SPOORNET
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HIGH MAST LIGHTING OF OUTDOOR AREAS

This specification covers the design, supply and installation of high mast lighting for Spoornet.

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1SCOPE
2This specification covers Spoornets requirements for the design, manufacture and supply of all eguipment and materials for and the complete installation and testing on site of, high mast lighting.

2REFERENCES
2.1The following publications and drawing (latest editions and amendments) are referred to herein.

2.1.1South African Bureau of Standards

SABS 0142 - Code of practice for the wiring of premises.
SABS 763 - Hot-dip (galvanised) zinc coatings.
SABS 1279 - Floodlighting luminaires.
SABS 150 - PUC insulated electric cables and flexible cords.
SABS 156 - Moulded-case circuit breakers.
SABS 767 - Core balance earth leakage protection units.

2.1.2British Standards Institution

BS 4360 - Weldable structural steels.
BS 5135 - Metal-arc welding of carbon and carbon manganese steels.
BS 721 - Worm gearing,

2.1.3Spoornet

CEE.0012 - Method of tendering.
CSS 183/13.16 - Paint, rubber, chlorinated, enamel.
CSS 183/13.IS - Paint, rubber, chlorinated, high build.
CSS 183/2.30 - Xylene.
CSS 183/14.02 - Remover, paint, non-flammable, dipping type.
CSS 285/18.10 - Cleaning compound, solvent detergent, medium duty.
CME 35 - Specification for steel wire ropes.

Lubricants and petroleum fuels standing and advisory committee Circular No. I.

Drawing No. CEE-PR-14 Cable markers.

3APPENDICES
The following appendices form part of this specification :

3.1Appendix 1 - Horizontal clearances.

3.2Appendix 2 - Schedule of requirements and deviations.

3.3Appendix 3 - Painting specification.

3.4Appendix 4 - Cable termination and earthing arrangement.

3.5Appendix 5 - Provision for lightning protection and mast to rail bonds.

3.6Appendix 6 - Technical Data Sheet.

3.7Appendix 7 - Schedule of rates for additions and omissions.

3.8Appendix 8 - Mast arrangement in typical marshalling yard.

4METHOD OF TENDERING
4.1Tenderers shall submit their tender in accordance with the Spoornets method of tendering No. CEE.0012 and clauses 4.2 to 4.8 below.

4.2Tenderers shall submit a clause by clause statement of compliance for Appendix 2 in addition to that required for the specification in terms of the aforementioned method of tendering.

4.2.1Duplicate documents, specified in clause 2.0 of CEE.0012, are not required.

4.3Tenderers shall submit complete and detailed information concerning their offers. This information shall include descriptions and drawings of the various items of equipment offered, as well as full photometric data issued by the South African Bureau of Standards, for the luminaires they propose using.

4.4Tenderers shall superimpose the number of luminaires per mast, vertical and azimuth aiming angles of each luminaire, 0 degrees and 90 degrees reference lines at each mast and isolux curves, on the drawing/s listed in Appendix 2, if not already shown.

4.5Tenderers shall allow for the supply, delivery, off-loading, handling on site, erection, installation and testing of all items of equipment and material necessary for the complete lighting installation. This shall include the supply and laying of cables to each mast from the point/s of supply of electric power indicated on the drawing/s listed in Appendix 2 and the connecting up of the cables at each mast. Cable connections at the electrical power supply point/s (substation/kiosk), will be arranged by the Transport Services.

4.6Tenderers shall submit a lump sum price for the complete installation specified. This price shall allow for all cables laid and foundations excavated, in soil.

4.6.1Soil will be taken as soil, sand and soft clay or soil with a light admixture of broken rock.

4.7The total price tendered shall not include for a maintenance cage, power tool and winch, all of which shall be quoted for separately in Appendix 7.

4.8The "Technical Data Sheet" and "Schedule of Additions and Omissions" forming Appendices 6 and 7 to this specification, shall be completed in full and submitted by tenderers as part of their tender,

5SERVICE CONDITIONS
5.1The lighting may be installed in areas where high humidity, high temperature, high wind, heavy rain, severe hail and a high incidence of lightning are encountered and where corrosive conditions including the presence of sulphur dioxide, prevail.

5.1.1Equipment installed shall be suitable for efficient operation under these conditions.

6ELECTRICITY SUPPLY SYSTEM
6.1The electricity supply system will be 3 phase, 4 wire, 50 Hz, alternating current with earthed neutral, at a nominal voltage of 380/220 V.

6.2The voltage may vary within the range of 95 persent to 105 persent of the nominal and equipment installed shall be suitable for efficient operation at any voltage within this range.

7STANDARD OF WORK, EQUIPMENT AND MATERIALS
7.1All work shall be carried out in a neat and orderly manner to the satisfaction of Spoornet, and all

equipment shall be easily accessible for maintenance purposes. Electrical work shall conform to the requirements of SABS 0142 and those laid down in this specification.

7.2Equipment and materials used, shall be of high quality design and manufacture, and shall comply with the relevant specifications and recommendations mentioned in this specification.

7.2.1Where equipment and material does not comply with the relevant specifications it shall be submitted to Spoornets Engineer for approval.

7.3Every reasonable precaution and provision shall be incorporated in the design of the equipment for the safety and security of the system and of those concerned with its operation and maintenance.

8OUTLINE OF SCHEME
8.1The lighting scheme shall consist of a number of high masts, each mast supporting a group of high intensity luminaires mounted on a carriage which can be raised and lowered for maintenance purposes.

8.2In marshalling yards, two rows of masts shall be installed in areas where the width of the yard, to be covered by the illumination specified, exceeds 90 metres, in order to reduce obscuring shadows between wagons.

8.2.1The distance between the first mast in each of the two rows of masts mentioned in clause 8.2 above and the adjacent single mast located within the area where the width of the yard to be covered by the illumination specified does not exceed 90 metres, as well as the distance between masts in any single row, shall not exceed 6 times the height of the mast.

8.2.2The aforementioned arrangement of masts, as well as the arrangement to be adopted in larger yards, is shown diagramatically in a typical yard layout in Appendix 8.

8.2.3Because of varying site conditions and yard configurations, it is not always possible to adopt the regular pattern of masts shown. In such cases deviations will be permitted provided the maximum spacings indicated in Appendix 8, are not exceeded.

8.3The masts shall be located such, that the distance from the edge of the mast to the centre line of any adjacent track or tracks, shsll be greater than the dimensions of the heavy solid lines representing the outline of areas from which fixed structures are restricted, shown in Appendix 1.

8.4In complying with the requirements of clause 8.3 above, tenderers shall ensure that the distance between the centre line of the mast and the centre line of the adjacent track is not less than 2 750 mm, on straight runs. The distance on curves shall be adequate to maintain the required clearances.

8.5The masts shall be located so as not to interfere with other facilities, such as electric traction overhead equipment structures, buildings, bridges, etc. A minimum clearance of 2 800 mm shall be maintained between these aforementioned facilities and any part of the lighting installation, when luminaires are lowered to the ground.

8.6Masts shall not he sited directly adjacent to main lines and other lines serving high speed traffic.

8.7The top surface of all mast foundations shall be level with top surfaces of adjacent tracks, or if not cast directly adjacent to tracks, 150 mm above final surrounding ground level.

8.8The successful tenderer's mast positions shall be approved by Spoornets Electrical and Civil Engineers before any work is commenced. Once approval is given, Spoornets Civil Engineer or his authorised representative, will peg the mast foundation positions and heights, on site. This action shall not relieve the successful tenderer of responsibility for compliance with clauses 8.3 to 8.7 of this specification.

8.9The overall diameter about the centre line of the mast, of the luminaire mounting carriage, luminaires, maintenance cage, (see clause 11.7) and any part thereof, shall not exceed 2 200 mm in the horizontal plane.

8.10The design of the installation shall provide for as uniform an illuminance as possible. The minimum maintained illuminance on the horizontal plane, at ground level, shall be 3 lux at all locations in the areas indicated on the drawing/s. Isolux curves, showing the guaranteed minimum maintained illuminance of 3 lux shall be superimposed on the drawing/s listed in Appendix 2 and submitted by tenderers as part of their tender.

8.11The lighting shall be provided by floodlighting luminaires aimed with their peak intensity axes at angles not exceeding 65 degrees from the downward vertical. Anti-glare shields, if required, shall be fitted to long range narrow beam floodlighting luminaires to reduce the luminous intensity above peak value as rapidly and smoothly as possible. Luminous intensities emitted at 80 degrees and above from the downward vertical, shall not exceed 100 cd/1 000 lm and the peak intensity of any luminaire offered, shall not exceed 2 500 cd/ 1 000 lm .

8.12Luminaires shall be mounted 30 metres above ground level unless otherwise stated in Appendix 2.

8.13The spacing between masts, to luminaire mounting height ratio, shall not exceed 6 to I. (The spscing to mounting height ratios in marshalling yards are covered in clause 8.2 and Appendix 8).

8.14Tenderers shall use lamp lumen deterioration and luminaire maintenance factors of O,9 and O,8 respectively, in their design calculations.

8.15The successful tenderer shall supply Spoornets Site Engineer with a plan showing mast positions, number of luminaires per msst, cable routes and sizes, for approval within 30 days of the tender being awarded and before any work is commenced. This information is required to enable the Transport Services to install the correctly rated protection equipment in kiosks/substations.

9MASTS
9.1The mast shall be constructed in the form of a tapering enclosed column of polygonal or circular cross-section.

9.2The design of the mast shall be adequate to resist a wind loading produced by a wind speed of 150 km/h, measured at a height of 10 metres above ground level and acting on the projected area of the mast, luminaires and luminaire mounting carriage. The maximum permissible deflection at the top of the mast shall not exceed 2,5 persent of the height of the mast under wind loading produced by a wind speed of 100 km/h . Provision shall be made in the mast design for minimising wind excited oscillation.

9.2.1Tenderers shall submit with their offer, a full set of design calculations, as well as dimensioned drawings of the mast structure including door opening strengthening and base plate connection details, signed by a registered professional engineer.

9.3The masts shall be designed for mounting on a reinforced concrete foundation by means of a base flange secured to a bolt cage cast into the foundation. The base flange shall be free from laminations and the welded connection to the mast, shall fully develop the strength of the section. Means shall be provided to enable masts to be adjusted from deviations from the vertical.

9.3.1The space between the top of the concrete foundation and the underside of the base flange shall be filled with a suitable compound after provision of a vermin proof drainage hole. The cable entry pipes shall not be obstructed,

9.4All steel used in the manufacture of the masts, luminaire mounting carriages, maintenance cages, etc., shall comply with the requirements of BS 4360 grades 43A or 50. No steel section used in the construction of

the mast shaft shall be less than S mm in thickness.

9.5Each mast shall be equipped with a suitable headframe accommodating mast top equipment associated with the raising and lowering gear. The headframe shall be designed to effectively seal the top of the maet sgainst the ingress of water,

9.5.1Problems are being experienced at certain locations with birds nesting in the vicinity of the shaft opening at the top of the mast, resulting in a build up of debris in the base of the mast. Tenderers shall describe with the aid of sketches/drawings, means adopted to avoid this problem in masts offered.

9.6An opening shall be provided in the side of the mast to give easy access to a power distribution board, cable terminations and the raising and lowering operating mechanism. The opening shall be protected by a lockable, close fitting, hinged door, incorporating a vermin proof ventilation opening and shall be effectively sealed against the weather. When the mast is installed, the opening shall face a direction parallel to adjacent tracks. Tenderers shall submit weatherproofing details with their tender documents.

9.6.1The sides of the base compartment opening under 9.6 above, shall be suitably reinforced with fully welded steel sections to restore the section modulus and prevent buckling.

9.7Brackets or mounting plates, drilled to template shall be welded into the mast to support the winch and mast electrical equipment.

9.8An M12 hex head stainless steel screw shall be welded to the main body of the mast in a readily accessible position, directly adjacent to, and level with the underside of the distribution bosrd within the base compartment, for earthing purposes,

9.9Access shall be provided through the bottom of the mast and foundation for looping the supply cables into and out of the mast. Non-ferrous pipes shall be used for this purpose.

9.10Welding shall be in accordance with BS 5135, general requirements for the metal-arc welding of mild, or high tensile steel. It shall be carried out by qualified welders to the satisfaction of Spoornet. Site welding will not be allowed without the written approval of the Engineer.

10FOUNDATIONS
10.1Tenderers shall include for the design and provision of, and the excavation and backfilling for, foundations complete with foundation bolts and anchor plates. The tendered price shall include for shoring of the track side of all foundation excavations within 3 400 mm of track centre lines, to guard against collapse due to rail traffic.

10.2The foundations shall be designed for a soil bearing pressure of 150 kPa, when surcharge due to loading of adjacent track/s is ignored. Before foundations are commenced, the successful tenderer shall ascertain from Spoornets Engineer, on site, the actual soil bearing pressure, to ensure that the design of his foundation is adequate for the location.

10.2.1Should excavations require deepening, due to the designed foundation depth being insufficient for the location, such additional excavations will be paid for at the relevant rates in Appendix 7. This additional excavation shall be backfilled to correct foundation level using a weak mix concrete having a strength of 15 MPa at 28 days.

10.3The mixture and strength of all concrete shall be in accordance with accepted practice but not less than 20 MPa at 28 days and shall be carefully controlled on site,

10.4All steel reinforcing and foundation bolte shall have a minimum cover of 150 mm of concrete. The portion of the foundation bolts outside the concrete and to a depth of at least 150 mm into the concrete, as well as the nuts and washers, shall be galvanised in accordance with SABS 763.

10.5In addition to the requirements of clause 9.9, a 50 mm diameter hole for an earth rod shall be provided through each foundation in the position indicated in Appendix s.

10.6When excavating for foundations, it is important that undermining of the track sleepers be avoided. (See clause 10.1). Where the lighting masts are located between tracks on straight runs, because of the limited space available, the length of the concrete foundation in the direction at right angles to the tracks shall not exceed 3 100 mm . Furthermore, no portion of the foundation will be permitted within a depth of 900 mm below the crown of the rails within a distance of 2 140 m from the centre line of the track, for any track.

10.7Full design details of the foundations, including concrete mix and strength, foundation bolt anchorage, reinforcing, etc. as well as detailed dimensioned drawings, signed by a registered professional engineer, shall be submitted with tenders.

10.8After the casting of the foundation, the holes shall be backfilled and the earth properly compacted. The area around the masts shall be brought to the original level and shall be left neat and tidy.

10.9All work in connection with the foundations shall be carefully supervised and carried out in close collaboration with Spoornets Engineer.

11RAISING AND LOWERING SYSTEM
11.1Each mast shall be provided with a carriage for mounting of the luminaires. The carriage shall be in two halves joined by bolted flanges to permit removal from the erected mast. It shall be possible to raise the luminaire carriage to the top of the mast for normal operation and lower it to the base of the maat for maintenance purposes. This shall be achieved by means of two independent suepension ropes operated from a winch mounted in the base of the mast, the ropes being contained within the mast and paseing over pulleys in the headframe to the carriage. The suspension ropes shall be permanently under tension and locking of the luminaire carriage in the rsised position by means of a latching device at the top of the mast, will not be acceptable.

11.1.1The design of the carriage shall be such that the structure embodies as far as possible the necessary mountings and housings for individual luminaires, control gear units and terminal boxes. All mountings shall be of rigid construction and fixings for control gear units and terminal boxes shall be such that these units can be readily removed, and are easily accessible for msintenance purposes without adjustment of floodlight aiming angles.

11.1.2The carriage shall operate in conjunction with suitable guides located on the headframe, to ensure automatic and precise alignment of the carriage in the final stages of the raising operation and to guard against any fouling of suspension ropes and electric cables.

11.1.3The carriage shall be provided with a soft rubbing surface to prevent damage to the mast protection during raising and lowering.

11.1.4The luminaires and control gear shall be mounted so as to balance the carriage as far as possible and the suspension system shall ensure that the luminaire carriage is supported in a horizontal position throughout the raising and lowering operation.

11.1.5A visible means of indication that the luminaire carriage has reached the fully raised position shall be provided in the base compartment of each mast.

11.1.6One specially designed bracket for clamping on to the mast directly above the door opening to support the luminaire carriage in the lowered position for maintenance purposes, shall be supplied per contract.

11.2Suspension rope pulleys shall be fitted with self-lubricated, maintenance free bearings, protected against the ingress of moisture and dirt and designed for operation over the life of the mast without further attention.

11.2.1The pulleys shall be machine grooved to a depth of not less than 1,5 times the diameter of the rope. The grooves shall be finished smoothly and be free from surface defects liable to damage the rope. The contour of the bottom of the groove shall be circular over an angle of approximately 120 degrees. The radius of this part of the groove shall be larger than the radius of the rope by O,8 mm .

11.2.2The diameter of the pulleys at the bottom of the groove shall not be less than 220 mm .

11.2.3The shafts on which the pulleys revolve shall be of large diameter to reduce the bearing loadings below normal design ratings. The shafts shall be positively secured in the head frame assembly to prevent rotation and shall be manufactured from stainless steel.

11.2.4Pulleys carrying ropes or electric cables shall be provided with close fitting guards to retain the ropes or cables in the grooves when operating either loaded or slack. The guards shall be securely located against movement. Arrangements shall be made to ensure that the electric cables snd steel wire ropes are separated before passing over their respective pulleys.

11.2.5Pulleys shall be easily accessible to personnel standing on the floor of a maintenance cage in the fully raised position.

11.3All pulleys, etc., at the top of the mast shall be protected against the ingress of water by means of a removable cover eecurely attached to the head frame and overlapping the equipment. The use of covers depending only on the security of gaskets for weatherproofing will not be acceptable.

11.4Suspension and winch ropes shall be manufactured of AISI grade 316, flexible, stranded, stainless steel not less than 6 mm diameter, in accordance with Specification No. CME 35 (rope detail as per table 39), with a factor of safety of not less than 10. Thimbles shall be secured by "Talurit" or equal approved compression splices, manufactured of copper and applied by mesns of a hydraulic tool.

11.4.1Suspension ropes shall be easily removable and replaceable for inspection purposes. Tenderers shall provide clear instructions how this can be done.

11.5All pulleys shall be manufactured from non-corrosive materials.

11.5.1Each suspension rope pulley shall have a factor of safety of at least 10,

11.6All equipment in contact with stainless steel wire ropes shall be entirely suitable for use in close contact with stainless steel without danger of electrolytic reaction occurring.

11.7It shall be possible to fit a maintenance cage to the raising and lowering system, in place of the luminaire carriage, to enable two men to be hoisted to the top of the mast in complete safety for painting and maintenance purposes. The two halves of the maintenance cage shall be diametrically opposite one another. Use of the maintenance cage shall not necessitate the re-aiming of floodlighting luminaires.

11.7.1Safety devices shall be incorporated in the construction of the maintenance cage to ensure it will not fall in the event of failure of the raising and lowering equipment. Tenderers shall submit drawings and describe fully, the type of equipment offered and include a separate price for the maintenance cage in their tender documents.

11.8All bolts, nuts, pins, etc., associated with the luminaire carriage, maintensnce cage and raising and lowering equipment shall be manufactured from stainless steel and locked by means of nylon inserts or split pins. Nylon inserts shall only be used in nuts that will not require removal in the normal course of maintenance. Pins shall be turned out of solid steel bar and wherever spring washers are used over elongated holes, s suitable flat washer shall be provided between the spring washer and the hole.

11.9Special attention shall be given to the safety, reliability and protection against corrosion of the entire suspension system, including rsising and lowering gear and ancillary equipment, all of which shall meet with the approval of Spoornets Mechnical Engineer before installation.

12PROTECTION AGAINST CORROSION
12.1Masts, luminaire carriages, maintenance cages and all ferrous parts associated therewith, shall be hot dip galvanised in accordance with SABS 763. The mass of galvanised coating shall be determined in accordance with the non-destructive method under clause 6.3 of the aforementioned specification.

12.2All welding, drilling, punching, stamping, cutting and bending of parts shall be completed and all burrs removed before the galvanising process is carried out.

12.3If specified in Appendix 2, paint treatment shall be applied to all exterior galvanised surfaces in accordance with the requirements of Appendix 3.

12.4Stringent precautions shall be taken to protect finished surfaces from injury or damage during assembly, transit, storage and erection.

13WINCH
13.1Provision shall be made in the base of the mast to accommodate a removable twin drum, totally enclosed, oil-bath type winch.

13.2The winch shall be used for raising and lowering of the luminaire carriage and maintenance cage. The winch shall have a factor of safety of not less than 4.

13.3The winch shall be of light weight construction and mounted on a suitable frame for easy transfer from one mast to another. It should also be easily coupled and uncoupled and removable through the door opening provided at the base of the mast. The design and mass of the unit shall allow easy handling and attachment to the mast by not more than two men. The total mass of the winch, including wire ropes and mounting frame shall not exceed 75 kg .

13.4Winches mounted outside the mast and connected to the suspension ropes through the door opening, will not be acceptable.

13.5Each luminaire carriage suspension rope shall be secured independently in the base of the mast, prior to removal of the winch. The method of securing the ropes shall be such that there will be no deflection of the ropes from the vertical in any direction.

13.5.1After fixing, the suspension ropes shall remain under tension to ensure that the luminaire carriage is retained in its fully raised position. This shall not be achieved by any kind of adjustment after the ropes have been secured.

13.5.2The method of transferring the tension from each winch drum to the lock position must be safe. Pins used shall be of such a design that they lock automatically in position and cannot be removed while the hoist ropes are under tension.

13.5.3A single drum winch and compensating pulley arrangement will not be acceptable. The two suspension ropes shall be attached independently to each of the twin drum winch ropes.

13.5.4Tenderers shall fully describe the method used for transferring the tension from the winch to the lock position and vice versa, prior to removal or replacement of the winch,

13.6The winch shall be of the worm-gear type, self-sustaining at all loads and operating speeds, without the use of brakes or clutches. It shall have a gear ratio of at least 50: I and be suitable for both hand and power operation.

13.7The winch shall be fitted with a safety device to ensure that the drum is locked positively when the cranking handle or power tool is removed from the drive shaft. The safety device shall be applied automatically.

13.8Winch drums shall be machine grooved to ensure a tidy rope lay. The bottom of the groove shall be circular over an angle of approximately 120 degrees. The radius of the groove shall be larger than the radius of the rope by not less than O,8 mm . The drum grooves shall be finished smoothly and be free from surface defects liable to damage the rope. The drum grooves shall be pitched so that there is a clearance between neighbouring turns of rope.

13.9The rope anchorage on the drum shall be such that it is possible to inspect the termination of the rope in service without dismantling any part of the winch. It shall be so designed that the first and all successive rope lays are reeled on the drum in regular and tidy layers without any undue bending of the rope at the first turn.

13.10The drum shall be so designed as to prevent the rope layers from stacking one on top of the other against the flange and also to prevent rope on any layer forcing its way down into lower layers.

13.11The design of the winch and installation shall allow st least five turns of the rope to remain on the drum when the winch rope is fully extended under normal operating and maintenance conditions.

13.12The winch shall incorporate a separate gearbox for each drum.

13.13Worm gearing shall comply with the requirements of BS 721.

13.14A test certificate, stating the safe working load of the winch and issued by a recognised testing authority, shall be supplied with each winch.

13.15Winches shall be fitted with a label and rating plate of a permanent nature in an easily visible position.

13.15.1The label shall carry the Manufacturer's or Supplier's name and type number, serial number, test certificate number, safe working load, maximum allowable speed of operation at the safe working load, recommended lubricant and year of manufacture or supply.

13.15.2The lubricant for the winch shall be selected from the Transport Services! standard list, and Tenderer's recommendations are to be based on the "Lubricants and Petroleum Fuels Standing Advisory Committee Circular No. 1". (Failure to complete form CSS 80 correctly could disqualify an offer).

13.16Tenderers shall quote separately for the twin drum winch.

13.17Tenderers shall include a separate quotation for the supply of an electric power tool, incorporating a torque limiting device, for operation of the winch. The power tool shall be suitable for operation on a 220 volt, 50 Hz, single phase supply.

13.17.1The operational speed of, and torque developed by, the power tool shall match the requirements of the winch and suspension system. Should a multi-speed power tool, having speeds in excess of the aforementioned operational speed, be supplied, positive means shall be provided on the power tool to prohibit its use at any speed greater than that recommended.

13.17.2It shall he possible to support the power tool accurately and securely in its operating position for remote control at a distance of 5 metres from the mast base. The remote control switch shall incorporate a push button reguiring constant pressure for operation,

13.17.3All the equipment shall be of robust construction, suitable for site use snd shall be complete with interconnecting cables and plug.

13.18An operating handle, incorporating a torque limiting device, shall be supplied for manual operation of the winch.

13.19The torque limiting devices shall be adjusted according to their function up to a maximum value of 40 Nm . The adqustment shall be so arranged that it cannot readily be altered during normal use of the tools on site.

14LUMINAIRES AND CONTROL GEAR
14.1Luminaires shall be designed for use, and be supplied complete, with 400 watt high pressure sodium discharge lamps and control gear.

14.2They shall be designed to withstand the movement and vibration expected at the site and at the height specified.

14.3Floodlighting luminaires shall comply with the requirements of SABS 1279.

14.4Luminaires shall be weatherproof and designed to inhibit the ingress of dirt and moisture. The lamp compartment shall he enclosed by a transparent, toughened glass cover, firmly bedded on a high grade gasket with even pressure on all surfaces.

14.4.1Front covers that reguire opening for lamp replacement purposes shall be hinged and secured by means of screws or nuts. Latches or clips shall not be used for this purpose.

14.5All external toggles, fixing screws, hinges, clips, etc., shall be manufactured from stsinless steel, grade AISI 316 or 304.

14.6The luminaire optical system shall consist of a high grade aluminium reflecting surface, capable of providing the light distribution required and maintaining this function under site conditions.

14.7Luminaires shall incorporate positive and substantial means of fixing to the luminaire carriage, designed to allow adjustment and to ensure thst once set in the required position, they remain locked.

14.8Protractor scales shall be provided on all floodlighting luminaires for the setting and adjustment of aiming angles.

14.8.1The scale shall either be incorporated in the construction of the luminaire body or be manufactured of durable material and securely fixed to a flat surface on the luminaire body by glueing and at least one screw/rivet.

14.8.2The scale shall be marked at 10 degree or smaller intervals with identificstion figures at 30 degree or smaller intervals.

14.8.3An identification mark shall be incorporated in the luminaire mounting bracket for aiming purposes.

14.8.4If the luminaire is mounted on a horizontal surface and the peak intensity axis is aimed at 90 degrees from the downward verticsl, the identification mark on the mounting bracket shall correspond with the 90 degree mark on the protractor scale.

14.9Lampholders shall be of the GES(E 40) type. They shall be capable of withstanding, without deterioration, the high voltages encountered during starting and the maximum temperature attained in service. An additional support for the lamp, at the end opposite to the cap, shall be provided in floodlighting luminaires, The lamp support shall be correctly aligned with the lampholder to ensure horizontal mounting of the lamp and shall be so designed that the pressure on the lamp is firm, but flexible enough to allow easy replacement of lamps.

14.10Control gear, if not integral with the luminaire shall be accommodated in a robustly constructed weatherproof container of non-corrosive material mounted on the luminaire carriage.

14.11Control gear, if integral with the luminaire, shall be so mounted that access thereto is only possible by the hinging of a light weight inspection cover.

14.11.1Covers on which control gear components are mounted, are not acceptable and all screws used for securing the covers, shall be of the captive type,

14.12The ballast and electronic ignition device shall be designed for correct and efficietnt operation with the lamp offered, as well as all types of 400 watt high pressure sodium lamps available on the local market.

14.13The electronic ignition device shall be of the three wire type operating on the superposed pulse principle. The circuitry shall be such that at starting, or on failure of a lamp, high voltage pulses will be confined to the high voltage lead between the ignitor and centre contact of the lampholder. Ignitors incorporating a switching element are not acceptsble.

14.13.1A fully electronic ignition circuit shall be utilized to trigger the pulse transformer.

14.13.2The natural frequency of the electronic ignition circuit shall be in the order of 100 kHz .

14.13.3The lamp ignition voltage shall remain constant within a mains voltage vsriation of 200 to 250 volts.

14.13.4Tenderers shall guarantee that pulsing of the ignitor on a failed lamp will not have a detrimental effect on the life and efficient operation of the control gear, ignitor, lampholder and circuit wiring.

14.14Capacitors shall be fitted with safety discharge resistors incorporated within the canister of the capacitor.

15DISTRIBUTION BOARD AND MAST CABLING
15.1A totally enclosed power distribution board of flame retardant, reinforced fibreglass construction shall be mounted in an easily accessible position in the base compartment of the mast.

15.1.1The board shall be provided with a front cover panel secured by captive type screws and allowing only operating toggles of switches/circuit breskers to protrude.

15.2The distribution board shall be equipped as follows :

15.2.1One adequately rated, triple pole, moulded case, main isolating switch.

15.2.2Three adequately rated, single pole, moulded case circuit breakers for control of the luminaires.

15.2.3One 15 amp, 3 pin, industrial type, switched socket outlet for control of the power tool.

15.2.4One 15 amp, single pole and neutral, moulded case circuit breaker with integral 20 mA earth leakage protection device for control of the switched socket outlet under clause 15.2.3. The earth leakage unit shall comply with the requirements of SABS 767.

15.2.5One three phase, neutral and earth socket outlet for connection of the supply cable to the luminaires and protected by the circuit breakers under clause 15.2.2 above.

15.2.6An adequate number of terminals of suitable size, allowing only one wire per terminal for looping of the incoming and outgoing supply cables. These terminals shall be provided with bridge pieces connecting any number of adjacent terminals together to form a buabar.

15.2.6.1Terminals shall be of the rail mounted clip-on type, with flash-barriers between terminals.

15.2.7An insulated neutral terminal block with sufficient ways for the number of circuits employed.

15.2.8An adequately rated earthing bar.

15.2.9Grommeted access holes in the bottom of the board for cable entry.

15.3All wiring in the distribution board shall be neatly arranged to run horizontally and vertically and shall be supported and fixed at regular intervals.

15.4All moulded case circuit breakers shall comply with the requirements of SABS 156. They shall be rated for 250 volts and have a breaking capacity of "Class SABS 5 kA".

15.5The main switch under clause 15.2.1 shall be of the same manufacture ss the moulded case circuit breakers specified. The switch shall be capable of carrying a fault current of I 000 A for 1 second without welding of the contacts or other damage to the unit.

15.6Each control unit on the distribution board shall be clearly labelled by means of engraved or printed labels of metal or plastic or other approved material, firmly attached to the board and indicating in both official languages the designation of each circuit controlled. Lsbels of embossed adhesive tape are not acceptable.

15.7A flexible, multicore, heavy duty trailing cable shall be installed between the distribution board in the base of the mast and the luminsire carriage, for the power supply to the luminaires. The cable shall be entirelv suitable for the bending and load carrying stresses involved.

15.8Guiding pulleys in the headframe shall he of adequate diameter and shall have a cable retaining groove sized to match and cable dismeter, to ensure that the cable is not subjected to abrasion or undue straining during raising and lowering operations.

15.9The cable shall be securely clamped at the luminaire carriage, the other end being secured to the suspension cable in an approved manner, to ensure that the lower end returns to the mast base during the luminaire raising operation snd does not become entangled with suspension ropes.

15.10The cable shall be so installed that it can be replaced from ground level without lowering the mast or the use of special equipment. Tenderers shall provide clear instructions on how this can be done.

15.11Both ends of the cable shall be fitted with sdequately rated, 3 phase, neutrsl and earth, plug-in connectors to match the socket outlet under clause 15.2.5 and a socket outlet mounted in/on a weatherproof, corrosion resistant terminal box on the luminaire carriage.

15.12The socket outlet, plug-in connector combinations on the distribution board and luminaire carriage shall be of the weatherproof type. When connected, the plug-in connectors shall be retained in position by suitable locking devices. The equipment shall be of Niphan, LPA-REM, Marechal (BICC), or equal approved manufacture.

15.13When in the lowered position, testing of the luminaires shsll be effected via a three metre length of flexible cable, of equal manufacture and cross-sectional area to that supplying the luminaires, and fitted with plug-in connectors on both ends to suit the socket outlets on the distribution board and luminaire carriage, One such cable shall be provided per contract.

15.14The terminal box on the luminaire carriage shall contain fixed terminal blocks of "KLIPPON", or egual manufacture, for connection of the cabling to the luminaires. Cabling between the terminal box and control

gear box of each luminaire shall be run in metal ducts or tubes provided in the construction of the luminaire carriage, or galvanised steel condults. Any cabling exposed to the effects of ultra violet radiation, shall be silicon insulated.

15.15All metalwork, including luminaires, control gear units and the luminaire carriage shall be bonded to the earth core of the luminaire supply cable.

15.16The following label in both official languages shall be affixed to the distribution board in a prominent position :

"Luminaire socket outlet and plug to be isolated and disconnected before lowering the luminaire carriage".

15.17The incoming and outgoing cable termination arrangement shall be as shown in Appendix 4.

16CABLES
16.1All cables used, with the exception of those under clause 15.7, shall be 600/l 000 V rating and shall be in accordance with SABS 150.

16.2All single core cables shall be PVC insulated and all multi core cables shall be PUC insulated, PVC sheathed, single wire armoured, PVC covered.

16.3The armouring shall incorporate a percentage of copper wires in accordance with clause 5.8.3(c) of SABS 150.

16.4All cables shall be adequately rated for the currents that may be carried such that the voltage drop at any luminaire does not exceed 5 persent of the nominal supply voltage, if fed from a substation and 2,5 persent of the nominal supply voltage, if fed from a kiosk.

16.5Joints in cables will not be permitted, unless authorised by Spoornets Engineer on site.

17CABLE LAYING
17.1Approved cable routes shall be adhered to, unless unknown buried services are encountered. Deviations will be allowed to avoid such services but all instances shall be referred to Spoornets Engineer for approval.

17.2Cables shall be buried in the ground in straight, neatly cut, trenches, approximately 300 mm wide, such that the top of any cable is at least 750 mm below the surrounding ground level.

17.3During trenching, care shall be taken when placing the excavated soil so as not to cause damage or nuisance of any description and the Contractor shall take all precautions necessary to prevent damage to any other cables, water mains, drainage systems, etc. Should any of the above be damaged by the Contractor's staff, it must be reported immediately to Spoornets Engineer who will arrange for the necessary repairs. The Contractor will be held responsible for the cost of the repairs.

17.4Should it be necessary to remove accumulated water from a trench, this shall be undertaken by the Contractor at his expense and should be taken into account at the time of tendering. The Contractor shall provide all pumps and appliances required to carry out this operation,

17.5Prior to laying the cables, the trenches shall be inspected thoroughly to ensure that they are free from any objects likely to damage the cables either during or after cable laying operations.

17.6During laying operations, cables shall be handled with as much care as possible to avoid strain, kinks and damage to the cable and outer sheath, Once commenced, the whole of the cable laying operation shall be followed through to completion as quickly as possible so as to cause the minimum of inconvenience and obstruction.

17.7Sleeve pipes constructed of asbestos cement, pitch fibre or other approved material and having a minimum internal diameter of 100 mm, shall be installed for csbles crossing under existing and proposed railway tracks, tarred or concrete areas. The successful tenderer shall be responsible for restoring tarred and concrete surfaces after installation of sleeve pipes.

17.7.1The pipes shall be installed 900 mm below crown of rail and shall extend at least 2 140 mm on either side of the centre line of the track and in the case of tarred and concrete areas, at least 900 mm beyond the edge of the tar or concrete.

17.7.2The installation of pipes under railway tracks shall be carried out under the supervision of Spoornets Engineer.

17.7.3The cost of the supervision will be to Spoornets account.

17.8Filling in of trenches shall not be commenced until Spoornets Engineer has inspected and approved the cables in situ. Such inspection will not be unreasonably delayed.

17.9The first 150 mm of backfill on top of the cables shall be of fine soil, sifted if necessary, to ensure that the cables are not in contact with stones or other hard objects which may dent or damage the outer sheath of the cable when the backfill is compacted.

17.10When backfilling, the soil shall be replaced in 150 mm layers, well rammed down and compacted, so that the final surface will match the surrounding level.

17.11Cable markers, conforming to Drawing No. CEE-PK-14 will be supplied by the Transport Services to the successful tenderer who will be responsible for installing them in the ground over the cable routes during cable laying. A cable marker shall be installed near the start where the cables leave the substation or kiosk and at intervals of 30 metres along the route. At each change in direction of the route, two cable markers shall be installed close to one another in such a way as to indicate the change in direction.

18EARTHING AND LIGHTNING PROTECTION

18.1The incoming and outgoing cable termination and earthing arrangement at each mast shall be as shown in Appendix 4.

18.2The earthing core of the cable supplying the luminaires (clause Is.7) shall be connected to the earthing bar in the distribution board.

18.3Lightning protection is required at all mssts.

18.3.1Each mast shall be equipped with a lightning conductor in the form of a galvanised steel rod screwed into the top of the head frame, through the head frame cover.

18.3.1.1The minimum dimensions of the conductor shall be 12 mm diameter and 600 mm long.

18.3.1.2The actual length of the conductor shall be adequate to afford a zone of protection to the luminaire carriage and ancillary equipment by an imaginary line drawn from the top of the rod at an angle not exceeding 45 degrees from the downward vertical.

18.3.2Depending on the mast location the earth termination shall be effected either by an earth rod, or mast to rail bond, or both.

18.3.2.1Mast to rail bonds and spark gaps, where reguired, will be supplied and installed by the Transport Services.

18.4The gusset arrangement and 50 mm diameter hole through the foundation shown in Appendix 5 shall be included in the tender price and provided at each mast.

18.5The earth rod described in clauses 18.6 to 18.9 below, shall be included in the tendered price for installation at all masts, in the manner shown in Appendix 5. The conductor between the earth rod and mast gusset plate will be supplied by the Transport Services for installation and connection to the earth rod by the contractor.

18.5.1Should earth rods for any reason not be required, adjustment will be effected at the rates shown in Appendix 7.

18.6The earth rod shall be of the "Cadweld Rolled Threaded" type, consisting of a heavy copper exterior, molecularly bonded to a high strength steel core. The copper shall have a minimum thickness of O,25 mm.

18.7Rods shall be supplied in 1,5 metre lengths of 16 mm diameter and joined together with a threaded coupling to ensure that soil contact is maintained throughout the length of the coupled rods.

18.8Tenderers shall allow a length of 3 metres of rod per mast. Should this length be insufficient to obtain the earth resistance specified, then further lengths will be paid for at the relevant rate in Appendix 7.

18.9Rods shall be driven into the ground in a professional manner to ensure that no unnecessary vibrations are set up. The manufacturer's recommended rod driving practice shall be closely followed.

18.10The resistance to earth, measured by an earth resistance tester shall not exceed 10 ohms . Salt or other corrosive substances shall not be used to reduce earth resistivity. Sanica Gel or other approved substances may be used.

19ERECTION OF MASTS
19.1Inspection of assembled masts prior to erection and witnessing of the load tests under clauses 19.5.1 and 19.5.2 are required and the successful tenderer shall advise Spoornets Engineer at least 14 days in advance of his anticipated date of erection, to enable the necessary arrangements to be made.

19.2Before commencing the erection of the masts, the successful tenderer shall consult with Spoornets Engineer, regarding the precuations necessary to avoid interference with, and danger from, train movements and accidental contact with live, traction, electrification overhead wires.

19.3Masts and other equipment awaiting erection shall be stored on site in such a manner to ensure that all regulations are complied with and no danger to trains working, or personnel, result.

19.4After erection of painted masts, all damage to paintwork ehall be repaired according to the requirements in Appendix 3.

19.5On completion of the installation, the successful tenderer will be required to carry out the following test at each mast :

19.5.1The test to consist of hoisting a test load, equal either to 1,25 times the mass of the luminaire carriage complete with all luminaires, or to 1,5 times the (mass of the maintenance cage + 180 kg), whichever is the greater, through the full height of the mast, holding in the uppermost position and lowering again. The results of the tests shall be recorded on RMD 9 log sheets provided by the engineer.

19.5.2If the maintenance cage is not used in the above test then it shall be rsised, supporting the aforementioned test mass, through the full height of at least one mast, to ensure the satisfactory workini thereof.

An approved notice, in both official languages, to the effect that the safe working load (S.W.L.) of the cage is

180 kg, shall be prominently displayed on the cage.

19.6The aforementioned tests shall be carried out using masses supplied by the successful tenderer and assized by an approved authority.

20DRAWINGS AND INSTRUCTION MANVALS
20.1The successful tenderer will be required to furnish 3 prints each of detailed dimensioned drawings of the foundations, masts, luminaire carriages, winch, raising and lowering mechanism and maintenance cage, as well as detailed instructions for the operation and maintenance of all equipment on completion of the installation.

20.2The drawings and instructions shall be supplied in properly bound manuals with durable covers.

21PACKING
21.1All equipment shall be packed in such a manner that it will be adequately protected against damage during transport and handling.

22INSPECTION
22.1The Transport Services reserves the right to inspect the equipment during or after manufacture and to be represented at any tests.

23ILLUMINANCE TESTS
23.1On completion of the installation the successful tenderer will be required to carry out, in collaboration with Spoornets Engineer, illuminance tests at a sufficient number of locations in the area covered by the lighting installation, to prove the values of illuminance claimed in his offer.

23.2To comply with the requirements of clauses 8.10 and 8.15, initial (100 hr) values measured, shall not be less than 4,2 lux in all areas,

23.3Should the values measured be below those specified, any subsequent return to site by Spoornets staff for further measurements will be to the successful tenderer's account.

24COMPLETION OF CONTRACT
24.1The installation will not be accepted as complete until the winch, maintenance cage, power tool, luminaire carriage support bracket and manuals have been delivered to Spoornets Engineer or his authorised representative on site.

25SPARES
25.1Tenderers shall submit a separate list of recommended spares. Individual prices shall be given for each item and tenderers shall comment on the future availability of spares from locally held stock.

26GUARANTEE
26.1The Contractor must undertake to repair all faults due to bad workmanship and/or faulty materials and to replace all defective apparatus or materisls during a period of six calendar months, calculated from the date that the completed electrical installation is accepted by Spoornet.

26.2Any defects that may become apparent during the guarantee period must be rectified to the satisfaction of and free of cost to Spoornet.

26.3The Contractor shall undertake work on the rectification of any defects that may arise during the guarantee period within 7 days of his being notified by Spoornet of such defects.

26.4Should the Contractor fail to comply with the requirements stipulated above, Spoornet shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or materials, and the Contractor shall reimburse Spoornet the total cost of such repair or replacements, including the labour costs

incurred in replacing defective material.

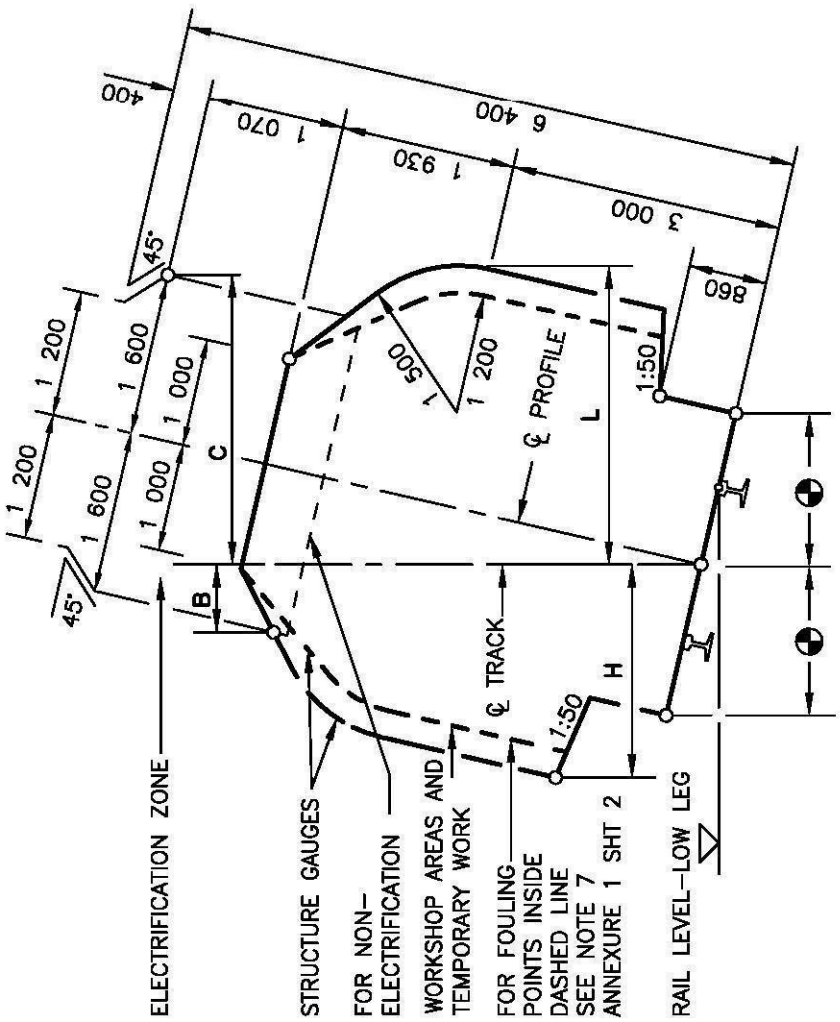
TENDERER'S SIGNATURE .....

DATE .....

CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)

ANNEXURE 1
SHEET 1 of 5
AMENDMENT

HORIZONTAL CLEARANCES : 1 065mm TRACK GAUGE



RADIUS (m)	WITH CANT		NO CANT	WITH CANT	
	H (mm)	L (mm)	H & L	B (mm)	C (mm)
90	2 730	3 090	2 780	1 130	2 100
100	2 700	3 030	2 750	1 140	2 050
120	2 650	2 970	2 700	1 160	2 010
140	2 620	2 920	2 660	1 175	1 990
170	2 590	2 870	2 630	1 190	1 970
200	2 570	2 820	2 600	1 205	1 950
250	2 550	2 790	2 580	1 230	1 920
300	2 540	2 760	2 560	1 250	1 900
350	2 530	2 730	2 540	1 270	1 890
400	2 520	2 710	2 530	1 290	1 875
500	2 510	2 680	2 520	1 320	1 850
600	2 500	2 660	2 510	1 340	1 830
800	2 490	2 620	2 500	1 365	1 790
1 000	2 480	2 600	2 490	1 380	1 760
1 200	2 480	2 580	2 490	1 200	1 730
1 500	2 480	2 550	2 480	1 415	1 700
2 000	2 480	2 500	2 480	1 440	1 660
3 000	2 470	2 470	2 470	1 500	1 600
>5 000	2 460	2 460	2 460	1 600	1 600

REMARKS:

1. **H** AND **B** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. **L** AND **C** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR WORKSHOP AREAS AND TEMPORARY WORK, CLEARANCES **H** AND **L** MAY BE REDUCED BY 300mm.
5. ◓ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.
6. ALSO REFER TO REMARKS 4 TO 8 OF ANNEXURE 1 SHEET 2.

Specification No. CEE.0018.90

Appendix 2

SCHEDULE OF REQUIREMENTS AND DEVIATIONS

1.0 LOCATION OF HIGH MAST LIGHTING INSTALLATION :

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.....

2.0DRAWING NUMBER/S OF RELEVANT DRAWING/S ATTACHED :

.....

.....

3.0 SPECIAL REQUIREMENTS AND DEVIATIONS FROM THE SPECIFICATION :

.....

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CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)

SPOORNET
a division of transnet limited
(infrastructure)(electrical)

REFERENCE :

Specification No. CEE.0018.90

Appendix 3

PAINTING OF LIGHTING MASTS

1PAINTS AND PAINT THINNERS

1.1Paints and paint thinners shall be obtained from a Spoornet approved paint manufacturer.

1.2The primer coating shall be Corrocote 3 by AECI Paints, or equal approved manufacture.

1.3The two coats covering the primed surface shall be Paint, Rubber, Chlorinated, High Build, colour Dark Admiralty Grey, to Spoornet Specification CSS 183/13.15/G12 for the first coat, followed by Paint, Rubber, Chlorinated, Enamel, colour French Grey to Spoornet Specification CSS 183/13,16/H30 for the final coat.

1.4Xylene, to Spoornet Specification CSS 183/2.30, shsll be used ss a thinner for the two top coats, if necessary.

1.5All paints shall be stirred and mixed to a homogeneous condition incorporating the whole contents of the paint container. Mixed paint shall be kept mixed and in good condition throughout, stirring when neceesary to keep the pigment in suspension. Thinning shall only be undertaken in accordance with manufacturer's written recommendations and directions. Partially used containers shall be resealed to prevent evaporation of solvent.

2PREPARATION OF EXTERIOR SURFACES

2.1Galvanised surfaces shall be scrubbed with steel wool soaked in a clesning solution of one part by volume of Cleaning Compound, Solvent Detergent, Medium Duty to CSS 285/18,10, one part water and two parts of Remover, Paint, Non-Flammable, Dipping Type to CSS 183/14.02 to remove the protective film against formation of white rust and all other foreign matter and aleo to provide a key for adhesion of the primer. Protective clothing, gloves and masks must be used by workers during this cleaning process. Rinse the cleaned surface copiously with water.

2.2All painted surfaces, prior to application of a following coat, shall be sound, dry and free from oil, grease and other contaminants. Any unsound paint to be removed completely, the surface prepared as in clause 2.1 above and repainted coat for coat as specified below.

3APPLICATION OF PAINTS AT MANUFACTURER'S PREMISES

3.1 After preparation of the galvanised surfaces apply one coat of primer by spraying to give a dry film thickness of 35 - 45 micrometres, to all surfaces with the exception of the mast interior which need not be painted. Allow to dry for a minimum period of 4 hours before overcoating.

3.2The primed surfaces shall then be coated with one coat of the Paint, Rubber, Chlorinated, High Build, colour Dark Admiralty Grey, by suitable airless spray equipment to give a dry film thickness of 75 - 125 micrometers for this coat.

3.3Paints shall be applied under suitable conditions of light, temperature, humidity and ventilation. At time of overcoating, the painted surface shall be clean, dry, sound and free of misses and defective paint. Each coat of paint shall be applied as a continuous, even film of uniform thickness.

3.4Painted steel shall not be handled until the pain has dried except where necesssry in turning for painting or stacking for drying. Paint damaged in handling shall be scraped off and touched up by replacing each coat of paint scraped off. Painted steel shall not be transported or packed for trsnsport until paint is dry.

4TRANSPORTATION OF PAINTED STEEL

4.1When loading at the manufacturer's premises and when offloading at the erection site, components shall be handled with hessian covered slings in order to cause minimum damage to paintwork. During transportation, the components shall be placed on wooden dunnage and securely fastened to prevent sliding and other movement.

5SITE PAINTING

5.1Prior to the erection of masts, damaged areas of paint shall be repaired by spot cleaning in a manner that will minimise damage to sound paint. Bared areas shall be spot primed and spot painted with the materials specified, to restore all coats.

5.2In restoring specified coats as referred to in clause 5.1 special care must be taken to ensure that the prime coat is not applied over areas covered with Paint, Rubber, Chlorinated, High Build, as this could lead to premature paint failure.

5.3An overall final coat of Paint, Rubber, Chlorinated, Enamel, colour French Grey, to give a dry film thickness of 25 - 35 micrometres shall then be applied to all accessible surfaces.

5.4The total dry film thickness of the primer and two successive coats shall be between 135 - 205 m .

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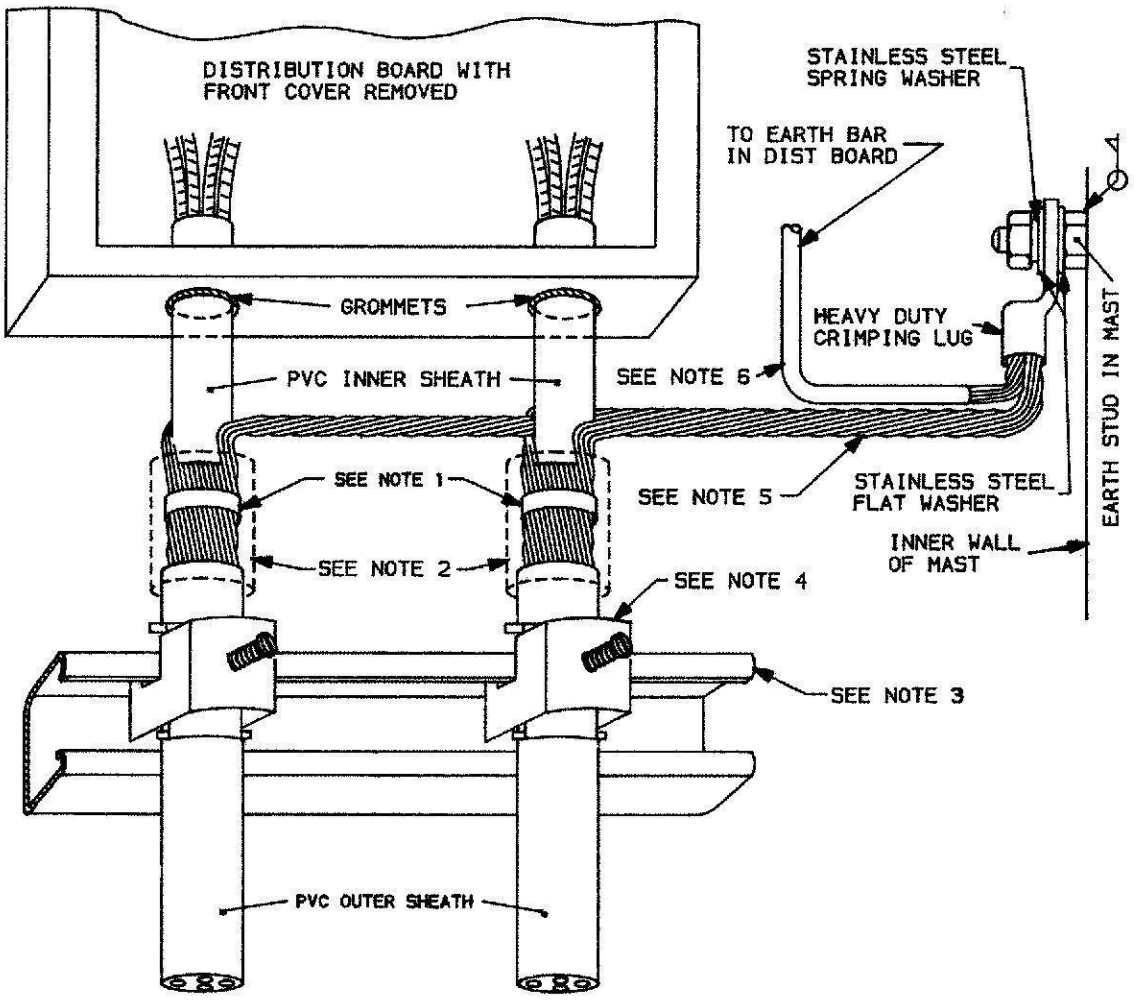
Appendix 3

5.5During erection, masts shall be handled with hessian covered slings to minimise damage to paintwork.

5.6After erection, paintwork shall be repaired in the manner described in clauses 5.1 to 5.4 above.

CABLE TERMINATION AND EARTHING ARRANGEMENT AT HIGH MASTS



NOTES

1. GALVANISED "STRAPIT" OR EQUAL SYSTEM TO MANUFACTURERS INSTRUCTIONS.

2. THICK WALL, HEAT SHRINKABLE TUBE WITH INTERNAL SEALANT TO MANUFACTURERS INSTRUCTIONS.

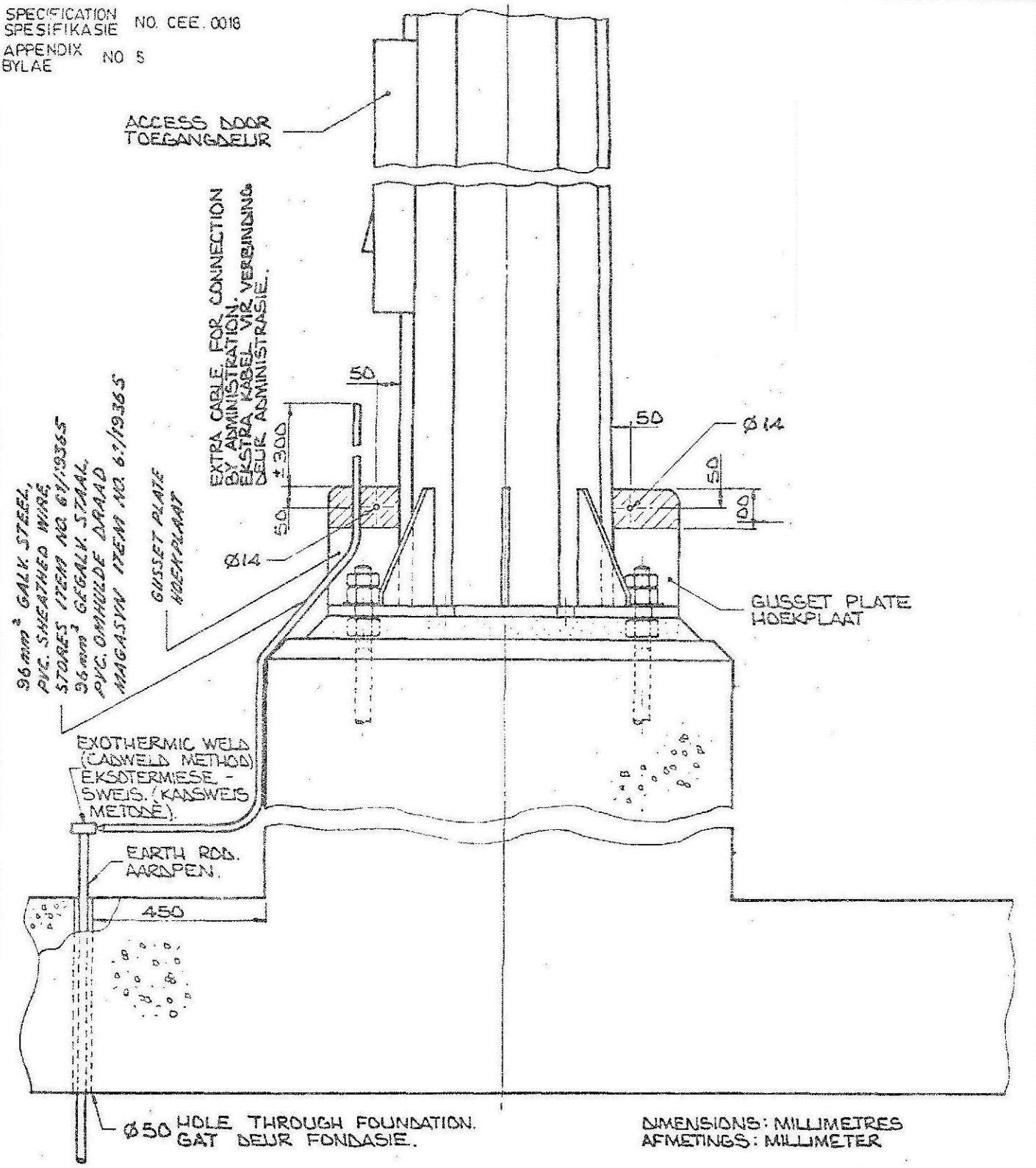
3. GALVANISED "UNISTRUT", "SANKEYSTRUT" OR EQUAL CHANNEL OF ADEQUATE SIZE FOR THE PURPOSE, RIGIDLY FIXED TO A SUITABLE MOUNTING BRACKET ON THE MAST IN AN EASILY ACCESSIBLE POSITION.

4. GALVANISED "UNISTRUT", "SANKEYSTRUT" OR EQUAL CABLE CLAMPS TO SUIT CABLE DIAMETER.

5. FULL COMPLIMENT OF TINNED COPPER WIRES FROM BOTH CABLES.

6. PVC INSULATED, STRANDED COPPER CONDUCTOR OF RATED AREA AT LEAST EQUAL TO THAT OF LARGEST CONDUCTOR OF CABLE TO LUMINAIRES BUT NOT LESS THAN $4mm^2$.

SPECIFICATION NO. CEE. 0018
SPESIFIKASIE
APPENDIX NO 5
BYLAE



DIMENSIONS: MILLIMETRES
AFMETINGS: MILLIMETER

NOTES/OPMERKINGS

1) THE TWO RECTANGULAR GUSSETS SHOWN, INCORPORATING THE Ø14 HOLE SHALL BE PROVIDED ON EACH MAST, ONE DIRECTLY BELOW THE DOOR OPENING AND ONE DIRECTLY OPPOSITE.
DIE TWEE REGHOEKIGE HOEKPLATE AANGETOON, INSLUITEND DIE Ø14 GAT, SAL VOORSIEN WORD OP ELKE MAS, EEN DIREK ONDER DIE DEUR OPENING EN EEN DIREK TEENOORGESTELD.

2) THE SHADED AREA ON BOTH SIDES OF THE TWO RECTANGULAR GUSSETS SHALL BE LEFT UNPAINTED AFTER GALVANISING.
DIE VERDONKERDE AREA OP BEIDE KANTE VAN DIE TWEE REGHOEKIGE HOEKPLATE MOET ONGEVERF BLY NA GALVANISERING.

PROVISION FOR LIGHTNING PROTECTION AND MAST TO RAIL BONDS.
VOORSIENING VIR WEERLIGBESKERMING EN MAS NA SPOOR VERBINDINGS

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Appendix 6

TECHNICAL DATA SHEET

(To be completed by tenderers and submitted as part of their tender. This information is in addition to that called for in the body of the specification.)

1MASTS
1.1Manufacturer : .....

1.2Height : .....

1.3Materials and minimum thickness : .....

.....

1.4Type of construction : .....

.....

2FOUNDATIONS
2.1Details of mixture and strength : .....

.....

2.2Number of foundation bolts per foundation : .....

.....

2.3Size and material of bolts : .....

.....

2.4Total length of bolts : .....

.....

.....

3LUMINAIRE CARRIAGE
3.1Material of carriage : .....

.....

3.2Type of construction : .....

.....

3.3Mass of carriage excluding luminaires and control gear : .....

.....

3.4Overall diameter of carriage complete with luminaires and control gear : .....

.....

3.5Vertical plane projected area of carriage complete with luminaires and control gear : .....

.....

4RAISING AND LOWERING SYSTEM

4.1Description of system : .....

.....

.....

.....

4.2Number, size and material of hoist ropes : .....

.....

.....

4.3Diameter and material of hoist rope pulleys : .....

.....

4.4Diameter and material of electrical cable pulley : .....

.....

4.5Details of pulley bearings : .....

.....

4.6Details of pulley shafts : .....

.....

4.7Type and frequency of lubrication required : .....

4.8Details of winch offered : .....

.....

.....

4.9Mass of winch and mounting attachment : .....

.....

4.10Details of electric power tool : .....

.....

.....

4.11Time to raise and lower (power) : .....

4.12Time to raise and lower (manual) : .....

4.13Safe working load of hoisting mechanism : .....

.....

4.14Breaking load of hoist ropes : .....

.....

4.15Mass of maintenance cage : .....

.....

4.16Overall diameter of maintenance cage when fitted to the mast : .....

.....

5LUMINAIRES AND CONTROL GEAR
5.1Manufacturer of luminaire : .....

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Appendix 6

5.2Type and catalogue number of luminaire : .....

.....

5.3Mass of luminaire complete with control gear : .....

5.4Maximum aiming angle of peak intensity axis of luminaire : .....

.....

5.5Manufacturer of lamp : .....

5.6Type and wattage of lamp : .....

5.7Lumen output (100 hr.) of lamp : .....

5.8Rated life of lamp : .....

5.9Manufacturer of ballast : .....

5.10Voltage and tappings of ballast : .....

.....

5.11Manufacturer and type of ignition device : .....

.....

5.12Pulse height (peak value) of ignition device : .....

.....

5.13Manufacturer, type and capacity of capacitor : .....

.....

5.14Working voltage of capacitor : .....

5.15Power factor of circuit : .....

5.16Length of time for lamps to reach full lumen output after switching on : .....

.....

5.17Length of time for lamps to reach full lumen output after a short interruption of the supply:

.....

5.18Types of lamps commercially available, guaranteed to operate satisfactorily at correct lamp characteristics with the ballast and ignitor combination stated above :

.....

.....

.....

5.19Period from date of commissioning of installation for which luminaires, control gear and lamps are guaranteed :

5.19.1Luminaires : .....

5.19.2Ballasts : .....

5.19.3Ignitors : .....

5.19.4Capacitors : .....

5.19.5Lamps : .....

AS WITNESSES

1.....

2.....

TENDERER'S SIGNATURE .....

DATE .....

CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)

SPOORNET
a division of transnet limited
(infrastructure)(electrical)

REFERENCE:

Specification No. CEE.0018.90

Appendix 7

SCHEDULE OF RATES FOR ADDITIONS AND OMISSIONS

Tenderers shall complete the following schedule of rates, for use in the event of any additions and/or omissions to/from the contract, and submit them as part of their tender documents.

1MASTS, LUMINAIRES AND ANCILLARY EQUIPMENT EACH

1.1Supply, installation and testing of a 30 metre mast complete .....with headframe, luminaire carriage and all accessories, fully equipped distribution board and cable connection to headframe, but excluding luminaires and control gear.

1.2Supply and installation of a floodlighting luminaire cable .....connection to headframe, but excluding luminaires and control gear.

1.3Supply and delivery of a twin drum winch complete with all .....components for attachment to mast.

1.4Supply and delivery of an electric power tool complete with all .....components for remote control operation.

1.5Supply and delivery of a maintenance cage. .....

2LIGHTNING PROTECTION

2.1Supply, installation and connecting up of earth rod 3 metres .....long.

2.2Extra over 2.1 per additional metre. .....

2.3Supply, installation and connecting up of a 70 mm square bare .....stranded copper trench earth 10 metres long.

2.4Extra over 2.3 above per additional metre. .....

3FOUNDATIONS

3.1Provision of a foundation in accordance with the requirements .....of the specification.

4EXCAVATIONS PER CUBIC METRE

4.1Rate for excavations in soil. .....

4.2Rate for excavations in soft rock. .....

4.3Rate for excavations in hard rock. .....

4.4Rate for the removal and replacement of ballast to its original .....condition.

4.5Rate for the removal and replacement of ballast and grit to its .....original condition.

4.6Provision of 15 MPa weak mix concrete in additional depth .....excavated below normal fonandation level, if required.

5CABLING PER METRE LAID PER CABLE TERMINATION
5.1Supply and installation of cables excluding trenching, but incuding termination. LABOUR MATERIAL LABOUR MATERIAL

5.1.1 5 mm square - 4 core ....

5.1.2 6 mm square - 4 core ....

5.1.3 10 mm square - 4 core ....

5.1.4 16 mm square - 4 core ....

5.1.5 25 mm square - 4 core ....

5.1.6 32 mm square - 4 core ....

5.1.7 50 mm square - 4 core ....

5.1.8 70 mm square - 4 core ....

5.2Supply and installation of PVC covered copper earthing cable. LABOUR MATERIAL LABOUR MATERIAL

5.2.1 10 mm square - 1 core ....

5.2.2 16 mm square - 1 core ....

5.2.3 25 mm square - 1 core ....

5.2.4 35 mm square - 1 core ....

Specification No. CEE.0018.90

Appendix 7

6 TRENCHING PER CUBIC METRE

6.1 Rate for trenching 750 mm deep in soil. .....

6.2 Rate for trenching 600 mm deep in soft rock. .....

6.3 Rate for trenching 600 mm deep in hard rock. .....

7 SLEEVE PIPES PER METRE LAID

7.1Rate for installation under tracks (including removal and .....replacement of ballast).

7.2Rate for installation under tarred areas (including removal and..... replacement of tar).

7.3Rate for installation under concrete areas (including removal .....and replacement of concrete).

8NOTES

8.1Soft rock will be taken as horoken or friable rock which can be removed by pick or mechanical excavator, or paving breaker. This includes hard clay.

8.2Hard rock will be taken as rock which cannot be removed by a mechanical excavator and requires drilling and blasting or splitting. This includes re-inforced or plain concrete.

8.3The attention of tenderers is drawn to the fact that the unit rates quoted for excavations, trenching, cabling and removal and replacement of ballast and grit, will be considered when adjudicating the tender.

AS WITNESSES

1.....

2.....

TENDERER'S SIGNATURE .....

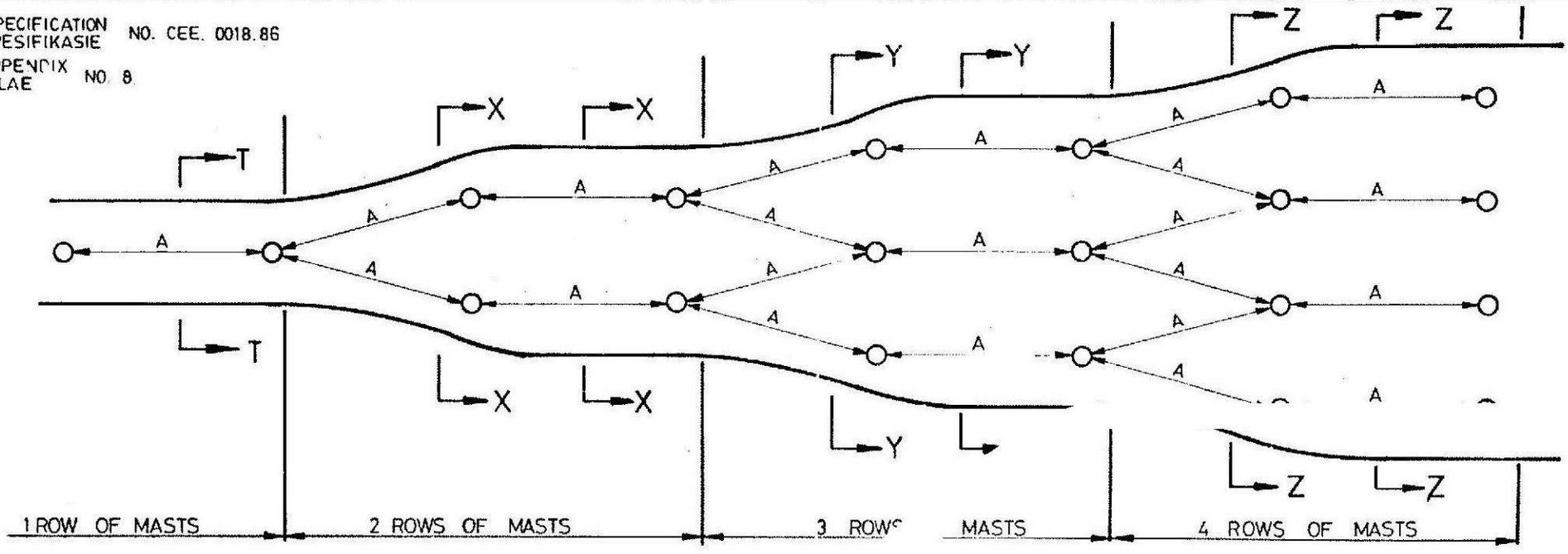
DATE .....

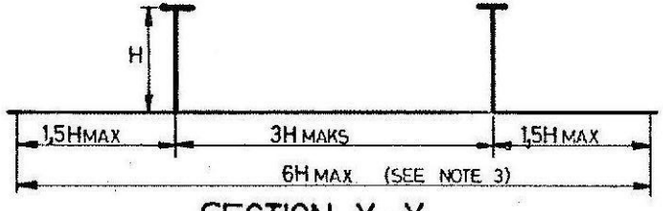
CHIEF ENGINEER (ELECTRICAL)
(INFRASTRUCTURE)

REFERENCE:

SPECIFICATION NO. CEE. 0018.86
SPESIFIKASIE

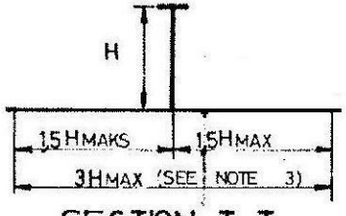
APPENDIX NO. 8
BYLAE





SECTION X-X

SECTION Y-Y



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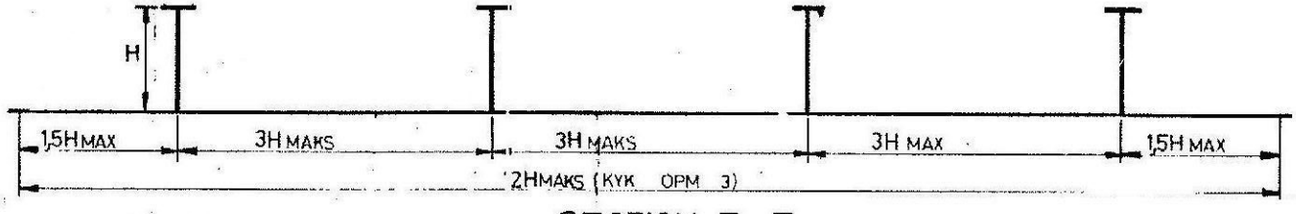

SECTION Z-Z

NOTES/ OPMERKINGS

1 DIMENSION H HEIGHT OF MAST.
AFMETING H HOOGTE VAN MAS.

2 DIMENSION A SPACING BETWEEN MASTS SHALL NOT EXCEED 6H.
AFMETING A SPASIEERING TUSSEN MASTE MAG NIE 6H OORSKRY NIE.

3 WIDTH OF AREA TO BE ILLUMINATED.
WYDTE VAN AREA WAT VERLIG MOET WORD.

MAST ARRANGEMENT IN TYPICAL MARSHALLING YARD.
MAS RANGSKIKKING IN TIPIESE RANGEERWERF.