TRANSNET
freight rail

RAIL NETWORK
TECHNICAL SPECIFICATION
Security lighting

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I. Document Authorisation

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II. Distribution

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III. Document Change History

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IV. Changes since Last Revision

CLAUSES	DESCRIPTION
1.10	

Abbreviation	Description
AC	Alternating Current
CCTV	Closed-circuit Television
CoC	Certificate of Compliance
DC	Direct Current
Hz	Hertz
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IP	Ingress Protection
km	kilometer
m	Meters
lm	Lumen
DF	Dirt factor
LLD	Lamp Lumen Depression
UF	Utilization Factor
V	Volts
W	Watts
SABS	South African Bureau of Standards
SANS	South African National Standards
PTZ	Pan-Tilt-Zoom

V. List of Abbreviations and Acronyms

VI. Standards and Publications

Unless otherwise specified all materials and equipment supplied shall comply with the applicable and latest editions of SANS and Transnet Freight Rail's publications.

a. Transnet freight rail specifications / engineering instructions:

Whenever "Transnet", "Spoornet" or "S.A. Transport Services" is used in the generic specifications, it should be read as "the Employer", and wherever "engineer" or similar terminology is used, it should be read as "the Engineering/Project Manager".

The Employer for this Contract is Transnet, SOC Ltd, trading as Transnet Freight Rail. The designs are based on the Transnet Freight Rail specifications.

The information and or requirements as stated in Transnet Freight Rail's specifications shall be considered as the minimum requirements for equipment to be offered. The Contractor may use the specifications as a requirement and offer material and equipment that comply with the

latest technology. The Contractor shall provide details indicating how the equipment offered differs from what was specified.

Whenever “Technical Officer or Site Agent” is used in the particular specification it refers to Transnet Freight Rail’s Contract Supervisor or his appointed representative.

b. Application Standard

The equipment shall comply with the latest issue of the following applicable specifications:

DOCUMENT NO.	DESCRIPTION	LOCATION
OHS Act 85 of 1993	Occupational Health and Safety Act	External
CEE-0019.90	Medium mast lighting of outdoor areas	Internal
CEE-0003.90	Luminaires for street and yard lighting	Internal
CEE-0188.89	Photo electric control unit	Internal
CEE- 0023.90	Specification for the installation of cables	Internal
CEE- 0082	Low voltage distribution boards	Internal
CEE- 0224	Drawing, Catalogues, instruction manual and pare lists for electrical equipment supplied under contract	Internal
BBC- 0198	Requirements for the supply of electric cables	Internal
CEE- 0177.86	Earth system for electric light and power and traction installation	Internal
S-420	Specification for Concrete Work	Internal
BBD- 8210: E7/1	Specification for General Work and Works On, Over, Under or Adjacent to Railway Lines and Near High Voltage Equipment	Internal
E4E	Safety Arrangement and Procedural Compliance with the Occupation Health and Safety Act (Act 85 of 1993) and Applicable Regulations	Internal
SANS 10142-1	The wiring of premises	External
SANS 1063	Earth rods selection	External
SABS 0292	Earthing of low voltage distribution systems	External
SANS 1091	National colour standards	External
SANS 10389-1	Exterior lighting Part 1: Artificial lighting of exterior areas for work and safety	External
SANS 10389-2	Exterior security lighting	External
SANS 10389-3	Guide on the limitation of effects of obtrusive light from outdoor lighting installation	External
SANS 10225	The design and construction of lighting masts	External
SATS 17576	Light-emitting diode products for interior lighting, Streetlighting and floodlighting performance requirements	External

SANS 10222-5-1-2	Electrical security installations. Part 5-1-2: CCTV installations- CCTV surveillance systems for use in security applications – Systems design requirements	External

1 Background

Transnet Freight Rail experiences theft on a daily basis. Theft and vandalism of TFR assets are prohibiting the company to reach its milestones and goals. Additional security measures will be implemented such as Double Fencing, Sterile Zone, CCTV networks and intrusion detection systems to form part of a security system. These technologies coupled with security operational processes/services will reduce or mitigate vandalism incidents. Lighting forms part of the overall security package and is complementary to other security measures such as guards, fencing and closed circuit television (CCTV).

2 Scope

This technical user specification covers Transnet Freight Rail's requirements for the supply, installation and commissioning of security lights for Transnet Freight Rail Substations, High sites and Relay room to promote safety and to assist in the night defence of premises, property and personnel against thereat of sabotage, theft and vandalism.

The scope of work includes the following

2.1. Excavation and casting of mast foundation for the mast structure

2.2. Supply and installation of mast poles

2.3. Supply and installation of luminaires.

2.4. Supply and installation of protection devices, earthing and bonding.

2.5. This specification also covers any other work arising out of or incidental to the above requirements for the proper completion of the works in accordance with the true meaning and intent of the contract documents.

3 Objective

The objective is to promote safety and to assist in the night defence of premises against sabotage, vandalism, illegal entry and theft by:

3.1. Deterring any would-be intruder and prevent a possible incident occurring

3.2. Reveal and where possible disorientate and delay any intruder during, or after and unlawful entry.

4 Material

4.1. The Contractor shall supply all the material required to complete the works.

4.2. Transnet Freight Rail approved material shall be used.

4.3. The material shall be as per applicable drawings and standards, generic and particular specification.

4.4. Any alternative material to be used should be approved by Transnet Freight Rail before an order is placed, Transnet shall accept no liability for breach of this process.

5 Compliance

5.1. Tenders shall comply with all the specifications and requirements as indicated in this document. Any deviation from the specification shall be indicated in the tenderer's submission document. Transnet Freight Rail shall have the prerogative to accept or reject any deviation which may lead to a disqualification of a noncompliant bidder.

5.2. Transnet Freight Rail reserves the right to inspect all equipment, components and subsystems before finalisation and approval of the contract.

6 General requirements

6.1. The Contractor must provide the suppliers and or manufacturers of his material and equipment with a copy of the equipment specification to ensure compliance.

6.2. The Contractor shall supply and install all material needed to complete the works, which shall be according to Transnet Freight Rail drawings, specifications and SABS.

6.3. The Contractor shall execute the Works in accordance with Transnet specification E7/1 and E4E.

6.4. The contractor shall commence work within the period specified in the schedule and the completion period shall be as indicate on the schedule.

7 Operating temperature

7.1. The rated maximum ambient temperature of luminaires shall be determined by thermal tests and under conditions described in the clause on thermal test (normal operations) of SANS 60598-1.

7.2. The luminaires shall have a rated maximum ambient temperature of 35 degrees Celsius as per clause 4.4.4 of SANS 475

8 Resistance to dust, solid objects and moisture

The luminaries used for security lighting should be capable of providing the service for which intended without undue deterioration in their safety, performance and appearance during normal life. The luminaires should have a minimum IP rating of 65 as per clause 4.5.2 of SANS 475

9 Design

9.1. The contractor should provide site specific simulation and design per site.

9.2. Every security lighting installation should be designed to suit local conditions, the construction and location of the buildings and other structures, surrounding premises and the extend and types of boundary walls and or fences.

9.3. Lighting used in conjunction with the fencing shall enable CCTV, Nerve centre operator or the security guards to observe both the fence and the area beyond.

9.4. The lighting should illuminate the whole inner surface of the fence and surveyed field, as uniformly as possible.

9.5. Care shall be taken in the design of outdoor area lighting for security purpose to ensure an acceptable level of uniformity and avoidance of dark shadows, which can occur when light comes from one direction only.

10 Lighting Requirements

10.1. The LED solar flood lights shall be used.

10.2. The recommended Lumen output per lamp for mounting height above 10 m is 40 000 lm and above as per Table 1 of section 7.1 SANS 10389-2.

10.3. Luminaires should be designed to withstand the movement and vibration expected on site and at the height specified.

10.4. The lights should be triggered to light by the sensors mounted on the fence

10.5. **Fencing and lighting**

10.5.1. The lighting should be able to illuminate the whole inner surface of the fence and surveyed field (It is the area outside the fence), as uniformly as possible.

10.5.2. The recommended setback, (the distance between the fence line and luminaire supports, it is the width of the area inside the fence, d by lighting.) is 6m, although10 m is preferred if space is available as per clause 6.2.2 SANS 10389-2.

10.5.3. The surveyed field shall extend outside the fence for a minimum distance of 20 m and should be reasonably flat and level.

10.5.4. The distance between the double fences should be at least 6 m to make bridging difficult as per clause 6.2.5 of SANS 10389-2.

10.5.5. The fence illuminance should be lower than that of the field view. The material of the fence used should be dark in colour as per clause 6.2.4 SANS 10389-2.

10.6. CCTV and lighting

10.6.1. The quality of the final CCTV images and the Intelligence conveyed are strongly influenced by the natural and or artificial light source illumination the scene. The contractor is required to do an analysis of the source(s) parameters (the spectrum, illumination level, etc) and match them to the spectral and sensitivity characteristics of the cameras.

10.6.2. The intensity of the horizontal illuminance and vertical illuminance should be sufficient to provide adequate sensor illumination to the camera.

10.6.3. The minimum illumination in colour and in monochrome mode is 0.2 Lux (F1.4), 0.02 lux for the CCTV as per Appendix A of the CCTV network and intrusion detection specification provided by Transnet Freight Rail.

10.6.4. The lighting designer should refer to Appendix A of the CCTV network and intrusion detection specification provided by Transnet Freight Rail for the sensor illuminance, lens speed, lens quality and scene reflection of the camera required to produce adequate scene illuminance for the CCTV to produce usable recording or full video.

10.6.5. The maximum to minimum uniformity ratio should not exceed 5 as per clause 8.5 of SANS 10389-2:2007. If the uniformity ratio is excessive, lighter areas will provide too much light causing blooming or washout details and the darker areas will not provide sufficient light for good resolution if the ratio is too small.

11 Foundations

11.1. The mixture and strength of all concrete shall be in accordance with acceptable practice but not less than 20 MPa at 28days according to CEE.0019.90 clause 10.3.

11.2. Full design details of the foundation, including concrete mix and strength, foundation bolt anchorage, reinforcing, etc. as well as detailed dimensioned drawing, signed by a registered professional civil engineer shall be submitted to Transnet Freight Rail.

11.3. After the casting of the foundation, the holes shall be backfilled and the earth properly compacted. The area around the mast shall be brought to the original level and shall be left neat and tidy as per CEE.0019.90 clause 10.7.

11.4. The Contractor shall arrange for sampling and testing of all concrete used, and shall submit full records to the Supervisor.

11.5. The method of sampling used shall comply with specification S420.

11.6. If the quantity which these samples were taken exceeds 40 m^3, it shall be subject to the testing of a minimum of 3 sets of samples per day from each grade of concrete placed in each independent structure.

11.7. If the quantity from which these samples were taken is less than 40 m^3, it shall be subject to the testing of a minimum of 2 sets of samples per day.

11.8. The contractor shall maintain the following daily records for every part of the concrete structure and shall make these available at all times during the progress of the work for inspection by the engineer. According to S420 clause 5.13, the following records should be delivered to the engineer each week:

11.8.1. The date and times during which concrete was placed.

11.8.2. Identification of the part of structure in which the concrete was placed.

11.8.3. The mix proportions and specified strength.

11.8.4. The type of and brand of cement.

11.8.5. The slump of the concrete.

11.8.6. The identifying marks of test cubes made.

11.8.7. Curing procedure applied to concrete placed.

11.8.8. The times when shuttering was stripped and props were removed.

11.8.9. The date of despatch of the cubes to the testing laboratory.

11.8.10. The acceptance criteria of the test results should be as per S420 clause 7.2.1 and 7.2.2.

11.9. If the contractor disputes the results of the tests on concrete cubes, the concrete presented by the cubes will be considered acceptable if the contractor, at its own cost, proves to the satisfactory of the Engineer that the estimated actual strength of cores taken from the structure, determine in accordance with SABS method 856, is not less than the specified strength.

11.10. If the strength of concrete fails to meet the acceptance criteria stipulated, the Engineer may in his sole discretion and in addition to the options listed in SABS 1200 G:

11.11. Accept the concrete subject to approved remedial measuring being undertaken by the Contractor; or

11.12. Permit the concrete to remain subject to the payment of penalty.

11.13. If ready-mix concrete is used, the Contractor shall submit certificates confirming the strength of concrete to the Supervisor. On no account shall water be added to a concrete mix after test cubes have been taken and no hand mixed concrete shall be allowed.

11.14. It is the contractor’s responsibility to obtain correct positioning and level specified for all foundation and the engineer should verify that.

11.15. The size, shape and depth of any excavation shall be approved by the engineer before concrete is placed.

11.16. Unless otherwise permitted by the engineer, no concrete shall be placed until the fixed reinforcement have been accepted by an engineer.

11.17. The Contractor shall ensure that the concrete strength supplied complies with CEE.0017.83 clause 11.1, the concrete strength should of 21 MPA at 28 days.

11.18. If the strength of concrete fails to meet the acceptance criteria stipulated, the engineer may in his sole discretion and in addition to the options listed in SABS 1200G

11.19. Accept the concrete subject to approved remedial measures being undertaken by the contractor; or

11.20. Permit the concrete to remain subject to the payment of a

11.21. Any rejected foundation should be removed at the contractor cost and replaced in terms of this specification.

11.22. The method of curing the concrete in foundation shall be as specified in clause 3.3 of specification S420. In all cases where a concrete curing compound is specified, the curing compound shall be a clear or white pigment membrane forming material complying with ASTM specification C 309, except that the maximum permissible water loss in the test shall be 040 kilogram per square metre. Alternately, the concrete compound shall be acceptable if the treated concrete retains 90% or more of its mixing water when subjected to the test set out in British standard specification 8110 part 1 – chapter 6.

11.23. Concrete should be well vibrated and foundation box should be overfilled so that any shirking of the concrete during setting will not lower its level below the top surface of the box

11.24. The method used for water removal shall be in agreement with the engineer and record on the site diary.

11.25. The contractor shall remove foundation spoil from site to a registered disposable site.

11.26. The Contractor should not dump any excess concrete on site. Should there be a requirement to use excess concrete for e.g. to better the service road, written permission shall be requested from the Transnet Freight Rail Network Maintenance Depot.

11.27. The Contractor shall completely level the top of the foundation block to a good finish so that the top of the erected mast does not deviate from true vertical by more than 12 mm.

11.28. All excavations should be protected with safety barriers.

12 Lighting Mast Requirement

12.1. The mast pole will be installed in the Substations, Relay rooms and High sites buildings. The size of the yard where the mast pole will be installed might be different from one site to another.

12.2. The camera will be mounted above the mast head to give as large as possible the field of view. The luminaries will be mounted on the same pole as the camera on the mounting ring bracket.

12.3. Maintenance of the camera and luminaires should be done without the use of step ladders, Cranes or Cherry picker.

12.4. Fixed winch operated mast or middle hinged mast pole may be used for easy maintenance of the camera and the luminaries.

12.5. The middle hinged mast pole may not be used at small sites which might not have enough clearance for the mast to be tilted.

12.6. The contractor is required to access each site before any installation is done.

12.7. Winch Operated masts

12.7.1. The mounting ring should be lowered for maintenance by means of a self-drum winch using a portable power tool.

12.7.2. The cables of the pully system must be capable of supporting their own weight for the height of the mast.

12.7.3. Suspension and winch ropes and their attachments shall be designed using a safety factor of at least 6 as per clause 7.13.2.1 of SANS 10225:2012 and shall be adequately protected against corrosion.

12.7.4. The winch-drive mechanism shall incorporate a torque-limiting device that prevents inadvertent overload of the ropes and maintains the required factor of safety as per SANS 10225:2012 clause 7.13.2.1.

12.7.5. The supply circuit of the electric drive mechanism shall be protected by a suitable rated earth leakage.

12.8. Middle hinged masts

12.8.1. The mast shall be hinged at a point approximately half of height of the mast to enable luminaires to be lowered for maintenance purposes as per specifications CEE.0019.90 clause 9.2.

12.8.2. The pivoting section of the mast, complete with the required number of luminaires attached thereto, shall be finely counterbalanced for ease of raising and lowering. Tenderers shall submit counter balancing details with their tender documents as per CEE.0019.90, clause 11.2.

12.8.3. Each mast should be locked in a vertical position as per CEE-0019.90 clause 9.3, each mast it must be fitted with a tampered proof, positive, locking device, to prevent lowering without special equipment.

12.8.4. The design of the mast should comply to CEE-0019.90 clause 9.4 should be adequate to resist, when in the locked vertical position, 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 and luminaires.

12.8.5. The luminaires shall be rigidly bolted to the mounting bracket. All nuts and bolts associated with the mounting of the luminaires shall be effectively protected against working loose, due to vibration or other causes, to ensure that the luminaires cannot change their position, or fall, after installation.

12.8.6. An opening shall be provided on the side of the mast shall be effectively sealed against the weather and protected against unauthorised entry as per CEE.0019.90 clause 9.10. When the mast is installed, the contractor shall submit weather proofing details with their tender documents.

12.9. The height of the mast pole should be between 18- 20m high depending on the lighting simulation result.

12.10. The mast or components shall be designed to safely and effectively resist all loads and influences that may reasonably be expected to act upon it, having regard to the expected service life of the mast.

13 Earthing

13.1. The earthing system for each mast shall comply with Transnet code of practice and SANS 10199.

13.2. Earthing rods are selected in accordance with SANS 1063:2015 with a cross sectional area of 95 mm2 copper for each mast pole to accommodate a short circuit current of 6.2kA.

13.3. The maximum distance from the mast to earth spike shall be 450mm and the depth shall be 1.5m

13.4. The main earth spike shall be used for testing purposes; therefore, it shall be exposed but covered with the water meter box as shown in Annexure B of CEE 0177-86

13.5. The reading between the main earth spike and the two test spikes shall be less than 5Ω as specified in SANS 10199.

14 Construction Limitation

14.1. The simulation program used for the yard light design might not allow the tilt angle of the light fittings to be adjusted independently. Onsite adjustments of the light fittings tilt angle must be made by the contractor for better illuminance.

14.2. Caution should be exercised to ensure the tilt angles are not taken very much out of the simulated angles to avoid compromising the glare.

14.3. Should the Contractor deviate from the planned programme a mitigation plan must be submitted to the Site Agent/ Technical Officer for review and approval.

14.4. The Contractor must make allowance for inclement weather and keep a record of rainfall. No claim will be entertained for abnormal rainfall if no verifiable records are offered.

14.5. Other departments of Transnet Freight Rail and other Contractors may be working within the confines of the contract site and general surrounding area during the course of the contract. The Contractor must make reasonable allowance in the rates for such interference.

15 Test, Inspection and quality assurance

15.1. TFR reserves the right to inspect the equipment during or after manufacture and to be represented at any tests.

15.2. After erection of the masts and before the installation is accepted as complete, the successful tenderer shall lower and raise the pivoting section of each mast in the company of a member of TFR's staff to ensure the satisfactory operation thereof and for inspection purposes clauses 22.1 of CEE.0019.90.

15.3. Certificates of compliance (COC's) for all installations must be submitted to Transnet Freight Rail by the contractor.

15.4. After foundation excavations have been completed, the Contractor shall verify the dimensions of the foundation holes as well as the condition of the cast foundation in conjunction with a Transnet Freight Rail representative.

15.5. The dimensions of the foundation holes should be signed off by Transnet Freight Rail representative before the foundation is casted.

15.6. On completion of the installation the successful tendered will be required to carry out, in collaboration with Transnet engineer, illuminance test at a sufficient number of locations in the area covered by the lightning installation, to prove the values of illuminance claimed in his offer as per CEE-0019.90 clause 23.1.

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

15.8. The cables shall be tested in accordance with SANS 1339. Type test certificates shall be submitted with the cables offered.

15.9. Test certificate certifying the load rating of all winches, ropes and hydraulic equipment shall be provided by the contractor.

15.10. Cube test shall; be undertaken by an approved authority and the results shall be made available.

16. Environmental

16.1. All construction work on site will be done in accordance with Transnet Freight Rail's environmental guidelines for electrical construction work, specification BBB2007.

17. Guarantees and defects

17.1. The guarantee for good workmanship shall expire after a period of 3 months commencing on the date of completion of the contract or the date the work if handed over to Transnet whichever is the latest.

17.2. All payment will be made after the work is found to be satisfactory

17.3. A penalty fee of R 2500.00 per day will be changed for any delays caused by the contractor

END OF SPECIFICATION