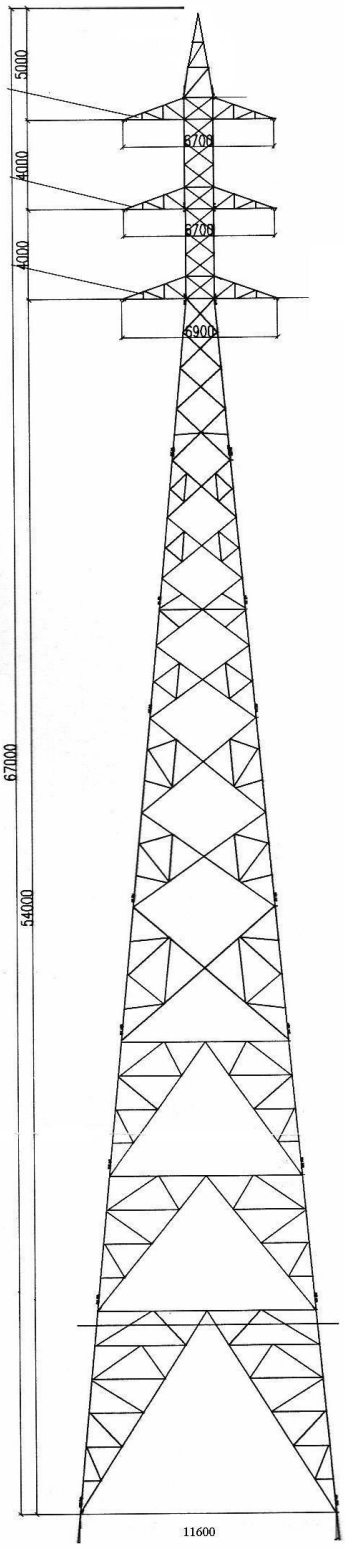
FOR TENDERING PURPOSE ONLY

LAYOUT OF TOWER 2SP2



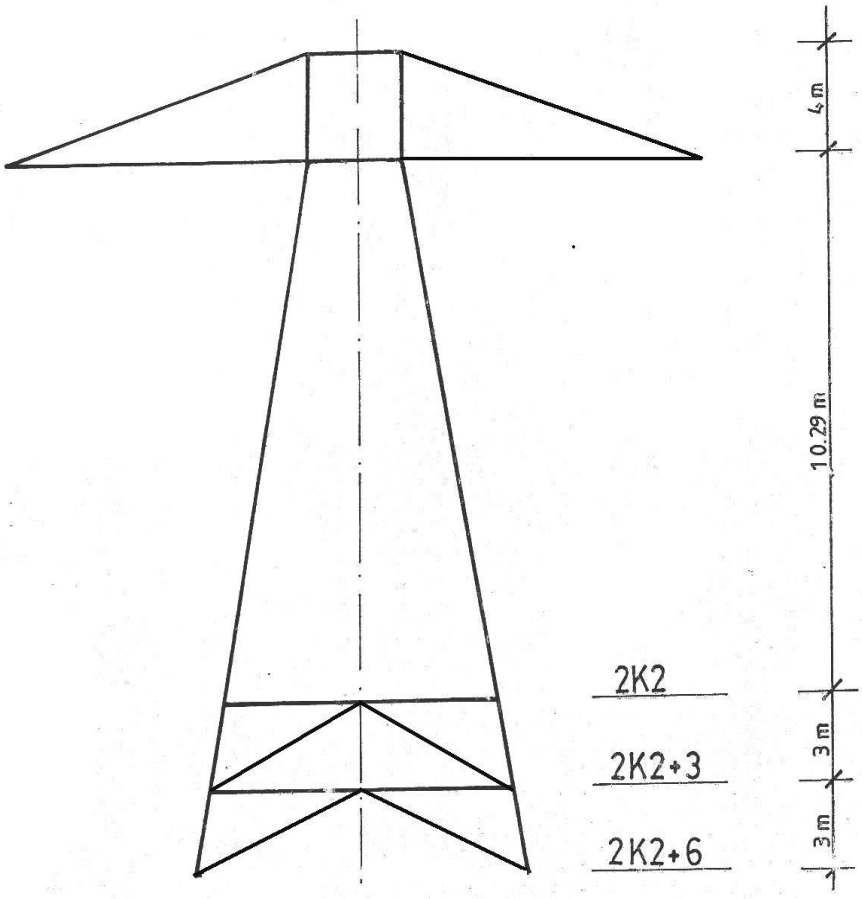
FOR TENDERING PURPOSE ONLY

LAYOUT OF TOWER 2R2



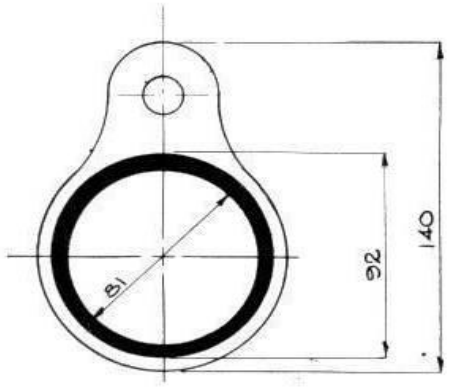
FOR TENDERING PURPOSE ONLY

LAYOUT OF TOWER 2 R2



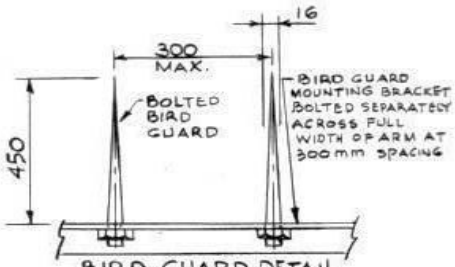
FOR TENDERING PURPOSE ONLY

LAYOUT OF TOWER 2K2

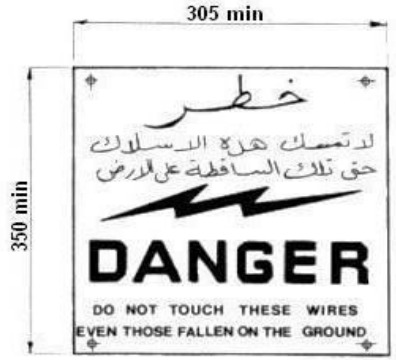


COLOURS: YELLOW WITH BLACK CIRCLE
RED WITH WHITE CIRCLE
BLUE WITH WHITE CIRCLE

PHASE PLATE

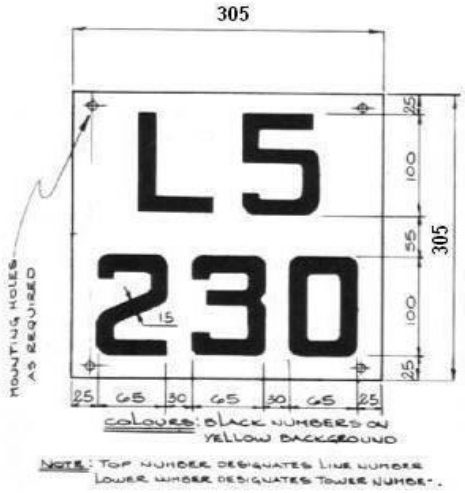


BIRD GUARD DETAIL
AND MOUNTING BRACKET



COLOURS: RED BACKGROUND
WHITE CHARACTERS

DANGER PLATE



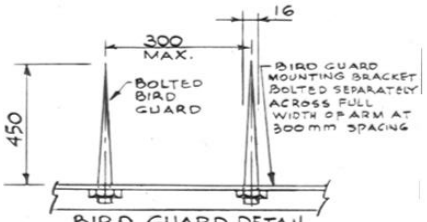
COLOURS: BLACK NUMBERS ON
YELLOW BACKGROUND

NOTE: TOP NUMBER DESIGNATES LINE NUMBER
LOWER NUMBER DESIGNATES TOWER NUMBER.

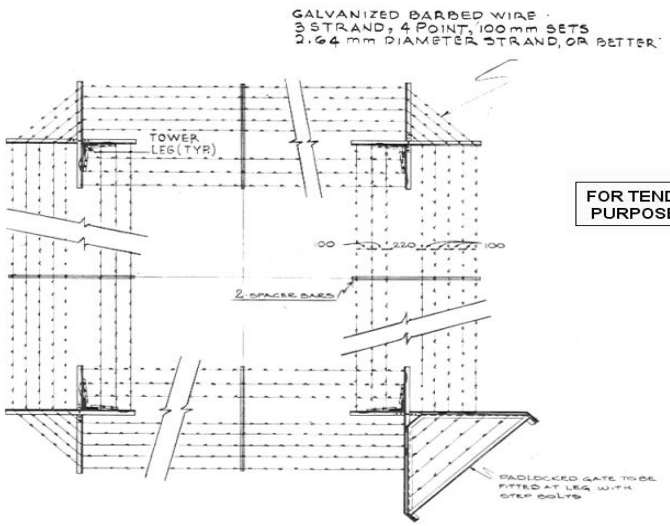
LINE AND POLE NUMBER PLATE

FOR TENDERING
PURPOSE ONLY

NOTES:-
1- ALL DIMENSIONS ARE IN MM.
2- SIGN PLATES TO BE 16 GAUGE MS ENAMEL FINISH.
3- FIBER WASHER TO BE SUPPLIED FOR EACH PLATE (2 PER BOLT HOLE).
4- ALL SIGNS TO BE BOLTED TO POLE OR ON MOUNTING BRACKETS.



BIRD GUARD DETAIL
AND MOUNTING BRACKET



ADJUSTABLE ANTI-CLIMBING DEVICE
(FOR ALL SELF-SUPPORTING TOWERS)

FOR TENDERING PURPOSE ONLY

NOTE
ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE NOTED.