C 2070/35

21

Common Form No. 37.
G. P. T. 1468, 200,000. 9-10-1108.

Address "Electrics"

In reply please quote No. date and short title

1595

TRAVANCORE.

Electricity Department.

No. 178 2224 dated 29-3-35

From

Name K.P.P. Menon, Esq., B.A., B.Sc., Hons. (London) D.I.C., A.M.I.E.E., A.M.I.Mech.E., M.I.E.(Ind.)

Designation Electrical Engineer to Government,

Station Travancore, Chithirapuram.

To

The Chief Secretary to Government,
Travancore, Trivandrum.

Subject:— Pallivasal Hydro Electric Scheme - Acquisition of land for Transmission Lines. - Appointment of a special Revenue staff for.

Reference:—G.O.R.O.C. No.2070/35/Rev., dated 26-3-1935.

Enclosures.

Sir,

With reference to the above sanctioning the appointment of the Land Acquisition Officer, I have the honour to state for the information of Government that the work in connection with the construction of the Transmission lines has been started at Pallom end and that it is therefore necessary that the Special Officer should commence his operations from that end. Although the necessary powers for entering into private lands for purposes of line construction are vested in me by virtue of G.O.R.Dis.No.68/33/P.W., dated 17-1-1933, the implications thereof are seldom understood by the people with the result that serious difficulty is being experienced by the construction staff of the contractors in entering private lands or using the property as contemplated in the British Telegraph Protection Regulation III of 1091. It will therefore greatly facilitate matters if the Land Acqusition Officer is posted at Pallom at present in which case there will be no occasion for troubles arising out of the Department exercising its legitimate powers conferred by Government. The Resident Engineer of the contractors is repeatedly writing to me that their work is very much hampered due to private land owners not permitting their entry and use of the land and consequently heavy loss is being sustained by the firm. The acquisition Officer will first see to the valuation of trees etc., that may have to be cut along the route of the line and when work

begins to get on unhampered he can proceed in advance and get on with the work of acquisition in places where land or buildings have to be acquired for the Department for putting up towers or other structures for the lines. I may mention in this connection that there is verylittle acquisition work to be done on this side of the Neriamangalam Bridge as the lines traverse through Reserve forest where the necessary clearing work has been completed in consultation with the Conservator of Forests and as per sanction contained in G.O.R.O.C. No.6457/34/PW., dated 4-2-1935.

I therefore request that Government may be pleased to issue immediate orders to the Land Revenue Commissioner to post the special staff at Pallom and commence their operations from that end. As the construction work is held up on account of the situation set forth above, I request that the matter may be treated as very urgent.

I have the honour to be,

Sir,

Your most obedient servant,

K.P.P. Nair

Electrical Engineer. 29/3/35

C. No. 356/8-4-1935.

From

The Electrical Engineer to Government,
Travancore, Chithirapuram.

To

The Land Acquisition Officer,
H.T.T.Line Construction, Kottayam.

Sub: P.H.E.Project - H.T.T.Line construction.

Ref: G.O. ROC No. 2070/35/Rev. dated 26-3-1935.

Sir,

With reference to your letter K dated 26-8-1110, I have the honour to inform you as follows:

1. The necessary articles of stationery required for you and your staff will be supplied to you as soon as I get a detailed list of your requirements.

2. Orders have been issued already to the Sub Division Officer, H.T.T.Line Construction Sub Division, Muvattupuzha to place at your disposal one of the buildings at Pallam for holding your office.

3. As regards the accurate details regarding actual acquisition to be done, I have to inform you as follows:

The construction work in connection with the Transmission Line has already commenced from the Pallam end and it is now proceeding towards Kothamangalam. The contractors responsible for this work have already located the tower positions for approximately 17 miles and the excavation for the foundations for the stubs have already been made in the major portion of this distance. The work they are doing at present is the setting up of the stubs and one of the company's surveyors is already working in advance locating the position of the towers and fixing the pegs for the actual sites of the stubs. The construction party that will follow behind the surveyor will dig out the holes to the required depths at these locations and the next party lays the concrete, fixes the stub and restores the ground to its original level. It very often happens that trees in private properties may

be standing at some of these locations and they have to be cut and removed to enable the stubs being placed in position. So the immediate programme of your work will be to send a surveyor of yours in advance who will make the necessary valuation of such trees that will have to be cut and cleared away so that the Department may be freed from such obstructions to enable the contractors to proceed with the tower erection. Immediately after this, the next item of work will be to mark and cut down all the trees standing to a width of one hundred feet around each tower and thereafter when the towers are erected the entire route from tower to tower will have to be cleared to a width of 150 ft. Under theprovisions of the British Telegraph Protection Regulation, there will be no necessity to acquire any land for this purpose, but only to compensate the owners for any damages caused by this construction. Cases may arise hereafter where buildings or property will have to be acquired and in such cases, the officer who is immediately in charge of the construction, viz. The Sub Division Officer, H.T.T. Line Construction, Muvattupuzha will be given instructions in the matter and he will meet you and address you regarding the accurate details of the land plan and area list. I am sending a copy of this letter to the Sub Division Officer, H.T.T.Line Construction, Muvattupuzha for his information and I am instructing him to co-operate with you in this wrk and also to instruct his Section Officers to render all possible assistance to your survey and revenue staff so that the whole work may be expedited as quickly as possible.

I have etc.
Sd/-K.P.P.Menon,
Electrical Engineer.

(True copy)

Electrical Engineer

15/7/31

ROC.No.2070/35/Rev. H. C. Gr

Trivandrum 26 March 1935

From

The Chief Secretary to Government.

To

The Land Revenue and Income Tax Commissioner, Travancore.

Sir,

In continuation of this office letter ROC.No.6457/34/P.W., dated the 3rd February 1935 re: acquisition of land in connection with the construction of the H.T.T. Line for the Pallivasal H.E. Scheme, I have the honour to inform you that

(1) Government sanction the appointment of Mr. G.Padmanabha Iyer B.A.,B.E., Tahsildar and Second Class Magistrate, Trivandrum, as Land Acquisition Officer for a period of four months with a deputation allowance of one-fifth of his salary during the period of special duty.

(2) Mr. Padmanabha Iyer is invested with the powers of a Division Peishkar under Section 3 clause (c) of the Land Acquisition XI of 1089. A notification to the effect has been arranged to be published in the next issue of the Gazette.

(3) The Division Peishkar, Kottayam, should be asked to place at the disposal of Mr. Padmanabha Iyer the special staff engaged in connection with the Cochin - Shoranur Railway conversion. If the above staff is found inadequate to cope with the

Submitted.
Palace sanction anticipated.

26-3-35

Regulation

work, Mr. Padmanabha Iyer may submit proposals for increased staff, after taking charge of the work. He may also apply for contingent funds.

(4) He will work under the Division Peishkar, Kottayam. The Division Peishkar should be asked to supply him with the required printed forms. The Electrical Engineer has necessary instructions to supply him with the necessary stationery articles.

(5) He should have his head-quarters at Pallivasal for a month. The Electrical Engineer has instructions to provide him with quarters at Pallivasal. ~~also the necessary stationery articles required in connection with his work.~~ After one month, when the work in the Hill Section is completed, his head-quarters should be shifted to the plains. You may fix his head-quarters subsequently.

(6) He is allowed to send notifications for publication in the Government Gazette direct. The Superintendent Government Press has also instructions to supply him with a copy of the Gazette.

(7) The Chief Engineer and the Conservator of Forests have been asked to issue necessary instructions to ~~the~~ their subordinate officers concerned to render Mr. Padmanabha Iyer necessary assistance in the valuation of trees and buildings on the H.T.T. Line.

(8) The Division Peishkar, Kottayam should be asked to issue instructions to the Tahsildars concerned to ~~the~~ supply Mr. Padmanabha Iyer with any information ~~asked~~ he may require ~~from him~~ in connection with his work.

(9) Mr. Padmanabha Iyer should be directed to take up the special duty forthwith.

I have &c.,

26.3.35

~~For~~ C. S.

Copy to the P.W. Section.

Copy to the Judicial Section.

Copy to the Account Officer.

Copy to the Chief Electrical Engineer, with sketch
Conservator of Forests, Division Peishkar, Sent: Govt. Press
Kottayam and the Chief Engineer for information and necessary action.

Copy to Mr. G. Padmanabha Iyer B.A.,B.L., Tahsildar and Second Class Magistrate, Trivandrum.

26-3-35

For C. S.

26.3.35

26/3/35

26/3/35.

THE

TRAVANCORE GOVERNMENT GAZETTE.

Vol. LXXII] PUBLISHED BY AUTHORITY. [No. 10

TRIVANDRUM TUESDAY 23RD OCTOBER 1934. 7TH THULAM 1110.

Electrical Department.

NOTICE

Is hereby given to the heirs or legal representatives of Mr. K. Mytheen Kunju, late Lineman on Rs. 25-5/3-40 grade in the Electrical Department who is reported to have died on 2nd Kumbhom 1108 that a sum of Rs. 44-18-1 is due to him being his pay and leave allowance for 1/108 to 7/108. His heirs or legal representatives are therefore requested to attend this office with the necessary succession certificate or any other satisfactory proof of their title to the amount within two months from the date of publication of this notice and claim the dues.

[illegible]

Office of the Trivandrum Electric Supply,
Trivandrum, 9th October, 1934.

P. C. CHERIYAN,
Superintendent.

NOTICE INVITING TENDERS.

ELECTRICITY DEPARTMENT.

PALLIVASAL HYDRO ELECTRIC PROJECT.

Description :—H. T. Line— Clearing Jungle along the line from Pallivasal to (Neriamangalam) 16th Mile M. M. Road.

Locality :— Between Pallivasal to Neriamangalam.

Tenders sealed and endorsed as such should be delivered at the office of the undersigned on or before 30th Thulam 1110|15th November 1934 at 2 P. M. on which day they will be opened by the undersigned at his office. Each tender should be accompanied by earnest money as per details below, either in cash, promissory notes, or a cheque on a recognised firm and should state the date of completion of the work.

The successful tenderer will, before signing the agreement and commencing work within a week after the acceptance of his tender has been intimated to him, have to deposit a sum equivalent to (5) five per cent. of the probable value of contract, as security for the proper fulfilment of the same, less of course the amount of earnest money deposited by him. If he fails to do this, the earnest money will be forfeited to Government and the contract put up to auction again. If it results in any loss to Government the same will be recovered from him in due course. But should the contract be given to another contractor at a profit to Government the original contractor shall have no claim whatever to the profit.

The acceptance of the Tender rests with the Electrical Engineer to Government who does not undertake to accept the lowest or any particular Tender.

The Department reserves to itself the right of putting the contract for this work up to auction or of carrying out the work in any manner different from the terms of this invitation that may be thought fit subsequent to the receipt of the tender.

Specification of work to be done and conditions of contract to be entered into may be seen at the office either of the H. T. T Line Construction Sub Division Officer or of the undersigned on office days during office hours.

Printed forms of tender can be obtained from the office of the undersigned at a cost of one chuckram each. Tenders not on printed forms will not necessarily be entertained.

The tender should add the following declaration in his tender..... I (the tenderer) do not agree|agree to carry out items selected from my tender at the rates quoted by me if the whole work is not given to me.

Any further information necessary can be obtained at the office of the undersigned.

Approximate amount of contract Rs. 12,000.

(A - Rs. 2850+B—Rs. 3000+C—Rs. 2250+D—Rs. 2600+E—Rs. 1300)

P. S. Separate tenders should be given for each section.

K. P. P. MENON,
Electrical Engineer.

SPECIFICATION.

1. The rates tendered by the contractor for the work should include the cost of
   (a) all labour and supervision, tools, implements of every description, cordage, tackle &c., required for the proper execution of the work.
   (b) all temporary sheds for coolies at the camping places.
   (c) providing and maintaining danger signals and such other precautions as are necessary for the protection of the public when works are in progress near the public road.
2. The contractor shall be bound to make good any damage done to the public road during the work. All trees and jungle falling on the road shall be removed without causing any obstruction to traffic.
3. Jungle includes all classes of growth thick or thorny and trees up to 15" girth. Clearing Jungle includes cutting clearing and removing jungle from the 150 ft. width of the line.

P. D. E. SCHEME—H. T. T. LINE—CLEARING JUNGLE FROM PALLIVASAL TO KOTHAMANGALAM.

	Unit for which rates should be quoted.	*Description of work.*	*Approximate quantity of work to be done.*	Probable amount of contract Rs.	Earnest money. Rs.	*Remarks.*
		Section "A" Pallivasal Power House to Devicolam Revenue Division Boundary 42nd mile M. M. Road—approximate length 5 miles 3293 ft.				
1	Mile.	Clearing jungle including shrubs, eatta, grass &c., and trees not exceeding 15 inches in girth and removing the same from the line for a width of 150'	5 miles 3293 ft. or 5·6 miles	2,850	140	
2	Do.	Uprooting jungle including shrubs and trees not exceeding 15" girth eatta, grass, etc., and removing the same from the line for a width of 50' along the centre	Do.	Do.	Do.	
		Section "B" 42nd mile M. M. Road to 33rd mile approximate length of line 5 miles 4574 ft.				
1	Mile.	Clearing jungle including shrubs and not exceeding 15" girth eatta, grass, etc., and removing the same from the line for a width of 150 ft.	5 miles 4574 ft. or 5·2 miles	3,000	150	
2	Do.	Uprooting jungle including [illegible]				

2	Do.	Uprooting jungle including trees not exceeding 15" girth cutta grass, etc, and removing the same from the line for a width of 50 ft. along the centre	Do.	Do.	Do.

Serial No.	Units for which rates should be quoted.	Description of work.	Approximate quantity of work to be done		Remarks.
		Section "C" 33rd mile M. M. Road to beginning of Valara rock above 28th mile 4th furlong M. M Road approximately 4 miles 1900 ft.			
1	Mile.	Clearing jungle including shrubs, eatta, grass and trees not exceeding 15" girth and removing the same from the line for a width of 150 ft.	4 miles 1900 ft. or 4·4 miles	2,250	110
2	Do.	Uprooting jungle including shrubs, eatta, grass and trees not exceeding 15" girth and removing the same from the line for a width of 50 ft. along the centre	Do.	Do.	Do.
		Section "D" Valara rock to Neriumangalam river approximate length of line 5 miles 182 ft.			
1	Mile.	Clearing jungle including shrub and trees not exceeding 15" girth grass, etc., and removing the same from the line for a width of 150 ft.	5 miles and 182 ft. or 5·1 miles	2,600	130
2	Do.	Uprooting jungle including shrub, and trees not exceeding 15" girth grass, eatta etc., and removing the same from the line for a width of 50 ft. along the centre	Do.	Do.	Do.
		Section "E" Neriumangalam river crossing to 14th mile M. M. Road approximate length 2 miles 2771 ft.			
1	Mile	Clearing jungle including the shrub and trees not exceeding 15" girth, eatta, grass, etc., and removing the same from the line for a width of 150 ft.	2 miles 2771 ft. or 2·5 miles	1,300	70
2	Do.	Uprooting jungle including shrubs and trees not exceeding 15" girth grass, eatta, etc., and removing the same from the line for a width of 50 ft. along the centre	Do.	Do.	Do.

NOTE.—Rates should be quoted for each item separately. They should be free from corrections and should be expressed in figures and words clearly. Tenders which are illegibly written or which contain corrections and overwritings will be rejected. The present survey of the lines is only approximate and the lines are likely to be shifted slightly. No extra claim will be allowed on account of such shifting.

The quantities are only approximate and the contractors should be prepared to carry out all items of works necessary whether in excess or deficit of the quantities noted in each section.

Jungle vary considerably in each section of the line and as such contractors should satisfy themselves by actual inspection of the site before tendering for the work.

THE

TRAVANCORE GOVERNMENT GAZETTE.

VOL. LXXIII.] PUBLISHED BY AUTHORITY [No. 26.

TRIVANDRUM, TUESDAY, 11TH FEBRUARY 1936.
29TH MAKARAM 1111.

Electrical Department.

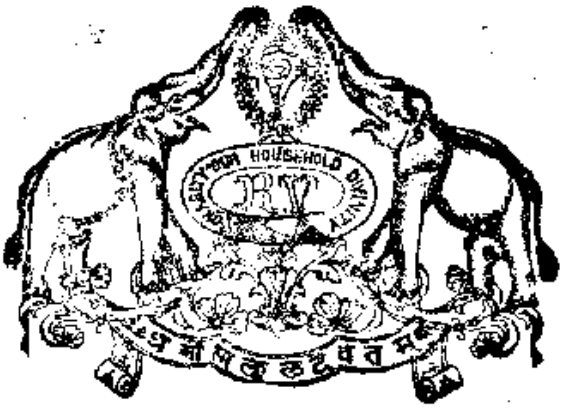
TRAVANCORE ELECTRICITY DEPARTMENT.

Notice is hereby given to all those it may concern that trees, planted in areas over which the H. T. T. Line from Pallivasal (in connection with the Pallivasal Hydro Electric Scheme) are placed, will be cut and removed by the Electrical Department, by virtue of the powers conferred under Section 18 of the Elecricity Regulation I of 1097, as and when such trees interrupt or interefere with the conveyance or transmission of electrical energy. Under Sub-section (4) of Section 18 referred to above, no compensation shall be payable in respect of such trees planted after the placing of the said H. T. T. Line.

[illegible]

Chithirapuram,
9th January 1936.

K. P. P. MENON,
Electrical Engineer.



THE

TRAVANCORE GOVERNMENT GAZETTE.

Vol. LXXIV.] PUBLISHED BY AUTHORITY [No. 1.

TRIVANDRUM, TUESDAY, 18TH AUGUST 1936.
3RD CHINGAM 1112.

Electrical Department.

NOTICE.

It has been brought to the notice of the undersigned that the High Tension Transmission Line in connection with the Pallivasal Hydro Electric Project is being tampered with by the public Instances are known where the transmission towers and their fittings have been roughly handled, and in some cases, conductors are also reported to be cut and removed. Such interferences are punishable under the Travancore Electricity Regulation and under the Travancore Penal Code Besides being punishable under the Regulation, the public are warned that any such interference with the conductors is very dangerous as these wires are likely to be charged to a potential which may prove fatal when touched. Although these lines are not carrying any current now for normal operations, it is quite possible that they may be raised to a dangerous potential due to static charge and may therefore prove fatal to those who touch the conductors It should be remembered that the Departmental men who are engaged in the construction and who have to handle these wires always take sufficient precautions before actually coming into contact with them, and it should not therefore be presumed that these conductors will always be safe to handle as it is not often likely that such precautions may have been taken especially in the cases of lines where work is not going on. The attention of the public is therefore drawn to the importance of not interfering with these towers, conductors, insulators, &c. and the Department will not be responsible for any consequences that may arise from any such act of theirs. The Department will also be constrained to take the necessary steps against such interference which will entail in a criminal prosecution.

[illegible]

Office of the Electrical Engineer to Government,
Travancore, Chithirapuram: 22nd June 1936

K. P. P. MENON,
Electrical Engineer.

P. H. E. Project—Civil Works, Munnar.

Hydrological Investigation. Constructing a R. C. Bridge at Grahamsland—Munnar.

Annexure:—Schedule A6 to Schedule tender, (Vide clause 14 of Tender notification.)

Serial No. of interim payments.	Stages of progress at which interim payment will be made for the work.
First.	On completion of Piers and Abutments.
Second.	On completion of concreting of beams and slab.
Final	After adjustments of all interim payments and after the works are finally accepted by competent authority.

Accepted. Approved.

Signature of selected tenderer:—

Name:—

Address.—

Resident Engineer,
P. H. E. Project, Civil Works.

NOTICE

Is hereby given to all those it may concern that trees planted in areas over which the H. T. T. Line from Pallivasal (in connection with the Pallivasal Hydro Electric Scheme are placed will be cut and removed by the Electrical Department, by virtue of the powers conferred under Section 18 of the Electricity Regulation I of 1097, as and when such trees interrupt or interfere with the conveyance or transmission of Electrical energy. Under sub-section (4) of Section 18 referred to above, no compensation shall be payable in respect of such trees planted after the placing of the said H. T. T. Line.

Chithirapuram,
9th January 1936.

K. P. P. Menon,
Electrical Engineer.

THE

TRAVANCORE GOVERNMENT GAZETTE

VOL LXXVIII.] PUBLISHED BY AUTHORITY [No. 16.

TRIVANDRUM, TUESDAY, 3RD DECEMBER 1940.
16TH VRISCHIGAM 1116.

Electrical Department.

INSTRUCTIONS TO TENDERERS.

1. Tenders in original, each copy complete with copies of covering letter, the specification hereto annexed, with its tender forms and schedules duly filled in and with accompanying tender drawings, pamphlets, illustrations and descriptive matter must be enclosed in a sealed cover marked "TENDER FOR PALLIVASAL HYDRO ELECTRIC PROJECT, 66 K. V. TRANSMISSION LINES FROM PALLIVASSAL TO ALWAYE" and addressed to the Secretary, Stores Purchase Committee, Trivandrum and its duplicate to the "ELECTRICAL ENGINEER TO GOVERNMENT, TRIVANDRUM, TRAVANCORE, SOUTH INDIA" so that it is delivered not later than 11 A. M. on or before Tuesday the 15th of April 1941. Tenders will be opened at 2 P. M on Wednesday the 16th of April 1941 by the Secretary, Stores Purchase Committee or by any officer duly authorised by him at his office in Trivandrum in the presence of the tenderers or their representatives who may be present at that time.

Tenders should be regarded as firm for acceptance till the 15th of June 1941.

2. The acceptance of the tender rests with Government who are not bound to accept the lowest or any tender; neither will they be responsible for any expenses or losses that may be incurred by the tenderer in the preparation of the tender.

3. Every tender in original should be accompanied by an earnest money of B. Rs.

5000. In the case of the tenderers doing business in the State, the earnest money should be remitted into the nearest Sirkar Treasury in chalans in triplicate, duly countersigned by the Secretary, Stores Purchase Committee. One copy of the chalan so obtained should be forwarded along with the tender. In the case of the tenderers outside the State, the earnest money should be in currency notes, or drafts on the Imperial Bank of India drawn in favour of the Secretary S. P. C. or G P. Notes drawn in favour of the Accountant General, Trivandrum or endorsed over to him. The earnest money of the unsuccessful tenderers will be returned as soon as possible after the tenders are settled, but that of the successful tenderers will be adjusted towards the security that will have to be deposited for the satisfactory fulfilment of the contract. No interest will be paid for the earnest money deposited.

4. No alteration shall be made in the tender form or in the specification annexed hereto except in filling up the tender forms and schedules. Tenderers are however, at liberty to add such details and conditions and offer such alternative designs as they may consider desirable. If they do so, they must type the same and annex the added matter to the tender submitted by them giving in every instance full reference to the clause and specification or general conditions or writing in the schedules to which the proposed alteration refers. But such additions or alterations shall not be binding on the Government except in so far as approved by Government and duly incorporated in the contract.

5. If the tenderer has any doubt the meaning of any portion of the General Conditions or specifications, he should at once submit the drafts thereof to the Engineer in writing in order that the doubt may be removed before the submission of the tender.

6. The successful tenderer shall, before he enters into an agreement in writing deposit a sum equal to 5 per cent of the total amount of the tender or any less sum fixed by Government as security for the performance of the contract.

7. Government may, however, waive this security and accept in lieu thereof sureties to the extent of 10 per cent. of the value of the contract as defined in clause 3 of the general conditions.

8. The ports of entry specified in the general conditions of contract are Cochin and Alleppey. Consignments weighing up to 4 1/2 tons will be imported through Alleppey where they will be admitted duty free. Tenderers are advised to inspect the various sites and get into touch with the local shipping agents and the transport contractors and get themselves thoroughly familiarised with the routes and the methods of transport. This is most important as it is very essential for the successful execution of the contract that the contractor should be furnished with information regarding local conditions to enable him to be in a position to handle all the materials and to transport them safely to the various sites.

Office of the Electrical Engineer,
Trivandrum, 3rd December 1940.

K. P. P. MENON,
Electrical Engineer.

Specifications for Pallivasal—Alwaye 66 K. V. Transmission Lines.

SECTION I. GENERAL.

1. *Scope.* The specification covers the manufacture, testing before despatch, delivery, distribution, erection, testing and setting to work of steel towers, insulators, conductors, guys etc., for the 66 K. V. double circuit line from Pallivasal to Alwaye—a distance of approximately 51 miles. (This comprises the 2nd stage of development of the Pallivasal Hydro Electric Project.)

2. *Route.* Drawing No. 193/116 shows the proposed routes of the transmission lines mentioned above. A 66 K. V. double circuit line from Pallivasal Power House to Kothamangalam substation and from there to Alwaye substation has already been constructed on steel towers and is in commercial operation. This specification provides for an additional 66 K. V. double circuit transmission line from Pallivasal Power House straight to Alwaye substation keeping as far as possible parallel to the existing double circuit transmission line but without touching the Kothamangalam substation.

3. *General description. a.* Galvanised steel towers shall be quoted for the double circuit lines. The normal span will be 650 feet. For one mile at both ends the lines will be brought down to a horizontal formation, with conductors at the same level supported by pole structures, spaced at 330 ft and provided with additional ground wires. Alternative quotations are also invited for painted steel towers, with Indian steel. The painting will have to be done according to the specifications mentioned under appropriate clauses.

b. Towers. Four types of towers will be used for normal conditions as described in section II of this specification. Any special towers that may be required will be specified separately at the time of placing the contract or during its currency. The contractor should supply such special towers at the unit rates which he should quote in his tender.

c. Insulators Standard 10 inch diameter 5 1/2 inch centre discs, six in

number for the lines from Pallivasal to Kothamangalam (33 miles) and five in number for the lines from Kothamangalam to Alwaye will be used for suspension strings. For the tension strings the number of insulators will be the same as in the corresponding suspension string. But in extra long spans (over 1000'), the tension string will contain an additional disc. For approach spans at both ends, 5 discs will be used for suspension and tension with adjustable arcing horns.

d. Conductor. The double circuit line towers will carry six hard drawn stranded copper conductors each consisting of 7 strands of 0·136 inch dia. In special long spans in the hilly tract, an equivalent cadmium copper conductor shall be used.

e. Ground wire. One number 7/10 S. W. G. Crapo galvanised ground wire will be taken at the top of the towers over the full length of the double circuit lines.

f. Road and river crossings. For important road and river crossings angle type towers will be used with single tension insulators. For the less important road crossings, crossing span shall be reduced to about 500 feet. There is no railway crossing in the route.

g. Telephone and telegraph line crossings. Where power lines cross telephone or telegraph communication circuits guard cradles will be provided over the latter on separate poles in accordance with the latest P. T. rules but this will be arranged departmentally in consultation with the authorities concerned.

h. Transposition. Each power conductor will be transposed so that there will be 2 complete barrels in the whole distance. This will mean a transposition at about 8 1/2 miles on the route. The transposition arrangement will be as shown on drawing No. 194/116.

4. *Temperature.* For overhead conductors carrying current and exposed to the Sun the temperature is expected to vary from 50°F to 150°F.

5. *Climatic conditions.* The structures, conductors, ground wires etc., shall be designed so that they are suitable for operation under the climatic conditions obtaining in Travancore summarised below.

1.	Maximum sun temperature	...	150 degs. Fahr.
2.	Maximum shade temperature	...	105 degs. Fahr.
3.	Minimum shade temperature	...	50 degs. Fahr.
4.	Rain	...	Heavy monsoon rain conditions with a possible fall of one inch of rain in one hour for eight months of the year.
5.	Salt	...	The territory is exposed to the saline winds from the Arabian Sea and Indian Ocean.
6.	Altitude	...	(a) Hill section 1000-4000 ft. above sea level. (b) Plains from sea level to 1000 feet above sea level.
7.	Dust.	...	There is very little dust and no dust storms.
8.	Wind	...	The design conditions for wind are specified in clause 6.
9.	Animals	...	The hill sections of the transmission line passes through jungles and country which is infested with different varieties of wild pig, leopard, tiger, bison, and elephants, and tenderers will have to put forward their suggestions for making the lines game and elephant proof.

6. *Wind pressure.* The following wind pressure shall be adopted in the line designs.

1. Wind pressure on conductors 25 lbs. per square foot on 2/3 of projected area.
2. Wind pressure on lattice towers. Not less than 25 lbs per square foot acting horizontally on 1 1/2 times the exposed area of one face.
3. On steel tubular poles, 66 per cent. of 25 lbs. per sq. foot of projected area acting horizontally.

7. *Elephant protection.* Each tower in the hills section will be protected by an elephant trench 10 feet wide and 10 feet deep around, and in rocky locations rock [illegible] these excavations will be done by the Depart-

pins will be grouted into the rock. [illegible]
ment.

6. *General conditions of contract.* All works covered by this specification shall be carried out in accordance with the "General Conditions" of contract for plant, machinery and manufactured equipment (herein after to be called "General Conditions") A copy of the general conditions is attached to this specification.

Where the conditions of tendering or directions to the tenderer embodied herein conflict with those specified in the General Conditions " the former shall be binding in preference to the latter.

9. *Payments.* Payments will be made in accordance with clause 26 of the general conditions. No payment will be made for materials damaged or broken during transit. Bills will not be passed until test certificates are received and approved.

For conductors and ground wires payments will be made on the basis of actual route length measured along centre lines of towers plus 2 per cent to cover, sag, jumper connections etc.

10. *Completeness of tender.* The tenders should be complete and include all minor accessories which may not have been specifically mentioned in the specification, schedules etc. but are essential for completeness of the work. The contractor shall not be eligible for any extra in respect of such minor accessories even though not specifically included in the tender or contract schedule.

11. *Departures from specifications.* The design of towers etc. shown in the specification drawings may be modified by the tenderer at his discretion provided the requisite factors of safety and clearness are maintained.

If the tenderer wishes to depart from the specification in any respect, he shall draw attention to such points of departure explaining fully the reasons therefor so that the relative merits of proposals may be considered. Unless this is done the requirements of the specification will hold good.

12. *Drawings.* The tenderer shall submit with his tender dimensioned drawings of the general arrangement of towers etc.

The contract drawings referred to in clause 4 of the general conditions shall be submitted within 10 weeks of awarding the contract.

Of the 3 sets of final drawings one set should be in ink on tracing cloth while the other two sets may be ferro-gallic prints or ferro prussiate prints mounted on cloth.

Any approval which the purchaser may have given to the detailed drawings submitted by the contractor will not relieve the latter of his responsibility for the correctness of design and for the execution of the contract in accordance with the terms of the specification.

13. *Materials and workmanship.* Unless otherwise specified, all materials shall be of the outdoor type, of the best class and capable of satisfactory operation when exposed to the tropical sun, atmospheric conditions and heavy rain fall. Unless otherwise specified they shall conform to the requirements of the appropriate current British Standard Specifications. In case where the British Standard Specifications are not available, the American Standards shall apply. No materials shall be erected unless previously passed by the Engineer.

14. *Tests.* The contractor shall furnish in duplicate manufacturer's test certificates in respect of all materials.

In addition to the tests called for in this specification, the purchaser reserves the right of having such tests as he desires carried out at his own expense to satisfy himself that the materials conform to the requirements of this specification.

15. *Electricity rules.* All work shall be carried out in accordance with the Travancore Electricity Act and the rules framed thereunder unless modified by this specification.

16. *Tools and spares.* The tenderer is requested to fill in schedule B such tools and spare parts as he recommends for 2 years operation. The purchaser may order such of the quantities as he may finally decide upon at the rates quoted under schedule B.

17. *Prices.* The prices quoted for the materials should be firm in rupees and independent of exchange variation or fluctuation in price of materials.

If the tenderer is unable to quote a firm price in respect of any particular item or items, he should endeavour to give a firm price which would hold good for atleast a month from the announced date of receipt of tenders. On acceptance within this period the price will be taken as absolutely firm for the contract and entered as such in the con-

tract documents

Customs, import and other taxes and duties should be included in the prices. But tenderers should note that as far as possible the materials coming from abroad should be packed in cases weighing less than 4 1/2 tons and imported through the port of Alleppey in Travancore where they will be arranged to be admitted free of any customs duty. The weight that the crane at Alleppey can handle is 4 1/2 tons.

The quantities mentioned in the schedules accompanying this tender are only approximate The purchaser reserves the right of revising the quantities at the time of placing the contract and of ordering more materials during the contract at the accepted rates.

For any class of materials for which rates are not available in the contract schedule payments will be made on the basis of actual cost plus 5 per cent. But this will not refer to minor accessories referred to in clause 10:

Actual cost shall mean the actual cost of materials and labour including petty supervision, but not charges of higher staff paid on monthly or contract basis.

18. *Inter changeability.* All similar materials and removable parts of similar equipment shall be interchangeable with each other.

19. *Surveys, tower locations, distribution and erection.* A survey of the proposed route is being arranged, and will be complete before receipt of the tenders. Right of way will be secured and clearing done by the department wherever necessary.

Before the work of construction is begun, the contractor should go over the line as pegged out by the preliminary survey party and submit to the Engineer any changes in the route to be followed if in his opinion such changes will result in a better and more economical alignment

The erection work may then be started after the approval of the Engineer of the final schedule to be submitted by the contractor.

The details relating to the method of erection etc. are specified under section VI.

20. *Date of completion.* Early completion is essential and will be an important consideration in awarding the contract. The guaranteed periods of delivery and completion should clearly be stated.

21. *Penalty.* Special attention is drawn to clause 33 of the General conditions of contract for plant machinery and manufactured equipment. The penalty stated therein will be enforced if there is delay in completion.

22. *Inspection.* A representative of the purchaser shall have access to the contractors or sub contractors works at any time during working hours for the purpose of inspecting the manufacture and testing of the materials covered by the contract. The contractor or sub contractor shall provide facilities for the necessary inspection.

23. *Programme.* The programme of work should be forwarded to the purchaser for approval.

24. Blank.

25. Blank.

Section II—Towers. (Main line—Double circuit.)

26. *Scope.* This section covers the manufacture, testing before despatch and delivery C. I. F. Alleppey for materials coming from abroad and C. I. F. Alleppey or F. O. R. Always for materials supplied from India, and distribution to site of steel towers and accessories specified below in detail.

27. *Types of towers.* (*a*) The type of main line double circuit towers to be used on the transmission lines are detailed below —

Type A. Tangent towers for straight runs and normal span of 800', capable of taking an angle up to 2 1/2° on suspension insulators.

Type B. Angle towers to take angles up to 7 1/2° on suspension insulators normal span 660'.

Type C. Anchor towers for dead ending and capable of taking large angles without any special modification, and with modified stubs capable of taking angles up to 45°.

Type D. Transposition towers shall be the same as type C except for modified cross arms to effect transpositions.

(*b*) The towers shall be all designed for double circuit lines with suspension insulators for type A and B towers, and tension insulators for type C and D.

(*c*) *Cross arms.* Shall generally be as shown on drawing No. 194/116 unless the tenderer wishes to modify them. The use of normal cross arms will be restricted to a span of 1000 foot and special cross arms will be used above this span.

(*d*) *General.* The standard types of towers will have the general design dimen-

(a) General. The [illegible] sions shown on drawing 104/116. But the designs may be altered at the discretion of the tenderer if he can put forward better and more economical types.

The towers shall be designed so as to be suitable for extensions up to 15' at the base without reducing the specified factors of safety in any manner. Some extensions will be needed where ground clearances are found to be inadequate. Separate unit prices for

5 feet extensions 10 feet extensions and 15 feet extensions should be given for each type of tower. Unit prices shall also be given for hill side extensions for each type of tower. The normal footings shall if possible be suitable for towers with or without extensions.

For extra long spans in crossing ravines in the hills section special wide spacing towers will be necessary for stringing cadmium copper conductors. Such designs shall be put forward by the contractor and supplied at a unit rate per ton of steel work which rate should be specified in the tender.

All the steel towers for the 66 K. V. double circuit lines shall be of the galvanised and bolted type. Alternative offers are invited for painted towers fabricated in India with Indian steel. The rate for painted towers should include a priming coat of approved anti corrosive paint and 2 over coats of Aluminium paint after erection.

28. *Transposition.* Each transposition tower is required for effecting one third of a complete transposition of each circuit and shall be similar in design to the type C tower, but with cross arms modified as shown in drawing, 194/116. The tenderer is at liberty to offer any other type of design in line with modern practice, but must provide the necessary minimum clearances specified in clause 35. The jumper connections on towers having special transposition cross arms should be of sufficient section to make them quite stiff. Lengths of power conductor may be used if recommended by the tenderer.

29. *Foundations.* All towers will have concrete foundations. In very loose or marshy soil special foundations shall be provided to suit actual conditions. All stubs shall be encased in concrete atleast 3" thick all round to a height of atleast 1 foot above ground level. Full particulars of foundations for the types of towers shall be given in the tender.

For footings it can be assumed that the earth weighs 90 lbs. per cubic foot and that the base of the footing will engage a frustrum of an inverted pyramid whose sides make an angle of 30° with the vertical. The weight of the concrete may be taken as 125 lbs./cft.

All the 4 stubs of normal towers should be similar irrespective of compression or uplift, but in the case of C and D type towers taking large angles, different stubs may be used on the compression and uplift sides.

Where the towers are on solid rock, suitable holes shall be drilled and grouted with cement or cement concrete. The tower stubs for rock foundations may be shorter than those for the ordinary concrete type. The recommended depth should be specified as also the size of holes to be drilled. Drilling is recommended due to the proximity of the existing 66 K. V. lines, but if this is uneconomical, blasting may be resorted to, taking every care to see that the existing lines are not damaged in any way and that the volume of concrete necessary is a minimum.

Templates for setting the tower must be provided by the contractor with the erection tools.

30. *Loading and factors of safety.* The towers shall be designed for the maximum conditions of loading given below and shall be able to withstand a test load equivalent to the maximum specified working load multiplied by the corresponding factor of safety without any injury or permanent deflection. The maximum loadings will occur at the specified minimum temperature of 50°F.

Type A. Tower —

1. Wind loading on tower structure and insulators.
2. Wind loading on 6 conductors and one ground wire for 150 per cent. of normal span.
3. Vertical loading due to the weight of six conductors and one ground wire for 150 per cent. of normal span.
4. Vertical loading due to weight of insulators.
5. Vertical loading due to weight of tower structure.
6. Unbalanced horizontal pull parallel to the line due to the breakage of one conductor or ground wire at the end of each cross arm and taken as being equal in magnitude to 100 per cent. of the maximum working load of the conductor or ground wire.
7. Horizontal load produced by the conductors and ground wires due to change in direction of the line at the tower of 3 degrees. Tenderers shall note

that all the above loads shall be considered as acting simultaneously.

Type B. Tower —

1. Wind loading on tower structures and insulators.
2. Wind loading on six conductors and one ground wire for 150 per cent. of normal span.

3. Vertical load due to weight of six conductors and one ground wire for 150 per cent. of normal span.

4. Vertical load due to weight of insulators.

5. Vertical load due to weight of tower structures.

6. Unbalanced horizontal pull parallel to the line due to breakage of one conductor or ground wire applied in turn at the end of each cross arm taken as being equal in magnitude to 100 per cent. of the maximum working load of the conductor or ground wire.

7. Horizontal loads produced by the conductors and ground wires due to a change in direction of the line at the tower of 7 1/2 degrees.

The above loads are to be taken as acting simultaneously.

Type C. Tower—

1. Wind loading on tower structure and insulators.

2. Wind loading on six conductors and 4 ground wires for 150 per cent. of normal span.

3. Vertical loading due to the weight of six conductors and 4 ground wires for 150 per cent. of normal span.

4. Vertical loading due to weight of insulators.

5. Vertical loading due to weight of tower structure

6. Unbalanced horizontal pulls parallel to the line due to the breakage of one conductor or ground wire applied in turn at the end of each cross arm and taken as being equal in magnitude to 100 per cent. of the maximum working load of the conductor or ground wire.

7. Horizontal loads produced by the conductors and ground wires due to a change in direction of the line at the tower of 45°.

8. Unbalanced horizontal pulls parallel to the line due to the dead ending of six conductors and 4 ground wires, each pull being taken as being 100 per cent. of the maximum working load of each conductor and ground wire.

9. Unbalanced horizontal pull parallel to the line due to the breakage of 3 conductors all on the same side of the tower, each pull shall be taken as being equal to 100 per cent. of the maximum working load of each conductor.

Tenderers shall note that loads 1, 2, 3, 4, 5, 6 and 8 alternatively loads 1, 2, 3, 4, 5, 6, 7 and 9 shall be taken as acting simultaneously.

Type D. Tower—Same as type C.

All structures shall be in addition designed sufficiently strong to support the weight of a man taken as 200 lbs. at the end of each cross arm.

The factors of safety shall not be less than the figures given below,

Under normal conditions for towers, cross arms etc.	2 1/2.
Under broken wire conditions	1 1/2.

The factors of safety against overturning shall be the same as above. For determining the bearing area of footings, the safe working bearing pressure under normal and broken wire conditions shall not exceed 1 ton and 1 1/2 tons per sq. foot respectively. An ultimate pressure of 2 1/2 tons per square foot may be assumed.

31. *Stresses.* In calculating the section of members the stresses in the material shall be based on using the qualities specified in the current edition of British Standards Association specification Nos 15 and 153. Based on clause 30 the following stresses shall not be exceeded.

(*a*) Members in tension. The maximum allowable tensile stress for direct dead or equivalent dead loads shall be 10600 lbs. per sq. inch subject to the following allowances being made.

1. In tension members in tension flanges under bending, for reduction of section by rivet or bolt holes, screw threads etc. In calculating these net areas the diameter of holes shall be taken as 1/8" greater than the nominal size of rivet or bolt.

2. In the effective area of single angle tension member attached by one leg only being assumed as the net area of the attached leg plus 50 per cent. of the area of the unattached leg.

(b) *Members in compression.*

1. Where the slenderness ratio L/R does not exceed 150 the maximum stress on the gross section of compression shall be (16000—69 L/R) lbs. per square inch with a maximum stress of 14000 lbs. per square inch.

2. Where the slenderness ratio lies between 150 and 250, the maximum stress on the gross section of compression shall be (12250—44 L/R) lbs. per square inch.

The slenderness ratio L/R shall not exceed 140 in the case of leg members and 200 in the case of all other members having calculated stresses it shall not exceed 250 for members having nominal stresses only. Angle iron struts with folded ends shall not be used except for members having nominal stresses only and these formulas do not apply to these angle iron struts. In the slenderness ratio in the expression L/R, L equals the unsupported length of the member and R equals the minimum radius of gyration.

(c) For bearing areas.

1. 26000 lbs. per sq. inch on shop rivets,
2. 23000 lbs. per sq. inch on field rivets.
3. 22000 lbs. per sq. inch on bolts.

(d) For parts in shear.

1. 18000 lbs. per sq. inch on shop rivets.
2. 11500 lbs. per sq. inch on field rivets.
3. 11000 lbs. per sq. inch on bolts.

The stress diagram and tables showing the permissible and actual loadings shall be furnished in the tender.

32. *Erection stresses.* The maximum permissible stress in any member of a structure being erected shall not exceed 133 1/3 per cent. of the maximum stresses given in clause 31. Where there is any danger of the stress in any member exceeding the value of 133 1/3 per cent. then such member shall be reinforced with additional material in order to reduce the stress within allowable limit.

33. *Grounding.* Each tower shall be grounded by means of a 2" galvanised iron pipe buried at least 8 feet into the ground and electrically connected to one of the tower legs by a 1" × 1/10" tinned copper tape painted over with bituimastic paint to withstand corrosion due to the effect of soil, and surrounded with a layer of finely broken coke at least 6" thick. Where the tower stands on rock an effort should be made to obtain a good ground by carrying a length of the copper tape from the tower leg to a pipe driven in damp soil at as short a distance as possible from the tower. The connecting wire should be buried in a groove cut in the rock surface and adequately protected from damage. The pipe should be suitably drilled at intervals to facilitate ingress of water into the pipe. The earth pipe is to be buried in a pit at sufficient distance from the stub. It shall not be buried in the same pit as the stub. The earth tape shall be buried 18" deep and connection to the tower leg should be made at about 6 inches below ground level. The price of a normal length of earth tape, and the earthing equipment should form part of the tower, and unit rate for either reduction or increase in length of the earthing strip should also be included in the tender for making adjustments for actual increase or decrease in lengths erected.

34. *Insulator attachment and ground wire clamps.* For the attachment of suspension strings, hangers of suitable size can be used. For strain insulators a strain plate of suitable dimensions on the underside of the cross arm is proposed.

The design of insulator attachments shall be suitable for the standard cross arms without any modifications. Full details should be given in the tender drawings.

For the ground cable, suitable suspension and tension clamps should be provided on the suspension and strain towers respectively. The ground wire should be suitably

bonded to the tower to ensure good electrical connections, and the ground wire clamps shall preferably be designed suitable for the bonding. If the tenderer recommends ground wire fixing clamp for suspension towers may form an integral part of the tower itself so that separate bonding does not become necessary for suspension towers Tension clamps still require bonding.

The fittings shall be of approved design and preferably either galvanised drop forgings or galvanised fabrications of mild steel. There shall be no castings used. The design of supporting hardware shall be such as to minimise as far as possible any tendency for conductors or ground wires to vibrate. All clamps shall be designed to withstand a slip of the specified conductor amounting approximately to a load of 60 percent of the maximum designed conductor working strength. All hardware shall be hot galvanised and shall comply with the galvanising specification No. 210-32 issued by the National Electric Light Association of America. They shall comply as regards details of construction with the requirements of the insulator specifications enclosed herewith.

35. *Clearances of live parts to cross arms and to ears.* The following minimum clearances should be maintained between the live parts and earthed tower or cross arm members.

In span due to swing to earth (to ground wire)	...	30"
Between phases	...	36"
On supporting structures.		
To earth	...	30"
Between phases	...	36"

The standard suspension and tension strings will have arcing horns on the line side only for the suspension string and on both sides for tension string. The clearances should be reckoned from the extreme edges of the hardware.

Where necessary, the jumpers may be weighted to give necessary clearances under wind conditions

The contractor shall submit the clearance drawings for the towers with suspension and tension strings.

36. *Material.* All steel employed for the tower members shall be open hearth steel with a high yield point and high ultimate tensile strength, and in accordance with the manufacturers standard specifications which must be submitted in full detail with the tender. Permissible variations in weight from calculated weights shall be strictly in accordance with clause 18 of B. S. S. No. 15—current edition.

The tenderer must state the names of makers from whom he proposes to obtain materials for the fabrication of the towers.

37. *Minimum thickness.* No galvanised material shall be less than $\frac{1}{4}$ inch in thickness when used for leg members, or three sixteenth inch if used for other members. In the case of painted members, no member shall be less than $\frac{1}{4}$ inch thick.

38. *Number of parts.* Tower structures shall be constructed to bolt together easily on the site and preference will be given to the design with the least number of parts and one which best facilitates transport erection and cleaning. In designing towers for a minimum number of parts the tenderer should not however employ parts of such dimensions as would prove difficult to handle. The length of the longest piece should not if possible exceed 20 ft.

39. *Bolts, nuts and washers.* All bolts and nuts shall be of mild steel of quality specified in clause 9 of part II of British Engineering standard specification No. 15, the heads being forged out of the solid truly concentric and square with shank which must be perfectly straight. All bolts should have hexagonal heads and nuts. All bolts should be threaded with British Standard Whitworth or American or other approved standard threads to take the full depth of the nut and shall be threaded far enough to permit firm gripping of the members, but no further. All nuts shall fit hand tight to the bolts. No appreciable fillet shall exist at the point where the shank of the bolt connects to the head. Steel and wrought iron tapered washers shall be provided wherever necessary.

Lock washers shall be provided for insertion under all nuts. These lock washers shall be of steel of the positive lock type and about 1/8" in thickness.

Two and a half percent excess bolts, nuts, tapered and lock washers shall be provided. The tenderer must give a specification as to the size of bolts, size of holes and any other special details of this character, but no bolts less than five eighths inch diameter nor any angle through which bolt passes having a leg less than 1 3/4 inches shall be

used.

40. *Drilling and punching.* Holes may be drilled and punched, but drilled holes will be preferred. The tenderer must state clearly the extent of punching covered in his tender. Where the material is over 5/8" thick all holes must be drilled when two or more holes together form part of one bolt connection. Holes for spliced joints shall be

drilled through the plates and sections forming a joint, in one operation. All burrs left by drill or punch shall be removed completely. Diameter of bolt holes shall be no more than one sixteenth inch larger than the diameter of the bolt.

41. *Splices.* Where a lap splice is used in leg members the back of the inside angle shall be chamfered to clear the fillet of the outside angle.

42. *Ladders.* Each tower shall be provided on one leg with step bolts of not less than 5/8 inch diameter—6 inches long spaced not more than 18 inches apart and extending from about 8 feet above ground level to the top of the tower. Each step bolt shall be provided with two nuts on one end to fasten the bolt securely to the tower and a button head at the other end to prevent the foot from slipping and shall be capable of withstanding a vertical load of not less than 300 lbs.

In the case of C towers taking angle, holes for taking step bolts shall be drilled on two of the legs which are diagonally opposite so that step bolts may be fitted on either for climbing up.

43. *Bird guards.* Each latticed tower of the suspension type shall be fitted with suitable bird guards to prevent birds perching on the cross arms immediately above the insulators. These bird guards shall be made of galvanised iron sheets with saw tooth edges bolted to the cross arm members and stays. Tenderers may offer suitable alternatives with details of proposals.

44. *Danger and number plates and anticlimbing devices.* Every tower shall be provided with a suitable danger plate which shall be made of sheet steel vitreous enamelled. Each danger plate shall have a white back ground on which lettering stand out in red. The danger plate shall have the number of such locations the word " Danger " in English and Malayalam, and also the voltage of the lines. Location numbers shall be preceded by the letters P. A. meaning Pallivasal Alwaye (ie numbers to be P. A. 1, P. A. 2 etc).

Each tower structure shall have 3 vitreous enamelled colour discs (red, yellow and blue) for each circuit. These discs shall be atleast 3" diameter and may be bolted in a conspicuous manner, preferably on either sides of the danger plate on separate flats. The tenderer should submit details of the design for the approval of the Engineer.

On Transposition towers, phase plates shall be fixed on both sides of the tower. The cost of these danger and phase plates shall be included in the price of the tower quoted.

The towers shall be provided with anti climbing devices made of galvanised barbed wire and arranged on the tower at suitable height to have 3 circles of wire in the form of an umbrella on the outside of the tower and similar number inside the tower. The price of each tower shall be inclusive of this protection.

45. *Galvanising.* All galvanised members of the towers shall be galvanised after fabrication by hot dipping process. Bolts and other special parts shall also be hot dip galvanised. Galvanising may be omitted on the threaded portion of the nut. Threads of nuts and bolts shall be so made that after galvanising the nuts will have a neat fit and can be turned with the fingers throughout the length of the thread of the bolt, and they shall be capable of developing the full strength of the bolt.

All hot dip galvanised materials shall satisfactorily withstand the test of specification No. D 210-22 of the National Electric Light Association (United States of America) for hot galvanising.

46. *Protection at wet locations and for members partly or fully, buried in earth.* In locations where the water level rises above the stub footings tower members shall be encased in a shell of cement-concrete of suitable thickness to one foot above the maximum water level. The same procedure should be adopted for hill side extension and other members which touch or are buried in the earth. Alternatively such parts may be painted with suitable bituminous paint. The tenderer may give details of his proposals for protection under such conditions and quote unit rate for the same.

47. *Assembling.* Towers including stubs may be shipped in sections for bolting

together in the field.

48. *Workmanship.* Workmanship and finish shall correspond to the best modern transmission line practice. All similar parts shall be made strictly interchangeable. All plate sections and parts before any work is done on them shall be carefully levelled straightened and made true by methods which will not injure the material so that when assembled the adjacent surfaces are in close contact throughout. No rough edges will be permitted any where throughout the work.

49. *Guarantee.* Any defects of workmanship or material appearing within a maintenance period of 1 year shall be made good by the contractor free of all cost.

50. *Drawings.* The tenderer shall submit with his tender dimensioned general arrangement drawings for each type of structure showing sizes of all sections, parts, fittings, bolts, attachments for insulators ground wires etc. together with corresponding calculations, stress diagrams and complete clearance diagram. The contractor shall submit within ten weeks of placing the order the contract drawings referred to in clause 12 of the general conditions, which shall include drawings showing the final design in detail, the calculation of stresses for various members and graphs showing the relationship between.

a. The angle of deviation and

b. The maximum sum of adjacent spans for each type of tower.

On all drawings submitted by the contractor there shall appear the name of the structure for which the material is intended.

The contractor shall furnish itemized list of maximum stresses on each member in accordance with this specification, and the calculated weight of each item of material for every part of the structure This may be incorporated either on the detailed drawings or made in the form of a separate shipping list.

The contractor shall also supply on tracing cloth dimensioned erection and assembly drawings for each type of structure bearing the same marking for each member as given in the materials list. These drawings shall be supplied to the purchaser before the final testing of the assembled structure referred to in clause 53 in order that the purchasers representative can check them with the assembled structure.

51. *Marking.* All pieces shall be distinctly marked with erection marks corresponding to those in the drawings. Steel stamping dyes of 1" minimum height shall be used in addition to any paint marks and special care shall be taken to see that all the erection marks be made in such a manner as not to be obliterated in transit or in any way damage the galvanising

In addition to numerals, shipping marks shall also include prefix letters A, B, C & D for the corresponding towers. Similarly shipping marks for extensions and any special structures shall also include prefix letters previously approved by the purchaser.

52. *Inspection.* A representative of the purchaser shall have access to the contractor's or sub contractor's works at any time during working hours for the purpose of inspecting the manufacture of the towers and may select test samples from the materials going into the towers. The contractor or sub contractor shall furnish facilities for testing such samples at any time.

53. *Tests at Contractor's premises.* One specimen type of each tower shall be fabricated by the contractor as soon as possible upon placing of the contract and before starting on the fabrication of the towers ordered. It shall be assembled on foundation as near as practicable to that used in the field and tested with a suitable test load as may be agreed upon, equivalent to the stresses specified in clause 30 multiplied by the corresponding factors of safety to ensure that the design complies with the requirements of the clause. Each structure shall be capable of withstanding the above test load without injury or permanent deflection of any of its parts, and if any member is found weak or damaged the design shall be suitably modified and the tower re-tested.

After the first lot of towers have been fabricated the members forming one tower of each type shall be selected at random from lots of similar members and assembled and bolted together in exactly the same manner as specified for towers at site. The tower shall then be set on a foundation as nearly as practicable to that to be used in the field and tested with loads equivalent to those for which the tower is designed multiplied by the corresponding factors of safety.

If desired by the purchaser such towers shall be tested to destruction at the expense of the purchaser by the contractor and under the general direction of the purchaser with the suitable test loads as may be agreed upon.

The tender price shall include the cost of carrying out all the above specified tests except the test to destruction for which an extra price must be quoted for each type of

tower.

No tower or any member thereof which fails under test should be supplied.

No tests need be carried out on the extensions or special structures, but they should be carefully designed and fabricated to give the requisite factors of safety.

54. *Packing.* All the above materials shall be boxed or bundled for export shipment (in cases where it is necessary) and shipped in the following manner.

a. Beams, channels and angles shall be shipped in bundles of, two or more securely wrapped four times around at each and every 5 feet with No. 9 gauge wire with ends twisted tightly. Gross weight of each bundle shall not exceed approximately 1000 lb and length of individual member 20'.

b. Clip angles, brackets, fillet plates and similar small loose pieces shall be nested, bolted together in multiples or securely wired together through holes wrapped round at least 4 times with No. 9 gauge wire and ends twisted tightly. Gross weight of any bundle shall not exceed approximately 150 lbs.

c. Bolts nuts and washers. The correct number of bolts, nuts and washers plus 2 1/2 per cent. excess for each tower extension cross arm set and attachments to cross arms etc. to be packed in heavy gunny bags accurately tagged in accordance with the contents and a number of bags packed in a solid box of 7/8" lumber with paralled ends to be securely nailed and further reinforced with battens around the sides at the ends and 1" wide No. 18 gauge hoop iron stretched entirely round with ends overlapping at least 6 inches. Gross weight of each box should not exceed approximately 150 lbs. All packing shall be subject to the approval of the purchaser or his appointed representatives. Each package shall be marked "Pallivasal Hydro Electric Project—Pallivasal-Alwaye line Towers".

The materials if shipped from overseas shall be imported through the port of Alleppey, Travancore where they will be admitted free of duty.

55. Blank.
56. „
57. „
58. „
59. „
60. „

SECTION II—A.

TOWERS FOR APPROACH LINES.

26. A. *Scope.* This section covers the manufacture testing before shipment, despatch and delivery C. I. F. Alleppey for materials coming from abroad, and C. I. F. Alleppey or F. O. R. Alwaye for materials supplied from India and distribution to site of steel approach towers and accessories specified below in detail.

27. A. *Types of towers.* The towers covered by this section are for use at the Pallivasal and Alwaye ends of the transmission lines for a distance of one mile each. The main double circuit line will terminate on a terminal C tower from which conductors will be taken in horizontal formation to the approach towers. The towers for taking the lines in parallel formation shall preferably be single circuit, with H type structure built up with steel tubular poles or channel section each carrying 3 power conductors at the same horizontal level, and 2 earth wires also in horizontal formation at the top. The normal spacing shall be 300 feet. If the tenderer is able to put forward a more suitable arrangement for the structures he may do so.

Approach towers will consist of 3 normal types. They are detailed below.

Type A approach. Shall be single circuit tangent tower with suspension insulators carrying 3 power conductors 7/0·136" size in horizontal formation and 2 G. I. earth conductors 7/·128 at top, with enough clearance. These towers shall be capable of taking an angle of 2 1/2° without any modification. They shall if necessary be stayed in both directions parallel to the line. Suitable stays, complete with stay rod and plate and turn buckles shall form part of the tower.

Type B approach. Structures shall be similar to type A, except that they will have to take angles up to 7 1/2°, using suspension insulators, or if the tenderer prefers with tension insulators, without any modification. These towers shall also be stayed in both directions parallel to the line. Stays with all fittings required shall form part of the tower.

Type C approach. Shall be similar to A & B, but suitable of taking angles up to 45°. These towers shall be fitted with tension insulators. Type C towers shall also be stayed in both directions when used at angle positions. These towers shall also be used for dead ending the conductors near the substation prior to connection to the substation strain gantry. Stays of suitable size shall be included as part of the tower.

The type of towers offered shall have the general design dimensions shown on drawing No. 145/11d. The designs may be altered at the discretion of the tenderer if he can put forward better and more economical types.

Full details of the towers and guying materials offered must be included in the tender.

28 A. Blank.

29 A. Foundations same as clause 29.

30 A. *Loading and factors of safety*

Type A approach. (Single circuit.)

1. Wind loading on pole structure and insulators.
2. Wind loading on 3 conductors and 2 ground wires for 150 per cent normal span.
3. Vertical loading due to weight of 3 conductors and 2 ground wires for 150 per cent of span.
4. Vertical loading due to weight of insulators.
5. Vertical loading due to weight of pole structures.
6. Unbalanced horizontal pull parallel to the line due to the breakage of one conductor or ground wire applied in turn at each conductor or ground wire position and taken as being in magnitude equal to 100 per cent of the maximum working load of conductor or ground wire.
7. Horizontal loads produced by the conductors and ground wires due to a change in direction of the line at the pole structure of 3 degrees.

Tenderers shall note that the above loads shall be taken as acting simultaneously.

Type B approach Single circuit same as above except that under (7) the tower shall stand horizontal loads produced by the conductors and ground wires due to a change in direction of the line at the pole structure of 7 1/2°.

All the loads to be taken as acting simultaneously.

Type C approach. Single circuit.

1. Wind loading on pole structure and insulators.
2. Wind loading on 3 conductors and 2 ground wires for 150 percent of normal span.
3. Vertical loading due to weight of three conductors and 2 ground wires for 150 percent of normal span.
4. Vertical loading due to weight of insulators.
5. Vertical loading due to weight of structure.
6. Unbalanced horizontal pull parallel to the line due to the breakage of one conductor or ground wire applied in turn at each conductor or ground wire position and being taken equal in magnitude to 100 percent of the maximum working load of conductor or ground wire.
7. Horizontal loads produced by the conductors and ground wires due to a change in direction of the line at the tower of 45°.
8. Unbalanced horizontal pulls parallel to the line due to the dead ending of 3 conductors and 2 earth wires, each pull being taken as 100 percent of the maximum working load of each conductor and ground wire.

All the above loads acting simultaneously.

H structures shall be suitably braced above the ground to have the following factors of safety.

(*a*) Transverse at right angles to the line—3 times the strength of 1 pole without using any slave against over turning or crippling.

(*b*) Longitudinal in the direction of the line (without slave) twice the strength of one pole against crippling.

The factors of safety shall not be less than the figures given below.

Under normal conditions—2 1/2.

Broken wire conditions—1 1/2.

Stay wires—3.

31 A. Stresses same as clause 31.

32 A. Erection stresses same as clause 32.

33 A. Grounding—same as clause 33.

34 A. Insulator attachment and ground wire clamps—same as clause 34.

35. A. *Clearances of live parts to cross arms and structures.* Same as under clause 35.

36. A. *Materials.* Same as under 36.

37. A. *The Structures* shall preferably be of steel tubular type made up of one section suitably stepped and they shall comply as far as possible with the latest edition of B. S. S. No. 134. Any departure from the specification shall be carefully explained in the tender in which case a complete specification of the structures offered shall be submitted. Tenderers may offer structures built up with channel or other sections as alternatives.

38. A. *Number of parts.* As under 36.
39. A. *Bolts nuts and washers.* As under 39.
40. A. *Drilling and punching.* As under 40.
41. A. Blank.
42. A. Blank.
43. A. *Bird guards.* Proper bird guards have to be installed to prevent birds from perching on the cross arms immediately above the insulators. The tenderer is requesred to include guards and to give details in his tender.

44. A. *Danger and number plates anticlimbing devices.* Same as under 44. The single circuit structures shall be serially numbered P. A. I. and P. A. IA for the 2 structures in the same position. Main line tower numbers shall be continuation of approach numbers.

Suitable anti-climbing devices shall be included as part of the structures.

45. A. Galvanising same as under 45.
46. A. *Protection at wet locations and for members partly or fully buried.* Same as under 46
47. A. *Assembling.* Same as under 47.
48. A. *Workmanship.* Same as under 48.
49. A. *Guarantee.* Same as under 49.
50. A. *Drawings,* Same as under 50.
51. A. *Marking.* Same as under 51.
52. A. *Inspection.* Same as under 52.
53. A. *Tests.* Same as under 53.
54. A. *Packing.* Same as under 54.
55. A. Blank.
56. A. „
57. A. „
58. A. „
59. A. „
60. A. „

SECTION III—*Insulators.*

61. *Scope.* This section covers the manufacture, testing before despatch, delivery C. I. F. Alleppey, landing, clearing and transport to site of all insulators and accessories required for the 66 K. V. transmission lines and described in detail below.

62. *Types of Insulators.* Suspension and strain type insulator strings consisting of standard 10 inch discs with 5 1/2 inch. centres will be used. The tenderer is at liberty to offer cap and pin, Hewlett or other type but the Ball and Socket type will be preferred. The colour of the units shall be brown. Single tension strings will be used at important trunk road and river crossings, with angle type towers. Suspension strings will be used for angles of 2 1/2°, and if recommended by the tenderer on B type towers also for angles up to 7 1/2 °.

In the main line between Pallivasal and Kothamangalam, six units will be used both for suspension and tension, but in the case of spans over 1000 ft. the tension string will consist of 7 units. 5 units will be used for suspension and tension between Kothamangalam and Alwaye. In the case of approach lines at either ends, five units will be used for suspension and tension, with adjustable arcing horns.

63. *Hardware.* Each insulator string shall be supplied complete in every respect and include,

a Clamps for attaching it to the 'U' bolt or strain plate supplied along with the tower.

b Clamp for attaching the conductor to the string and suitably lined to prevent damage to the conductor.